

### Nonlinear guided waves: Preface

This special issue presents a collection of experimental and theoretical research in nonlinear waves, with emphasis on nonlinear optics, which were presented at the conference Nonlinear Guided Waves VIII held at the Hotel Victoria, Oaxaca, Mexico in April 2016. This preface provides a short history of the conference series Nonlinear Guided Waves and short introductions to the contributed papers which puts them in context.

### General information

Publication status: Published

MoE publication type: B1 Article in a scientific magazine

Organisations: Photonics, Nonlinear Optics and OptoElectronics Lab, University "Roma Tre", Optics Laboratory, Department of Physics, Tampere University of Technology, CNR-ISC, Institute for Complex Systems, University of Edinburgh

Contributors: Assanto, G., Smyth, N. F.

Publication date: 1 Dec 2016

Peer-reviewed: No

### Publication information

Journal: Journal of Nonlinear Optical Physics and Materials

Volume: 25

Issue number: 4

Article number: 1650041

ISSN (Print): 0218-8635

Ratings:

Scopus rating (2016): CiteScore 1.3 SJR 0.301 SNIP 0.493

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Physics and Astronomy (miscellaneous)

Keywords: discrete systems, Nonlinear optics, solitary waves, solitons

DOIs:

10.1142/S0218863516500417

Source: Scopus

Source ID: 85011382866

Research output: Contribution to journal > Article > Scientific

### 0.6V threshold voltage thin film transistors with solution processable indium oxide ( $\text{In}_2\text{O}_3$ ) Channel and Anodized High- $\kappa$ $\text{Al}_2\text{O}_3$ Dielectric

Low-voltage operation and low processing temperature of metal oxide transistors remain a challenge. Commonly metal oxide transistors are fabricated at very high processing temperatures (above 500°C) and their operating voltage is quite high (30-50 V). Here, thin-film transistors (TFT) are reported based upon solution processable indium oxide ( $\text{In}_2\text{O}_3$ ) and room temperature processed anodized high- $\kappa$  aluminum oxide ( $\text{Al}_2\text{O}_3$ ) for gate dielectrics. The  $\text{In}_2\text{O}_3$  TFTs operate well below the drain bias ( $V_{\text{ds}}$ ) of 3.0 V, with on/off ratio  $10^5$ , subthreshold swing (SS) 160 mV/dec, hysteresis 0.19 V, and low threshold voltage ( $V_{\text{th}}$ ) ~0.6 V. The electron mobility ( $\mu$ ) is as high as 3.53  $\text{cm}^2/\text{V}\cdot\text{s}$  in the saturation regime and normalized transconductance ( $g_{\text{m}}$ ) is 75  $\mu\text{S}/\text{mm}$ . In addition, the detailed capacitance-voltage (C-V) analysis to determine interface trap states density was also investigated. The interface trap density ( $D_{\text{it}}$ ) in the oxide/semiconductor interface was quite low, i.e.,  $0.99 \times 10^{11}$  -  $2.98 \times 10^{11} \text{ eV}^{-1} \cdot \text{cm}^{-2}$ , signifying acceptable compatibility of  $\text{In}_2\text{O}_3$  with anodic  $\text{Al}_2\text{O}_3$ .

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Engineering, Columbia University in the City of New York, VTT Technical Research Centre of Finland, Department of Electrical and Computer Engineering, Ohio State University

Contributors: Bhalerao, S. R., Lupo, D., Zangiabadi, A., Kymissis, I., Leppäniemi, J., Alastalo, A., Berger, P. R.

Number of pages: 4

Pages: 1112-1115

Publication date: 1 Jul 2019

Peer-reviewed: Yes

### Publication information

Journal: IEEE Electron Device Letters

Volume: 40

Issue number: 7

ISSN (Print): 0741-3106

Ratings:

Scopus rating (2019): CiteScore 7.4 SJR 1.397 SNIP 1.633

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: anodization, indium oxide (InO), interface state density, low voltage, Metal oxide semiconductors, solution processing, TFT

DOIs:

10.1109/LED.2019.2918492

Source: Scopus

Source ID: 85068181785

Research output: Contribution to journal › Article › Scientific › peer-review

### 10 kA Joints for HTS Roebel Cables

Future HTS high field magnets using multi-tape HTS cables need 10 kA low resistance connections. The connections are needed between the poles of the magnets and at the terminals in a wide operating temperature range, from 1.9-85 K. The EuCARD WP10 Future Magnets collaboration aims at testing HTS based Roebel cables in an accelerator magnet. Usually, LTS cables are jointed inside a relatively short soldered block. Powering tests at CERN have highlighted excess heating of a joint following classical LTS joint design. The HTS Roebel cables are assembled from REBCO coated conductor tapes in a transposed configuration. Due to this, the tapes surface the cable at an angle with the cable axis. A low-resistance joint requires a sufficiently large interface area for each tape. Within one twist pitch length, each tape is located at the surface of the cable over a relatively small non-constant area. This geometry prevents making a well-controlled joint in a compact length along the cable. This paper presents a compact joint configuration for the Roebel cable overcoming these practical challenges. A new joint called fin-block is designed. The joint resistance is estimated computationally. Finally the test results as a function of current and temperature are presented.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, European Organization for Nuclear Research

Contributors: Murtomaeki, J. S., Kirby, G., van Nugteren, J., Contat, P. A., Fleiter, J., De Frutos, O. S., Pincot, F. O., DeRijk, G., Rossi, L., Ruuskanen, J., Stenvall, A., Wolf, F.

Publication date: 2018

Peer-reviewed: Yes

Early online date: 9 Feb 2018

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 28

Issue number: 3

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Cables and current leads, Heating systems, High-temperature superconductors, HTS Magnets, Pressure Measurement, Resistance, Resistance measurement, Soldering, Superconducting cables, Superconducting magnets, Superconducting Magnets, Temperature measurement

DOIs:

10.1109/TASC.2018.2804951

Source: Scopus

Source ID: 85041856536

Research output: Contribution to journal › Article › Scientific › peer-review

### 3-D mechanical modeling of 20 T HTS clover leaf end coils - Good practices and lessons learned

Very high electromagnetic forces are generated in the superconducting coils of high field accelerator magnets. The cables, which are used to wind the coils, can withstand limited pressure levels and strains generated during the powering without degradation. To protect the cables from mechanical damage, reliable prediction of strain and stress inside the coil is paramount for designing suitable support structure of the magnet. This is naturally done before a magnet is built and tested, which emphasizes the need for reliable modeling. Conventionally, the mechanics in superconducting coils are modeled assuming homogenized material properties inside a homogenized coil volume. Using this so-called coil block approach, predicting the actual cable strain or stress inside the homogenized volume is unreliable. In order to predict reliably the stress in the cable, more detailed representation of the modeling domain is needed. This paper presents a workflow to perform a detailed mechanical analysis using finite-element analysis following the envisioned and more detailed approach. As an example, a high field 20 T+ magnet with clover leaf ends is studied, and results are discussed. The results reveal considerable difference between the behavior of modeled homogenized coil blocks and coils where turns are individually considered.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Electrical Engineering, European Organization for Nuclear Research  
Contributors: Murtomäki, J. S., Van Nugteren, J., Stenvall, A., Kirby, G., Rossi, L.  
Publication date: 1 Aug 2019  
Peer-reviewed: Yes

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Issue number: 5  
Article number: 8642381  
ISSN (Print): 1051-8223  
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Scopus rating (2019): CiteScore 3.3 SJR 0.419 SNIP 1.108  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering  
Keywords: Accelerator magnets: dipoles, computer aided engineering, correctors, finite element methods, HTS magnets, magnet structure, magnet supports, modeling, quadrupoles, simulation, stress, superconducting magnet mechanical factors  
DOIs:  
10.1109/TASC.2019.2899317  
Source: Scopus  
Source ID: 85065098308  
Research output: [Contribution to journal](#) › [Article](#) › [Scientific](#) › [peer-review](#)

### 3-D Numerical Modeling of AC Losses in Multifilamentary MgB<sub>2</sub> Wires

Due to their high current carrying capacity, round geometry and low cost, MgB<sub>2</sub> wires are promising candidates for realizing high power cables. However, their operating temperature comprised between 4.2 K and 25 K makes AC losses a critical issue for those cables. In order to optimize the cable architecture for minimizing AC losses, one must be able to predict them quite accurately. As a first step in this direction, we addressed the numerical computation of a single multifilamentary MgB<sub>2</sub> wire that forms the basic element of a high current cable. The wire under consideration has 36 twisted MgB<sub>2</sub> filaments disposed on three concentric layers and embedded in a pure nickel matrix. An initial comparison between 2-D and 3-D finite elements was performed in order to justify the need of a full 3-D model, without which coupling losses in the matrix cannot be modeled properly. This is of prime importance since coupling loss is the dominant loss mechanism at high applied fields. Then, simulations of simpler geometries (6- and 18- filament wires) submitted to various transport currents and/or applied fields were performed to identify trends in AC losses and find the best numerical tools for scaling up simulations to the full 36-filament case. The complexity of the model was increased progressively, starting with MgB<sub>2</sub> filaments in air matrix, then adding electrical conductivity and magnetic properties in the nickel matrix.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Research area: Electromagnetics, Department of Electrical Engineering, G2Elab/Institut Néel, Polytechnique Montréal, Cedrat S.A. 15 Chemin de Malacher-Inovallé, Nexans France  
Contributors: Escamez, G., Sirois, F., Lahtinen, V., Stenvall, A., Badel, A., Tixador, P., Ramdane, B., Meunier, G., Perrin-Bit, R., Bruzek, C. É.  
Publication date: 1 Apr 2016  
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Early online date: 2016

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Volume: 26  
Issue number: 3  
Article number: 4701907  
ISSN (Print): 1051-8223  
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Scopus rating (2016): CiteScore 2.6 SJR 0.398 SNIP 1.132  
Original language: English  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials  
Keywords: AC losses, FEM modelling, MgB<sub>2</sub>, power cable

DOIs:

10.1109/TASC.2016.2533024

Source: Scopus

Source ID: 84963878465

Research output: Contribution to journal › Article › Scientific › peer-review

### **3GPP LTE-assisted Wi-Fi-direct: Trial implementation of live D2D technology**

This paper is a first-hand summary on our comprehensive live trial of cellular-assisted device-to-device (D2D) communications currently being ratified by the standards community for next-generation mobile broadband networks. In our test implementation, we employ a full-featured 3GPP LTE network deployment and augment it with all necessary support to provide realtime D2D connectivity over emerging Wi-Fi-Direct (WFD) technology. As a result, our LTE-assisted WFD D2D system enjoys the required flexibility while meeting the existing standards in every feasible detail. Further, this paper provides an account on the extensive measurement campaign conducted with our implementation. The resulting real-world measurements from this campaign quantify the numerical effects of D2D functionality on the resultant system performance. Consequently, they shed light on the general applicability of LTE-assisted WFD solutions and associated operational ranges.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Wireless Communications and Positioning (WICO), Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Brno University of Technology, Intel Corporation

Contributors: Pyattaev, A., Hosek, J., Johnsson, K., Krkos, R., Gerasimenko, M., Masek, P., Ometov, A., Andreev, S., Sedy, J., Novotny, V., Koucheryavy, Y.

Number of pages: 11

Pages: 877-887

Publication date: 1 Oct 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: ETRI Journal

Volume: 37

Issue number: 5

ISSN (Print): 1225-6463

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.393 SNIP 1.185

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science(all), Electronic, Optical and Magnetic Materials

Keywords: 3GPP LTE, Cellular assistance, Commercial opportunities, Device-to-device, Live trial, Performance measurements, Standardization, Wi-Fi-Direct

Electronic versions:

3GPP LTE-assisted Wi-Fi-direct 2015

DOIs:

10.4218/etrij.15.2415.0003

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202004033069>

Source: Scopus

Source ID: 84942596109

Research output: Contribution to journal › Article › Scientific › peer-review

### **A 0.5-6MHz Active-RC LPF with Fine Gain Steps Using Binary Interpolated Resistor Banks**

This paper proposes an active-RC filter that achieves a wide pseudo-continuous bandwidth-tuning range and a wide gain range with fine steps using a novel switched resistor architecture. A channelselection filter with the proposed resistor bank is designed for a multi-mode mobile-TV receiver with the 6th order Chebyshev-I topology. The bandwidth, 0.5-6 MHz with 5% steps, supports multiple mobile-TV standards with sufficient margins for process and temperature variations. The filter also accomplishes a 30-dB variable gain range with 6-dB steps, and it relaxes the dynamic range requirement of a succeeding programmable gain amplifier. The power consumption of the filter, 3.4-5.0mW, is adjustable according to the bandwidth and the signal level. The filter was fabricated with on-chip bandwidth-calibration circuitry in 0.18- $\mu$ m CMOS and occupied 0.81mm<sup>2</sup>.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed  
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Future Communication ICs Inc., Georgia Electronic Design Center  
Contributors: Beck, S., Jeong, S., Min, S., Hwang, M. W., Kim, S. T., Lim, K., Tentzeris, E. M.  
Number of pages: 4  
Pages: 1328-1331  
Publication date: Aug 2011  
Peer-reviewed: Yes

#### Publication information

Journal: IEICE TRANSACTIONS ON ELECTRONICS

Volume: E94-C

Issue number: 8

ISSN (Print): 0916-8524

Ratings:

Scopus rating (2011): CiteScore 1 SJR 0.233 SNIP 0.624

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Active filters, Calibration, Receivers, Variable-gain amplifiers

DOIs:

10.1587/transele.E94.C.1328

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<http://www.scopus.com/inward/record.url?scp=79961033079&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79961033079

Research output: Contribution to journal > Article > Scientific > peer-review

#### Absorption profile and femtosecond intraband relaxation of the intense upper Davydov component in oligothiophenes

The diffuse shape of the high-energy absorption band observed in oligothiophene crystals is interpreted in terms of Fano-type mixing between the discrete upper Davydov component at  $k=0$  and the continuum of phonon-accompanied exciton states at other values of crystal momentum. In temporal domain, this mixing is viewed as a crystal version of radiationless transition, and is followed by subsequent intra-band exciton relaxation due to scattering processes with phonon release. The rates of energy dissipation in these latter processes, mediated by different intramolecular vibrational modes, are estimated from a simple expression based on the Fermi golden rule. Depopulation of long-lived vibronic intermediates, acting as bottlenecks, is attributed to thermally activated processes with absorption of low-frequency phonons. All essential input parameters are obtained from independent nonempirical calculations. The results are in excellent agreement both with the experimentally observed absorption band shapes and with energy-dependent femtosecond dynamics afforded by measurements of sexithiophene (6T) fluorescence and photoinduced absorption.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Computational Science X (CompX), Uniwersytet Jagiellonski w Krakowie, K. Gumiński Department of Theoretical Chemistry

Contributors: Petelenz, P., Kulig, W.

Number of pages: 4

Pages: 412-415

Publication date: Feb 2011

Peer-reviewed: Yes

#### Publication information

Journal: Physica Status Solidi B: Basic Solid State Physics

Volume: 248

Issue number: 2

ISSN (Print): 0370-1972

Ratings:

Scopus rating (2011): CiteScore 2.5 SJR 0.931 SNIP 0.723

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Femtosecond spectroscopy, Intra-band relaxation, Oligothiophenes

DOIs:

10.1002/pssb.201000640

URLs:

<http://www.scopus.com/inward/record.url?scp=79251512350&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79251512350

Research output: Contribution to journal › Article › Scientific › peer-review

### **Accelerator-quality HTS dipole magnet demonstrator designs for the EuCARD-2 5-T 40-mm clear aperture magnet**

Future high-energy accelerators will need very high magnetic fields in the range of 20 T. The Enhanced European Coordination for Accelerator Research and Development (EuCARD-2) Work Package 10 is a collaborative push to take high-temperature superconductor (HTS) materials into an accelerator-quality demonstrator magnet. The demonstrator will produce 5 T stand alone and between 17 and 20 T when inserted into the 100-mm aperture of a Fresca-2 high-field outsert magnet. The HTS magnet will demonstrate the field strength and the field quality that can be achieved. An effective quench detection and protection system will have to be developed to operate with the HTS superconducting materials. This paper presents a ReBCO magnet design using a multistrand Roebel cable that develops a stand-alone field of 5 T in a 40-mm clear aperture and discusses the challenges associated with a good field quality using this type of material. A selection of magnet designs is presented as the result of the first phase of development.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, Karlsruhe Institute of Technology, Institute for Technical Physics, Germany, European Organization for Nuclear Research, French Atomic Energy Commission (CEA) Saclay, Physical Science Division (DSM), Institute of Research into the Fundamental Laws of the Universe (IRFU), Lawrence Berkeley National Laboratory, Karlsruhe Institute of Technology

Contributors: Kirby, G. A., Van Nugteren, J., Ballarino, A., Bottura, L., Chouika, N., Clement, S., Datskov, V., Fajardo, L., Fleiter, J., Gauthier, R., Gentini, L., Lambert, L., Lopes, M., Perez, J. C., De Rijk, G., Rijllart, A., Rossi, L., Ten Kate, H., Durante, M., Fazilleau, P., Lorin, C., Härö, E., Stenvall, A., Caspi, S., Marchevsky, M., Goldacker, W., Kario, A.

Publication date: 1 Jun 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 3

Article number: 4000805

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Accelerator magnet, EuCARD-2, HTS magnet design, quench protection, ReBCO, Superconducting Magnets, YBCO Roebel cable

DOIs:

10.1109/TASC.2014.2361933

Source: Scopus

Source ID: 84920829736

Research output: Contribution to journal › Article › Scientific › peer-review

### **Adaptive multiresolution method for MAP reconstruction in electron tomography**

3D image reconstruction with electron tomography holds problems due to the severely limited range of projection angles and low signal to noise ratio of the acquired projection images. The maximum a posteriori (MAP) reconstruction methods have been successful in compensating for the missing information and suppressing noise with their intrinsic regularization techniques. There are two major problems in MAP reconstruction methods: (1) selection of the regularization parameter that controls the balance between the data fidelity and the prior information, and (2) long computation time. One aim of this study is to provide an adaptive solution to the regularization parameter selection problem without having additional knowledge about the imaging environment and the sample. The other aim is to realize the reconstruction using sequences of resolution levels to shorten the computation time. The reconstructions were analyzed in terms of accuracy and computational efficiency using a simulated biological phantom and publically available experimental datasets of electron tomography. The numerical and visual evaluations of the experiments show that the adaptive multiresolution method can provide more accurate results than the weighted back projection (WBP), simultaneous iterative reconstruction technique (SIRT), and sequential MAP expectation maximization (sMAPEM) method. The method is superior to sMAPEM also in terms of computation time and usability since it can reconstruct 3D images significantly faster without requiring any parameter to be set by the user.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Signal Processing, BioMediTech  
Contributors: Acar, E., Peltonen, S., Ruotsalainen, U.  
Number of pages: 11  
Pages: 24-34  
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Peer-reviewed: Yes

#### Publication information

Journal: Ultramicroscopy  
Volume: 170  
ISSN (Print): 0304-3991  
Ratings:

Scopus rating (2016): CiteScore 5.5 SJR 1.896 SNIP 1.184

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Instrumentation

Keywords: Adaptive reconstruction, Electron tomography (ET), Maximum a posteriori (MAP) reconstruction, Missing wedge, Multiresolution reconstruction, Regularization parameter

DOIs:

10.1016/j.ultramic.2016.08.002

Source: Scopus

Source ID: 84981309739

Research output: Contribution to journal > Article > Scientific > peer-review

#### A Database for Storing Magnet Parameters and Analysis of Quench Test Results in HL-LHC Nb<sub>3</sub>Sn Short Model Magnets

In recent years, several Nb<sub>3</sub>Sn high field magnet prototypes have been designed and tested in preparation for the LHC Luminosity upgrade and also for the potential Future Circular Collider (FCC). In this paper we present a Microsoft Excel-based database tool for storing magnet design parameters and results from quench protection tests. The hierarchical and flexible structure of the relational database allows for systematic and coherent analysis of the test data from different magnet assemblies and works as a practical reference for magnet design evolution. Data from quench protection heater tests in several high-field Nb<sub>3</sub>Sn magnet prototypes has been stored in the database. We use this data to validate the quench simulation assumptions used in FCC 16 T dipole magnet design.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Engineering, Research group: Modelling and superconductivity, CERN, European Organization for Nuclear Research (CERN)

Contributors: Salmi, T., Tarhasaari, T., Izquierdo-Bermudez, S.

Number of pages: 5

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

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Issue number: 4

Article number: 4703705

ISSN (Print): 1051-8223

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: quench protection, quench protection heaters, Superconducting magnets

Electronic versions:

A Database for Storing Magnet Parameters 2020

DOIs:

10.1109/TASC.2020.2981304

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202006116037>

Source: Scopus

Source ID: 85084795321

Research output: Contribution to journal > Article > Scientific > peer-review

### **Adsorption and dissociation of molecular oxygen on $\alpha$ -Pu (0 2 0) surface: A density functional study**

Molecular and dissociative oxygen adsorptions on the  $\alpha$ -Pu (0 2 0) surface have been systematically studied using the full-potential linearized augmented-plane-wave plus local orbitals (FP-LAPWlo) basis method and the PerdewBurkeErnzerhof (PBE) exchange-correlation functional. Chemisorption energies have been optimized for the distance of the admolecule from the Pu surface and the bond length of OO atoms for four adsorption sites and three approaches of O<sub>2</sub> admolecule to the (0 2 0) surface. Chemisorption energies have been calculated at the scalar relativistic level with no spinorbit coupling (NSOC) and at the fully relativistic level with spinorbit coupling (SOC). Dissociative adsorptions are found at the two horizontal approaches (O<sub>2</sub> is parallel to the surface and perpendicular/parallel to a lattice vector). Hor2 (O<sub>2</sub> is parallel to the surface and perpendicular to a lattice vector) approach at the one-fold top site is the most stable adsorption site, with chemisorption energies of 8.048 and 8.415 eV for the NSOC and SOC cases, respectively, and an OO separation of 3.70 Å. Molecular adsorption occurs at the Vert (O<sub>2</sub> is vertical to the surface) approach of each adsorption site. The calculated work functions and net spin magnetic moments, respectively, increase and decrease in all cases upon chemisorption compared to the clean surface. The partial charges inside the muffin-tins, the difference charge density distributions, and the local density of states have been used to investigate the Pu-admolecule electronic structures and bonding mechanisms.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Computational Science X (CompX), University of Texas at Arlington

Contributors: Wang, J., Ray, A. K.

Number of pages: 10

Pages: 3285-3294

Publication date: 1 Sep 2011

Peer-reviewed: Yes

#### **Publication information**

Journal: Physica B: Condensed Matter

Volume: 406

Issue number: 17

ISSN (Print): 0921-4526

Ratings:

Scopus rating (2011): CiteScore 1.9 SJR 0.595 SNIP 0.797

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: Adsorption, Density Functional Theory, Dissociation, Oxygen, Plutonium

DOIs:

10.1016/j.physb.2011.05.041

URLs:

<http://www.scopus.com/inward/record.url?scp=79959360654&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79959360654

Research output: Contribution to journal > Article > Scientific > peer-review

### **A Fast Quench Protection System for High-Temperature Superconducting Magnets**

For reaching very high magnetic fields in fully superconducting magnets, beyond 16 T for particle accelerators dipoles and beyond 23 T for solenoids, the use of High-Temperature Superconductors (HTS) is unavoidable. Due to the high Minimum Quench Energy in HTS these coils are much more difficult to protect against quenches using conventional methods such as quench heaters or Coupling Loss Induced Quench (CLIQ). Although it is possible to use a dump resistor on a short HTS magnet, extracting the energy externally, this does not provide a solution for longer magnets or magnets operated in a string, because the extraction voltage becomes unacceptably high. Here a method named E3SPreSSO is proposed that allows for fast energy extraction in HTS magnets. The E3SPreSSO comprises of units with a near-zero self-inductance superconducting circuit, connected in series with the main magnet. When the protection is triggered, these devices are turned resistive, using quench heaters, over-current or CLIQ, causing them to absorb the energy of the system. The units can be located outside the main magnet and do not generate magnetic field. Therefore it is possible to use relatively cost-efficient and robust Nb-Ti or possibly MgB<sub>2</sub> (at higher temperatures). This paper introduces the concept and provides an analytical method weighing the different options for designing the E3SPreSSO units themselves.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, European Organization for Nuclear Research, CERN

Contributors: van Nugteren, J., Murtomäki, J., Ruuskanen, J., Kirby, G., Hagen, P., DeRijk, G., Ten Kate, H., Bottura, L., Rossi, L.

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Journal: IEEE Transactions on Applied Superconductivity

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ISSN (Print): 1051-8223

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Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Coils, Heating systems, High-temperature superconductors, High-Temperature-Superconductors (HTS), Magnetic circuits, Quench Protection, Resistance, Resistors, Superconducting magnets, Superconducting Magnets, Switch

DOIs:

10.1109/TASC.2018.2848229

#### Bibliographical note

EXT="Murtomäki, Jaakko"

Source: Scopus

Source ID: 85048658780

Research output: Contribution to journal > Article > Scientific > peer-review

#### A Finite Element Simulation Tool for Predicting Hysteresis Losses in Superconductors Using an H-Oriented Formulation with Cohomology Basis Functions

Currently, modelling hysteresis losses in superconductors is most often based on the H-formulation of the eddy current model (ECM) solved using the finite element method (FEM). In the H-formulation, the problem is expressed using the magnetic field intensity  $H$  and discretized using edge elements in the whole domain. Even though this approach is well established, it uses unnecessary degrees of freedom (DOFs) and introduces modelling error such as currents flowing in air regions due to finite air resistivity. In this paper, we present a modelling tool utilizing another H-oriented formulation of the ECM, making use of cohomology of the air regions. We constrain the net currents through the conductors by fixing the DOFs related to the so-called cohomology basis functions. As air regions will be truly non-conducting, DOFs and running times of these nonlinear simulations are reduced significantly as compared to the classical H-formulation. This fact is demonstrated through numerical simulations.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, Microsoft Research Cambridge, UK, École Polytechnique de Montréal

Contributors: Lahtinen, V., Stenvall, A., Sirois, F., Pellikka, M.

Number of pages: 10

Pages: 2345-2354

Publication date: 22 Apr 2015

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Superconductivity and Novel Magnetism

Volume: 28

Issue number: 8

ISSN (Print): 1557-1939

Ratings:

Scopus rating (2015): CiteScore 1.8 SJR 0.318 SNIP 0.513

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Cohomology, Finite element method, Hysteresis losses, Superconductors

DOIs:

10.1007/s10948-015-3074-x

URLs:

<http://www.scopus.com/inward/record.url?scp=84928155270&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84943356220

Research output: Contribution to journal › Article › Scientific › peer-review

### **AlGaAs/AlGaInP VECSELs with Direct Emission at 740-770 nm**

An optically-pumped vertical-external-cavity surface-emitting laser (OP-VECSEL) with 3.25-W output power emitting around 750 nm is demonstrated. The gain structure incorporates AlGaAs quantum wells (QWs) and barriers, and AlGaInP claddings. The emission wavelength could be tuned from 740 to 770 nm. The development addresses the need for high brightness lasers at a wavelength range that has proven difficult to reach. The demonstrated structure exhibits polarization-related peculiarities, which cause polarization switching under increased pump power due to mode competition. The presence of birefringence inside the active region is attributed to known long-range ordering within the AlGaInP claddings which causes distorted beam profiles. This influence on laser features has not been reported in VECSELs so far.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics

Contributors: Nechay, K., Kahle, H., Penttinen, J., Rajala, P., Tukiainen, A., Ranta, S., Guina, M.

Number of pages: 4

Pages: 1245-1248

Publication date: 1 Aug 2019

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Photonics Technology Letters

Volume: 31

Issue number: 15

ISSN (Print): 1041-1135

Ratings:

Scopus rating (2019): CiteScore 5.5 SJR 0.945 SNIP 1.212

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: AlGaAs, AlGaInP, quantum well lasers, semiconductor disk lasers, semiconductor growth, semiconductor laser, vertical-external-cavity surface-emitting lasers (VECSELs)

DOIs:

10.1109/LPT.2019.2924289

#### **Bibliographical note**

INT=phys,"Rajala, Patrik"

Source: Scopus

Source ID: 85069529749

Research output: Contribution to journal › Article › Scientific › peer-review

### **Ambient-Pressure XPS Study of a Ni-Fe Electrocatalyst for the Oxygen Evolution Reaction**

Chemical analysis of solid-liquid interfaces under electrochemical conditions has recently become feasible due to the development of new synchrotron radiation techniques. Here we report the use of "tender" X-ray ambient-pressure X-ray photoelectron spectroscopy (APXPS) to characterize a thin film of Ni-Fe oxyhydroxide electrodeposited on Au as the working electrode at different applied potentials in 0.1 M KOH as the electrolyte. Our results show that the as-prepared 7 nm thick Ni-Fe (50% Fe) film contains Fe and Ni in both their metallic as well as oxidized states, and undergoes further oxidation when the sample is subjected to electrochemical oxidation-reduction cycles. Metallic Fe is oxidized to Fe<sup>3+</sup> and metallic Ni to Ni<sup>2+/3+</sup>. This work shows that it is possible to monitor the chemical nature of the Ni-Fe catalyst as a function of potential when the corresponding current densities are small. This allows for operando measurements just above the onset of OER; however, current densities as they are desired in photoelectrochemical devices (~1-10 mA cm<sup>-2</sup>) could not be achieved in this work, due to ohmic losses in the thin electrolyte film. We use a two-dimensional model to describe the spatial distribution of the electrochemical potential, current density, and pH as a function of the position above the electrolyte meniscus, to provide guidance toward enabling the acquisition of operando APXPS at high current density. The shifts in binding energy of water with applied potential predicted by the model are in good agreement with the experimental values.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Surface Science, SUNCAT Center for Interface Science and Catalysis, SLAC National Accelerator Laboratory, Department of Chemical and Biomolecular Engineering, Berkeley, Materials Sciences Division, Lawrence Berkeley National Laboratory, Materials and Corrosion Engineering, Exponent, Inc., Polymer Science and Materials Chemistry

Contributors: Ali-Löyty, H., Louie, M. W., Singh, M. R., Li, L., Sanchez Casalongue, H. G., Ogasawara, H., Crumlin, E. J., Liu, Z., Bell, A. T., Nilsson, A., Friebel, D.

Number of pages: 7

Pages: 2247-2253

Publication date: 4 Feb 2016

Peer-reviewed: Yes

### Publication information

Journal: Journal of Physical Chemistry C

Volume: 120

Issue number: 4

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2016): CiteScore 7.9 SJR 1.964 SNIP 1.189

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

Electronic versions:

MS+SI(post-print). Embargo ended: 4/01/17

DOIs:

10.1021/acs.jpcc.5b10931

URLs:

<http://urn.fi/URN:NBN:fi:ty-201606034213>. Embargo ended: 4/01/17

Source: Scopus

Source ID: 84957588014

Research output: Contribution to journal > Article > Scientific > peer-review

### An ab initio study of $\text{PuO}_{2\pm 0.25}$ , $\text{UO}_{2\pm 0.25}$ , and $\text{U}_0.5\text{Pu}_0.5\text{O}_{2\pm 0.25}$

Hybrid density functional theory has been used to systematically study the electronic, geometric, and magnetic properties of strongly correlated materials  $\text{PuO}_{2\pm x}$ ,  $\text{UO}_{2\pm x}$ , and  $\text{U}_0.5\text{Pu}_0.5\text{O}_{2\pm x}$  with  $x = 0.25$ . The calculations have been performed using the all-electron full-potential linearized augmented plane wave plus local orbitals basis (FP-L/APW+lo) method. Each compound has been studied at the ferromagnetic (FM) and anti-ferromagnetic (AFM) configurations with and without spin-orbit coupling (SOC) and full geometry optimizations. The optimized lattice constants, bulk moduli, and band gaps are reported. Total energy calculations indicate that the ground states are AFM for all compounds studied here and the band gaps are typically higher than 1.0 eV, characteristic of semiconductors. The total energy is lowered significantly and the band gaps increase with the inclusion of SOC. The chemical bonds between the actinide metals and oxygen atoms are primarily ionic in character.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Computational Science X (CompX), University of Texas at Arlington

Contributors: Ma, L., Ray, A. K.

Number of pages: 11

Pages: 103-113

Publication date: May 2011

Peer-reviewed: Yes

### Publication information

Journal: European Physical Journal B

Volume: 81

Issue number: 1

ISSN (Print): 1434-6028

Ratings:

Scopus rating (2011): CiteScore 2.8 SJR 1.034 SNIP 0.906

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1140/epjb/e2011-10759-0

URLs:

<http://www.scopus.com/inward/record.url?scp=79960055408&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79960055408

Research output: Contribution to journal › Article › Scientific › peer-review

### **Analysis of uncertainties in protection heater delay time measurements and simulations in Nb<sub>3</sub>Sn high-field accelerator magnets**

The quench protection of superconducting high-field accelerator magnets is presently based on protection heaters, which are activated upon quench detection to accelerate the quench propagation within the winding. Estimations of the heater delay to initiate a normal zone in the coil are essential for the protection design. During the development of Nb<sub>3</sub>Sn magnets for the LHC luminosity upgrade, protection heater delays have been measured in several experiments, and a new computational tool CoHDA (Code for Heater Delay Analysis) has been developed for heater design. Several computational quench analyses suggest that the efficiency of the present heater technology is on the borderline of protecting the magnets. Quantifying the inevitable uncertainties related to the measured and simulated delays is therefore of pivotal importance. In this paper, we analyze the uncertainties in the heater delay measurements and simulations using data from five impregnated high-field Nb<sub>3</sub>Sn magnets with different heater geometries. The results suggest that a minimum variation of 3 ms or 20% should be accounted in the heater design for coil outer surfaces and at least 10 ms or 40% in the inner surfaces due to more uncertain heater contact. We also propose a simulation criterion that gives an upper bound enclosing 90% of the measured delays for heaters on the coil outer surface.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, CERN, Conseil Européen pour la Recherche Nucléaire, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory

Contributors: Salmi, T., Chlachidze, G., Marchevsky, M., Bajas, H., Felice, H., Stenvall, A.

Publication date: 1 Aug 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 4

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Nb<sub>3</sub>Sn accelerator magnets, Protection heaters, Quench protection, Thermal modelling

DOIs:

10.1109/TASC.2015.2437332

Source: Scopus

Source ID: 84933046736

Research output: Contribution to journal › Article › Scientific › peer-review

### **Analytical and Numerical Methods to Estimate the Effective Mechanical Properties of Rutherford Cables**

Superconducting Nb<sub>3</sub>Sn Rutherford cables can be used in the accelerator magnets above 10 T regions that cannot be reached with NbTi. These cables are composed of superconducting multifilamentary strands, interstitial epoxy, and insulation materials. To properly design the magnets made from these cables, it is essential to analyze their mechanical behavior. The prerequisite for this is the knowledge of the mechanical performance of Rutherford cables. In large magnets, these cables cannot be modeled with all details but effective properties and homogenization are typically required. In this work, an analytical model and numerical approach for predicting the effective mechanical properties of Rutherford cables are developed. The analytical model is established on a two-step homogenization and mechanical analysis for composite. The effective mechanical properties of the filament area and the transverse Young's modulus of the strand are first determined by means of utilizing the mechanical theory of the unit cell approach. The composite effective mechanical properties of the strand and interstitial epoxy are homogenized in the first step. The second step homogenization derives the effective mechanical properties of the strands epoxy composite and insulation layers. The numerical approach to determine the effective mechanical properties is based on the finite-element analysis. The developed methodologies are used to obtain the effective mechanical properties of two Nb<sub>3</sub>Sn Rutherford cables. The influence of the insulation thickness and modulus, the strand's modulus, is studied.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Electrical Engineering, Lanzhou University  
Contributors: Zhao, J., Stenvall, A., Gao, Y., Salmi, T.  
Publication date: 1 Aug 2020  
Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity  
Volume: 30  
Issue number: 5  
Article number: 8400808  
ISSN (Print): 1051-8223  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering  
Keywords: Composite modeling, finite-element analysis (FEA), homogenization, Rutherford cable  
DOIs:  
10.1109/TASC.2020.2968924  
Source: Scopus  
Source ID: 85080860589  
Research output: Contribution to journal > Article > Scientific > peer-review

### Analytical computation of the demagnetizing energy of thin-film domain walls

Due to its nonlocal nature, calculating the demagnetizing field remains the biggest challenge in understanding domain structures in ferromagnetic materials. Analytical descriptions of demagnetizing effects typically approximate domain walls as uniformly magnetized ellipsoids, neglecting both the smooth rotation of magnetization from one domain to the other and the interaction between the two domains. Here, instead of the demagnetizing field, we compute analytically the demagnetizing energy of a straight domain wall described by the classical tanh magnetization profile in a thin film with perpendicular magnetic anisotropy. We then use our expression for the demagnetizing energy to derive an improved version of the 1D model of field-driven domain wall motion, resulting in accurate expressions for important properties of the domain wall such as the domain wall width and the Walker breakdown field. We verify the accuracy of our analytical results by micromagnetic simulations.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Physics, Research area: Computational Physics  
Contributors: Skaugen, A., Murray, P., Laurson, L.  
Publication date: 25 Sep 2019  
Peer-reviewed: Yes

### Publication information

Journal: Physical Review B  
Volume: 100  
Issue number: 9  
Article number: 094440  
ISSN (Print): 2469-9950  
Ratings:  
Scopus rating (2019): SJR 1.811 SNIP 1.025  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
DOIs:  
10.1103/PhysRevB.100.094440  
Source: Scopus  
Source ID: 85072773246  
Research output: Contribution to journal > Article > Scientific > peer-review

### A near-infrared optoelectronic approach to detection of road conditions

We introduce and test an original approach for the optical assessment of road conditions due to various atmospheric perturbations such as the presence of ice, wet surfaces and rain. The technique is based on measuring diffused and reflected light under near infrared illumination, extracting the polarization contrast after reflection. Several tests, carried out on various types of asphalt and various thicknesses of water and ice layers, demonstrate that the system exhibits selectivity and robustness to allow the recognition of dry asphalt, water-layered, wet asphalt and asphalt with ice.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Frontier Photonics, University "Roma Tre", Nonlinear Optics and OptoElectronics Lab  
Contributors: Colace, L., Santoni, F., Assanto, G.  
Number of pages: 4  
Pages: 633-636  
Publication date: May 2013  
Peer-reviewed: Yes

### Publication information

Journal: Optics and Lasers in Engineering  
Volume: 51  
Issue number: 5  
ISSN (Print): 0143-8166  
Ratings:  
Scopus rating (2013): CiteScore 4.2 SJR 0.864 SNIP 1.851  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Mechanical Engineering  
Keywords: Ice detection, Near-infrared, Optical sensors  
DOIs:  
10.1016/j.optlaseng.2013.01.003  
URLs:  
<http://www.scopus.com/inward/record.url?scp=84874118385&partnerID=8YFLogxK> (Link to publication in Scopus)  
Source: Scopus  
Source ID: 84874118385  
Research output: Contribution to journal > Article > Scientific > peer-review

### A new power-consumption optimization technique for two-stage operational amplifiers

This paper proposes a technique for two-stage operational amplifiers (OPAMPs) to optimize power consumption according to various channel conditions of wireless communication systems. The proposed OPAMP has the ability of reducing the quiescent current of each stage independently by introducing additional common-mode feedback, therefore more optimization is possible according to the channel conditions than conventional two-stage OPAMPs. The simulations verify the benefits of the technique. As a proof-of-concept topology, the proposed OPAMPs were used in a channel-selection filter for a multi-standard mobile-TV receiver. The power consumption of the filter, 3.4-5.0mW, was adjustable according to the bandwidth, the noise, and the jammer level. The performance of the filter meets the requirements and verifies the effectiveness of the proposed approach. The filter was fabricated in 0.18- $\mu\text{m}$  CMOS and occupied 0.64mm<sup>2</sup>.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Electronic Design Center  
Contributors: Beck, S., Kim, S. T., Lee, M., Lim, K., Laskar, J., Tentzeris, M. M.  
Number of pages: 3  
Pages: 1138-1140  
Publication date: Jun 2011  
Peer-reviewed: Yes

### Publication information

Journal: IEICE TRANSACTIONS ON ELECTRONICS  
Volume: E94-C  
Issue number: 6  
ISSN (Print): 0916-8524  
Ratings:  
Scopus rating (2011): CiteScore 1 SJR 0.233 SNIP 0.624  
Original language: English  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials  
Keywords: Active filters, Low-power consumption, Operational amplifier, Power optimization  
DOIs:  
10.1587/transele.E94.C.1138  
URLs:  
<http://www.scopus.com/inward/record.url?scp=79957937458&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79957937458

Research output: Contribution to journal › Article › Scientific › peer-review

### **An integrated "sense-and-communicate" broad-/narrow-band optically controlled reconfigurable antenna for cognitive radio systems**

An optically controlled reconfigurable antenna with operability in both wide and narrow bands is investigated for cognitive radio systems. The proposed antenna consists of a U-shaped patch for the spectrum sensing over a wide band and two open annuli for communication in narrow sub-bands within the frequency range of 3.1-10.6 GHz. The integration of narrow and wide bands devices makes the whole antenna structure compact with a dimension of  $40 \times 38.5 \text{ mm}^2$ . With an inherent property of being electromagnetically transparency, four appropriately placed laser-controlled photoconductive silicon switches are adopted to achieve reconfigurable frequency characteristics in the four bands of 5.8-6.8, 6.7-7.3, 7.0-8.4, and 7.9-9.2 GHz with the reflection coefficient below -10 dB. The wide-narrowband antenna is fed by two coplanar waveguides with the isolation of  $S_{21}$

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Sensing Systems for Wireless Medicine (MediSense), South China University of Technology, Georgia Institute of Technology

Contributors: Liu, X., Fan, Y., Tentzeris, M. M.

Number of pages: 8

Pages: 1016-1023

Publication date: 1 Apr 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Microwave and Optical Technology Letters

Volume: 57

Issue number: 4

ISSN (Print): 0895-2477

Ratings:

Scopus rating (2015): CiteScore 1.5 SJR 0.318 SNIP 0.507

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: cognitive radio, Frequency reconfigurable antenna, optical control, photoconductive switches

DOIs:

10.1002/mop.29004

URLs:

<http://www.scopus.com/inward/record.url?scp=84923411745&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84923411745

Research output: Contribution to journal › Article › Scientific › peer-review

### **Anisotropic and strain-dependent model of magnetostriction in electrical steel sheets**

This paper presents an anisotropic and mechanical strain-dependent model of magnetostriction in electrical steel sheets and its application in finite-element computations. The presented model is bidirectional and the data needed for its derivation is extracted solely from unidirectional measurements under mechanical loading. The model has six parameters that describe the magnetic and strain behavior and two parameters that describe the anisotropy. The validation of the model is carried out through measurements and computations on a single-phase transformer-like device. The comparison between computation and measurement results seems to be reasonable regardless of the fact that the magnetic behavior is modeled as single valued, isotropic, and anhysteretic. Original magnetostriction measurements are also presented and the importance of magnetostriction anisotropy in a priori isotropic electrical steel sheets is demonstrated. The model is easy to implement in existing codes and the anisotropic behavior is straightforward to modify according to a specific material.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Smart Energy Systems (SES), Aalto University, Universiteit Gent, Ghent University, Zwijnaarde, Belgium

Contributors: Belahcen, A., Singh, D., Rasilo, P., Martin, F., Ghalamestani, S. G., Vandeveld, L.

Publication date: 1 Mar 2015

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Magnetics

Volume: 51

Issue number: 3

Article number: 2001204

ISSN (Print): 0018-9464

Ratings:

Scopus rating (2015): CiteScore 2.8 SJR 0.575 SNIP 1.189

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Anisotropy, magnetomechanical effects, magnetostriction, soft magnetic materials, transformers, vibrations

DOIs:

10.1109/TMAG.2014.2361681

Source: Scopus

Source ID: 84928813895

Research output: Contribution to journal > Article > Scientific > peer-review

### An Optical Sensor for Volatile Amines Based on an Inkjet-Printed, Hydrogen-Bonded, Cholesteric Liquid Crystalline Film

A printable hydrogen-bonded cholesteric liquid crystal (CLC) polymer film is described, which can be used as a sensor for detection of gaseous trimethylamine (TMA). In this optical sensor the virgin CLC polymer network reflects green light. When anhydrous TMA gas penetrates the film, disruption of the hydrogen bonds occurs, with the simultaneous formation of carboxylate salts. The consequent reduction of the molecular order causes the green reflecting CLC film to become colorless. However, exposure to TMA in water-saturated nitrogen gas results in a red reflecting film. Due to the hygroscopic nature of the polymer salt that is formed by TMA, water vapor which is present in the environment is absorbed by the films. This leads to swelling of the film, resulting in an increase in pitch size and therefore a red shift of the reflection band. Interestingly, after exposure to ambient conditions, restoration of the green reflecting film takes place, showing that the sensor can be used multiple times. In a proof of principle experiment, it was shown that these CLC films can be used as optical sensors to detect volatile amines, that are produced by decaying fish. Facile determination of volatile amines in an optical fashion is possible with the use of hydrogen-bonded cholesteric liquid crystalline polymer films. Due to a response of the film to trimethylamine gas, the cholesteric reflector changes its color. This optical sensor is inkjet-printed on a foil, making it suitable for food packaging applications.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Functional Organic Materials and Devices, Eindhoven University of Technology, School of Mathematical Sciences

Contributors: Stumpel, J. E., Wouters, C., Herzer, N., Ziegler, J., Broer, D. J., Bastiaansen, C. W. M., Schenning, A. P. H. J.

Number of pages: 6

Pages: 459-464

Publication date: 2014

Peer-reviewed: Yes

### Publication information

Journal: Advanced Optical Materials

Volume: 2

Issue number: 5

ISSN (Print): 2195-1071

Ratings:

Scopus rating (2014): CiteScore 2.9 SJR 1.812 SNIP 1.755

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Keywords: Amine detection, Cholesteric liquid crystals, Inkjet printing, Sensors, Stimuli-responsive materials

DOIs:

10.1002/adom.201300516

URLs:

<http://www.scopus.com/inward/record.url?scp=84900420820&partnerID=8YFLogxK> (Link to publication in Scopus)

### Bibliographical note

EXT="Stumpel, Jelle"

Source: Scopus

Source ID: 84900420820

Research output: Contribution to journal > Article > Scientific > peer-review

### **A Novel Enhanced-Performance Flexible RFID-Enabled Embroidered Wireless Integrated Module for Sensing Applications**

A novel wireless embroidered integrated platform for radio frequency identification (RFID)-enabled strain sensing that takes advantage of the nonlinear behavior of the RFID chip impedance as a function of the incident power is introduced. Due to the nonlinearity of the chip impedance as a function of the power, a large variation of chip impedance value and thus a large difference of radar cross section values for appropriately chosen power levels are achieved. Taking advantage of this idea, the sensing parameter is detected by interrogation of the sensor tag using two distinct transmitting power levels and calculating the difference of backscattered response. As a proof of concept, we applied the proposed method for the detection of an embroidered RFID-enabled strain sensor that is fabricated using electrotexiles in order to observe the variations of the magnitude and the corresponding strain levels. The proposed model for the chip impedance helps in predicting the RFID chip impedance variation for different strain conditions, an extremely important issue for RF/RFID modules and packages operating over a wide power dynamic range as well as enabling the accurate estimation of the maximum range of the RFID-enabled sensing modules for the maximum allowable power levels.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Sensing Systems for Wireless Medicine (MediSense), Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, University of Montpellier

Contributors: Hasani, M., Vena, A., Sydänheimo, L., Tentzeris, M. M., Ukkonen, L.

Number of pages: 9

Pages: 1244-1252

Publication date: 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Components, Packaging and Manufacturing Technology

Volume: 5

Issue number: 9

ISSN (Print): 2156-3950

Ratings:

Scopus rating (2015): CiteScore 3.3 SJR 0.499 SNIP 1.156

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Industrial and Manufacturing Engineering

DOIs:

10.1109/TCPMT.2015.2461661

URLs:

<http://www.scopus.com/inward/record.url?scp=84940198964&partnerID=8YFLogxK> (Link to publication in Scopus)

#### **Bibliographical note**

EXT="Vena, Arnaud"

Research output: Contribution to journal > Article > Scientific > peer-review

### **Architectures and codecs for real-time light field streaming**

Light field 3D displays represent a major step forward in visual realism, providing glasses-free spatial vision of real or virtual scenes. Applications that capture and process live imagery have to process data captured by potentially tens to hundreds of cameras and control tens to hundreds of projection engines making up the human perceivable 3D light field using a distributed processing system. The associated massive data processing is difficult to scale beyond a specific number and resolution of images, limited by the capabilities of the individual computing nodes. The authors therefore analyze the bottlenecks and data flow of the light field conversion process and identify possibilities to introduce better scalability. Based on this analysis they propose two different architectures for distributed light field processing. To avoid using uncompressed video data all along the processing chain, the authors also analyze how the operation of the proposed architectures can be supported by existing image/video codecs.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Signal Processing, Research group: 3D MEDIA, Holografika, Nokia

Contributors: Kovács, P. T., Zare, A., Balogh, T., Bregovic, R., Gotchev, A.

Publication date: 1 Jan 2017

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Imaging Science and Technology

Volume: 61

Issue number: 1

Article number: 010403

ISSN (Print): 1062-3701

Ratings:

Scopus rating (2017): CiteScore 0.9 SJR 0.237 SNIP 0.718

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Chemistry(all), Atomic and Molecular Physics, and Optics, Computer Science Applications

Electronic versions:

Architectures and codecs for real-time 2017

DOIs:

10.2352/J.ImagingSci.Technol.2017.61.1.010403

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202002282426>

Source: Scopus

Source ID: 85016298177

Research output: Contribution to journal › Article › Scientific › peer-review

### **Are coarse-grained models apt to detect protein thermal stability? the case of OPEP force field**

We present the first investigation of the kinetic and thermodynamic stability of two homologous thermophilic and mesophilic proteins based on the coarse-grained model OPEP. The object of our investigation is a pair of G-domains of relatively large size, 200 amino acids each, with an experimental stability gap of about 40 K. The OPEP force field is able to maintain stable the fold of these relatively large proteins within the hundred-nanosecond time scale without including external constraints. This makes possible to characterize the conformational landscape of the folded protein as well as to explore the unfolding. In agreement with all-atom simulations used as a reference, we show that the conformational landscape of the thermophilic protein is characterized by a larger number of substates with slower dynamics on the network of states and more resilient to temperature increase. Moreover, we verify the stability gap between the two proteins using replica-exchange simulations and estimate a difference between the melting temperatures of about 23 K, in fair agreement with experiment. The detailed investigation of the unfolding thermodynamics allows to gain insight into the mechanism underlying the enhanced stability of the thermophile relating it to a smaller heat capacity of unfolding.

### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Multi-scaled biodata analysis and modelling (MultiBAM), Laboratoire de Biochimie Théorique, Institut Universitaire de France

Contributors: Kalimeri, M., Derreumaux, P., Sterpone, F.

Number of pages: 8

Pages: 494-501

Publication date: 1 Jan 2015

Peer-reviewed: Yes

### **Publication information**

Journal: Journal of Non-Crystalline Solids

Volume: 407

ISSN (Print): 0022-3093

Ratings:

Scopus rating (2015): CiteScore 3.6 SJR 0.663 SNIP 1.083

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Ceramics and Composites, Electronic, Optical and Magnetic Materials, Materials Chemistry

Keywords: Coarse-grained force field, Conformational substates network, Molecular dynamics, Protein thermodynamic stability, Thermophilic proteins

DOIs:

10.1016/j.jnoncrysol.2014.07.005

URLs:

<http://www.scopus.com/inward/record.url?scp=84922435805&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84922435805

Research output: Contribution to journal › Article › Scientific › peer-review

### **Aryl end-capped quaterthiophenes applied as anode interfacial layers in inverted organic solar cells**

Four aryl end-capped quaterthiophene derivatives were synthesized and their material properties were studied by computational, spectroscopic, electrochemical, and thermoanalytical methods. Compounds were applied as interfacial layers between the bulk heterojunction active layer and Ag anode in inverted organic solar cells. Results show that p-cyanophenyl end-capped quaterthiophene with hexyl side chains increases both the short circuit current density and power conversion efficiency notably compared to reference interlayer material, tris-(8-hydroxyquinoline)aluminum. The improved cell performance was attributed to the optimal positions of the highest occupied molecular orbital and the lowest unoccupied molecular orbital (LUMO) of this material, relative to those of the photoactive electron donor poly(3-hexylthiophene) and Ag anode, and evenly distributed LUMO. In addition, the use of these materials as an anode interfacial layer increases the absorption of the solar cell, which could contribute to the formation of excitons and additional current production by the cell.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Chemistry and Bioengineering, Research group: Supramolecular photochemistry, Frontier Photonics, University of Oulu, Department of Chemistry and Mathematics, Faculty of Petroleum and Mining Engineering, Suez University

Contributors: Heiskanen, J. P., Manninen, V. M., Pankov, D., Omar, W. A. E., Kastinen, T., Hukka, T. I., Lemmetyinen, H. J., Hormi, O. E. O.

Number of pages: 11

Pages: 196-206

Publication date: 1 Jan 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Thin Solid Films

Volume: 574

ISSN (Print): 0040-6090

Ratings:

Scopus rating (2015): CiteScore 3.5 SJR 0.68 SNIP 0.923

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Materials Chemistry, Metals and Alloys, Surfaces, Coatings and Films, Surfaces and Interfaces

Keywords: Anode interfacial layer, Bulk heterojunction, Computational research, Inverted organic solar cell, Oligothiophene, Spectroscopy, Suzuki-Miyaura

DOIs:

10.1016/j.tsf.2014.12.007

URLs:

<http://www.scopus.com/inward/record.url?scp=84921286591&partnerID=8YFLogxK> (Link to publication in Scopus)

#### **Bibliographical note**

EXT="Heiskanen, J. P."

Source: Scopus

Source ID: 84921286591

Research output: Contribution to journal > Article > Scientific > peer-review

### **A study of electric transport in n- and p-type modulation-doped GaInNAs/GaAs quantum well structures under a high electric field**

We present the results of longitudinal carrier transport under a high electrical field in n- and p-type modulation-doped Ga<sub>0.68</sub>In<sub>0.32</sub>N<sub>y</sub>As<sub>1-y</sub>/GaAs (y = 0.009, 0.017) quantum well (QW) structures. Nitrogen composition-dependent drift velocities of electrons are observed to be saturated at and at 77 K for the samples with y = 0.009 and y = 0.017, respectively, while the drift velocities of holes do not saturate but slightly increase at the applied electric field in the range of interest. The hole drift velocity is observed to be higher than the electron drift velocity. The electron mobility exhibits an almost temperature-independent characteristic. On the other hand, the hole mobility exhibits a conventional temperature dependence of modulation-doped QW structures. As the temperature increases, the drift velocity of the electrons exhibits an almost an temperature-insensitive characteristic, but, on the other hand, for holes, drift velocity decreases approximately from 10<sup>7</sup>-10<sup>6</sup> cm s<sup>-1</sup>. It is observed that the drift velocities of electrons and holes are N-dependent and suppressed at higher electric fields. Furthermore, experimental results show that there is no evidence of negative differential velocity (NDV) behaviour for both n- and p-type samples. To explore the observed electron and hole drift velocity characteristic at high electric fields, we use a simple theoretical model for carrier transport, which takes into account the effect of non-drifting hot phonons. The mobility mapping technique (comparison method) is used to extract hot hole temperature in order to employ it in the non-drifted phonon distribution and to obtain the drift velocity-electric field curves. Then hot electron temperatures are obtained from the drift velocity-electric field curves as a fit parameter using non-drifted hot phonon dynamics. The analytical model is well-matched to the experimental -E curves, indicating that carrier-hot phonon scattering is the main reason for suppressing the NDV mechanism in GaInNAs/GaAs QW structures

with a carrier density higher than  $10^{17} \text{ cm}^{-3}$ .

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: ORC, Istanbul University

Contributors: Sarcan, F., Mutlu, S., Cokduygular, E., Donmez, O., Erol, A., Puustinen, J., Guina, M.

Publication date: 4 May 2018

Peer-reviewed: Yes

#### Publication information

Journal: Semiconductor Science and Technology

Volume: 33

Issue number: 6

Article number: 064003

ISSN (Print): 0268-1242

Ratings:

Scopus rating (2018): CiteScore 4 SJR 0.744 SNIP 1.014

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering, Materials Chemistry

Keywords: dilute nitride, GaInNAs, hot phonons, hot-electron and hole temperature, modulation-doped GaInNAs/GaAs quantum well

DOIs:

10.1088/1361-6641/aabc39

Source: Scopus

Source ID: 85048073763

Research output: Contribution to journal › Article › Scientific › peer-review

#### Better understanding of the role of $\text{SiO}_2$ , $\text{P}_2\text{O}_5$ and $\text{Al}_2\text{O}_3$ on the spectroscopic properties of $\text{Yb}^{3+}$ doped silica sol-gel glasses

$\text{Yb}^{3+}$  doped silica sol-gel glass powders were prepared with different concentrations of  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$  and  $\text{P}_2\text{O}_5$  in order to understand the impact of the glass composition on the  $\text{Yb}^{3+}$  emission properties. In this paper, we clearly show that not only the Al/P ratio but also the  $\text{SiO}_2$  content have an impact on the  $\text{Yb}^{3+}$  spectroscopic properties. Our results provide new insight on the real impact of the composition on the spectroscopic properties of  $\text{Yb}^{3+}$  doped sol-gels: we demonstrate that an increase in the  $\text{Al}_2\text{O}_3$  content at the expense of  $\text{P}_2\text{O}_5$  leads to an increase in the intensity of the emission at 1000nm of the  $\text{Yb}^{3+}$  ions whereas an increase in the  $\text{SiO}_2$  content decreases it. We clearly showed that the inexpensive sol-gel approach can be easily used when investigating new  $\text{Yb}^{3+}$  doped silica glasses.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: Nanophotonics, Faculty of Biomedical Sciences and Engineering, Research group: Biomaterials and Tissue Engineering Group, Research group: Photonics Glasses, Institut de Chimie de la Matière Condensée de Bordeaux, Turun Yliopisto/Turun Biomateriaalikeskus

Contributors: Glorieux, B., Salminen, T., Massera, J., Lastusaari, M., Petit, L.

Pages: 46-51

Publication date: 2018

Peer-reviewed: Yes

Early online date: 2017

#### Publication information

Journal: Journal of Non-Crystalline Solids

Volume: 482

ISSN (Print): 0022-3093

Ratings:

Scopus rating (2018): CiteScore 4.3 SJR 0.689 SNIP 1.186

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Condensed Matter Physics, Materials Chemistry

Keywords: Silica glass, Sol-gel, Spectroscopic properties, Yb doping

DOIs:

10.1016/j.jnoncrysol.2017.12.021

Source: Scopus

Source ID: 85037629421

### Block copolymer lithography: Feature size control and extension by an over-etch technique

Block copolymer lithography based on block copolymer (BCP) self-assembly can be used to develop soft mask nanoscale templates for subsequent pattern transfer to generate substrate features. Self-assembly of lamellar polystyrene-b-polymethylmethacrylate BCP of varying molecular weights to generate silicon nanoscale features is reported here. It has also been demonstrated that the feature size can be controlled by a plasma over-etch process and discussed.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Materials Chemistry and Analysis Group, University College Cork, Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), Trinity College Dublin, Tyndall National Institute at National University of Ireland, Cork, Collinstown Industrial Estate

Contributors: Rasappa, S., Borah, D., Senthamaraiakannan, R., Faulkner, C. C., Shaw, M. T., Gleeson, P., Holmes, J. D., Morris, M. A.

Number of pages: 6

Pages: 318-323

Publication date: 1 Nov 2012

Peer-reviewed: Yes

#### Publication information

Journal: Thin Solid Films

Volume: 522

ISSN (Print): 0040-6090

Ratings:

Scopus rating (2012): CiteScore 3.3 SJR 0.897 SNIP 1.153

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Materials Chemistry, Metals and Alloys, Surfaces, Coatings and Films, Surfaces and Interfaces

Keywords: Block copolymer, Lithography, Over-etching, Plasma etching, Polystyrene-b-polymethylmethacrylate, Self-assembly, Silicon nanowires

DOIs:

10.1016/j.tsf.2012.09.017

URLs:

<http://www.scopus.com/inward/record.url?scp=84868593394&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84868593394

Research output: Contribution to journal > Article > Scientific > peer-review

### Boron delta-doping dependence on Si/SiGe resonant interband tunneling diodes grown by chemical vapor deposition

Si/SiGe resonant interband tunnel diodes (RITD) were fabricated using CVD on 200-mm silicon wafers. The RITD devices consist of a  $p^+ - i - n^+$  structure with  $\delta$ -doped quantum wells providing resonant interband tunneling through a nominally intrinsic Si/SiGe region. The vapor-phase doping technique was used to obtain abrupt degenerate doping profiles. The boron doping in the  $\delta$ -doped region was varied, and its effect on peak current density  $J_p$  and peak-to-valley current ratio (PVCR) was studied. As the flow rate is reduced,  $J_p$  was found to reduce while the PVCR initially increases and then decreases. Device simulations were performed using the ATLAS simulator developed by SILVACO to interpret the results. A maximum PVCR of 2.95 was obtained, and the highest  $J_p$  recorded was  $600 \text{ A/cm}^2$ . This is the highest reported PVCR for any CVD-grown Si/SiGe RITD.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Augmented Human Activities (AHA), Ohio State University, Department of Electrical and Computer Engineering, Imec

Contributors: Ramesh, A., Growden, T. A., Berger, P. R., Loo, R., Vandervorst, W., Douhard, B., Caymax, M.

Number of pages: 8

Pages: 602-609

Publication date: Mar 2012

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Electron Devices

Volume: 59

Issue number: 3  
ISSN (Print): 0018-9383  
Ratings:

Scopus rating (2012): CiteScore 4.6 SJR 1.317 SNIP 1.736

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Band-to-band tunneling, chemical vapor deposition (CVD), Delta doping, resonant interband tunnel diodes (RITD), resonant tunneling, Si, SiGe

DOIs:

10.1109/TED.2011.2180532

Source: Scopus

Source ID: 84857652658

Research output: Contribution to journal › Article › Scientific › peer-review

### **Bringing High-Performance GaInNAsSb/GaAs SOAs to True Data Applications**

We experimentally demonstrate the high-speed data processing capabilities of a GaInNAsSb semiconductor optical amplifier operating at 1.55  $\mu\text{m}$ . The investigated structure exhibits good thermal characteristics and fast gain dynamics with 10%-90% recovery time of 55 ps. Successful wavelength conversion of 10-Gb/s signals is reported. A maximum power penalty of <2.4 dB for return to zero formatting and of 1.9 dB for nonreturn to zero is demonstrated.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Research group: Nanophotonics, Frontier Photonics, Photonics Research Communications Laboratory, National Technological University of Athens

Contributors: Giannoulis, G., Korpjärvi, V., Iliadis, N., Mäkelä, J., Viheriälä, J., Apostolopoulos, D., Guina, M., Avramopoulos, H.

Number of pages: 4

Pages: 1691-1694

Publication date: 15 Aug 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Photonics Technology Letters

Volume: 27

Issue number: 16

Article number: 7113825

ISSN (Print): 1041-1135

Ratings:

Scopus rating (2015): CiteScore 5.2 SJR 1.19 SNIP 1.254

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials

Keywords: dilute nitrides, Photonic integration, semiconductor optical amplifier (SOA), wavelength conversion

DOIs:

10.1109/LPT.2015.2436697

URLs:

<http://www.scopus.com/inward/record.url?scp=84937146617&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84937146617

Research output: Contribution to journal › Article › Scientific › peer-review

### **Broadband finite-Difference Time-Domain modeling of plasmonic organic photovoltaics**

We develop accurate finite-difference time-domain (FDTD) modeling of polymer bulk heterojunction solar cells containing Ag nanoparticles between the hole-transporting layer and the transparent conducting oxide-coated glass substrate in the wavelength range of 300 nm to 800 nm. The Drude dispersion modeling technique is used to model the frequency dispersion behavior of Ag nanoparticles, the hole-transporting layer, and indium tin oxide. The perfectly matched layer boundary condition is used for the top and bottom regions of the computational domain, and the periodic boundary condition is used for the lateral regions of the same domain. The developed FDTD modeling is employed to investigate the effect of geometrical parameters of Ag nanospheres on electromagnetic fields in devices. Although negative plasmonic effects are observed in the considered device, absorption enhancement can be achieved when favorable geometrical parameters are obtained.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Augmented Human Activities (AHA), University Seoul, Ohio State University, Ajou University

Contributors: Jung, K. Y., Yoon, W. J., Park, Y. B., Berger, P. R., Teixeira, F. L.

Number of pages: 8

Pages: 654-661

Publication date: 2014

Peer-reviewed: Yes

### Publication information

Journal: ETRI Journal

Volume: 36

Issue number: 4

ISSN (Print): 1225-6463

Ratings:

Scopus rating (2014): CiteScore 2.5 SJR 0.442 SNIP 1.395

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science(all), Electronic, Optical and Magnetic Materials

Keywords: FDTD, Organic photovoltaics, Plasmonics

DOIs:

10.4218/14.0113.0767

Source: Scopus

Source ID: 84905972119

Research output: [Contribution to journal](#) > [Article](#) > [Scientific](#) > [peer-review](#)

### Bursty magnetic friction between polycrystalline thin films with domain walls

Two magnets in relative motion interact through their dipolar fields, making individual magnetic moments dynamically adapt to the changes in the energy landscape and bringing about collective magnetization dynamics. Some of the energy of the system is irrevocably lost through various coupling mechanisms between the spin degrees of freedom and those of the underlying lattice, resulting in magnetic friction. In this work, we use micromagnetic simulations to study magnetic friction in a system of two thin ferromagnetic films containing quenched disorder mimicking a polycrystalline structure. We observe bursts of magnetic activity resulting from repeated domain wall pinning due to the disorder and subsequent depinning triggered by the dipolar interaction between the moving films. These domain wall jumps result in strong energy dissipation peaks. We study how the properties of the polycrystalline structure such as grain size and strength of the disorder, along with the driving velocity and the width of the films, affect the magnetization dynamics, average energy dissipation, and the statistical properties of the energy dissipation bursts.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Aalto University

Contributors: Rissanen, I., Laurson, L.

Number of pages: 9

Publication date: 4 Oct 2019

Peer-reviewed: Yes

### Publication information

Journal: Physical Review B

Volume: 100

Issue number: 14

Article number: 144408

ISSN (Print): 2469-9950

Ratings:

Scopus rating (2019): SJR 1.811 SNIP 1.025

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.100.144408

Source: Scopus

Source ID: 85073384530

Research output: [Contribution to journal](#) > [Article](#) > [Scientific](#) > [peer-review](#)

### Calculated electronic density of states and structural properties of tetrahedral amorphous carbon

A series of tetrahedral amorphous carbon structures with different microscopic mass densities was generated by calculations based on the density functional theory with a local density approximation and using a method of melting-cooling cycles. A detailed investigation of the properties of the simulated structures has been carried out. Particularly, the short-range order, nearest neighbour distances, fractions of  $sp^1$ ,  $sp^2$  and  $sp^3$  sites, average C-C-C bond angles and electronic density of states have been analyzed. The simulated structures and calculated properties are in good agreement with those obtained by others and with the experimental data. An unexpected observation is the presence of planar structures, which are typical for graphite, in the sample with low density. In addition, the nearest neighbour distance in the sample with mass density  $3.54 \text{ g/cm}^3$  is different from those reported previously. Possibilities to compare the density of states obtained from the simulations with the experimental results from scanning tunnelling spectroscopy and X-ray near edge spectrum are discussed.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: University of Oulu, Department of Physical Sciences  
Contributors: Koivusaari, K. J., Rantala, T. T., Leppävuori, S.  
Number of pages: 5  
Pages: 736-740  
Publication date: Apr 2000  
Peer-reviewed: Yes

#### Publication information

Journal: Diamond and Related Materials  
Volume: 9  
Issue number: 3  
ISSN (Print): 0925-9635  
Ratings:  
Scopus rating (2000): SJR 1.393 SNIP 0.943  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Materials Chemistry, Surfaces, Coatings and Films, Surfaces and Interfaces  
DOIs:  
10.1016/S0925-9635(99)00286-1  
Source: Scopus  
Source ID: 0033748066  
Research output: Contribution to journal > Article > Scientific > peer-review

### Calculation of the scalar diffraction field from curved surfaces by decomposing the three-dimensional field into a sum of Gaussian beams

We present a local Gaussian beam decomposition method for calculating the scalar diffraction field due to a two-dimensional field specified on a curved surface. We write the three-dimensional field as a sum of Gaussian beams that propagate toward different directions and whose waist positions are taken at discrete points on the curved surface. The discrete positions of the beam waists are obtained by sampling the curved surface such that transversal components of the positions form a regular grid. The modulated Gaussian window functions corresponding to Gaussian beams are placed on the transversal planes that pass through the discrete beam-waist position. The coefficients of the Gaussian beams are found by solving the linear system of equations where the columns of the system matrix represent the field patterns that the Gaussian beams produce on the given curved surface. As a result of using local beams in the expansion, we end up with sparse system matrices. The sparsity of the system matrices provides important advantages in terms of computational complexity and memory allocation while solving the system of linear equations.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Signal Processing Research Community (SPRC), Bilkent University  
Contributors: Şahin, E., Onural, L.  
Number of pages: 10  
Pages: 527-536  
Publication date: 2013  
Peer-reviewed: Yes

#### Publication information

Journal: Journal of the Optical Society of America A: Optics Image Science and Vision

Volume: 30  
Issue number: 3  
ISSN (Print): 1084-7529  
Ratings:

Scopus rating (2013): CiteScore 3.3 SJR 1.046 SNIP 1.331

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Computer Vision and Pattern Recognition

URLs:

<http://www.scopus.com/inward/record.url?scp=84875512966&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84875512966

Research output: Contribution to journal › Article › Scientific › peer-review

### Capability assessment of inkjet printing for reliable RFID applications

In this paper, inkjet-printed silver traces and interconnections produced with the print-on-slope technique were used in an radio-frequency identification (RFID) structure operating in the ultra-high-frequency range. Underfill material was used to attach silicon RFID chips onto flexible, 125- $\mu\text{m}$ -thick polymer substrates. The cured underfill was also used as a sloped surface for printing interconnection traces from the chip to the plastic substrates radiators. Inkjet printing was performed in one phase, producing both the interconnections to the chip and the radiators. This enables the use of a single-phase continuous roll-to-roll compatible process instead of the commonly used twophase stop-and-go process. To further investigate the behavior of the printed low-temperature nanoparticle ink and its compatibility with different substrate materials, basic conductive traces were printed onto the substrates. Thereafter, the structures were exposed to thermal/humidity tests at 85 ° C temperature/85% relative humidity (85/85%h) for up to a 2000-h period. To gain an understanding of the response of the structures under stress, the samples were intermittently characterized by using a read range measurement device, followed by the removal of failed samples from the test. The samples were characterized also by optical imaging and field-emission scanning electron microscopy. The bulk conductive traces were characterized electrically by measuring their resistances during test breaks. The results point out that although some challenges are still to overcome, inkjet printing is a feasible way of producing conductive traces for RFID structures, and that the print-on-slope technique is utilizable also in practical applications as a cost-effective method with adequate reliability for producing interconnections between chip and substrate.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Univ of Oulu, Meyer Burger B.V., Microelectronics Research, School of Management (JKK)

Contributors: Putaala, J., Niittynen, J., Hannu, J., Myllymäki, S., Kunnari, E., Mäntysalo, M., Hagberg, J., Jantunen, H.

Number of pages: 10

Pages: 281-290

Publication date: 1 Jun 2017

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Device and Materials Reliability

Volume: 17

Issue number: 2

ISSN (Print): 1530-4388

Ratings:

Scopus rating (2017): CiteScore 3.7 SJR 0.44 SNIP 1.093

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Safety, Risk, Reliability and Quality, Electrical and Electronic Engineering

Keywords: 85/85 test, Direct chip attachment, Inkjet, interconnections, Reliability

Electronic versions:

FINAL VERSION

DOIs:

10.1109/TDMR.2016.2636342

URLs:

<http://urn.fi/URN:NBN:fi:tty-201712202438>

### Bibliographical note

EXT="Niittynen, Juha"

EXT="Myllymäki, Sami"

EXT="Kunnari, Esa"

Source: Scopus

Source ID: 85025617207

Research output: Contribution to journal › Article › Scientific › peer-review

### **Cascaded crystalline raman lasers for extended wavelength coverage: Continuous-wave, third-stokes operation**

The development of high-power laser sources with narrow emission, tunable within the water transmission window around 1.7  $\mu\text{m}$ , is of interest for applications as diverse as medical imaging and atmospheric sensing. Where suitable laser gain media are not available, operation in this spectral region is often achieved via nonlinear frequency conversion, and optical parametric oscillators (OPOs) are a common solution. A practical alternative to OPOs, to avoid birefringent-or quasi-phase-matching requirements, is the use of stimulated Raman scattering within a suitable material to convert a pump source to longer wavelengths via one or more Stokes shifts; however, as this is a  $\chi^3$  nonlinear process, such frequency conversion is usually the preserve of high-energy pulsed lasers. Semiconductor disk lasers (SDLs), on the other hand, have very high-finesse external resonators, suitable for efficient intracavity nonlinear conversion even in continuous-wave (CW) operation. Here we report, to the best of our knowledge, the first continuous-wave third-Stokes crystalline Raman laser and the longest emission wavelength from an SDL-pumped Raman laser, achieving high power, CW output, and broad wavelength tuning around 1.73  $\mu\text{m}$ . The KGd WO<sub>4</sub> (KGW) Raman laser, which was intracavity-pumped by a 1.18  $\mu\text{m}$  InGaAs-based SDL, demonstrated cascaded CW Stokes oscillation at 1.32  $\mu\text{m}$ , 1.50  $\mu\text{m}$ , and 1.73  $\mu\text{m}$  with watt-level output achievable at each wavelength. The 1.73  $\mu\text{m}$  Stokes emission was diffraction limited ( $M^2 < 1.01$ ) and narrow linewidth (<46 pm FWHM; measurement limited). By rotation of a birefringent filter placed within the fundamental resonator, we attained three tunable emission wavelength bands, one centred at each Stokes component, and achieved up to 65 nm tuning for the third-Stokes Raman laser from 1696 nm to 1761 nm. We have thus demonstrated a platform laser technology that takes well-developed InGaAs-based SDLs and provides spectral coverage and high performance in the near-infrared water transmission windows using commercially available components.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, University of Strathclyde

Contributors: Casula, R., Penttinen, J., Guina, M., Kemp, A. J., Hastie, J. E.

Number of pages: 8

Pages: 1406-1413

Publication date: 20 Nov 2018

Peer-reviewed: Yes

#### **Publication information**

Journal: Optica

Volume: 5

Issue number: 11

ISSN (Print): 2334-2536

Ratings:

Scopus rating (2018): CiteScore 15.6 SJR 4.914 SNIP 3.162

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

DOIs:

10.1364/OPTICA.5.001406

Source: Scopus

Source ID: 85059018872

Research output: Contribution to journal › Article › Scientific › peer-review

### **Catalytic Activity of AuCu Clusters on MgO(100): Effect of Alloy Composition for CO Oxidation**

Density functional simulations have been performed for Au<sub>7</sub>Cu<sub>23</sub> and Au<sub>23</sub>Cu<sub>7</sub> clusters on MgO(100) supports to probe their catalytic activity for CO oxidation. The adsorption of reactants, O<sub>2</sub> and CO, and potential O<sub>2</sub> dissociation have been investigated in detail by tuning the location of vacancies (F-center, V-center) in MgO(100). The total charge on Au<sub>7</sub>Cu<sub>23</sub> and Au<sub>23</sub>Cu<sub>7</sub> is negative on all supports, regardless of the presence of vacancies, but the effect is significantly amplified on the F-center. Au<sub>7</sub>Cu<sub>23</sub>/MgO(100) and Au<sub>23</sub>Cu<sub>7</sub>/MgO(100) with an F-center are the only systems to bind O<sub>2</sub> more strongly than CO. In each case, O<sub>2</sub> can be effectively activated upon adsorption and dissociated to 2 × O atoms. The different reaction paths based on the Langmuir-Hinshelwood (LH) and Eley-Rideal (ER) mechanisms for CO oxidation have been explored on the Au<sub>7</sub>Cu<sub>23</sub> and Au<sub>23</sub>Cu<sub>7</sub> clusters on F-centers, and the results are compared with the previous findings for Au<sub>15</sub>Cu<sub>15</sub>. Overall, the reaction barriers are small, but the changes in the Au:Cu ratio tune the reactant adsorption energies and sites considerably, showing also varying selectivity for CO and O<sub>2</sub>. The microkinetic model built on the basis of the above results shows a pronounced CO<sub>2</sub> production rate at low temperature for the clusters on F-centers.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Physics, Research group: Materials and Molecular Modeling, COMP Centre of Excellence, Department of Applied Physics, Aalto University, Aalto University, Norwegian Univ. of Sci. and Technol.  
Contributors: Ma, L., Laasonen, K., Akola, J.  
Number of pages: 11  
Pages: 10876-10886  
Publication date: 25 May 2017  
Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 121

Issue number: 20

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2017): CiteScore 7.9 SJR 2.135 SNIP 1.133

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Energy(all), Surfaces, Coatings and Films, Physical and Theoretical Chemistry

Electronic versions:

Catalytic Activity of AuCu Clusters on MgO(100) Effect of Alloy Composition for CO Oxidation. Embargo ended: 17/02/18  
DOIs:

10.1021/acs.jpcc.6b12054

URLs:

<http://urn.fi/URN:NBN:fi:tty-201905021452>. Embargo ended: 17/02/18

Source: Scopus

Source ID: 85020757142

Research output: Contribution to journal > Article > Scientific > peer-review

#### Cavity formation in split ring resonators

We report that it is possible to obtain a cavity structure by the deformation of a unit cell of an split ring resonator (SRR) structure. We presented the Q-factor of the cavity resonance as 192 for an SRR-based single cavity. Subsequently, we brought two and three cavities together with an intercavity distance of two metamaterial unit cells and investigated the transmission spectrum of SRR-based interacting 2-cavity and 3-cavity systems. The splitting of eigenmodes due to the interaction between the localized electromagnetic cavity modes was observed. Eventually, in taking full advantage of the effective medium theory, we modeled SRR-based cavities as 1D Fabry-Perot reflectors (FPRs) with a subwavelength cavity at the center. Finally, we observed that at the cavity resonance, the effective group velocity was reduced by a factor of 67 for an SRR-based single cavity compared to the electromagnetic waves propagating in free space.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Nanotechnology Research Center, Harvard University

Contributors: Caglayan, H., Bulu, I., Loncar, M., Ozbay, E.

Number of pages: 5

Pages: 200-204

Publication date: Dec 2008

Peer-reviewed: Yes

#### Publication information

Journal: Photonics and Nanostructures - Fundamentals and Applications

Volume: 6

Issue number: 3-4

ISSN (Print): 1569-4410

Ratings:

Scopus rating (2008): SJR 1.212 SNIP 1.169

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Hardware and Architecture, Condensed Matter Physics, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials

Keywords: Cavity, Metamaterials, Split ring resonator

DOIs:

10.1016/j.photonics.2008.09.001

URLs:

<http://www.scopus.com/inward/record.url?scp=56049112536&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Caglayan, Humeyra"

Source: Scopus

Source ID: 56049112536

Research output: Contribution to journal › Article › Scientific › peer-review

#### Chip-by-chip configurable interconnection using digital printing techniques

Printed electronics technologies add new fabrication concepts to the classical set of microelectronic processes. Among these, the use of digital printing techniques such as inkjet permits the deposition of materials on top of preexisting substrates without any mask. This allows individual personalization of electronic circuits. Different proposals have been made to make use of such a property: (1) wiring new metallic layers on top of circuits to build programmable logic array-like circuits, (2) programming OTP ROM like memories, and (3) building inkjet-configurable gate arrays. The capability of building an individual circuit with technological steps simpler than photolithographic ones opens a concept similar to the successful field programmable gate array. Although nowadays the process resolution is still low, it can quickly evolve to higher wiring densities and therefore permit a greater level of transistor integration. In this paper, we propose a new structure to realize the connections only by deposition of conductive dots oriented to optimize the area needed to implement the drop-on-demand (DoD) wiring at circuit level. One important feature of this structure is that it minimizes the amount of printed material required for the connection thereby reducing failures often seen with DoD printing techniques for conductive lines. These structures have been validated by two different DoD technologies: inkjet and superfine jet, and have been compared to mask-based photolithography technology with promising results.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Universitat Autònoma de Barcelona, Centre for Process Innovation (CPI), A UK Based OSC Materials Company, IMB-CNM (CSIC)

Contributors: Mashayekhi, M., Winchester, L., Laurila, M., Mäntysalo, M., Ogier, S., Terés, L., Carrabina, J.

Publication date: 6 Mar 2017

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Micromechanics and Microengineering

Volume: 27

Issue number: 4

Article number: 045009

ISSN (Print): 0960-1317

Ratings:

Scopus rating (2017): CiteScore 3.7 SJR 0.554 SNIP 1.015

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials, Mechanical Engineering, Electrical and Electronic Engineering

Keywords: digital circuits, digital printing, drop-on-demand, inkjet, inkjet configurable gate array, interconnection, printed electronics

Electronic versions:

Manuscript-20170127

DOIs:

10.1088/1361-6439/aa5ef3

URLs:

<http://urn.fi/URN:NBN:fi:tty-201712202440>

Source: Scopus

Source ID: 85016467042

Research output: Contribution to journal › Article › Scientific › peer-review

#### Cold test results of the LARP HQ Nb<sub>3</sub>Sn quadrupole magnet at 1.9 K

The high gradient quadrupole magnet is a 120-mm-aperture, 1-m-long Nb<sub>3</sub>Sn quadrupole developed by the LHC Accelerator Research Program collaboration in support of the High-Luminosity LHC project. Several tests were performed at Lawrence Berkeley National Laboratory in 2010-2011 achieving a maximum gradient of 170 T/m at 4.4 K. As a next step in the program, the latest model (HQ01e) was sent to CERN for testing at 1.9 K. As part of this test campaign, the magnet training has been done up to a maximum current of 16.2 kA corresponding to 85% of the short sample limit. The ramp rate dependence of the quench current is also identified. The efficiency of the quench heaters is then studied at 4.2 K and at 1.9 K. The analyses of the magnet resistance evolution during fast current discharge showed evidence of quench whereas high energy quenches have been successfully achieved and sustained with no dump resistor.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Research area: Electromagnetics, European Organization for Nuclear Research, Fermi National Accelerator Laboratory, Brookhaven National Laboratory, Lawrence Berkeley National Laboratory

Contributors: Bajas, H., Ambrosio, G., Anerella, M., Bajko, M., Bossert, R., Caspi, S., Chiuchiolo, A., Chlachidze, G., Dietderich, D., Dunkel, O., Felice, H., Ferracin, P., Feuvrier, J., Fiscarelli, L., Ghosh, A., Giloux, C., Godeke, A., Hafalia, A. R., Marchevsky, M., Russenschuck, S., Sabbi, G. L., Salmi, T., Schmalzle, J., Todesco, E., Wanderer, P., Wang, X., Yu, M.

Publication date: 2013

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 23

Issue number: 3

Article number: 4002606

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2013): CiteScore 2.1 SJR 0.443 SNIP 1.148

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: High gradient quadrupole (HQ), LHC Accelerator Research Program (LARP), magnet protection, NbSnquadrupole

DOIs:

10.1109/TASC.2013.2245281

Source: Scopus

Source ID: 84878130018

Research output: Contribution to journal > Article > Scientific > peer-review

### Combination of E-jet and inkjet printing for additive fabrication of multilayer high-density RDL of silicon interposer

The additive nature and high resolution of electrohydrodynamic inkjet (E-jet) printing can be utilized for manufacturing micrometer scale conductive tracks such as those required in the high-density redistribution layers (RDLs) of silicon interposers used in electronics packaging for 3-D integration. Compared to the current lithographic fabrication method, this approach promises to increase the customizability of the process and reduce the amount of waste materials, thereby lowering the costs and the environmental impact of the manufacturing process. In this paper, multilayer interdigitated capacitor and meander resistor structures with 5/5  $\mu\text{m}$  conductor width/spacing are used to demonstrate the feasibility of E-jet printing of high-density multilayer RDLs. A sheet resistance of 28.5  $\Omega/\text{square}$  was achieved for the first metallization layer (MET1) conductors and 313.2  $\Omega/\text{square}$  for the MET2 conductors. The thickness of the conductors was 6.9  $\mu\text{m}$  for MET1 and 5.4  $\mu\text{m}$  for MET2.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Research group: Wireless Communications and Positioning

Contributors: Laurila, M., Khorramdel, B., Mäntysalo, M.

Number of pages: 8

Pages: 1217-1224

Publication date: 1 Mar 2017

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Electron Devices

Volume: 64

Issue number: 3

ISSN (Print): 0018-9383

Ratings:

Scopus rating (2017): CiteScore 4.7 SJR 0.839 SNIP 1.485

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: 3-D integration, additive manufacturing, electrohydrodynamic inkjet (E-jet) printing, electronics packaging, high-density printing, printed electronics, silicon interposer

Electronic versions:

Combination of E-jet and inkjet printing for additive fabrication of multilayer RDL

DOIs:

10.1109/TED.2016.2644728

URLs:

<http://urn.fi/URN:NBN:fi:tty-201708021645>

Source: Scopus

Source ID: 85009833867

Research output: Contribution to journal > Article > Scientific > peer-review

### **Comparative Analysis of Injection Microdisk Lasers Based on InGaAsN Quantum Wells and InAs/InGaAs Quantum Dots**

**Abstract:** The results of comparative analysis of the spectral and threshold characteristics of room-temperature injection microdisk lasers of the spectral range  $1.2 \times \mu\text{m}$  with different active regions, notably, InGaAsN/GaAs quantum wells or InAs/InGaAs/GaAs quantum dots are presented. It is found that microlasers of a comparable size with quantum wells possess a larger laser generation threshold when compared with microlasers with quantum dots. At the same time, the latter are characterized by a noticeably smaller fraction of emitted power corresponding to laser modes. The jump to lasing via an excited-state optical transition is also characteristic for them. Microdisk lasers based on InGaAsN alloy do not have these disadvantages.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Russian Academy of Science, St. Petersburg State Polytechnical University, Ioffe Physico-Technical Institute

Contributors: Moiseev, E. I., Maximov, M. V., Kryzhanovskaya, N. V., Simchuk, O. I., Kulagina, M. M., Kadinskaya, S. A., Guina, M., Zhukov, A. E.

Number of pages: 5

Pages: 263-267

Publication date: 1 Feb 2020

Peer-reviewed: Yes

#### **Publication information**

Journal: Semiconductors

Volume: 54

Issue number: 2

ISSN (Print): 1063-7826

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Condensed Matter Physics

Keywords: microlaser, nitrogen-containing semiconductors, quantum dots, quantum wells

DOIs:

10.1134/S1063782620020177

Source: Scopus

Source ID: 85081636724

Research output: Contribution to journal > Article > Scientific > peer-review

### **Comparison of the optical, thermal and structural properties of Ge-Sb-S thin films deposited using thermal evaporation and pulsed laser deposition techniques**

Thin films of  $\text{Ge}_{23}\text{Sb}_{70}\text{S}_{70}$  glass were prepared by thermal evaporation (TE) and pulsed laser deposition (PLD) techniques. We measured their thermal, optical and structural properties and compared with those of the parent bulk. The probe penetration temperature ( $T_p$ ) of the bulk glass, measured using a micro-thermal analyzer, was found to be  $412 \pm 10$  °C, while those of the TE and PLD films were  $468$  and  $470 \pm 10$  °C, respectively. The refractive index of the bulk and thin films was measured by ellipsometry and ultraviolet-visible-near infrared transmission spectroscopy, and we show that the films have similar refractive indices, which are lower than those of the parent bulk glass. Using micro-Raman spectroscopy, the structure of the film was investigated. The films contain homopolar Ge-Ge bonds and a lower number of homopolar S-S bonds compared to bulk material, which leads to an increase in the proportion of corner shared  $\text{GeS}_{4/2}$  units in the films as compared to the bulk glass. Comparison of structural entities associated with each deposition process showed that the TE film possesses a lower number of S-S bonds and a slightly higher number of  $\text{SbS}_{3/2}$  units compared to the PLD film. These structural changes lead to a more interconnected glass network, and therefore to a higher viscosity at elevated temperatures, as well as a higher refractive index, presumably through increased density. Post-deposition of annealing of these films causes their thermal and optical properties to revert to a more bulk-like state, suggesting that these property differences are due to a difference in the thermal histories of the bulk and film glass networks. For the first time to our knowledge, the refractive index of the bulk glass in the  $0.6$ - $10.6$   $\mu\text{m}$  range, measured using the prism coupling technique, is also presented.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Frontier Photonics, Clemson University, Massachusetts Institute of Technology, School of Materials Science and Engineering/COMSET  
Contributors: Musgraves, J. D., Carlie, N., Hu, J., Petit, L., Agarwal, A., Kimerling, L. C., Richardson, K. A.  
Number of pages: 8  
Pages: 5032-5039  
Publication date: Jul 2011  
Peer-reviewed: Yes

### Publication information

Journal: Acta Materialia  
Volume: 59  
Issue number: 12  
ISSN (Print): 1359-6454  
Ratings:  
Scopus rating (2011): CiteScore 6.5 SJR 3.215 SNIP 2.757  
Original language: English  
ASJC Scopus subject areas: Ceramics and Composites, Metals and Alloys, Polymers and Plastics, Electronic, Optical and Magnetic Materials  
Keywords: Chalcogenide glass, Micro-thermal analysis, Pulsed laser deposition, Thermal evaporation, Thin films  
DOIs:  
10.1016/j.actamat.2011.04.060  
URLs:  
<http://www.scopus.com/inward/record.url?scp=79958132088&partnerID=8YFLogxK> (Link to publication in Scopus)  
Source: Scopus  
Source ID: 79958132088  
Research output: Contribution to journal › Article › Scientific › peer-review

### Comparison of three light doses in the photodynamic treatment of actinic keratosis using mathematical modeling

Photodynamic therapy (PDT) is an emerging treatment modality for various diseases, especially for cancer therapy. Although high efficacy is demonstrated for PDT using standardized protocols in nonhyperkeratotic actinic keratoses, alternative light doses expected to increase efficiency, to reduce adverse effects or to expand the use of PDT, are still being evaluated and refined. We propose a comparison of the three most common light doses in the treatment of actinic keratosis with 5-aminolevulinic acid PDT through mathematical modeling. The proposed model is based on an iterative procedure that involves determination of the local fluence rate, updating of the local optical properties, and estimation of the local damage induced by the therapy. This model was applied on a simplified skin sample model including an actinic keratosis lesion, with three different light doses (red light dose, 37 J/cm<sup>2</sup>, 75 mW/cm<sup>2</sup>, 500 s; blue light dose, 10 J/cm<sup>2</sup>, 10 mW/cm<sup>2</sup>, 1000 s; and daylight dose, 9000 s). Results analysis shows that the three studied light doses, although all efficient, lead to variable local damage. Defining reference damage enables the nonoptimal parameters for the current light doses to be refined and the treatment to be more suitable.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Frontier Photonics, Univ Paris 06, Centre National de la Recherche Scientifique (CNRS), Pierre & Marie Curie University - Paris 6, Institut de Recherche pour le Développement (IRD), Inria, Institut National de la Santé et de la Recherche Médicale (Inserm), Univ Sorbonne, CNRS, ICM, UMR S 1127, UMR 7225, U1127, INSERM, Inria Paris Rocquencourt, Inst Cerveau & Mo, Univ Lille Nord de France, Lille University Hospital - CHRU  
Contributors: Vignion-Dewalle, A. S., Betrouni, N., Tylcz, J. B., Vermandel, M., Mortier, L., Mordon, S.  
Publication date: 1 May 2015  
Peer-reviewed: Yes

### Publication information

Journal: JOURNAL OF BIOMEDICAL OPTICS  
Volume: 20  
Issue number: 5  
Article number: 058001  
ISSN (Print): 1083-3668  
Ratings:  
Scopus rating (2015): CiteScore 5.3 SJR 1.173 SNIP 1.276  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Biomaterials, Biomedical Engineering

Keywords: light doses comparison, mathematical modeling, photodynamic therapy, protoporphyrin IX

DOIs:

10.1117/1.JBO.20.5.058001

URLs:

<http://www.scopus.com/inward/record.url?scp=84930001957&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84930001957

Research output: Contribution to journal › Article › Scientific › peer-review

### **Compatibilization of natural rubber/nitrile rubber blends by sol–gel nano-silica generated by in situ method**

**Abstract:** Controlled growth of in situ silica, into natural rubber (NR)/nitrile rubber (NBR) blend (40/60 composition by weight) following solution sol–gel method, results in a coherent blend morphology with enhanced composite properties. Similar composites, i.e., in situ silica-filled NR/NBR blend (40/60 by weight), showed better mechanical properties than any other composition that were prepared by soaking sol–gel method in earlier study. However, silica content in the rubber blend was limited to 20 phr (parts per hundred parts of rubber) and could not be increased under experimental condition following soaking sol–gel method. In the present work, silica content is increased (up to 30 phr) beyond that limit for the same blend composition. Accordingly, mechanical properties of the NR/NBR composites are improved. Use of a silane coupling agent, viz., bis-(3-triethoxysilylpropyl)-tetra sulfide, in the reactive sol–gel system during in situ silica generation brings in remarkable effect in silica distribution, rubber–filler interaction and mechanical properties of the composites. TEM micrographs of the selected composites reveal that silica is mostly grown at the interfacial region, when silane is used in particular. This results in further enhancement in mechanical properties and compatibility of the blend at the same silica content as evident from stress–strain and dynamic mechanical analysis studies. The reinforcement of effect in situ silica is assessed by Guth–Gold equation and modified form of Guth equation (with shape factor  $f = 2.53$ ). The results are supported by the detailed studies on rheological, morphological, mechanical and viscoelastic properties of the composites. Graphical Abstract: [Figure not available: see fulltext.]

### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Materials Science, Visvesvaraya National Institute of Technology, Indian Rubber Manufacturers Research Association, Department of Elastomers, Leibniz-Institut für Polymerforschung Dresden E.V., University of Kalyani

Contributors: Bansod, N. D., Kapgate, B. P., Das, C., Das, A., Basu, D., Debnath, S. C.

Number of pages: 12

Pages: 548–559

Publication date: 2016

Peer-reviewed: Yes

### **Publication information**

Journal: JOURNAL OF SOL-GEL SCIENCE AND TECHNOLOGY

Volume: 80

Issue number: 2

ISSN (Print): 0928-0707

Ratings:

Scopus rating (2016): CiteScore 2.6 SJR 0.48 SNIP 0.678

Original language: English

ASJC Scopus subject areas: Chemistry(all), Condensed Matter Physics, Biomaterials, Ceramics and Composites, Electronic, Optical and Magnetic Materials, Materials Chemistry

Keywords: In situ silica, Reinforcement, Rubber blend, Rubber–filler interaction, Silane treatment, Sol–gel method

DOIs:

10.1007/s10971-016-4114-0

Source: Scopus

Source ID: 84974817789

Research output: Contribution to journal › Article › Scientific › peer-review

### **Composition dependent growth dynamics in molecular beam epitaxy of GaInNAs solar cells**

We have investigated the role of the nitrogen content, the growth parameters, and the annealing processes involved in molecular beam epitaxy of GaInNAs solar cells lattice-matched to GaAs. The nitrogen composition was varied between 1% and 5%. The influence of the growth temperature was assessed by performing photoluminescence, atomic force microscopy, X-ray diffraction, reflection high-energy electron diffraction, quantum efficiency and light-biased current-voltage measurements. The growth temperature ensuring the best cell parameters was found to be 440 C. At this temperature we were able to incorporate up to 4% of nitrogen and achieve a good material quality. Further increase of the N composition to 5% led to phase separation. For the lattice matched samples grown within the optimal temperature range, we have identified a clear (1×3) surface reconstruction. Using the optimized growth we have demonstrated a GaInNAs p-i-n solar cell structure containing 4% nitrogen, that exhibited a short-circuit current density as high as 33.8

$\text{mW/cm}^2$  in respect to effective area illuminated. These measurements have been performed under real sun AM1.5 ( $\sim 1000 \text{ W/m}^2$ ) illumination. © 2014 Elsevier B.V.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Frontier Photonics, Department of Physics and Astronomy, University of Turku, Turun Yliopisto/Turun Biomateriaalikeskus

Contributors: Aho, A., Polojärvi, V., Korpijärvi, V. M., Salmi, J., Tukiainen, A., Laukkanen, P., Guina, M.

Number of pages: 9

Pages: 150-158

Publication date: May 2014

Peer-reviewed: Yes

### Publication information

Journal: Solar Energy Materials and Solar Cells

Volume: 124

ISSN (Print): 0927-0248

Ratings:

Scopus rating (2014): CiteScore 10.1 SJR 2.19 SNIP 2.368

Original language: English

ASJC Scopus subject areas: Renewable Energy, Sustainability and the Environment, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films

Keywords: Concentrated photovoltaics, Dilute nitrides, GaInNAs, Multi-junction solar cells, Plasma-assisted molecular beam epitaxy

DOIs:

10.1016/j.solmat.2014.01.044

URLs:

<http://www.scopus.com/inward/record.url?scp=84894584078&partnerID=8YFLogxK> (Link to publication in Scopus)

### Bibliographical note

Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-04-29<br/>Publisher name: Elsevier

Source: researchoutputwizard

Source ID: 58

Research output: Contribution to journal > Article > Scientific > peer-review

### Computational super-resolution phase retrieval from multiple phase-coded diffraction patterns: Simulation study and experiments

In this paper, we consider computational super-resolution inverse diffraction phase retrieval. The optical setup is lensless, with a spatial light modulator for aperture phase coding. The paper is focused on experimental tests of the super-resolution sparse phase amplitude retrieval algorithm. We start from simulations and proceed to physical experiments. Both simulation tests and experiments demonstrate good-quality imaging for super-resolution with a factor of 4 and a serious advantage over diffraction-limited resolution as defined by Abbe's criterion.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Signal Processing, Research group: Computational Imaging-CI, Department of Photonics and Optical Information Technology, ITMO University

Contributors: Katkovnik, V., Shevkunov, I., Petrov, N. V., Egiazarian, K.

Number of pages: 9

Pages: 786-794

Publication date: 20 Jul 2017

Peer-reviewed: Yes

### Publication information

Journal: Optica

Volume: 4

Issue number: 7

ISSN (Print): 2334-2536

Ratings:

Scopus rating (2017): CiteScore 11.9 SJR 4.602 SNIP 2.811

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Keywords: Discrete optical signal processing, Image processing, Noise in imaging systems, Phase retrieval, Superresolution

DOIs:

10.1364/OPTICA.4.000786

Source: Scopus

Source ID: 85025162894

Research output: [Contribution to journal](#) > [Article](#) > [Scientific](#) > [peer-review](#)

### **Computation of torque of an electrical machine with different types of finite element mesh in the air gap**

In the numerical analysis of electrical machines, accurate computation of the electromagnetic torque is desired. Maxwell stress tensor method and Coulomb's method are the most commonly used methods for computing torque numerically. However, several other methods have also been developed and are being used. These methods are observed to have several accuracy issues related to the finite element discretization used in the air gap of the machine. In this paper, the effect of various finite element meshes in the air gap of the machine and the effect of the shape of the elements used to compute the torque are studied and discussed. This paper carefully compares the torques obtained from a direct method and a method based on the power balance of the machine.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Smart Energy Systems (SES), Aalto University

Contributors: Silwal, B., Rasilo, P., Perkkio, L., Oksman, M., Hannukainen, A., Eirola, T., Arkkio, A.

Publication date: 1 Dec 2014

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Magnetics

Volume: 50

Issue number: 12

Article number: 8105909

ISSN (Print): 0018-9464

Ratings:

Scopus rating (2014): CiteScore 2.7 SJR 0.696 SNIP 1.45

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Electromagnetic torque, energy balance, finite element method, induction machine, mesh

DOIs:

10.1109/TMAG.2014.2333491

Source: Scopus

Source ID: 84919467497

Research output: [Contribution to journal](#) > [Article](#) > [Scientific](#) > [peer-review](#)

### **Considerations on a Cost Model for High-Field Dipole Arc Magnets for FCC**

In the frame of the European circular collider, a conceptual design study for a post-Large Hadron Collider research infrastructure based on an energy-frontier 100 TeV circular hadron collider, a cost model for the dipole arc magnets is being developed. This paper presents an analysis of the different cost drivers for these magnets, in particular for what concerns magnet aperture, the nature and extent of grading, margin and operating temperature.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Power engineering, Research group: Modelling and superconductivity, European Organization for Nuclear Research, IRFM, CIEMAT, Università degli Studi di Milano, Istituto Nazionale Di Fisica Nucleare, Frascati

Contributors: Schoerling, D., Durante, M., Lorin, C., Martinez, T., Ruuskanen, J., Salmi, T., Sorbi, M., Tommasini, D., Toral, F.

Publication date: 1 Jun 2017

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Applied Superconductivity

Volume: 27

Issue number: 4

Article number: 4003105

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2017): CiteScore 2.7 SJR 0.408 SNIP 0.962

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: cost optimization, FCC, Nb Sn multifilamentary superconductor, Superconducting magnets

DOIs:

10.1109/TASC.2017.2657510

Source: Scopus

Source ID: 85014853660

Research output: Contribution to journal › Article › Scientific › peer-review

### **Construction of an Interconnected Nanostructured Carbon Black Network: Development of Highly Stretchable and Robust Elastomeric Conductors**

In the present work, a strong filler-filler network of conductive carbon black was strategically established in an elastomer matrix, which leads to a unique combination of electrical and mechanical properties. The novelty of our composites was the development of a strong percolated morphology of nanostructured conducting carbon black particles by the incorporation of relatively large nonreinforcing spherical silica particles, inside the soft elastomer matrix. This technique allowed us to fabricate solution styrene butadiene rubber (S-SBR) composites with outstanding electrical conductivity of 40 S/m, tensile strength ~10 MPa, and extensibility up to 200%. Furthermore, the electrical conductivity was strain-independent up to 50% elongation strain. The electrical conductivity was found to be unaltered after 2000 loading-unloading cycles. This is the first ever report of a robust elastomeric system with such high electrical conductivity where all the basic ingredients used were selected from well-known commercially available raw materials of rubber industry. This work directly manifests an industrially viable method for preparing high-performance elastic conductors that can be utilized in robust and flexible applications.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS), Leibniz-Institut für Polymerforschung Dresden E.V., Technische Universität Dresden, Institut für Werkstoffwissenschaft, Institut für Polymerwerkstoffe E.V., Elkem AS, Silicon Materials

Contributors: Bhagavatheswaran, E. S., Parsekar, M., Das, A., Le, H. H., Wiessner, S., Stöckelhuber, K. W., Schmaucks, G., Heinrich, G.

Number of pages: 9

Pages: 21723-21731

Publication date: 17 Sep 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Physical Chemistry C

Volume: 119

Issue number: 37

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2015): CiteScore 7.9 SJR 1.886 SNIP 1.246

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

10.1021/acs.jpcc.5b06629

URLs:

<http://www.scopus.com/inward/record.url?scp=84941928016&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84941928016

Research output: Contribution to journal › Article › Scientific › peer-review

### **Controlling the plasmon resonance via epsilon-near-zero multilayer metamaterials**

Localized plasmon resonance of a metal nanoantenna is determined by its size, shape and environment. Here, we diminish the size dependence by using multilayer metamaterials as epsilon-near-zero (ENZ) substrates. By means of the vanishing index of the substrate, we show that the spectral position of the plasmonic resonance becomes less sensitive to the characteristics of the plasmonic nanostructure and is controlled mostly by the substrate, and hence, it is pinned at a fixed narrow spectral range near the ENZ wavelength. Moreover, this plasmon wavelength can be adjusted by tuning the ENZ region of the substrate, for the same size nanodisk (ND) array. We also show that the difference in the phase of the scattered field by different size NDs at a certain distance is reduced when the substrate is changed to ENZ metamaterial. This provides effective control of the phase contribution of each nanostructure. Our results could be utilized to manipulate

the resonance for advanced metasurfaces and plasmonic applications, especially when precise control of the plasmon resonance is required in flat optics designs. In addition, the pinning wavelength can be tuned optically, electrically and thermally by introducing active layers inside the hyperbolic metamaterial.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: Metaplasmonics

Contributors: Habib, M., Briukhanova, D., Das, N., Yildiz, B. C., Caglayan, H.

Number of pages: 8

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

Journal: Nanophotonics

Volume: 9

Issue number: 11

Article number: 20200245

ISSN (Print): 2192-8614

Original language: English

ASJC Scopus subject areas: Biotechnology, Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: epsilon near zero, hyperbolic metamaterial, localized surface plasmon, pinning effect

Electronic versions:

Controlling the plasmon resonance 2020

DOIs:

10.1515/nanoph-2020-0245

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202008316784>

#### Bibliographical note

INT=phys,"Briukhanova, Daria"

INT=phys,"Das, Nekhel"

INT=phys,"Yildiz, Bilge Can"

Source: Scopus

Source ID: 85089689543

Research output: [Contribution to journal](#) > [Article](#) > [Scientific](#) > [peer-review](#)

#### Crystallization of supercooled liquid antimony: A density functional study

Crystallization of liquid antimony has been studied at 600 K using six density functional/molecular dynamics simulations with up to 882 atoms and three scenarios: one completely disordered sample that did not crystallize even after 570 ps, four with fixed crystalline slab templates, and one with a fixed crystalline seed. Crystallization proceeded layer-by-layer in most cases and was rapid (~36 m/s) with templates and somewhat slower with the seed. The seed simulation shows an unusual percolation asymmetry where the crystallite grows faster in the direction normal to the zigzag planes. Changes in pair distribution functions, bond angle distributions, ring statistics, nearest-neighbor distances, and cavity volumes were monitored. Diffusion plays a minor role in the process, and the evolution of bond lengths and ring statistics supports the bond-interchange model introduced to explain the rapid crystallization of Sb-rich phase change materials.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Aalto University, Norwegian Univ. of Sci. and Technol., Forschungszentrum Jülich (FZJ)

Contributors: Ropo, M., Akola, J., Jones, R. O.

Publication date: 3 Nov 2017

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 96

Issue number: 18

Article number: 184102

ISSN (Print): 2469-9950

Ratings:

Scopus rating (2017): CiteScore 3.34 SJR 1.604 SNIP 1.149

Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
DOIs:  
10.1103/PhysRevB.96.184102  
Source: Scopus  
Source ID: 85038856403  
Research output: Contribution to journal › Article › Scientific › peer-review

### **Crystallization processes in the phase change material Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub>: Unbiased density functional/molecular dynamics simulations**

Three extensive density functional/molecular dynamics simulations of the crystallization of amorphous Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub> (460 atoms) [Phys. Rev. B 90, 184109 (2014)PRBMDO1098-012110.1103/PhysRevB.90.184109] have been completed with simulation times of up to 8.2 ns. Together with the results of earlier simulations with and without a crystallite seed, the results clarify essential features of a complicated process. They emphasize, in particular, the stochastic nature of crystallization, the effect of bond orientations and percolation, and the importance of extended simulations of sufficiently large samples. This is particularly evident in describing the role of crystallites that can merge to form larger units or hinder complete crystallization by the formation of grain boundaries. The total pair distribution functions for the final structures are compared with available neutron and x-ray diffraction data.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Physics, Singapore University of Technology and Design, COMP Centre of Excellence, Aalto University, Forschungszentrum Jülich (FZJ)  
Contributors: Kalikka, J., Akola, J., Jones, R. O.  
Publication date: 17 Oct 2016  
Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B  
Volume: 94  
Issue number: 13  
Article number: 134105  
ISSN (Print): 1098-0121  
Ratings:  
Scopus rating (2016): CiteScore 8.6 SJR 2.339 SNIP 1.183  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
DOIs:  
10.1103/PhysRevB.94.134105  
Source: Scopus  
Source ID: 84992161291  
Research output: Contribution to journal › Article › Scientific › peer-review

### **Cysteine-tagged chimeric avidin forms high binding capacity layers directly on gold**

Cysteine-tagged, genetically engineered avidin named ChiAvd-Cys and wild-type avidin form monolayers or bilayer structures when immobilised directly on gold. Non-specific binding can be reduced by a post-treatment of the avidin layers with a N-[tris(hydroxymethyl)methyl]-acrylamide (pTHMMAA) polymer. ChiAvd-Cys showed excellent activity when immobilised on gold. About 70% of the ChiAvd-Cys molecules were able to bind two biotinylated green fluorescent proteins (per avidin tetramer). Amino-biotinylated antibody F(ab')<sub>2</sub> fragments could be bound to every 4th and 8th ChiAvd-Cys and wild-type avidin molecule, respectively, whereas on average one thiol-biotinylated antibody Fab'-fragment was bound to every ChiAvd-Cys. Antigen binding to the thiol-biotinylated Fab'-fragment bound to the ChiAvd-Cys/pTHMMAA layer was almost twice compared to that of the amino-biotinylated F(ab')<sub>2</sub>-fragments. The high antigen binding was due to a site-directed orientation of the thiol-biotinylated fragments. The ChiAvd-Cys/pTHMMAA layers offer high capacity that may be used to couple biotinylated compounds on biosensor surfaces.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Multi-scaled biodata analysis and modelling (MultiBAM), VTT Technical Research Centre of Finland, School of Management (JKK), Adult Stem Cells, Tampere University Hospital  
Contributors: Vikholm-Lundin, I., Auer, S., Paakkunainen, M., Määttä, J. A. E., Munter, T., Leppiniemi, J., Hytönen, V. P., Tappura, K.  
Number of pages: 9

Pages: 440-448  
Publication date: Aug 2012  
Peer-reviewed: Yes

#### Publication information

Journal: Sensors and Actuators B: Chemical

Volume: 171-172

ISSN (Print): 0925-4005

Ratings:

Scopus rating (2012): CiteScore 6.1 SJR 1.412 SNIP 1.653

Original language: English

ASJC Scopus subject areas: Instrumentation, Materials Chemistry, Surfaces, Coatings and Films, Metals and Alloys, Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Avidin, Biotin, Cysteine tagged, Non-specific binding, Self-assembled monolayer

DOIs:

10.1016/j.snb.2012.05.008

URLs:

<http://www.scopus.com/inward/record.url?scp=84864284365&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84864284365

Research output: Contribution to journal > Article > Scientific > peer-review

#### Decreasing the extremely low-frequency electric field exposure with a Faraday cage during work tasks from a man hoist at a 400 kV substation

Earlier studies have shown that the occupational exposure of electric fields at 400 kV substations can be higher than the low action level of 10 kV/m set by the Directive 2013/35/EU. One possibility for decreasing the occupational exposure is to surround the worker with a Faraday cage. The objective of the study was to investigate how effective a Faraday cage is in decreasing the ELF electric field exposure during work tasks from a man hoist at a 400 kV substation. First, we measured the electric field exposure while performing maintenance tasks from a man hoist. We then constructed a Faraday cage around the man hoist and measured the exposure again, with hopes that the exposure would be sufficiently reduced to create a safe working environment. The Faraday cage was constructed from a steel net 0.5m in width with 19-mm meshes. The net was made of hotdip galvanized steel wire, 1.0mm in diameter. The net and the man hoist were then grounded. The maximum electric field without the cage was 28.8 kV/m, and with the cage, it was 0.5 kV/m. The electric field, therefore, was decreased by 96.8–99.9%, validating the efficacy of Faraday cages.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Fingrid Oyj

Contributors: Pirkkalainen, H., Elovaara, J., Korpinen, L.

Number of pages: 12

Pages: 55-66

Publication date: 2016

Peer-reviewed: Yes

#### Publication information

Journal: Progress In Electromagnetics Research M

Volume: 48

ISSN (Print): 1937-8726

Ratings:

Scopus rating (2016): CiteScore 1 SJR 0.188 SNIP 0.46

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

URLs:

<http://www.jpier.org/pierm/pier.php?paper=16021501>

Source: Scopus

Source ID: 84964820068

Research output: Contribution to journal > Article > Scientific > peer-review

#### Deformation of lamellar $\gamma$ -TiAl below the general yield stress

The occurrence of plasticity below the macroscopic yield stress during tensile monotonic loading of nearly lamellar Ti-45Al-2Nb-2Mn(at%)-0.8 vol% TiB<sub>2</sub> at both 25 °C and 700 °C, and in two conditions of lamellar thickness, was measured by digital image correlation strain mapping of a remodelled Au surface speckle pattern. Such initial plasticity, not necessarily related to the presence of common stress concentrators such as hard particles or cracks, could occur at

applied stresses as low as 64% of the general yield stress. For a same applied strain it was more prominent at room temperature, and located as slip and twinning parallel to, and near to or at (respect.) lamellar interfaces of all types in soft mode-oriented colonies. These stretched the full colony width and the shear strain was most intense in the centre of the colonies. Further, the most highly operative microbands of plasticity at specimen fracture were not those most active prior to yielding. The strain mapping results from polycrystalline tensile loading were further compared to those from microcompression testing of soft-mode stacks of lamellae milled from single colonies performed at the same temperatures. Combined with post-mortem transmission electron microscopy of the pillars, the initial plasticity by longitudinal dislocation glide was found to locate within 30–50 nm of the lamellar interfaces, and not at the interfaces themselves. The highly localised plasticity that precedes high cycle fatigue failure is therefore inherently related to the lamellar structure, which predetermines the locations of plastic strain accumulation, even in a single loading cycle.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Materials Science, Research group: Materials Characterization, University of Cambridge, Swiss Federal Laboratories for Materials Science and Technology

Contributors: Edwards, T. E. J., Di Gioacchino, F., Goodfellow, A. J., Mohanty, G., Wehrs, J., Michler, J., Clegg, W. J.

Number of pages: 18

Pages: 122-139

Publication date: 15 Jan 2019

Peer-reviewed: Yes

Early online date: 2018

#### Publication information

Journal: Acta Materialia

Volume: 163

ISSN (Print): 1359-6454

Ratings:

Scopus rating (2019): CiteScore 13.8 SJR 3.662 SNIP 3.037

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Polymers and Plastics, Metals and Alloys

Keywords: Deformation twinning, Digital image correlation, Electron backscattering diffraction (EBSD), Pre-yield plasticity, Titanium aluminide

DOIs:

10.1016/j.actamat.2018.09.061

Source: Scopus

Source ID: 85055112164

Research output: Contribution to journal > Article > Scientific > peer-review

#### Demonstration of optical nonlinearity in InGaAsP/InP passive waveguides

We report on the study of the third-order nonlinear optical interactions in  $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{P}_{1-y}/\text{InP}$  strip-loaded waveguides. The material composition and waveguide structures were optimized for enhanced nonlinear optical interactions. We performed self-phase modulation, four-wave mixing and nonlinear absorption measurements at the pump wavelength 1568 nm in our waveguides. The nonlinear phase shift of up to  $2.5\pi$  has been observed in self-phase modulation experiments. The measured value of the two-photon absorption coefficient  $\alpha_2$  was 19 cm/GW. The four-wave mixing conversion range, representing the wavelength difference between maximally separated signal and idler spectral components, was observed to be 45 nm. Our results indicate that InGaAsP has a high potential as a material platform for nonlinear photonic devices, provided that the operation wavelength range outside the two-photon absorption window is selected.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, University of Ottawa, Canada, Middle East Technical Univ.

Contributors: Saeidi, S., Rasekh, P., Awan, K. M., Tüğen, A., Huttunen, M. J., Dolgaleva, K.

Number of pages: 7

Pages: 524-530

Publication date: 1 Oct 2018

Peer-reviewed: Yes

#### Publication information

Journal: Optical Materials

Volume: 84

ISSN (Print): 0925-3467

Ratings:

Scopus rating (2018): CiteScore 3.9 SJR 0.59 SNIP 1.025

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Computer Science(all), Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: Integrated optics, Nonlinear optics, Optical devices

DOIs:

10.1016/j.optmat.2018.07.037

Source: Scopus

Source ID: 85050358317

Research output: Contribution to journal > Article > Scientific > peer-review

### **Design, fabrication, and testing of a low AC-loss conduction-cooled cryostat for magnetization loss measurement apparatus**

Conduction cooling has become a viable alternative for cooling superconducting devices. However, the thermal pathways of a conduction-cooled cryostat can be problematic for applications where time-varying magnetic fields are present. Such alternating magnetic fields are present, e.g., in a magnetization ac-loss measurement system. The losses in the thermal pathways are unwanted as they increase the heat load into the cryostat and interfere with the measurement. To solve this challenge, a conduction-cooled cryostat with special attention in limiting eddy-current losses in the cryostat structures was constructed. The design process is illustrated in detail starting from the specifications and proceeding through the fabrication of individual components. The loss dissipated in the cryostat is experimentally examined, and the finished conduction-cooled magnetization loss measurement system is demonstrated by characterizing a multifilamentary  $\text{MgB}_2$  conductor.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, Lappeenranta University of Technology, LUT Energy, Slovak Academy of Sciences

Contributors: Järvelä, J., Lyly, M., Stenvall, A., Juntunen, R., Souc, J., Mikkonen, R.

Publication date: 1 Feb 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 1

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/TASC.2014.2357754

Source: Scopus

Source ID: 84916620705

Research output: Contribution to journal > Article > Scientific > peer-review

### **Designing materials with desired electromagnetic properties**

In this work, we suggest and demonstrate a robust method to tune the plasma frequencies of wire mediums. The method we suggest involves the use of two or more wire arrangements in the unit cell. By incorporating the method we suggested it is possible to tune the plasma frequencies of wire mediums effectively by use of lower metal densities. In addition, we study the effective permittivities and permeabilities of labyrinth based metamaterials. Our results show that the effective permeability of the labyrinth based metamaterial medium is negative above a certain frequency. The results of the effective permittivity calculations for the labyrinth based metamaterial medium reveal that the labyrinth structure exhibits a strong dielectric response near the magnetic resonance frequency. Finally, we design labyrinth based left-handed mediums that have several desired properties such as simultaneous  $\mu$ ,  $\epsilon = -1$  and  $\mu$ ,  $\epsilon = 0$ .

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Bilkent University, Nanotechnology Research Center

Contributors: Bulu, I., Caglayan, H., Ozbay, E.

Number of pages: 5  
Pages: 2611-2615  
Publication date: Dec 2006  
Peer-reviewed: Yes

#### Publication information

Journal: Microwave and Optical Technology Letters

Volume: 48

Issue number: 12

ISSN (Print): 0895-2477

Ratings:

Scopus rating (2006): SJR 0.564 SNIP 0.685

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Effective medium, Metamaterials, Negative index, Split ring

DOIs:

10.1002/mop.21988

URLs:

<http://www.scopus.com/inward/record.url?scp=33750556414&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Caglayan, Humeyra"

Source: Scopus

Source ID: 33750556414

Research output: Contribution to journal > Article > Scientific > peer-review

#### Design of a Nb3Sn 400 T/m quadrupole for the Future Circular Collider

For the Future Circular Collider (FCC), a 100 TeV post Large Hadron Collider machine, 750 main quadrupoles with a gradient of around 400 T/m are required. This paper presents an electromagnetic design optimization of a double aperture Nb3Sn quadrupole, fulfilling the specifications and a structural design of a single aperture configuration towards a prototype

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Power engineering, Research group: Modelling and superconductivity, Institut de Recherche sur les Lois Fondamentales de l'Univers, Service des accélérateurs, de cryogénie et de magnétisme, European Organization for Nuclear Research

Contributors: Lorin, C., Simon, D., Felice, H., Rifflet, J. M., Salmi, T., Schoerling, D.

Publication date: 2018

Peer-reviewed: Yes

Early online date: 24 Jan 2018

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 28

Issue number: 3

Article number: 4004905

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: 4 layers, FCC, main quadrupoles, Nb3Sn, superconducting quadrupole

DOIs:

10.1109/TASC.2018.2797945

Source: Scopus

Source ID: 85040993010

Research output: Contribution to journal > Article > Scientific > peer-review

#### Detection of 3,4-methylenedioxymethamphetamine (MDMA, ecstasy) by displacement of antibodies

A molecular layer with low non-specific binding enabling determination of low concentrations of 3,4-methylenedioxymethamphetamine (MDMA) by the displacement of antibodies has been developed. Antibody Fab'-

fragments at various concentrations have been site-directly immobilised on gold and intercalated with a hydrophilic non-ionic polymer that reduces non-specific binding. Bovine serum albumin conjugated with MDMA and various concentrations of anti-MDMA antibodies were bound to the layer. The amount of conjugates and antibodies bound was dependent on the amount of Fab'-fragments in the layer. Antibodies were also bound to the conjugates physisorbed directly onto the gold surface and in mixtures with the polymer or with a lipoamide. A high displacement of antibodies was observed by surface plasmon resonance (SPR) on interaction of MDMA with the different layers in buffer solution. No displacement could, however, be observed in saliva with the pure conjugate layer because of a high non-specific binding of proteins. When the conjugates were coupled to the surface through the antibody Fab'-fragment/polymer layer, MDMA concentrations as low as  $0.02 \text{ ng mL}^{-1}$  ( $0.14 \text{ nM}$ ) could easily be detected in buffer. In diluted saliva the lowest limit of detection was  $0.4 \text{ ng mL}^{-1}$  enabling determination of drugs from saliva with a cut-off concentration of  $2 \text{ ng mL}^{-1}$ . The molecular layer of antibody Fab'-fragments and polymer thus shows great potential for binding conjugates and antibodies that can be displaced on the interaction with very low concentrations of small-sized molecules. A low non-specific binding is guaranteed by the presence of the hydrophilic polymer.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Multi-scaled biodata analysis and modelling (MultiBAM), VTT Technical Research Centre of Finland, Biosensors Applications AB

Contributors: Vikholm-Lundin, I., Auer, S., Hellgren, A. C.

Number of pages: 7

Pages: 28-34

Publication date: 10 Aug 2011

Peer-reviewed: Yes

#### Publication information

Journal: Sensors and Actuators B: Chemical

Volume: 156

Issue number: 1

ISSN (Print): 0925-4005

Ratings:

Scopus rating (2011): CiteScore 6 SJR 1.485 SNIP 1.752

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Instrumentation, Condensed Matter Physics, Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry, Electrical and Electronic Engineering

Keywords: Antibody displacement, Drugs of abuse, Ecstasy, Immobilisation, MDMA, Surface plasmon resonance

DOIs:

10.1016/j.snb.2011.03.069

URLs:

<http://www.scopus.com/inward/record.url?scp=79957806721&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79957806721

Research output: Contribution to journal › Article › Scientific › peer-review

#### Determination of beam incidence conditions based on the analysis of laser interference patterns

Beam incidence conditions in the formation of two-, three- and four-beam laser interference patterns are presented and studied in this paper. In a laser interference lithography (LIL) process, it is of importance to determine and control beam incidence conditions based on the analysis of laser interference patterns for system calibration as any slight change of incident angles or intensities of beams will introduce significant variations of periods and contrasts of interference patterns. In this work, interference patterns were captured by a He-Ne laser interference system under different incidence conditions, the pattern period measurement was achieved by cross-correlation with, and the pattern contrast was calculated by image processing. Subsequently, the incident angles and intensities of beams were determined based on the analysis of spatial distributions of interfering beams. As a consequence, the relationship between the beam incidence conditions and interference patterns is revealed. The proposed method is useful for the calibration of LIL processes and for reverse engineering applications.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Changchun University of Science and Technology, University of Bedfordshire, Xi'An Jiaotong-Liverpool University, DCSSE

Contributors: Wang, D., Wang, Z., Yue, Y., Yu, J., Tan, C., Li, D., Qiu, R., Maple, C.

Number of pages: 6

Pages: 2902-2907

Publication date: 1 Nov 2015

Peer-reviewed: Yes  
Early online date: 17 Jul 2015

### Publication information

Journal: Optik  
Volume: 126  
Issue number: 21  
ISSN (Print): 0030-4026  
Ratings:

Scopus rating (2015): CiteScore 1.4 SJR 0.332 SNIP 0.682

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics

Keywords: Beam incidence condition, Interference lithography, Laser interference, Modulation period

DOIs:

10.1016/j.ijleo.2015.07.039

URLs:

<http://www.scopus.com/inward/record.url?scp=84942373998&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84942373998

Research output: Contribution to journal › Article › Scientific › peer-review

### Development of a new illumination procedure for photodynamic therapy of the abdominal cavity

A homogeneous illumination of intra-abdominal organs is essential for successful photodynamic therapy of the abdominal cavity. Considering the current lack of outstanding light-delivery systems, a new illumination procedure was assessed. A rat model of peritoneal carcinomatosis was used. Four hours after intraperitoneal injection of hexaminolevulinate, a square illuminating panel connected to a 635-nm laser source was inserted vertically into the abdominal cavity. The abdominal incision was sutured and a pneumoperitoneum created prior to illumination. Light dosimetry was based on the calculation of the peritoneal surface by MRI. The rats were treated with a light dose of 20, 10, 5 or 2.5 J/cm<sup>2</sup> administered continuously with an irradiance of 7 mW/cm<sup>2</sup>. The homogeneity of the cavity illumination was assessed by quantification of the photobleaching of the tumor lesions according to their localization and by scoring of that of the liver and of the bowel immediately after treatment. Photobleaching quantification for tumor lesions relied on the calculation of the fluorescence intensity ratio (after/before treatment) after recording of the lesions during blue-light laparoscopy and determination of their fluorescence intensity with Sigmascan Pro software. The procedure led to a homogeneous treatment of the abdominal cavity. No statistical difference was observed for the photobleaching values according to the localization of the lesions on the peritoneum ( $p = 0.59$ ) and photobleaching of the liver and of the intestine was homogeneous. We conclude that this procedure can successfully treat the major sites involved in peritoneal carcinomatosis.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Lille University Hospital - CHRU, Univ Lille Nord de France, GDR 3049

Contributors: Cuyon, L., Lesage, J. C., Betrouni, N., Mordon, S.

Publication date: Mar 2012

Peer-reviewed: Yes

### Publication information

Journal: JOURNAL OF BIOMEDICAL OPTICS

Volume: 17

Issue number: 3

Article number: 038001

ISSN (Print): 1083-3668

Ratings:

Scopus rating (2012): CiteScore 4.9 SJR 1.292 SNIP 1.329

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Biomaterials, Biomedical Engineering

Keywords: Hexaminolevulinate, Light dosimetry, Peritoneal carcinomatosis, Photobleaching, Photodynamic therapy

DOIs:

10.1117/1.JBO.17.3.038001

URLs:

<http://www.scopus.com/inward/record.url?scp=84864951116&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84864951116

### Development of MQXF: The Nb<sub>3</sub>Sn Low-β Quadrupole for the HiLumi LHC

The High Luminosity (HiLumi) Large Hadron Collider (LHC) project has, as the main objective, to increase the LHC peak luminosity by a factor five and the integrated luminosity by a factor ten. This goal will be achieved mainly with a new interaction region layout, which will allow a stronger focusing of the colliding beams. The target will be to reduce the beam size in the interaction points by a factor of two, which requires doubling the aperture of the low-β (or inner triplet) quadrupole magnets. The use of Nb<sub>3</sub>Sn superconducting material and, as a result, the possibility of operating at magnetic field levels in the windings higher than 11 T will limit the increase in length of these quadrupoles, called MQXF, to acceptable levels. After the initial design phase, where the key parameters were chosen and the magnet's conceptual design finalized, the MQXF project, a joint effort between the U.S. LHC Accelerator Research Program and the Conseil Européen pour la Recherche Nucleaire (CERN), has now entered the construction and test phase of the short models. Concurrently, the preparation for the development of the full-length prototypes has been initiated. This paper will provide an overview of the project status, describing and reporting on the performance of the superconducting material, the lessons learnt during the fabrication of superconducting coils and support structure, and the fine tuning of the magnet design in view of the start of the prototyping phase.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, European Organization for Nuclear Research, Fermi National Accelerator Laboratory, Brookhaven National Laboratory, Lawrence Berkeley National Laboratory, Istituto Nazionale Di Fisica Nucleare, Frascati

Contributors: Ferracin, P., Ambrosio, G., Anerella, M., Ballarino, A., Bajas, H., Bajko, M., Bordini, B., Bossert, R., Cheng, D. W., Dietderich, D. R., Chlachidze, G., Cooley, L., Felice, H., Ghosh, A., Hafalia, R., Holik, E., Izquierdo Bermudez, S., Fessia, P., Grosclaude, P., Guinchart, M., Juchno, M., Krave, S., Lackner, F., Marchevsky, M., Marinozzi, V., Nobrega, F., Oberli, L., Pan, H., Perez, J. C., Prin, H., Rysti, J., Rochepault, E., Sabbi, G., Salmi, T., Schmalzle, J., Sorbi, M., Sequeira Tavares, S., Todesco, E., Wanderer, P., Wang, X., Yu, M.

Publication date: 1 Jun 2016

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 26

Issue number: 4

Article number: 4000207

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2016): CiteScore 2.6 SJR 0.398 SNIP 1.132

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: High Luminosity LHC, Interaction Regions, Low-β Quadrupoles

DOIs:

10.1109/TASC.2015.2510508

Source: Scopus

Source ID: 84962432718

Research output: Contribution to journal › Article › Scientific › peer-review

### Diffusion on aluminum-cluster surfaces and the cluster growth

Diffusion of adatoms have been studied on fcc polyhedral aluminum-cluster surfaces by molecular-dynamics simulations using the effective-medium theory. Diffusion of adatoms has been shown to take place by hopping along (Formula presented) facets at very low temperatures. Diffusion from one (Formula presented) facet to other (Formula presented) facets takes place at higher temperatures through a variety of mechanisms, and finally diffusion to and along (Formula presented) facets takes place at high temperatures. Diffusion from (Formula presented) to (Formula presented) facets is possible only close to the melting temperature of the cluster. The appearance of different diffusion processes as a function of temperature is in good agreement with the calculated activation energies of diffusion mechanisms along different facets and from one facet to another, including different hopping and exchange processes as well as more exotic events like the chain mechanism through a (Formula presented) facet between two (Formula presented) facets. Observed diffusion mechanisms imply that fcc clusters can grow epitaxially, having only (Formula presented) facets in accord with experimental observation. Our dynamical simulations of cluster growth support these findings.

#### General information

Publication status: Published

MoE publication type: Not Eligible  
Organisations: Jyväskylän yliopisto  
Contributors: Valkealahti, S., Manninen, M.  
Number of pages: 8  
Pages: 15533-15540  
Publication date: 1 Jan 1998  
Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B - Condensed Matter and Materials Physics  
Volume: 57  
Issue number: 24  
ISSN (Print): 1098-0121  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
DOIs:  
10.1103/PhysRevB.57.15533  
Source: Scopus  
Source ID: 0001165185  
Research output: Contribution to journal › Article › Scientific › peer-review

#### Dilute nitride triple junction solar cells for space applications: Progress towards highest AM0 efficiency

We report a detailed performance assessment of triple junction dilute nitride solar cells fabricated by a combined molecular beam epitaxy-metal organic chemical vapor deposition process and designed for space applications. The experimental sample exhibits an efficiency level of 30.8% under AM0 illumination. Analyses of the isotype single junction dilute nitride bottom cells reveal a band gap voltage offset of 0.49 V at one sun illumination and a value as low as 0.47 V for full spectrum excitation without filter layers. The analyses point out the limitation of the design in terms of current balancing. With optimized design, an efficiency of 32.1% is possible, revealing the maturity reached by dilute nitride technology in the quest for improving the efficiency of lattice-matched multijunction solar cells.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Photonics, Research group: ORC, CESI S.p.A.  
Contributors: Aho, A., Isoaho, R., Tukiainen, A., Gori, G., Campesato, R., Guina, M.  
Number of pages: 5  
Pages: 740-744  
Publication date: Sep 2018  
Peer-reviewed: Yes  
Early online date: Apr 2018

#### Publication information

Journal: Progress in Photovoltaics: Research and Applications  
Volume: 26  
Issue number: 19  
ISSN (Print): 1062-7995  
Ratings:  
Scopus rating (2018): CiteScore 16.5 SJR 1.942 SNIP 2.42  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Renewable Energy, Sustainability and the Environment, Condensed Matter Physics, Electrical and Electronic Engineering  
Electronic versions:  
Dilute Nitride Triple Junction Solar Cells for Space Applications Progress Towards Highest AM0 Efficiency\_ AuthorVersion  
DOIs:  
10.1002/pip.3011  
URLs:  
<http://urn.fi/URN:NBN:fi:tuni-201910183934>  
Source: Scopus  
Source ID: 85045098254  
Research output: Contribution to journal › Article › Scientific › peer-review

#### Direct measurement of vapour-metal shifts in photo- and Auger electron spectra of Zn and Cd

Photo- and Auger electron spectra have been measured simultaneously from vapour and solid metal for both zinc and cadmium by using Al K alpha X-ray excitation. The differences in the shifts of Auger and photoelectron spectra have been determined with essentially improved experimental accuracy from directly observed vapour-metal shifts.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: University of Oulu  
Contributors: Kumpula, R., Vayrynen, J., Rantala, T., Aksela, S.  
Publication date: 1979  
Peer-reviewed: Yes

### Publication information

Journal: Journal of physics c-Solid state physics  
Volume: 12  
Issue number: 21  
Article number: 001  
ISSN (Print): 0022-3719  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
DOIs:  
10.1088/0022-3719/12/21/001  
Source: Scopus  
Source ID: 25744469528  
Research output: Contribution to journal › Article › Scientific › peer-review

### Dissolution behavior of the bioactive glass S53P4 when sodium is replaced by potassium, and calcium with magnesium or strontium

The initial dissolution behavior of glasses based on bioactive glass S53P4 was studied with a dynamic measurement setup in a Tris-buffered solution. The glass composition was modified systematically on a molar basis by replacing sodium oxide with potassium oxide (0-100% K) and calcium oxide with magnesium (0-18% Mg) or strontium oxide (0-100% Sr). The concentrations of the ions dissolving from the glasses were measured continuously on-line in the fluid flow for 15 to 25 min using an inductively coupled plasma emission optical spectrometer. This method enabled attainment of detailed information on the initial dissolution mechanisms without the, for bioactive glasses typical, interference of apatite layer formation. The results showed that initial dissolutions of sodium and potassium were markedly higher from the mixed alkali oxide glasses than from the compositions containing only one alkali oxide. Introducing MgO in S53P4 caused a minor decrease in the dissolution rates of all ions. The glass containing 3 mol% of MgO showed the best chemical durability. In contrast, replacing CaO gradually with SrO increased the dissolution rates of all ions. The glasses with the highest replacement of CaO with SrO showed rapid release of both Sr and Na ions. The results corroborate the overall knowledge of glass durability and can be utilized to design bioactive glasses with controlled ion release rate for tissue engineering applications.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Johan Gadolin Process Chemistry Centre, Abo Akademi University, Paroc Group Oy, Åbo Akademi University  
Contributors: Hupa, L., Fagerlund, S., Massera, J., Björkvik, L.  
Number of pages: 6  
Pages: 41-46  
Publication date: 2016  
Peer-reviewed: Yes  
Early online date: 10 Apr 2015

### Publication information

Journal: Journal of Non-Crystalline Solids  
ISSN (Print): 0022-3093  
Ratings:  
Scopus rating (2016): CiteScore 3.5 SJR 0.685 SNIP 1.154  
Original language: English  
ASJC Scopus subject areas: Condensed Matter Physics, Ceramics and Composites, Electronic, Optical and Magnetic Materials, Materials Chemistry  
Keywords: Bioactive glass, Chemical durability, Dynamic solution, Ion dissolution  
DOIs:  
10.1016/j.jnoncrysol.2015.03.026  
Source: Scopus  
Source ID: 84948073019  
Research output: Contribution to journal › Article › Scientific › peer-review

### **Dynamics of photovoltaic-generator-interfacing voltage-controlled buck power stage**

This paper investigates the dynamic properties of the photovoltaic-generator-interfacing voltage-controlled buck power stage operating in both the maximum and limited power point tracking modes. The photovoltaic generator (PVG) is known to possess both current- and voltage-source properties with respect to its maximum power point. While voltage-fed operation is conventional, current-fed action is nontrivial and is thoroughly analyzed in this paper. The photovoltaic-generator-interfacing converter is formed by adding a capacitor at conventional voltage-fed converter input terminals, turning it into a current-fed power stage. During the maximum power point tracking phase, converter input voltage is regulated, possessing nontrivial dynamics. The situation is burdened further when output-voltage control should be alternatively realized to limit the voltage of the converter terminating the energy storage element. It is shown that both the photovoltaic generator and the terminating energy storage greatly affect the combined system dynamics. Parallel as well as cascaded control arrangements are proposed to support dual-mode system operation. Extended experimental results are shown to enforce presented theory and reveal nontrivial dynamics-related issues.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Power engineering, Smart Energy Systems (SES), Hybrid Energy Sources RandD Laboratory, Ariel University, ABB Oy, Drives

Contributors: Sitbon, M., Leppäaho, J., Suntio, T., Kuperman, A.

Number of pages: 8

Pages: 633-640

Publication date: 1 Mar 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Journal of Photovoltaics

Volume: 5

Issue number: 2

ISSN (Print): 2156-3381

Ratings:

Scopus rating (2015): CiteScore 7 SJR 1.865 SNIP 1.929

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Current-fed buck converter, dynamics, photovoltaic generator (PVG)

DOIs:

10.1109/JPHOTOV.2014.2379094

#### **Bibliographical note**

EXT="Leppäaho, J."

Research output: Contribution to journal > Article > Scientific > peer-review

### **Dynamic speckle analysis with smoothed intensity-based activity maps**

Pointwise intensity-based algorithms are the most popular algorithms in dynamic laser speckle measurement of physical or biological activity. The output of this measurement is a two-dimensional map which qualitatively separates regions of higher or lower activity. In the paper, we have proposed filtering of activity maps to enhance visualization and to enable quantitative determination of activity time scales. As a first step, we have proved that the severe spatial fluctuations within the map resemble a signal-dependent noise. As a second step, we have illustrated implementation of the proposed idea by applying filters to non-normalized and normalized activity estimates derived from synthetic and experimental data. Statistical behavior of the estimates has been analyzed to choose the filter parameters, and substantial narrowing of the probability density functions of the estimates has been achieved after the filtering. The filtered maps exhibit an improved contrast and allowed for quantitative description of activity.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Signal Processing, Research group: 3D MEDIA, Bulgarian Academy of Sciences, Korea Electronics Technology Institute

Contributors: Stoykova, E., Berberova, N., Kim, Y., Nazarova, D., Ivanov, B., Gotchev, A., Hong, J., Kang, H.

Number of pages: 11

Pages: 55-65

Publication date: 1 Jun 2017

Peer-reviewed: Yes

## Publication information

Journal: Optics and Lasers in Engineering

Volume: 93

ISSN (Print): 0143-8166

Ratings:

Scopus rating (2017): CiteScore 6.2 SJR 1.018 SNIP 1.919

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Mechanical Engineering, Electrical and Electronic Engineering

Keywords: Digital image processing, Dynamic speckle, Speckle, Speckle metrology

Electronic versions:

Dynamic speckle analysis with smoothed intensity-based activity maps

DOIs:

10.1016/j.optlaseng.2017.01.012

URLs:

<http://urn.fi/URN:NBN:fi:tty-201704251342>

Source: Scopus

Source ID: 85010222438

Research output: Contribution to journal > Article > Scientific > peer-review

## Effect of heat-treatment on the upconversion of NaYF<sub>4</sub>:Yb<sup>3+</sup>, Er<sup>3+</sup> nanocrystals containing silver phosphate glass

Novel NaYF<sub>4</sub>:Yb<sup>3+</sup>, Er<sup>3+</sup> nanocrystals containing phosphate glass with composition 83.25NaPO<sub>3</sub>-9.25NaF-5ZnO-2.5Ag<sub>2</sub>O (in mol%) was prepared by adding the NaYF<sub>4</sub>:Yb<sup>3+</sup>, Er<sup>3+</sup> nanocrystals in the glass using the direct doping method. The optical and luminescence properties of this new glass are presented and discussed. The newly developed glass exhibits visible emission under 980 nm pumping with high intensity confirming the presence of the NaYF<sub>4</sub>:Yb<sup>3+</sup>, Er<sup>3+</sup> nanocrystals in the glass. From the absorption spectrum of the as-prepared glass, it is showed that the as-prepared glasses contains already Ag nanoparticles which are thought to precipitate due to the decomposition of some of the NaYF<sub>4</sub>:Yb<sup>3+</sup>, Er<sup>3+</sup> nanocrystals occurring during the glass preparation. A heat treatment of the glass was found to lead to the migration of Ag species at the surface of the glass as evidenced using SEM and to a decrease of the intensity of the upconversion mostly due to an increase of the inter defects in the NaYF<sub>4</sub>:Yb<sup>3+</sup>, Er<sup>3+</sup> nanocrystals due to the heat treatment.

## General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Technical University of Cluj-Napoca Universitatea Tehnica din Cluj-Napoca

Contributors: Ojha, N., Bogdan, M., Galatus, R., Petit, L.

Publication date: 15 Sep 2020

Peer-reviewed: Yes

Early online date: Jun 2020

## Publication information

Journal: Journal of Non-Crystalline Solids

Volume: 544

Article number: 120243

ISSN (Print): 0022-3093

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Condensed Matter Physics, Materials Chemistry

Keywords: Absorption, Luminescence, NaYF:Yb, Er nanocrystals, Phosphate glass, Silver nanoparticles

DOIs:

10.1016/j.jnoncrysol.2020.120243

Source: Scopus

Source ID: 85086450328

Research output: Contribution to journal > Article > Scientific > peer-review

## Effect of Hole Transporting Material on Charge Transfer Processes in Zinc Phthalocyanine Sensitized ZnO Nanorods

The photoinduced electron transfer processes were studied for hybrid systems consisting of self-assembled monolayer of zinc phthalocyanine (ZnPc) assembled on ZnO nanorods and a film of organic hole transporting material (HTM) atop. Polythiophene (P3HT) or Spiro-OMeTAD were used as HTM. The study was carried out by ultrafast transient absorption spectroscopy technique with selective excitation of ZnPc at 680 nm or P3HT at 500 nm. Data analysis revealed that photoexcitation of ZnPc in the structure ZnO|ZnPc|P3HT results in a fast (1.8 ps) electron transfer from ZnPc to ZnO, which is followed by a hole transfer from the ZnPc cation to P3HT roughly in 30 ps. However, in the case of ZnO|ZnPc|Spiro-OMeTAD structure, the primary reaction upon excitation of ZnPc is a fast (0.5 ps) hole transfer from ZnPc to Spiro-OMeTAD, and the second step is electron injection from the ZnPc anion to ZnO in roughly 120 ps. Thus, we demonstrate two structurally very similar hybrid architectures that implement two different mechanisms for photoinduced

charge separation found in dye-sensitized or in organic solar cells.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Chemistry and Bioengineering, Research group: Supramolecular photochemistry

Contributors: Hakola, H., Sariola-Leikas, E., Efimov, A., Tkachenko, N. V.

Number of pages: 8

Pages: 7044-7051

Publication date: 21 Apr 2016

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 120

Issue number: 13

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2016): CiteScore 7.9 SJR 1.964 SNIP 1.189

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

10.1021/acs.jpcc.6b01583

Source: Scopus

Source ID: 84964529902

Research output: Contribution to journal > Article > Scientific > peer-review

#### Effect of incorporation of CdS NPs on performance of PTB7: PCBM organic solar cells

It has been well known that incorporation of nano-heterostructures of various metals, semiconductors and dielectric materials in the active layer of organic solar cells (OSCs) helps in improving power conversion efficiency (PCE). In the present study, we demonstrated microwave synthesis of CdS nanoparticles (NPs) for their application in one of most efficient OSCs consisting of poly[[4,8-bis[(2-ethylhexyl)oxy]benzo[1,2-b:4,5-b']dithiophene-2,6-diyl] [3-fluoro-2-[(2-ethylhexyl)carbonyl] thieno[3,4-b]thiophenediyl]] (PTB7): [6,6]-phenyl C<sub>71</sub>-butyric acid methyl ester (PCBM) photoactive blend. This is crucial to fully explore the promising features of low cost and scalability in organic-inorganic hybrid solar cells. Synthesized CdS NPs are slightly elongated and highly crystalline with their absorption lies in the visible region as confirmed by High resolution transmission electron microscopy (HRTEM), X-ray diffraction (XRD), UV-Vis absorption spectroscopy studies. Our experimental results for the devices in an inverted geometry having a structure ITO/ZnO/PTB7: CdS: PCBM/MoO<sub>3</sub>/Ag has shown increase in J<sub>sc</sub> and PCE by nearly 10%. However, it was observed that this increase is only when NPs were added in the low concentration in active layer. UV-Vis absorption spectroscopy, Photoluminescence (PL) and atomic force microscopy (AFM) studies were carried out in order understand the device performance.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electronics and Communications Engineering, Indian Institute of Technology Bombay, Organic and Nano-electronics Group

Contributors: Sharma, R., Bhalerao, S., Gupta, D.

Number of pages: 7

Pages: 274-280

Publication date: 1 Jun 2016

Peer-reviewed: Yes

#### Publication information

Journal: Organic Electronics: physics, materials, applications

Volume: 33

ISSN (Print): 1566-1199

Ratings:

Scopus rating (2016): CiteScore 6.3 SJR 1.081 SNIP 0.944

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Chemistry(all), Condensed Matter Physics, Materials Chemistry, Electrical and Electronic Engineering

Keywords: CdS nanoparticles, Microwave synthesis, Organic solar cells, PCBM, PL quenching, PTB7

DOIs:

10.1016/j.orgel.2016.03.030

Source: Scopus

Source ID: 84962355464

Research output: Contribution to journal › Article › Scientific › peer-review

### **Effect of sol-gel derived in situ silica on the morphology and mechanical behavior of natural rubber and acrylonitrile butadiene rubber blends**

Silica particles were generated and grown in situ by sol-gel method into rubber blends comprised of natural rubber (NR) and acrylonitrile butadiene rubber (NBR) at various blend ratios. Silica formed into rubber matrix was amorphous in nature. Amount of in situ silica increased with increase in natural rubber proportion in the blends during the sol-gel process. Morphology studies showed that the generated in situ silica were nanoparticles of different shapes and sizes mostly grown into the NR phase of the blends. In situ silica filled NR/NBR blend composites showed improvement in the mechanical and dynamic mechanical behaviors in comparison to those of the unfilled and externally filled NR/ NBR blend composites. For the NR/NBR blend at 40/60 composition, in particular, the improvement was appreciable where size and dispersion of the silica particles into the rubber matrix were found to be more uniform. Dynamic mechanical analysis revealed a strong rubber-in situ silica interaction as indicated by a positive shift of the glass transition temperature of both the rubber phases in the blends.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Engineering materials science and solutions (EMASS), Visvesvaraya National Institute of Technology, Leibniz-Institut für Polymerforschung Dresden E.V.

Contributors: Kappate, B. P., Das, C., Das, A., Basu, D., Reuter, U., Heinrich, G.

Number of pages: 9

Pages: 501-509

Publication date: Sep 2012

Peer-reviewed: Yes

#### **Publication information**

Journal: JOURNAL OF SOL-GEL SCIENCE AND TECHNOLOGY

Volume: 63

Issue number: 3

ISSN (Print): 0928-0707

Ratings:

Scopus rating (2012): CiteScore 2.8 SJR 0.732 SNIP 1.133

Original language: English

ASJC Scopus subject areas: Chemistry(all), Condensed Matter Physics, Biomaterials, Ceramics and Composites, Electronic, Optical and Magnetic Materials, Materials Chemistry

Keywords: In situ silica, Reinforcement, Rubber blend, Rubber-filler interaction, Sol-gel

DOIs:

10.1007/s10971-012-2812-9

URLs:

<http://www.scopus.com/inward/record.url?scp=84875426374&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84875426374

Research output: Contribution to journal › Article › Scientific › peer-review

### **Effect of the addition of Al<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub> and ZnO on the thermal, structural and luminescence properties of Er<sup>3+</sup>-doped phosphate glasses**

Er-doped phosphate glasses were fabricated by melt-quenching technique. The changes in their thermal, structural and luminescence properties with the addition of Al<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub> or ZnO were studied. Physical and thermal properties were investigated through density measurement and differential thermal analysis. Structural characterization was performed using the Raman and Infrared spectroscopy. In order to study the influence of the composition on the luminescence properties of the glasses, the refractive index, the luminescence spectra and the lifetime values were measured. The results show that with the addition of Al<sub>2</sub>O<sub>3</sub> and TiO<sub>2</sub> the phosphate network becomes more connected increasing the glass transition temperature, whereas the addition of ZnO does not show significant changes in the optical, thermal and structural properties but it leads to a larger emission cross-section at 1540 nm as compared to the other glasses. As the site of the Er<sup>3+</sup> is not strongly affected by the change in the glass composition, we think that the emission properties of the glasses depend on the glass structure connectivity, which has an impact on the Er<sup>3+</sup> ions solubility.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Faculty of Biomedical Sciences and Engineering, Research group: Biomaterials and Tissue Engineering Group, Politecnico di Torino, Istituto Superiore Mario Boella, CSMFO Lab.

Contributors: Lopez-Isoa, P., Petit, L., Massera, J., Janner, D., Boetti, N. G., Pugliese, D., Fiorilli, S., Novara, C., Giorgis, F., Milanese, D.  
Number of pages: 8  
Pages: 161-168  
Publication date: 15 Mar 2017  
Peer-reviewed: Yes

#### Publication information

Journal: Journal of Non-Crystalline Solids

Volume: 460

ISSN (Print): 0022-3093

Ratings:

Scopus rating (2017): CiteScore 4 SJR 0.722 SNIP 1.178

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Condensed Matter Physics, Materials Chemistry

Keywords: Er luminescence property, Infrared spectroscopy, Phosphate glass, Raman spectroscopy

DOIs:

10.1016/j.jnoncrysol.2017.01.030

Source: Scopus

Source ID: 85010441113

Research output: Contribution to journal › Article › Scientific › peer-review

#### Effect of the glass melting condition on the processing of phosphate-based glass-ceramics with persistent luminescence properties

In this paper, we discuss the impact of the temperature and the duration of the melting on the persistent luminescence properties of phosphate glasses within the  $P_2O_5$ - $Na_2O$ - $CaO$  and  $P_2O_5$ - $Na_2O$ - $SrO$  systems prepared using a standard melting process in normal atmosphere by adding  $Sr_4Al_{14}O_{25}:Eu^{2+}, Dy^{3+}$  microparticles in the glass batch before melting. Glasses with persistent luminescence properties can be successfully prepared if the melting conditions are carefully controlled.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Abo Akad Univ, Abo Akademi University, Dept Phys, Academy of Sciences, Turun Yliopisto/Turun Biomateriaalikeskus, University of Turku, University of São Paulo

Contributors: Massera, J., Gaussiran, M., Gluchowski, P., Lastusaari, M., Petit, L., Hölsä, J., Hupa, L.

Number of pages: 6

Pages: 56-61

Publication date: 1 Feb 2016

Peer-reviewed: Yes

#### Publication information

Journal: Optical Materials

Volume: 52

ISSN (Print): 0925-3467

Ratings:

Scopus rating (2016): CiteScore 3.8 SJR 0.636 SNIP 1.061

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Computer Science(all)

Keywords: Energy dispersive analysis of X-rays (EDS or EDAX), Glasses, Heat treatment, Luminescence

DOIs:

10.1016/j.optmat.2015.12.006

Source: Scopus

Source ID: 84959313726

Research output: Contribution to journal › Article › Scientific › peer-review

#### Effects of insertion of strain-engineering Ga(In)NAs layers on optical properties of InAs/GaAs quantum dots for high-efficiency solar cells

We report study on stacked InAs/GaNAs quantum dots heterostructures with dilute nitride GaInNAs strain mediating layers embedded in GaAs p-i-n solar cell structure. The insertion of GaInNAs strain mediating layers in the vicinity of the strain compensated InAs/GaNAs quantum dots heterostructures enhances their surface density, improves and significantly red shifts their light emission. Embedding a stack of the strain-mediated InAs/GaInNAs/GaNAs quantum dots in the i region of

a GaAs p-i-n solar cell leads also to a red shift of the absorption edge of the solar cells and improves the solar cell photogenerated currents at longer wavelengths beyond 1200 nm.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, National Institute for Research and Development in Microtechnologies Romania, Faculty of Exact Sciences and Engineering, Hyperion University

Contributors: Pavelescu, E., Polojärvi, V., Schramm, A., Tukiainen, A., Aho, A., Zhang, W., Puustinen, J., Salmi, J., Guina, M.

Number of pages: 4

Pages: 177-180

Publication date: 1 Feb 2016

Peer-reviewed: Yes

#### Publication information

Journal: Optical Materials

Volume: 52

ISSN (Print): 0925-3467

Ratings:

Scopus rating (2016): CiteScore 3.8 SJR 0.636 SNIP 1.061

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Computer Science(all)

Keywords: Dilute nitrides, Molecular beam epitaxy, Optical properties

DOIs:

10.1016/j.optmat.2015.12.035

#### Bibliographical note

EXT="Pavelescu, Emil-Mihai"

Source: Scopus

Source ID: 84959293536

Research output: Contribution to journal > Article > Scientific > peer-review

#### Effects of thinning and heating for TiO<sub>2</sub>/AlInP junctions

TiO<sub>2</sub>/AlInP junctions are used to construct the antireflection coatings for solar cells and to passivate III-V nanostructure surfaces. The thickness of AlInP epilayer affects light absorption and appropriate Al composition determining further the energy barrier for carriers. We report on reducing the AlInP thickness by dry etching down to 10 nm without introducing harmful defect states at TiO<sub>2</sub>/AlInP interface and AlInP/GaInP interface below, according to photoluminescence. Synchrotron-radiation photoelectron spectroscopy reveals that increased oxidation of phosphorus is not harmful to TiO<sub>2</sub>/AlInP and that post heating of the material enhances AlInP oxidation and group III element segregation resulting in decreased material homogeneity.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics, Department of Physics and Astronomy, University of Turku, University of Turku

Contributors: Mäkelä, J., Tuominen, M., Yasir, M., Polojärvi, V., Aho, A., Tukiainen, A., Kuzmin, M., Punkkinen, M. P. J., Laukkanen, P., Kokko, K., Guina, M.

Number of pages: 4

Pages: 6-9

Publication date: 24 Aug 2015

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Electron Spectroscopy and Related Phenomena

Volume: 205

ISSN (Print): 0368-2048

Ratings:

Scopus rating (2015): CiteScore 2.7 SJR 0.817 SNIP 0.813

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Physical and Theoretical Chemistry, Spectroscopy, Condensed Matter Physics, Atomic and Molecular Physics, and Optics, Radiation

Keywords: AllnP, Passivation, Solar cell, TiO<sub>2</sub>

DOIs:

10.1016/j.elspec.2015.08.004

URLs:

<http://www.scopus.com/inward/record.url?scp=84939833093&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Laukkanen, P."

EXT="Tuominen, M."

EXT="Kuzmin, M."

Source: Scopus

Source ID: 84939833093

Research output: Contribution to journal > Article > Scientific > peer-review

#### Efficient photon upconversion at remarkably low annihilator concentrations in a liquid polymer matrix: when less is more

A green-to-blue triplet-triplet annihilation upconversion of 24.5% quantum yield was achieved at a remarkably low 600  $\mu\text{M}$  annihilator concentration in a viscous polymer matrix. This was made possible by utilizing a ZnTPP-based photosensitizer with exceptionally long 11 ms phosphorescence lifetime. Higher 3 mM annihilator concentration resulted in lower 24% upconversion quantum yield.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Chemistry and Bioengineering

Contributors: Durandin, N. A., Isokuortti, J., Efimov, A., Vuorimaa-Laukkanen, E., Tkachenko, N. V., Laaksonen, T.

Number of pages: 4

Pages: 14029-14032

Publication date: 2018

Peer-reviewed: Yes

#### Publication information

Journal: Chemical Communications

Volume: 54

Issue number: 99

ISSN (Print): 1359-7345

Ratings:

Scopus rating (2018): CiteScore 11.6 SJR 2.177 SNIP 1.145

Original language: English

ASJC Scopus subject areas: Catalysis, Electronic, Optical and Magnetic Materials, Ceramics and Composites, Chemistry(all), Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

Keywords: triplet-triplet annihilation, triplet-triplet energy transfer, triplet state lifetime, upconversion, triplet fusion

Electronic versions:

Efficient photon upconversion at remarkably low annihilator concentrations: when less is more. Embargo ended: 22/11/19

DOIs:

10.1039/c8cc07592a

URLs:

<http://urn.fi/URN:NBN:fi:tty-201901141089>. Embargo ended: 22/11/19

Source: Scopus

Source ID: 85058301188

Research output: Contribution to journal > Article > Scientific > peer-review

#### Electrical Contacts in SOI MEMS Using Aerosol Jet Printing

In this study, an additive method to make electrical contacts in SOI MEMS devices with aerosol jet printing is introduced. Small grooves were etched to the frame of MEMS accelerometer in the same step with the active structure release. Aluminum ink was jetted to the trenches in wafer-level to bridge the device layer to the handle wafer with the minimum amount of material. After subsequent annealing ohmic contacts between p-type device layer and p-type handle silicon were verified by I-V measurements. The via resistance less than 4  $\Omega$  per via is measured. The method demonstrated in this work provides simple and low-cost approach for SOI handle contact where additional packaging of wafer process steps can be avoided.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Murata Electronics Oy  
Contributors: Khorramdel, B., Torkkeli, A., Mäntysalo, M.  
Pages: 34-40  
Publication date: 2017  
Peer-reviewed: Yes  
Early online date: 19 Oct 2017

#### Publication information

Journal: IEEE Journal of the Electron Devices Society  
Volume: 6  
ISSN (Print): 2168-6734  
Ratings:

Scopus rating (2017): CiteScore 4.7 SJR 1.016 SNIP 1.465

Original language: English

ASJC Scopus subject areas: Biotechnology, Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: additive manufacturing., aerosol jet printing, Aerosols, Cavity resonators, Electrical resistance measurement, Ink, inkjet printing, microelectromechanical systems (MEMS), Micromechanical devices, Printing, silicon on insulator (SOI), Silicon-on-insulator

Electronic versions:

Khorramdel Torkkeli Mäntysalo - 2018 - Electrical Contacts in SOI MEMS Using Aerosol Jet Printing

DOIs:

10.1109/JEDS.2017.2764498

URLs:

<http://urn.fi/URN:NBN:fi:tty-201901291188>

Source: Scopus

Source ID: 85032682442

Research output: Contribution to journal > Article > Scientific > peer-review

#### Electronic transport in n-type modulation-doped AlGaAs/GaAsBi quantum well structures: Influence of Bi and thermal annealing on electron effective mass and electron mobility

We investigate electronic transport properties of as-grown and annealed n-type modulation-doped  $\text{Al}_{0.15}\text{Ga}_{0.85}\text{As}/\text{GaAs}_{1-x}\text{Bi}_x$  ( $x = 0$  and  $0.04$ ) quantum well (QW) structures using magnetotransport measurements in the temperature range  $4.2$  K and  $60$  K and at magnetic fields up to  $18$  T. Thermal annealing process was applied at two different temperatures,  $700$  °C and  $350$  °C during  $60$  s and  $180$  s, respectively. We find that electron effective mass and 2D electron density in as-grown Bi-containing sample are slightly lower than that in Bi-free one. Furthermore, quantum electron mobility and quantum scattering time are observed to be decreased in Bi-containing samples. The annealing process at  $700$  °C causes a slight increase in electron effective mass and 2D electron density. A negligible decrease in electron effective mass and an increase in 2D electron density are determined following annealing at  $350$  °C. The observed change in electron effective mass following thermal annealing process is attributed to changing 2D electron density in the samples. No improvement on quantum electron mobility and quantum scattering time are observed following thermal annealing at both process temperatures. We determine that one electron subband ( $e_1$ ) for as-grown and annealed (at  $700$  °C for  $60$  s) Bi-containing QWs and two electron subbands ( $e_1$  and  $e_2$ ) for the annealed (at  $350$  °C for  $180$  s) GaAsBi QW sample and the Bi-free QW sample contribute to electronic transport. Our results reveal that there is no significant direct effect of Bi on effective electron mass, but an indirect effect, in which Bi can provoke changes in 2D electron density and hence causes not to observe actual band-edge electron mass but a deviation from its band-edge value. Therefore, it can be concluded that dispersion curve of conduction band does not change as an effect of Bi incorporation in GaAs.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Istanbul University, Eskişehir Technical University (ESTU), Istanbul University-Cerrahpasa

Contributors: Donmez, O., Aydin, M., Ardali, Yildirim, S., Tiraş, E., Nutku, F., Cetinkaya, C., okduygulular, E., Puustinen, J., Hilska, J., Guina, M., Erol, A.

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

Journal: Semiconductor Science and Technology

Volume: 35

Issue number: 2

Article number: 025009

ISSN (Print): 0268-1242

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering, Materials Chemistry  
Keywords: bismuthindependent effective mass, Electron effective mass in GaAsBi, electron mobility in GaAsBi, electronic transport in GaAsBi, n-type GaAsBi  
DOIs:  
10.1088/1361-6641/ab5d8d  
Source: Scopus  
Source ID: 85082305824  
Research output: Contribution to journal > Article > Scientific > peer-review

### **Electro-optic steering of nematicons**

We study the angular steering of spatial solitons in nematic liquid crystals, i.e. nematicons, exploiting their electro-optic response. Approaches to electro-optic steering include acting on the optic axis and walk-off, propagating the soliton through a voltage-adjusted refractive interface or getting it totally internally reflected. Using comb electrodes in a planar cell, maximum angular deflections of 70° are expected with the standard nematic liquid crystal mixture E7.

### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Frontier Photonics, Nonlinear Optics and OptoElectronics Lab, University "Roma Tre"  
Contributors: Assanto, G., Piccardi, A., Barboza, R., Alberucci, A.  
Number of pages: 3  
Pages: 2-4  
Publication date: 2012  
Peer-reviewed: Yes

### **Publication information**

Journal: Photonics Letters of Poland  
Volume: 4  
Issue number: 1  
Ratings:  
Scopus rating (2012): CiteScore 2.2 SJR 0.328 SNIP 0.581  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials  
DOIs:  
10.4302/plp.2012.1.02  
Source: Scopus  
Source ID: 84859416329  
Research output: Contribution to journal > Article > Scientific > peer-review

### **Electro-optic steering of random laser emission in liquid crystals**

Using an external low-frequency electric field applied to dye-doped nematic liquid crystals, we demonstrate that random lasing obtained by optical pumping can be steered in an angular direction by routing an all-optical waveguide able to collect the emitted light. By varying the applied voltage from 0 to 2 V, we reduce the walk-off and sweep the random laser guided beam over 7 degrees.

### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Physics, Research group: Nonlinear Optics, University of Rome Roma Tre, University "Roma Tre"  
Contributors: Assanto, G., Perumbilavil, S., Piccardi, A., Kauranen, M.  
Number of pages: 3  
Pages: 103-105  
Publication date: 2018  
Peer-reviewed: Yes

### **Publication information**

Journal: Photonics Letters of Poland  
Volume: 10  
Issue number: 4  
ISSN (Print): 2080-2242  
Ratings:  
Scopus rating (2018): CiteScore 0.8 SJR 0.214 SNIP 0.357

Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials  
DOIs:  
10.4302/plp.v10i4.852  
Source: Scopus  
Source ID: 85062032353  
Research output: Contribution to journal › Article › Scientific › peer-review

### **Electrospun Black Titania Nanofibers: Influence of Hydrogen Plasma-Induced Disorder on the Electronic Structure and Photoelectrochemical Performance**

This work encompasses a facile method for tailoring surface defects in electrospun TiO<sub>2</sub> nanofibers by employing hydrogen plasma treatments. This amiable processing method was proven with SQUID, EPR, and XPS to be highly effective in generating oxygen vacancies, accompanied by the reduction of Ti<sup>4+</sup> centers to Ti<sup>3+</sup>, resulting in the formation of black titania. The treatment temperature was found to affect the Ti<sup>3+</sup>/Ti<sup>4+</sup> ratios and surface valence, while preserving the original 1D morphology of the titania fibers. Ab initio DFT calculations showed that a high concentration of oxygen vacancies is highly efficient in producing midgap states that enhance the system absorption over the whole visible range, as observed with UV/vis/NIR diffuse reflectance spectroscopy. Pristine TiO<sub>2</sub> nanofibers produced a photocurrent density of similar to 0.02 mA/cm<sup>2</sup> at 1.23 V vs RHE, whereas the hydrogen plasma treatment resulted in up to a 10-fold increase in the photoelectrochemical performance.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Chemistry and Bioengineering, Research group: Supramolecular photochemistry, Universita degli Studi di Padova, Italy, Univ Cologne, University of Cologne, Dept Chem, Chair Inorgan & Mat Chem, Padova University, INSTM, J. Heyrovský Institute of Physical Chemistry, Academy of Sciences of the Czech Republic, Institute of Inorganic Chemistry, Catalonia Institute for Energy Research (IREC), Multiscale Materials Modelling and Tribo Simulation, CNR-IENT  
Contributors: Lepcha, A., Maccato, C., Mettenböcker, A., Andreu, T., Mayrhofer, L., Walter, M., Olthof, S., Ruoko, T. P., Klein, A., Moseler, M., Meerholz, K., Morante, J. R., Barreca, D., Mathur, S.  
Number of pages: 8  
Pages: 18835-18842  
Publication date: 20 Aug 2015  
Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Physical Chemistry C  
Volume: 119  
Issue number: 33  
ISSN (Print): 1932-7447  
Ratings:  
Scopus rating (2015): CiteScore 7.9 SJR 1.886 SNIP 1.246  
Original language: English  
ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)  
Keywords: ROOM-TEMPERATURE, WATER, SURFACE, NANOSTRUCTURES, NANOPARTICLES, PHOTOCATALYSIS, INSULATORS, CONVERSION, DEFECTS, ARRAYS  
Electronic versions:  
Electrospun\_black\_titania\_nanofibers\_post-print  
DOIs:  
10.1021/acs.jpcc.5b02767  
URLs:  
<http://urn.fi/URN:NBN:fi:tty-201612094845>  
URLs:  
<http://www.scopus.com/inward/record.url?scp=84939825598&partnerID=8YFLogxK> (Link to publication in Scopus)  
Source: Scopus  
Source ID: 84939825598  
Research output: Contribution to journal › Article › Scientific › peer-review

### **Energy density-method: An approach for a quick estimation of quench temperatures in high-field accelerator magnets**

Accelerator magnets for future particle accelerators are designed to work with as high energy densities as possible to achieve high fields and compact magnet designs. A key factor limiting the energy density is given by the protection in case of quench: If a quench occurs, the stored energy must be first absorbed by the windings, and the magnet temperature shall not exceed a given limit. In this paper, we present a back-of-the-envelope method for estimating the

magnet's maximum temperature after a quench based on its stored energy. The method combines the existing concepts of MITs, time margin, and protection delay to allow for easy and direct calculation of the hot-spot temperature. We apply the proposed method to several Nb<sub>3</sub>Sn dipole and quadrupole magnets developed for HL-LHC (High Luminosity LHC) and the FCC-hh (Future Circular Collider for hadron-hadron collisions) and compare the results to a more detailed simulation. The proposed Energy density-method is a useful tool for fast feedback in the early magnet design phase to ensure that the magnet is not impossible to protect.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Power engineering, Research group: Modelling and superconductivity, European Organization for Nuclear Research

Contributors: Salmi, T., Schoerling, D.

Publication date: Jun 2019

Peer-reviewed: Yes

Early online date: 2018

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 29

Issue number: 4

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2019): CiteScore 3.3 SJR 0.419 SNIP 1.108

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Conductivity, Copper, Energy storage, Heating systems, Magnetic circuits, Superconducting magnets, Temperature

DOIs:

10.1109/TASC.2018.2880340

Source: Scopus

Source ID: 85056300732

Research output: [Contribution to journal](#) > [Article](#) > [Scientific](#) > [peer-review](#)

#### Engineering of Chern insulators and circuits of topological edge states

Impurities embedded in electronic systems induce bound states which under certain circumstances can hybridize and lead to impurity bands. Doping of insulators with impurities has been identified as a promising route toward engineering electronic topological states of matter. In this paper we show how to realize tuneable Chern insulators starting from a three-dimensional topological insulator whose surface is gapped and intentionally doped with magnetic impurities. The main advantage of the protocol is that it is robust and in particular not very sensitive to the impurity configuration. We explicitly demonstrate this for a square lattice of impurities as well as a random lattice. In both cases we show that it is possible to change the Chern number of the system by one through manipulating its topological state. We also discuss how this can be used to engineer circuits of edge channels.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, University College Dublin, Ireland, Christina Thorpe, Utrecht University, Aalto University, COMP Centre of Excellence

Contributors: Minarelli, E. L., Poyhönen, K., Van Dalum, G. A., Ojanen, T., Fritz, L.

Publication date: 10 Apr 2019

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 99

Issue number: 16

Article number: 165413

ISSN (Print): 2469-9950

Ratings:

Scopus rating (2019): SJR 1.811 SNIP 1.025

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.99.165413

Source: Scopus

Source ID: 85065257719

Research output: Contribution to journal > Article > Scientific > peer-review

### **ESD qualification data used as the basis for building electrostatic discharge protected areas**

ESD control programs that are based on the standards IEC61340-5-1 and ANSI/ESD S20.20 are targeted to provide safer handling of electronic parts now susceptible to damage by electrostatic discharge. However, ESD failures have occurred in EPA even when all standard control methods are met. To further improve EPAs, ESD control programs should be updated to cover all known common discharge scenarios, and multiple parallel ESD source parameters should be used to assess the level of ESD risks. In addition, a reliable ESD risk assessment should be based on discharge source circuit analysis and product sensitivity tests using the real discharge waveforms found in EPA.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Cascade Metrology

Contributors: Tamminen, P., Viheriäkoski, T., Sydänheimo, L., Ukkonen, L.

Number of pages: 8

Pages: 174-181

Publication date: 1 Oct 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Electrostatics

Volume: 77

Article number: 3024

ISSN (Print): 0304-3886

Ratings:

Scopus rating (2015): CiteScore 2.4 SJR 0.48 SNIP 1.189

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Condensed Matter Physics, Biotechnology

Keywords: CDM, Control program, EPA, ESD, HBM, Standards

DOIs:

10.1016/j.elstat.2015.08.009

Source: Scopus

Source ID: 84940760492

Research output: Contribution to journal > Article > Scientific > peer-review

### **Essential Measurements for Finite Element Simulations of Magnetostrictive Materials**

We discuss which magnetoelastic material properties are essential to measure in order to model magnetostrictive materials in finite element simulations. We show knowing the magnetic constitutive relation is sufficient, if the elastic behavior without magnetic field is known a priori. We neglect hysteresis, and our starting point is to express the effect of mechanical deformation on the magnetic constitutive relation with a small strain tensor and magnetic flux density. It follows that the (energetic) state of a magnetostrictive material is independent of its history. Then, a certain choice of history allows us to keep magnetism and elasticity distinct. We demonstrate with open source software Elmer, how one can set up such magnetoelastic simulations. These simulations rely on data obtained from magnetostrictive measurements. Finally, it is discussed how a measurement setup and the finite element model should be combined in order to verify the approach with experiments.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering

Contributors: Poutala, A., Kovanen, T., Kettunen, L.

Publication date: 2018

Peer-reviewed: Yes

Early online date: 16 Nov 2017

#### **Publication information**

Journal: IEEE Transactions on Magnetics

Volume: 54

Issue number: 1  
Article number: 7200107  
ISSN (Print): 0018-9464  
Ratings:

Scopus rating (2018): CiteScore 3.1 SJR 0.539 SNIP 1.019

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: Finite element analysis, Magnetic hysteresis, magnetomechanical coupling, Magnetostriction, magnetostriction, Strain, Tensile stress

DOIs:

10.1109/TMAG.2017.2766599

Source: Scopus

Source ID: 85035114341

Research output: Contribution to journal > Article > Scientific > peer-review

### **Evaluation of Aerosol, Superfine Inkjet, and Photolithography Printing Techniques for Metallization of Application Specific Printed Electronic Circuits**

Application specific printed electronic circuits (ASPECs) are the corresponding term with application-specified ICs for printed electronics. The same as any new technology, printed electronics is suffering from some restrictions in design and process technology aspects. An important stage in the ASPEC design is the final wiring of the organic thin-film transistor arrays or gate arrays to customize it to implement any specific target application that fits in their structure. In this paper, we evaluate two additive manufacturing technologies: aerosol jet using Optomec M3D and electrohydrodynamic printer using superfine inkjet. Both techniques are based on direct-writing of the pattern corresponding to any individual circuit being fabricated (digital printing) enabled by the mask-free noncontact deposition of materials. Finally, these structures will be compared with the corresponding photolithography mask technology. Some parameterized test vehicles, with different instantiations for the variation of line widths and separations, have been designed to be wired using the target technologies. These test vehicles have been fabricated at the Centre for Process Innovation by a five masks lithography and subtractive patterning technology. Results show that both direct printing technologies are feasible for the fabrication of the gate-array customization, thus allowing individual personalization of every circuit what can produce added value functionalities at low cost such as the equivalent effect of having an ROM memory which final contents could be customized at home by using low-cost digital printing technologies. Further interactions between transistor bulk and wiring technologies can improve the obtained performance in order to end up in an industrialized process.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Universitat Autònoma de Barcelona, Centre for Process Innovation Limited, NeuDrive Ltd., National Research Council, University Autònoma of Barcelona

Contributors: Mashayekhi, M., Winchester, L., Evans, L., Pease, T., Laurila, M., Mäntysalo, M., Ogier, S., Teres, L., Carrabina, J.

Number of pages: 8

Pages: 1246-1253

Publication date: 1 Mar 2016

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Electron Devices

Volume: 63

Issue number: 3

ISSN (Print): 0018-9383

Ratings:

Scopus rating (2016): CiteScore 5.2 SJR 1.009 SNIP 1.668

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Additive manufacturing, aerosol jet (AJ), application specific printed electronic circuits (ASPECs), application-specified IC (ASIC), gate array, photolithography, printed electronics, superfine inkjet (SIJ)

DOIs:

10.1109/TED.2016.2522388

Source: Scopus

Source ID: 84969344785

Research output: Contribution to journal > Article > Scientific > peer-review

### Evaluation of crushing strength of spray-dried MgAl<sub>2</sub>O<sub>4</sub> granule beds

The crushing strengths of four different experimental magnesium aluminate spinel (MgAl<sub>2</sub>O<sub>4</sub>) granule beds were monitored with the axial die pressing test after heat treatments. Precursor, magnesium hydroxide (Mg(OH)<sub>2</sub>) and magnesium oxide (MgO) as Mg precursor and aluminium oxide hydroxide Al(O)OH and α-Al<sub>2</sub>O<sub>3</sub> as Al precursor, were used for experimental granules, which were manufactured via a dispersion manufacturing and spray-drying process. After spray-drying, granules were heat treated in air at 1000, 1100, 1200, 1300 and 1400 °C. In order to understand the potential effect of precursor, phase structure, morphology, particle size distribution and density of granules on crushing strength behaviour, scanning X-ray diffraction (XRD) was used together with electron microscopy (SEM) and laser diffraction (LDPA) for characterisation. All precursor mixtures formed spherical granules during the spray-drying process and pure spinel phase structure during heat treatment. The crushing strength test results indicated that the Al precursor clearly affected the crushing strength behaviour of experimental granule beds. The highest strength was observed for granule beds with Al(O)OH as Al and Mg(OH)<sub>2</sub> as Mg precursor.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS), VTT Technical Research Centre of Finland

Contributors: Kanerva, U., Suhonen, T., Lagerbom, J., Levänen, E.

Number of pages: 7

Pages: 8494-8500

Publication date: 1 Aug 2015

Peer-reviewed: Yes

#### Publication information

Journal: Ceramics International

Volume: 41

Issue number: 7

ISSN (Print): 0272-8842

Ratings:

Scopus rating (2015): CiteScore 4 SJR 0.823 SNIP 1.353

Original language: English

ASJC Scopus subject areas: Ceramics and Composites, Process Chemistry and Technology, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Materials Chemistry

Keywords: Axial pressing, Granule, MgAl<sub>2</sub>O<sub>4</sub> spinel, The crushing strength

DOIs:

10.1016/j.ceramint.2015.03.056

URLs:

<http://www.scopus.com/inward/record.url?scp=84929271760&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Lagerbom, Juha"

EXT="Kanerva, Ulla"

Source: Scopus

Source ID: 84929271760

Research output: Contribution to journal › Article › Scientific › peer-review

### Evaluation of screen printed silver trace performance and long-term reliability against environmental stress on a low surface energy substrate

Otherwise attractive substrate materials for printed electronics may have such surface characteristics that make patterning challenging. This article focuses on the printability and performance characterization of conductive patterns on a low surface energy substrate. Surface characteristics of a hydrophobic polyphenylene ether (PPE) substrate and the effects of surface modification using chemical and physical pre-treatments were studied. In addition, silver ink performance and its reliability on this substrate were evaluated. The surface was characterized by surface energy measurements and surface profile analysis. Screen-printed test patterns were characterized to evaluate print quality and electrical and mechanical performance. A further inspection of substrate-ink interactions was conducted using environmental reliability tests. It was observed that ink adhesion could be significantly promoted by choosing a suitable surface pre-treatment method. Low sheet resistances were obtained, and thus, suitable inks for further characterization were found. In addition, it was observed that environmental stress has a significant impact on ink-substrate interactions.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electronics and Communications Engineering, Nano Communication Centre

Contributors: Mikkonen, R., Mäntysalo, M.

Number of pages: 12  
Pages: 54-65  
Publication date: 1 Jul 2018  
Peer-reviewed: Yes

#### Publication information

Journal: Microelectronics Reliability  
Volume: 86  
ISSN (Print): 0026-2714  
Ratings:

Scopus rating (2018): CiteScore 2.6 SJR 0.376 SNIP 1.017

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Condensed Matter Physics, Safety, Risk, Reliability and Quality, Surfaces, Coatings and Films, Electrical and Electronic Engineering

Keywords: Adhesion, Environmental stress, PPE, Printed electronics, Reliability, Surface modification

Electronic versions:

MR-D-17-00926\_accepted. Embargo ended: 21/05/20

DOIs:

10.1016/j.microrel.2018.05.010

URLs:

<http://urn.fi/URN:NBN:fi:tuni-201909273544>. Embargo ended: 20/05/20

Source: Scopus

Source ID: 85047240351

Research output: Contribution to journal > Article > Scientific > peer-review

#### Exciton localization and structural disorder of GaAs<sub>1-x</sub>Bi<sub>x</sub>/GaAs quantum wells grown by molecular beam epitaxy on (311)B GaAs substrates

In this work, we have investigated the structural and optical properties of GaAs<sub>(1-x)</sub>Bi<sub>x</sub>/GaAs single quantum wells (QWs) grown by molecular beam epitaxy on GaAs (311)B substrates using x-ray diffraction, atomic force microscopy, Fourier-transform Raman (FT-Raman) and photoluminescence spectroscopy techniques. The FT-Raman results revealed a decrease of the relative intensity ratio of transverse and longitudinal optical modes with the increase of Bi concentration, which indicates a reduction of the structural disorder with increasing Bi incorporation. In addition, the PL results show an enhancement of the optical efficiency of the structures as the Bi concentration is increased due to important effects of exciton localization related to Bi defects, nonradiative centers and alloy disorder. These results provide evidence that Bi is incorporated effectively into the QW region. Finally, the temperature dependence of the PL spectra has evidenced two distinct types of defects related to the Bi incorporation, namely Bi clusters and pairs, and alloy disorder and potential fluctuation.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: ORC, Universidade Federal de São Carlos, University of Nottingham, Adana Science and Technology University, University of São Paulo

Contributors: Prando, G. A., Orsi Gordo, V., Puustinen, J., Hilska, J., Alghamdi, H. M., Som, G., Gunes, M., Akyol, M., Souto, S., Rodrigues, A. D., Galeti, H. V., Henini, M., Gobato, Y. G., Guina, M.

Publication date: 17 Jul 2018

Peer-reviewed: Yes

#### Publication information

Journal: Semiconductor Science and Technology

Volume: 33

Issue number: 8

Article number: 084002

ISSN (Print): 0268-1242

Ratings:

Scopus rating (2018): CiteScore 4 SJR 0.744 SNIP 1.014

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering, Materials Chemistry

Keywords: dilute bismide, exciton localization, photoluminescence, structural disorder

DOIs:

10.1088/1361-6641/aad02e

Source: Scopus

Source ID: 85051332383

Research output: Contribution to journal › Article › Scientific › peer-review

### Experimental realization of wave-packet dynamics in cyclic quantum walks

Quantum walks present novel tools for redesigning quantum algorithms, universal quantum computations, and quantum simulators. Hitherto, one- and two-dimensional quantum systems (lattices) have been simulated and studied with photonic systems. Here, we report the photonic simulation of cyclic quantum systems, such as hexagonal structures. We experimentally explore the wavefunction dynamics and probability distribution of a quantum particle located on a six-site system, along with three- and four-site systems while under different initial conditions. Various quantum walk systems employing Hadamard, C-NOT, and Pauli-Z gates are experimentally simulated, where we find configurations capable of simulating particle transport and probability density localization. Our technique can potentially be integrated into small-scale structures using microfabrication, and thus would open a venue towards simulating more complicated quantum systems comprised of cyclic structures.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: University of Ottawa, Canada, Austrian Academy of Sciences

Contributors: Nejadstattari, F., Zhang, Y., Bouchard, F., Larocque, H., Sit, A., Cohen, E., Fickler, R., Karimi, E.

Number of pages: 7

Pages: 174-180

Publication date: 20 Feb 2019

Peer-reviewed: Yes

#### Publication information

Journal: Optica

Volume: 6

Issue number: 2

ISSN (Print): 2334-2536

Ratings:

Scopus rating (2019): CiteScore 18.1 SJR 5.6 SNIP 3.375

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

DOIs:

10.1364/OPTICA.6.000174

URLs:

<http://www.scopus.com/inward/record.url?scp=85063372591&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 85063372591

Research output: Contribution to journal › Article › Scientific › peer-review

### Exploration of Two Layer Nb<sub>3</sub>Sn Designs of the Future Circular Collider Main Quadrupoles

The goal of this study is to propose an alternative FCC quadrupole design where the risk from both their fabrication and their operation in the machine is reduced compared to previous analysis. Therefore, the number of coil layers has been reduced from four to two and the load-line margin has been increased from 14% to 20% compared to previous investigations ('Design of a Nb<sub>3</sub>Sn 400 T/m quadrupole for the future circular collider,' IEEE Trans. Appl. Supercond., vol. 28, no. 3, p. 4004905, Apr. 2018). Indeed, the idea is to only challenge the ~5000 FCC main dipoles and stay at a relatively low complexity for the ~700 FCC main quadrupoles so they have a limiting impact on the machine operation and reliability. An exploration of the strand diameter (0.7-0.9 mm), the cable size (40-60 strands), as well as the protection delay (30-40 ms) is performed on two-dimensional (2-D) magnetic designs of the FCC main quadrupole. A discussion on cable windability allows for the selection of one design generating 367 T/m. The design is mechanically constrained with a conventional collar structure leading to collaring peak stress of 115 MPa. A single coupling-loss-induced quench unit ensures a safe magnet operation with a 300 K hotspot temperature.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Engineering, IRFM, European Organization for Nuclear Research

Contributors: Lorin, C., Fleiter, J., Salmi, T., Schoerling, D.

Publication date: 1 Aug 2019

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 29  
Issue number: 5  
Article number: 4001005  
ISSN (Print): 1051-8223  
Ratings:

Scopus rating (2019): CiteScore 3.3 SJR 0.419 SNIP 1.108

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: collar structure, CLIQ protection system, MQ, Nb Sn coil

DOIs:

10.1109/TASC.2019.2892814

Source: Scopus

Source ID: 85061237007

Research output: Contribution to journal > Article > Scientific > peer-review

### **Fabrication of ssDNA/Oligo(ethylene glycol) monolayers and patterns by exchange reaction promoted by ultraviolet light irradiation**

Using a representative test system, we present here a versatile approach to prepare mixed monolayers of thiolated single-stranded DNA (ssDNA) and oligo(ethylene glycol) substituted alkanethiols (OEG-AT) in a broad range of compositions as well as ssDNA/OEG-AT patterns of desired shape imbedded into a biorepulsive background. The procedure involves two steps. First, a primary, well-defined OEG-AT monolayer on a solid support is exposed to UV light in either homogeneous or lithographic fashion. Second, the exchange reaction between the damaged OEG-AT species in the film and ssDNA substituents in solution occurs, resulting in formation of ssDNA/OEG-AT monolayer or pattern. The above procedure relies on commercially available compounds and does not require vacuum, which simplifies its application in research and industrial laboratories. The composition of the mixed films or ssDNA/OEG-AT spots (lithography) can be precisely adjusted by UV dose in an almost entire composition range. It was demonstrated that the procedure can be performed with UV light of different wavelengths (254 or 365 nm), which opens new possibilities for lithography. Using advanced spectroscopic tools, it was shown that ssDNA molecules imbedded into the OEG-AT matrix maintain their identity and intact character as well as exhibit predominant upright orientation typical of one-component films of thiolated ssDNA. The OEG-AT constituents of the mixed monolayers were found to be intact as well, with all UV damaged OEG-AT species being exchanged for ssDNA. Finally, a representative ssDNA/OEG-AT pattern was fabricated.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Integrated Technologies for Tissue Engineering Research (ITTE), Universitat Heidelberg

Contributors: Khan, M. N., Zharnikov, M.

Number of pages: 11

Pages: 24883-24893

Publication date: 27 Nov 2013

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Physical Chemistry C

Volume: 117

Issue number: 47

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2013): CiteScore 8.3 SJR 2.143 SNIP 1.432

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

10.1021/jp408819k

URLs:

<http://www.scopus.com/inward/record.url?scp=84889582340&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84889582340

Research output: Contribution to journal > Article > Scientific > peer-review

### **Fabrication of ssDNA/oligo(ethylene glycol) monolayers by promoted exchange reaction with thiol and disulfide substituents**

Biorepulsive oligo(ethylene glycol)-substituted alkanethiolate (OEG-AT) monolayers on gold can serve as primary templates for promoted (by electron irradiation) exchange reaction with thiolated ssDNA species, resulting in the formation

of mixed OEG-AT/ssDNA monolayers of desired composition. Here we test the ability of alternative, disulfide precursors to serve as substituents in such a reaction. Two representative molecules, based on adenine-based homo-oligonucleotide (25-mer), were used, viz., asymmetric disulfide with a short second chain (A25SSOH) and symmetric disulfide (A25SSA25). The results were compared to the reference system of thiolated ssDNA (A25SH). Both disulfide precursors were found to be suitable for the reaction, further extending the types of commercially available compounds which can be used for this approach. A25SSOH exhibited quite high efficiency, similar to A25SH, while the efficiency of A25SSA25 was noticeably lower, especially at low irradiation doses (2). Also, the single component, A25SSA25-based ssDNA monolayer, was of lower quality as compared to the films prepared from the A25SH and A25SSOH precursors. The above observations were explained by the bulky character and conformational flexibility of A25SSA25, which hinder the proper assembly and efficient exchange reaction.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Integrated Technologies for Tissue Engineering Research (ITTE), Universitat Heidelberg

Contributors: Khan, M. N., Zharnikov, M.

Number of pages: 9

Pages: 3093-3101

Publication date: 13 Feb 2014

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 118

Issue number: 6

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2014): CiteScore 8.4 SJR 2.032 SNIP 1.434

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

10.1021/jp411353f

URLs:

<http://www.scopus.com/inward/record.url?scp=84894037828&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84894037828

Research output: Contribution to journal › Article › Scientific › peer-review

#### Features of correlation measurements of the parameters of pulsed hyperspectral optical fields using an asymmetric interferometer

Differences in correlation measurements of the parameters of pulsed hyperspectral optical fields using symmetric and asymmetric interferometers are considered. It is shown analytically that the resulting cross-correlation function is sensitive to phase perturbations in the original wave field. The considered setup, which contains a telescopic reflective 4f system of parabolic mirrors in one arm, demonstrates that in the case of an asymmetric interferometer, the presence of aberrations leads to degradation of the reconstructed image, whereas in the case of symmetric interferometers these aberrations do not affect the result.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Computing Sciences, Research group: Computational Imaging-CI, ITMO University

Contributors: Kulya, M. S., Katkovnik, V. Y., Egiazarian, K., Petrov, N. V.

Number of pages: 4

Pages: 679-682

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

Journal: Quantum Electronics

Volume: 50

Issue number: 7

ISSN (Print): 1063-7818

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Statistical and Nonlinear Physics, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: correlation measurements, hyperspectral fields, symmetric and asymmetric interferometers

DOIs:

10.1070/QEL17292

Source: Scopus

Source ID: 85090382756

Research output: Contribution to journal › Article › Scientific › peer-review

### **FEM for directly coupled magneto-mechanical phenomena in electrical machines**

A directly coupled magneto-mechanical model is proposed for simulating the effect of the magnetostriction and electromagnetic stress in iron. The model is based on the general balance laws of electromagnetism, mechanics, and continuum thermodynamics. It is implemented in 2-D by using a conforming finite element method for the magnetic vector potential and the displacement field. The method is applied to two different types of induction machines.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Aalto University

Contributors: Fonteyn, K., Belahcen, A., Kouhia, R., Rasilo, P., Arkkio, A.

Number of pages: 4

Pages: 2923-2926

Publication date: Aug 2010

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Magnetics

Volume: 46

Issue number: 8

ISSN (Print): 0018-9464

Ratings:

Scopus rating (2010): SJR 0.712 SNIP 1.134

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: electromagnetic stress tensor, finite element analysis, Magneto-mechanical coupling, magnetostriction

DOIs:

10.1109/TMAG.2010.2044148

Source: Scopus

Source ID: 77954840624

Research output: Contribution to journal › Article › Scientific › peer-review

### **First Cold Powering Test of REBCO Roebel Wound Coil for the EuCARD2 Future Magnet Development Project**

EuCARD-2 is a project partly supported by FP7-European Commission aiming at exploring accelerator magnet technology for 20 T dipole operating field. The EuCARD-2 collaboration is liaising with similar programs for high field magnets in the USA and Japan. EuCARD-2 focuses, through the work-package 10 'Future magnets,' on the development of a 10 kA-class superconducting, high current density cable suitable for accelerator magnets, for a 5 T stand-alone dipole of 40 mm bore and about 1 m length. After standalone testing, the magnet will possibly be inserted in a large bore background dipole, to be tested at a peak field up to 18 T. This paper starts by reporting on a few of the highlight simulations that demonstrate the progress made in predicting: dynamic current distribution and influence on field quality, complex quench propagation between tapes, and minimum quench energy in the multitape cable. The multiphysics output importantly helps predicting quench signals and guides the development of the novel early detection systems. Knowing current position within individual tapes of each cable we present stress distribution throughout the coils. We report on the development of the mechanical component and assembly processes selected for Feather-M2 the 5 T EuCARD2 magnet. We describe the CERN variable temperature flowing helium cold gas test system. We describe the parallel integration of the FPGA early quench detection system, using pickup coils and temperature sensors, alongside the standard CERN magnet quench detection system using voltage taps. Finally we report on the first cold tests of the REBCO 10 kA class Roebel subscale coil named Feather-M0.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research group: Modelling and superconductivity, European Organization for Nuclear Research, IRFM, Karlsruhe Institute of Technology, Campus North, Bruker HTS

Contributors: Kirby, G. A., Van Nugteren, J., Bajas, H., Benda, V., Ballarino, A., Bajko, M., Bottura, L., Broekens, K., Canale, M., Chiuchio, A., Gentini, L., Peray, N., Perez, J. C., De Rijk, G., Rijllart, A., Rossi, L., Murtomaeki, J., Mazet, J., Pincot, F. O., Volpini, G., Durante, M., Fazilleau, P., Lorin, C., Stenvall, A., Goldacker, W., Kario, A., Usoskin, A.

Publication date: 1 Jun 2017

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 27

Issue number: 4

Article number: 4003307

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2017): CiteScore 2.7 SJR 0.408 SNIP 0.962

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: accelerators magnets, cryogenic systems, EuCARD-2, future magnets, high-temperature-superconductors, HTS, metal 3-D printing, Roebel cable, Superconducting magnets

DOIs:

10.1109/TASC.2017.2653204

Source: Scopus

Source ID: 85017652750

Research output: Contribution to journal > Article > Scientific > peer-review

### First principles prediction of the solar cell efficiency of chalcopyrite materials $\text{AgMX}_2$ (M=In, Al; X=S, Se, Te)

Using the spectroscopic limited maximum efficiency, and Shockley and Queisser predictor models, we compute the solar efficiency of the chalcopyrites  $\text{AgMX}_2$  (M = In, Al; X = S, Se, Te). The results presented are based on the estimation of the electronic and optical properties obtained from first principles density functional theory as well as the many-body perturbation theory calculations. The results from this report were consistent with the experimental data. The optical bandgap was accurately estimated from the absorption spectra, obtained by solving the Bethe and Salpeter equation. Fitting the Tauc's plot on the absorption spectra, we also predicted that the materials studied have a direct allowed optical transition. The theoretical estimations of the solar cell performance showed that the efficiencies from the Shockley and Queisser model are higher than those from the spectroscopic limited maximum efficiency model. This improvement is attributed to the absorption, the recombination processes and the optical transition accounted in the calculation of the efficiency.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Engineering, University of South Africa, University of Witwatersrand

Contributors: Dongho-Nguimdo, G. M., Igumbor, E., Zambou, S., Joubert, D. P.

Publication date: 1 Dec 2019

Peer-reviewed: Yes

### Publication information

Journal: Computational Condensed Matter

Volume: 21

Article number: e00391

ISSN (Print): 2352-2143

Ratings:

Scopus rating (2019): CiteScore 1.7 SJR 0.341 SNIP 0.706

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Materials Science (miscellaneous), Condensed Matter Physics, Materials Chemistry

Keywords: Chalcopyrites, First principles, Solar cell efficiency

DOIs:

10.1016/j.cocom.2019.e00391

Source: Scopus

Source ID: 85065198754

Research output: Contribution to journal > Article > Scientific > peer-review

### Fluid flow simulations meet high-speed video: Computer vision comparison of droplet dynamics

Hypothesis: While multiphase flows, particularly droplet dynamics, are ordinary in nature as well as in industrial processes, their mathematical and computational modelling continue to pose challenging research tasks - patent approaches for tackling them are yet to be found. The lack of analytical flow field solutions for non-trivial droplet dynamics hinders validation of computer simulations and, hence, their application in research problems. High-speed videos and computer vision algorithms can provide a viable approach to validate simulations directly against experiments. Experiments:

Droplets of water (or glycerol-water mixtures) impacting on both hydrophobic and superhydrophobic surfaces were imaged with a high-speed camera. The corresponding configurations were simulated using a lattice-Boltzmann multiphase scheme. Video frames from experiments and simulations were compared, by means of computer vision, over entire droplet impact events. Findings: The proposed experimental validation procedure provides a detailed, dynamic one-on-one comparison of a droplet impact. The procedure relies on high-speed video recording of the experiments, computer vision, and on a software package for the analyzation routines. The procedure is able to quantitatively validate computer simulations against experiments and it is widely applicable to multiphase flow systems in general.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Natural Resources Institute Finland (Luke), BioFluidix GmbH, Faculty of Information Technology, Jyväskylän yliopisto

Contributors: Kulju, S., Riegger, L., Koltay, P., Mattila, K., Hyväluoma, J.

Number of pages: 9

Pages: 48-56

Publication date: 15 Jul 2018

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Colloid and Interface Science

Volume: 522

ISSN (Print): 0021-9797

Ratings:

Scopus rating (2018): CiteScore 9 SJR 1.29 SNIP 1.342

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Surfaces, Coatings and Films, Colloid and Surface Chemistry

Keywords: Computer vision, Droplet, Experimental, High-speed video, Hydrophobic, Lattice Boltzmann, Simulation

DOIs:

10.1016/j.jcis.2018.03.053

#### Bibliographical note

EXT="Kulju, S."

Source: Scopus

Source ID: 85044153494

Research output: Contribution to journal › Article › Scientific › peer-review

#### Fluorimetric oxygen sensor with an efficient optical read-out for in vitro cell models

This paper presents a phase fluorimetric sensor for the monitoring of the oxygen concentration in in vitro cell models. The sensing surface of the sensor consists of oxygen sensitive fluorescent dyes (platinum(II) octaethylporphyrinketone) embedded in a thin polystyrene film. In order to optimize the optical read-out scheme of the sensor, we carried out electromagnetic simulations of a fluorescently doped polystyrene film deposited on a glass-water interface. The simulation results showed highly anisotropic angular emission distribution with the maximum irradiance being at super critical angles, which attracts tailored optical designs to maximize the fluorescence collection efficiency. For this purpose, we applied an efficient optical read-out scheme based on an in-contact parabolic lens. The use of parabolic lens also facilitates confocal total internal reflection excitation from the substrate side. This makes the excitation effective and insensitive to biofouling or other optical changes in the sensing surface and, more importantly, greatly reduces the amount of excitation power radiated into the cell culture chamber. Experimental results show that when applied together with phase fluorimetric lifetime sensing, this optical scheme allows one to use thin films (

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: BioMediTech, Faculty of Biomedical Sciences and Engineering, Research group: Micro and Nanosystems Research Group, Research area: Microsystems, Research group: Sensor Technology and Biomeasurements (STB), VTT Technical Research Centre of Finland, BioMediTech Institute and Faculty of Biomedical Sciences and Engineering

Contributors: Välimäki, H., Verho, J., Kreutzer, J., Kattiparambil Rajan, D., Ryyänen, T., Pekkanen-Mattila, M., Ahola, A., Tappura, K., Kallio, P., Lekkala, J.

Number of pages: 9

Pages: 738-746

Publication date: 1 Oct 2017

Peer-reviewed: Yes

#### Publication information

Journal: Sensors and Actuators B: Chemical

Volume: 249

ISSN (Print): 0925-4005

Ratings:

Scopus rating (2017): CiteScore 9.3 SJR 1.406 SNIP 1.453

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Instrumentation, Condensed Matter Physics, Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry, Electrical and Electronic Engineering

Keywords: Cardiac cells, Enhanced optical read-out, Fluorimetric oxygen sensor, in vitro cell models, PtOEPK, Thin film fluorescence

DOIs:

10.1016/j.snb.2017.04.182

Source: Scopus

Source ID: 85019164799

Research output: Contribution to journal › Article › Scientific › peer-review

### Frequency modulation of semiconductor disk laser pulses

A numerical model is constructed for a semiconductor disk laser mode-locked by a semiconductor saturable absorber mirror (SESAM), and the effect that the phase modulation caused by gain and absorption saturation in the semiconductor has on pulse generation is examined. The results demonstrate that, in a laser cavity with sufficient second-order dispersion, alternating-sign frequency modulation of pulses can be compensated for. We also examine a model for tuning the dispersion in the cavity of a disk laser using a Gires - Tournois interferometer with limited thirdorder dispersion.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Ulyanovsk State University

Contributors: Zolotovskii, I. O., Korobko, D. A., Okhotnikov, O. G.

Number of pages: 7

Pages: 628-634

Publication date: 2015

Peer-reviewed: Yes

### Publication information

Journal: Quantum Electronics

Volume: 45

Issue number: 7

ISSN (Print): 1063-7818

Ratings:

Scopus rating (2015): CiteScore 1.9 SJR 0.589 SNIP 1.177

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Statistical and Nonlinear Physics

Keywords: Frequency modulation of pulses., Semiconductor disk laser

DOIs:

10.1070/QE2015v045n07ABEH015670

Source: Scopus

Source ID: 84938310088

Research output: Contribution to journal › Article › Scientific › peer-review

### Full-field mode sorter using two optimized phase transformations for high-dimensional quantum cryptography

High-dimensional encoding schemes have emerged as a novel way to perform quantum information tasks. For high dimensionality, temporal and transverse spatial modes of photons are the two paradigmatic degrees of freedom commonly used in such experiments. Nevertheless, general devices for multi-outcome measurements are still needed to take full advantage of the high-dimensional nature of encoding schemes. We propose a general full-field mode sorting scheme consisting of only up to two optimized phase elements based on evolutionary algorithms that allows for joint sorting of azimuthal and radial modes. We further study the performance of our scheme through simulations in the context of high-dimensional quantum cryptography, where sorting in different mutually unbiased bases and high-fidelity measurement schemes are crucial.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Austrian Academy of Sciences, University of Ottawa, Canada, University of Ulm Medical Center, Centro S3, Max Planck Institute for the Science of Light, Friedrich-Alexander-Universität Erlangen-Nürnberg  
Contributors: Fickler, R., Bouchard, F., Giese, E., Grillo, V., Leuchs, G., Karimi, E.  
Number of pages: 7  
Publication date: 2020  
Peer-reviewed: Yes

#### Publication information

Journal: Journal of Optics (United Kingdom)

Volume: 22

Issue number: 2

Article number: 024001

ISSN (Print): 2040-8978

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Keywords: mode demultiplexing high-dimensional quantum information, quantum cryptography, transverse spatial modes

Electronic versions:

Fickler\_2020\_J.\_Opt.\_22\_024001

DOIs:

10.1088/2040-8986/ab6303

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202003202782>

Source: Scopus

Source ID: 85079689477

Research output: Contribution to journal › Article › Scientific › peer-review

#### Fundamental gaps of quantum dots on the cheap

We show that the fundamental gaps of quantum dots can be accurately estimated at the computational effort of a standard ground-state calculation supplemented with a non-self-consistent step of negligible cost, all performed within density-functional theory at the level of the local-density approximation.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: Quantum Control and Dynamics, Università degli Studi di Modena e Reggio Emilia, Centro S3

Contributors: Guandalini, A., Rozzi, C. A., Räsänen, E., Pittalis, S.

Publication date: 25 Mar 2019

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 99

Issue number: 12

Article number: 125140

ISSN (Print): 2469-9950

Ratings:

Scopus rating (2019): SJR 1.811 SNIP 1.025

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.99.125140

URLs:

<http://www.scopus.com/inward/record.url?scp=85064152482&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 85064152482

Research output: Contribution to journal › Article › Scientific › peer-review

#### GaInAsSb/AlGa(In)AsSb type I quantum wells emitting in 3µm range for application in superluminescent diodes

In this paper, we present results of Fourier-transformed photoluminescence measurements of quaternary GaInAsSb quantum wells with quinary AlGaInAsSb barriers grown on GaSb substrate, designed for spectral range of mid-infrared. Here, we show an emission shift towards longer wavelength as a result of incorporation of indium into the quantum wells reaching up to 3 µm at room temperature (RT). Additionally, we have observed an additional low-energy photoluminescence signal with maximum wavelength of 3.5 µm at RT, which we have attributed as states localised on the

layer interfaces. The activation energy of carriers trapped in those states is estimated to be 35 meV.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Research group: ORC, Physics, Wrocław University of Technology

Contributors: Kurka, M., Dyksik, M., Suomalainen, S., Koivusalo, E., Guina, M., Motyka, M.

Number of pages: 5

Pages: 274-278

Publication date: 1 May 2019

Peer-reviewed: Yes

#### Publication information

Journal: Optical Materials

Volume: 91

ISSN (Print): 0925-3467

Ratings:

Scopus rating (2019): CiteScore 4.4 SJR 0.594 SNIP 1.068

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Computer Science(all), Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: Fourier-transformed spectroscopy, MBE, Optical gas sensing, Photoluminescence, Superluminescent diodes  
DOIs:

10.1016/j.optmat.2019.03.036

Source: Scopus

Source ID: 85063381328

Research output: Contribution to journal > Article > Scientific > peer-review

#### Generalized slip transformations and air-gap harmonics in field models of electrical machines

In numerical field analysis of steady states of electrical machines, frequency-domain methods are often much faster than time-domain methods. Frequency-domain techniques often involve simplifications that impact their accuracy on harmonic effects due to slotting, saturation, and time harmonics in winding currents. The nature of these inaccuracies and their relationship to air-gap field harmonics is not that well covered in the literature. Correct prediction of air-gap field harmonics can be based on careful use of spectral Dirichlet-to-Neumann mappings and generalized slip transformations. We show how nonzero harmonics in the air-gap fields can be reliably predicted and explain the nature of inaccuracies in certain common steady-state solution techniques.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics

Contributors: Räisänen, V., Suuriniemi, S., Kettunen, L.

Publication date: 1 Sep 2016

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Magnetics

Volume: 52

Issue number: 9

Article number: 8107708

ISSN (Print): 0018-9464

Ratings:

Scopus rating (2016): CiteScore 3 SJR 0.653 SNIP 0.949

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: Boundary value problems, Fourier series, harmonics, rotating machines

DOIs:

10.1109/TMAG.2016.2561907

#### Bibliographical note

EXT="Räisänen, Ville"

Source: Scopus

Source ID: 84983678510

Research output: Contribution to journal > Article > Scientific > peer-review

### **Generation of a broad IR spectrum and N-soliton compression in a longitudinally inhomogeneous dispersion-shifted fibre**

The propagation of N-soliton pulses in an optical fibre with slowly decreasing, shifted anomalous dispersion has been studied experimentally and theoretically. Using a generalised nonlinear Schrodinger equation, we have constructed an adequate numerical model for light propagation in such fibre. Using numerical simulation, we have shown that the use of dispersion-decreasing fibres ensures higher average dispersive radiation intensity and better uniformity of the supercontinuum spectrum. A reduction in the third-order dispersion of such fibres enables supercontinuum generation with a bandwidth exceeding that in homogeneous fibres by several hundred nanometres even in the case of a medium-power subpicosecond source.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Ulyanovsk State University, Optoelectronics Research Centre, Tampere University of Technology, A. M. Prokhorov General Physics Institute, Russian Academy of Sciences

Contributors: Zolotovskii, I. O., Korobko, D. A., Okhotnikov, O. G., Stolyarov, D. A., Sysolyatin, A. A.

Number of pages: 9

Pages: 844-852

Publication date: 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Quantum Electronics

Volume: 45

Issue number: 9

ISSN (Print): 1063-7818

Ratings:

Scopus rating (2015): CiteScore 1.9 SJR 0.589 SNIP 1.177

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Statistical and Nonlinear Physics

Keywords: Dispersion-shifted fibres, Generation of a broad spectrum, Longitudinally inhomogeneous optical fibres.

DOIs:

10.1070/QE2015v045n09ABEH015690

Source: Scopus

Source ID: 84943269989

Research output: Contribution to journal > Article > Scientific > peer-review

### **Generation of bound states of pulses in a soliton laser with complex relaxation of a saturable absorber**

A numerical model of a soliton fibre laser with a semiconductor saturable absorber mirror (SESAM), characterised by the complex dynamics of absorption relaxation, is considered. It is shown that stationary bound states of pulses can be formed in this laser as a result of their interaction via the dispersion-wave field. The stability of stationary bound states of several pulses is analysed. It is shown that an increase in the number of pulses in a stationary bound state leads eventually to its decay and formation of a random bunch. It is found that the bunch stability is caused by the manifestation of nonlinear self-phase modulation, which attracts pulses to the bunch centre. The simulation results are in qualitative agreement with experimental data.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Frontier Photonics, Ulyanovsk State University

Contributors: Zolotovskii, I. O., Korobko, D. A., Gumenyuk, R. V., Okhotnikov, O. G.

Number of pages: 9

Pages: 26-34

Publication date: 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Quantum Electronics

Volume: 45

Issue number: 1

ISSN (Print): 1063-7818

Ratings:

Scopus rating (2015): CiteScore 1.9 SJR 0.589 SNIP 1.177

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Statistical and Nonlinear Physics

Keywords: soliton fibre laser, semiconductor saturable absorber mirror, bound states of pulses, FIBER LASER, MODE-LOCKING, OPTICAL-FIBERS, DISPERSION, RECOVERY, GAIN, TECHNOLOGY, ABSORPTION, MIRRORS, SLOW DOIs:

10.1070/QE2015v045n01ABEH015558

Source: WOS

Source ID: 000349382000006

Research output: Contribution to journal > Article > Scientific > peer-review

### Generation of Sub-100 ps Pulses at 532, 355, and 266 nm Using a SESAM Q-Switched Microchip Laser

We report a single-frequency semiconductor saturable absorber mirror Q-switched microchip laser system generating sub-100 ps pulses at 532, 355, and 266 nm. The system consists of a 1064 nm Nd:YVO<sub>4</sub> master oscillator, Nd:YVO<sub>4</sub> power amplifier, and one or two nonlinear crystals for single-pass frequency-conversion to visible and UV. The average output power is about 720 mW at 532 nm, 150 mW at 355 nm and 83 mW at 266 nm for a pulse repetition rate of 100 kHz. At 532 nm the peak power is nearly 80 kW with pulse energy of about 7.2 μJ and spectral width of about 0.026 nm. The optical-to-optical conversion efficiency from 808 to 532 nm is about 8.3%. In comparison with mode-locked picosecond systems, the proposed laser has intrinsically low repetition rate, which is desirable in certain applications. The laser has also inherently narrow spectral width, and high peak power and pulse energy. This unique combination of output parameters could make the system useful in several applications including fluorescence lifetime imaging microscopy, high-accuracy submarine LIDAR, STED microscopy, time-gated Raman spectroscopy two-photon polymerization, diamond Raman laser pumping, photo-acoustic imaging, and micro-machining/marking.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics

Contributors: Nikkinen, J., Härkönen, A., Leino, I., Guina, M.

Number of pages: 4

Pages: 1816-1819

Publication date: 1 Nov 2017

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Photonics Technology Letters

Volume: 29

Issue number: 21

ISSN (Print): 1041-1135

Ratings:

Scopus rating (2017): CiteScore 5.2 SJR 0.961 SNIP 1.267

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: Microchip lasers, pulsed lasers, Q-switched lasers, UV lasers, visible lasers

DOIs:

10.1109/LPT.2017.2752421

Source: Scopus

Source ID: 85030256814

Research output: Contribution to journal > Article > Scientific > peer-review

### Geometric Structure and Chemical Ordering of Large AuCu Clusters: A Computational Study

Understanding the structure and composition of nanosized gold-copper (AuCu) clusters is crucial for designing an effective AuCu catalyst. Global optimization of AuCu clusters using atomistic force fields is a viable solution for clusters with at least a few nm sizes, because of its fast computation. Here we develop an atomistic many-body potential for AuCu on the basis of the second-moment approximation to the tight-binding model. We show that our potential is in good agreement with density-functional theory calculations, and use it to study the structure and chemical ordering of clusters of sizes up to ~4 nm by means of global optimization searches. We show that the clusters present a surface enrichment in Au, while subsurface and central sites are enriched in Cu. Surface enrichment in Au and center enrichment in Cu are stronger in icosahedra. Surface Cu atoms prefer terrace sites on (111) facets. Both atomistic and DFT calculations show that L1<sub>0</sub> and L1<sub>2</sub> ordered phases are not favorable, even at their ideal compositions for these sizes, because of the tendency of Au to surface segregation. The stability range of icosahedral structures is wider in AuCu nanoalloys than in Au and Cu pure clusters.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, COMP Centre of Excellence, Department of Applied Physics, Aalto University, Aalto University, Università di Genova

Contributors: Goh, J., Akola, J., Ferrando, R.

Number of pages: 8

Pages: 10809-10816

Publication date: 25 May 2017

Peer-reviewed: Yes

### Publication information

Journal: Journal of Physical Chemistry C

Volume: 121

Issue number: 20

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2017): CiteScore 7.9 SJR 2.135 SNIP 1.133

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Energy(all), Physical and Theoretical Chemistry, Surfaces, Coatings and Films

DOIs:

10.1021/acs.jpcc.6b11958

Source: Scopus

Source ID: 85016919329

Research output: Contribution to journal > Article > Scientific > peer-review

### Geometry Analysis in Screen-Printed Stretchable Interconnects

Deformability of interconnects and conductors as the skeleton of soft electronic devices plays an important role in the stretchability of the whole system. To make the interconnects stretchable, either employing deformable materials or tailoring the design are the primary approaches. It is also possible to combine the two strategies. In advanced stretchable electronic circuits, there is a frequently need for the interconnects to transform from a narrow to a wide geometry. Therefore, this paper assesses three different geometries that accommodate a narrow-to-wide transition along the interconnects. First, the geometry is modeled using Finite Element (FE) analysis. Second, in order to verify the accuracy of the FE model, screen-printed interconnects are fabricated accordingly by using silver flake ink on a deformable substrate. The geometrical modification shows a considerable improvement in the stretchability of the whole system. Additionally, the effect of encapsulation with thermoplastic polyurethane (TPU) on the performance of stretchable interconnects is investigated.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electronics and Communications Engineering, Materials Science

Contributors: Mosallaei, M., Jokinen, J., Honkanen, M., Iso-Ketola, P., Vippola, M., Vanhala, J., Kanerva, M., Mantysalo, M.

Pages: 1344-1352

Publication date: Aug 2018

Peer-reviewed: Yes

Early online date: 8 Jul 2018

### Publication information

Journal: IEEE Transactions on Components, Packaging and Manufacturing Technology

Volume: 8

Issue number: 8

ISSN (Print): 2156-3950

Ratings:

Scopus rating (2018): CiteScore 3.3 SJR 0.552 SNIP 1.269

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Industrial and Manufacturing Engineering, Electrical and Electronic Engineering

Keywords: Conductivity, finite element analysis, Geometry, Integrated circuit interconnections, Plastics, printed electronics, screen-printing, Strain, Stress, stretchable interconnects., Substrates

DOIs:

10.1109/TCPMT.2018.2854635

Additional files:

TCPMT\_milad

Source: Scopus

Source ID: 85049772255

Research output: [Contribution to journal](#) › [Article](#) › [Scientific](#) › [peer-review](#)

### **Germanium-on-glass solar cells: Fabrication and characterization**

We report on Germanium on Glass solar cells realized by wafer bonding, layer splitting and epitaxial regrowth. We provide a detailed description of the layer transfer process and discuss the material characterization. The solar cells are fabricated and tested to extract the most significant figures of merit, evaluating their performance versus device area and operating temperature. The cells exhibit typical conversion efficiencies exceeding 2.4% under AM1.5 irradiation and a maximum efficiency of 3.7% under concentrated excitation. This Germanium on Glass approach is promising in terms of added flexibility in multi-junction engineering and allows a significant cost reduction thanks to the re-usability of the Ge substrates.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, University "Roma Tre", Circadian Solar, Nonlinear Optics and OptoElectronics Lab

Contributors: Sorianello, V., Colace, L., Maragliano, C., Fulgoni, D., Nash, L., Assanto, G.

Number of pages: 13

Pages: 216-228

Publication date: 2013

Peer-reviewed: Yes

#### **Publication information**

Journal: Optical Materials Express

Volume: 3

Issue number: 2

ISSN (Print): 2159-3930

Ratings:

Scopus rating (2013): CiteScore 3.8 SJR 1.757 SNIP 2.34

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.1364/OME.3.000216

URLs:

<http://www.scopus.com/inward/record.url?scp=84874144417&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84874144417

Research output: [Contribution to journal](#) › [Article](#) › [Scientific](#) › [peer-review](#)

### **Ghost imaging in the time domain**

Ghost imaging is a novel technique that produces the image of an object by correlating the intensity of two light beams, neither of which independently carries information about the shape of the object. Ghost imaging has opened up new perspectives to obtain highly resolved images, even in the presence of noise and turbulence. Here, by exploiting the duality between light propagation in space and time, we demonstrate the temporal analogue of ghost imaging. We use a conventional fast detector that does not see the temporal 'object' to be characterized and a slow integrating 'bucket' detector that does see the object but without resolving its temporal structure. Our experiments achieve temporal resolution at the picosecond level and are insensitive to the temporal distortion that may occur after the object. The approach is scalable, can be integrated on-chip, and offers great promise for dynamic imaging of ultrafast waveforms.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research area: Optics, Research group: Nonlinear Fiber Optics

Contributors: Ryczkowski, P., Barbier, M., Friberg, A. T., Dudley, J. M., Genty, G.

Number of pages: 4

Pages: 167-170

Publication date: 1 Feb 2016

Peer-reviewed: Yes

#### **Publication information**

Journal: Nature Photonics

Issue number: 10  
ISSN (Print): 1749-4885  
Ratings:

Scopus rating (2016): CiteScore 61 SJR 15.689 SNIP 9.052

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics  
DOIs:

10.1038/nphoton.2015.274

Source: Scopus

Source ID: 84957042861

Research output: Contribution to journal > Article > Scientific > peer-review

### **Goos-Hänchen and Imbert-Fedorov shifts for epsilon-near-zero materials**

We investigate the reflection of a Gaussian beam impinging upon the surface of an epsilon-near-zero (ENZ) medium. In particular, we discuss the occurrence of Goos-Hänchen and Imbert-Fedorov shifts. Our calculations reveal that spatial shifts are significantly enhanced owing to the ENZ nature of the medium, and that their value and angular position can be tuned by tuning the plasma frequency of the medium.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Università dell'Aquila

Contributors: Nieminen, A., Marini, A., Ornigotti, M.

Publication date: 28 Jan 2020

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Optics

Volume: 22

Issue number: 3

Article number: 035601

ISSN (Print): 2040-8978

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Keywords: beam shifts, Epsilon-near-zero, physical reflection

DOIs:

10.1088/2040-8986/ab6ae7

Source: Scopus

Source ID: 85080149323

Research output: Contribution to journal > Article > Scientific > peer-review

### **Graphene-based tunable plasmon induced transparency in gold strips**

Plasmon induced transparency (PIT) has been numerically investigated and experimentally realized by two parallel gold strips on graphene for the mid-infrared (MIR) range. The PIT response is realized by the weak hybridization of two bright modes of the gold strips. The response of the device is adjusted with the lengths of two strips and tuned electrically in real time by changing the Fermi level ( $E_f$ ) of the graphene.  $E_f$  is changed to tune the resonance frequency of the transparency window. A top gating is used to achieve high tunability and a 263 nm shift is obtained by changing the gate voltage from -0.6 V to 2.4 V. The spectral contrast ratio of our devices is up to 82%. (C) 2018 Optical Society of America under the terms of the OSA Open Access Publishing Agreement.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Bilkent University, Department of Electrical and Electronics Engineering, Laboratory of Photonics

Contributors: Habib, M., Rashed, A. R., Ozbay, E., Caglayan, H.

Number of pages: 6

Pages: 1069-1074

Publication date: 1 Apr 2018

Peer-reviewed: Yes

#### **Publication information**

Journal: Optical Materials Express

Volume: 8

Issue number: 4  
ISSN (Print): 2159-3930  
Ratings:

Scopus rating (2018): CiteScore 5 SJR 0.886 SNIP 1.045

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Keywords: ELECTROMAGNETICALLY INDUCED TRANSPARENCY, SLOW LIGHT, METAMATERIAL, SPECTROSCOPY, RESONATORS, DYNAMICS, ANALOG

Electronic versions:

ome-8-4-1069

DOIs:

10.1364/OME.8.001069

10.1364/OME.8.001069

URLs:

<http://urn.fi/URN:NBN:fi:tyy-201804191516>

Source: Scopus

Source ID: 85044841180

Research output: Contribution to journal > Article > Scientific > peer-review

### **Hafnium oxide thin films as a barrier against copper diffusion in solar absorbers**

The thermal stability of copper substrate material used in solar thermal collectors was investigated with and without atomic layer deposited (ALD) hafnium oxide barrier films at temperatures of 200–400 °C. HfO<sub>2</sub> films were studied as barriers against thermal diffusion of copper substrate atoms. The ALD HfO<sub>2</sub> thin films were deposited in a thermal process at 200 °C using Tetrakis(Dimethylamido)Hafnium(Hf(NMe<sub>2</sub>)<sub>4</sub>) and H<sub>2</sub>O precursors, with 200, 400, and 600 cycles. The Cu substrates with and without HfO<sub>2</sub> thin films were aged by means of heat treatment in air. The influence of the HfO<sub>2</sub> barriers was determined by optical, microstructural, and morphological analyses before and after the ageing procedures. The optical performance of the HfO<sub>2</sub> barriers as a part of solar absorber stack was modelled with CODE Coating Designer. The copper surface without a HfO<sub>2</sub> barrier thin film oxidized significantly, which increased thermal emittance and surface roughness. 200 cycles of HfO<sub>2</sub> deposition did not result in a completely continuous coating and only provided a little protection against oxidation. Films of 200 and 400 cycles gave continuous coverage and the thickest HfO<sub>2</sub> thin film studied, which was deposited from 600 ALD cycles and had a thickness ~50 nm, prevented Cu oxidation and diffusion processes after 2 h heat treatment in air at 300 °C, and retained low thermal emissivity. At 400 °C, diffusion and formation of copper oxide hillocks were observed but the HfO<sub>2</sub> thin film significantly retarded the degradation when compared to a Cu substrate without and with thinner barrier layers.

### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Materials Science, Research group: Surface Engineering, R&D Center for Low-Cost Plasma and Nanotechnology Surface Modifications (CEPLANT), Masaryk University

Contributors: Kotilainen, M., Krumpolec, R., Franta, D., Souček, P., Homola, T., Cameron, D. C., Vuoristo, P.

Number of pages: 7

Pages: 140-146

Publication date: 1 Jul 2017

Peer-reviewed: Yes

### **Publication information**

Journal: Solar Energy Materials and Solar Cells

Volume: 166

ISSN (Print): 0927-0248

Ratings:

Scopus rating (2017): CiteScore 9.2 SJR 1.459 SNIP 1.537

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Renewable Energy, Sustainability and the Environment, Surfaces, Coatings and Films

Keywords: Copper diffusion, Diffusion barrier, HfO thin film, Solar absorber, Thermal ageing

DOIs:

10.1016/j.solmat.2017.02.033

Source: Scopus

Source ID: 85016025672

Research output: Contribution to journal > Article > Scientific > peer-review

### **Halogen bonding stabilizes a cis-azobenzene derivative in the solid state: A crystallographic study**

Crystals of trans- and cis-isomers of a fluorinated azobenzene derivative have been prepared and characterized by single-crystal X-ray diffraction. The presence of F atoms on the aromatic core of the azobenzene increases the lifetime of the metastable cis-isomer, allowing single crystals of the cis-azobenzene to be grown. Structural analysis on the cis-azobenzene, complemented with density functional theory calculations, highlights the active role of the halogen-bond contact (N...I synthon) in promoting the stabilization of the cis-isomer. The presence of a long aliphatic chain on the azobenzene unit induces a phase segregation that stabilizes the molecular arrangement for both the trans- and cis-isomers. Due to the rarity of cis-azobenzene crystal structures in the literature, our paper makes a step towards understanding the role of non-covalent interactions in driving the packing of metastable azobenzene isomers. This is expected to be important in the future rational design of solid-state, photoresponsive materials based on halogen bonding. We show by single-crystal X-ray diffraction studies and computational analysis that halogen bonding can stabilize a metastable cis-azobenzene derivative in the solid state.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Chemistry and Bioengineering, Research group: Supramolecular photochemistry, Research group: Chemistry & Advanced Materials, Politecnico di Milano, Aalto University

Contributors: Saccone, M., Siiskonen, A., Fernandez-Palacio, F., Priimägi, A., Terraneo, G., Resnati, G., Metrangolo, P.

Number of pages: 7

Pages: 227-233

Publication date: 1 Apr 2017

Peer-reviewed: Yes

#### **Publication information**

Journal: ACTA CRYSTALLOGRAPHICA SECTION B : STRUCTURAL SCIENCE, CRYSTAL ENGINEERING AND MATERIALS

Volume: 73

Issue number: 2

ISSN (Print): 2052-5192

Ratings:

Scopus rating (2017): CiteScore 6.1 SJR 1.654 SNIP 1.602

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Metals and Alloys, Materials Chemistry

Keywords: azobenzene, halogen bonding, isomerization

Electronic versions:

Halogen bonding stabilizes a cis-azobenzene derivative 2017

DOIs:

10.1107/S2052520617003444

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202005085078>

Source: Scopus

Source ID: 85017113549

Research output: Contribution to journal > Article > Scientific > peer-review

### **Halogen bonding versus hydrogen bonding in driving self-assembly and performance of light-responsive supramolecular polymers**

Halogen bonding is arguably the least exploited among the many non-covalent interactions used in dictating molecular self-assembly. However, its directionality renders it unique compared to ubiquitous hydrogen bonding. Here, the role of this directionality in controlling the performance of light-responsive supramolecular polymers is highlighted. In particular, it is shown that light-induced surface patterning, a unique phenomenon occurring in azobenzene-containing polymers, is more efficient in halogen-bonded polymer-azobenzene complexes than in the analogous hydrogen-bonded complexes. A systematic study is performed on a series of azo dyes containing different halogen or hydrogen bonding donor moieties, complexed to poly(4-vinylpyridine) backbone. Through single-atom substitution of the bond-donor, control of both the strength and the nature of the noncovalent interaction between the azobenzene units and the polymer backbone is achieved. Importantly, such substitution does not significantly alter the electronic properties of the azobenzene units, hence providing us with unique tools in studying the structure-performance relationships in the light-induced surface deformation process. The results represent the first demonstration of light-responsive halogen-bonded polymer systems and also highlight the remarkable potential of halogen bonding in fundamental studies of photoresponsive azobenzene-containing polymers.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Tokyo Institute of Technology, Politecnico di Milano, Università degli Studi di Milano, Aalto University, VTT Technical Research Centre of Finland  
Contributors: Priimagi, A., Cavallo, G., Forni, A., Gorynsztejn-Leben, M., Kaivola, M., Metrangolo, P., Milani, R., Shishido, A., Pilati, T., Resnati, G., Terraneo, G.  
Number of pages: 8  
Pages: 2572-2579  
Publication date: 20 Jun 2012  
Peer-reviewed: Yes

#### Publication information

Journal: Advanced Functional Materials

Volume: 22

Issue number: 12

ISSN (Print): 1616-301X

Ratings:

Scopus rating (2012): CiteScore 15.9 SJR 5.689 SNIP 2.624

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Condensed Matter Physics, Electrochemistry

Keywords: halogen bonding, optically active materials, self-assembly, supramolecular polymers, surface relief gratings  
DOIs:

10.1002/adfm.201200135

URLs:

<http://www.scopus.com/inward/record.url?scp=84862000539&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84862000539

Research output: Contribution to journal > Article > Scientific > peer-review

#### Harmonic mode-locking fiber ring laser with a pulse repetition rate up to 12 GHz

We experimentally demonstrate a harmonically mode-locked Er-doped fiber laser. The distinctive feature of the laser is highly stable pulse trains generated via self-starting hybrid mode-locking triggered by frequency-shifting and nonlinear polarization evolution. A intra-cavity tunable bandpass filter allows getting a pulse repetition rate up to 12 GHz with local adjustment of the wavelength.

#### General information

Publication status: E-pub ahead of print

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: Nanophotonics, Ulyanovsk State University, St. Petersburg State Polytechnical University, ITMO University

Contributors: Korobko, D. A., Stoliarov, D. A., Itrin, P. A., Odnoblyudov, M. A., Petrov, A. B., Gumenyuk, R. V.

Number of pages: 6

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

Journal: Optics and laser technology

Volume: 133

Article number: 106526

ISSN (Print): 0030-3992

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: Fiber lasers, Harmonic mode-locking, High-repetition pulse trains

DOIs:

10.1016/j.optlastec.2020.106526

Source: Scopus

Source ID: 85089483506

Research output: Contribution to journal > Article > Scientific > peer-review

#### Hematite Surface Modification toward Efficient Sunlight-Driven Water Splitting Activity: The Role of Gold Nanoparticle Addition

Localized surface plasmon resonance has been investigated to enhance light harvesting in hematite-based photoelectrodes modified with gold nanoparticles (AuNPs); meanwhile, an extensive understanding about the different processes involved in the hematite-AuNP system remains unclear. This work addresses a majority of effects associated with AuNP addition by comparing charge transfer, catalytic and light harvesting efficiencies. The obtained results revealed

that the lower AuNP amount leads to a higher photocurrent response of  $1.20 \text{ mA cm}^{-2}$  at  $1.23 \text{ V}_{\text{RHE}}$  in comparison with all photoelectrodes designed here. X-ray photoelectron data revealed that hematite photoelectrodes loaded with higher concentrations of AuNPs immersed in an alkaline electrolyte showed hydrated/oxidized gold phase formation at the electrode/electrolyte interface. This change on the semiconductor-metal interface may affect the conductivity impairing the photocatalytic performance because of the passivation layer on the AuNP surface, decreasing the efficiency of charge transfer. Notoriously, increasing AuNP amount supported on the hematite surface clearly promoted higher light absorption, which was surprisingly not followed by photoelectrochemical efficiency. This result suggests here that the plasmon effect is not a dominant phenomenon that drives the photoelectrode performance. In fact, a deeper analysis showed that the loaded hematite photoelectrodes with low amounts of AuNPs provides a Schottky contact at the semiconductor-metal interface leading to Fermi level equilibration enhancing charge transport efficiency, which is classified as the predominant effect leading to higher photoresponse in the system.

#### General information

Publication status: E-pub ahead of print

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Universidade Federal do ABC, Microscopy Centre

Contributors: Tofanello, A., Freitas, A. L., Carvalho, W. M., Salminen, T., Niemi, T., Souza, F. L.

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

ISSN (Print): 1932-7447

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Energy(all), Physical and Theoretical Chemistry, Surfaces, Coatings and Films

DOIs:

10.1021/acs.jpcc.9b11966

Source: Scopus

Source ID: 85082009064

Research output: Contribution to journal > Article > Scientific > peer-review

#### High-dimensional quantum gates using full-field spatial modes of photons

Unitary transformations are the fundamental building blocks of gates and operations in quantum information processing, allowing the complete manipulation of quantum systems in a coherent manner. In the case of photons, optical elements that can perform unitary transformations are readily available only for some degrees of freedom, e.g., wave plates for polarization. However, for high-dimensional states encoded in the transverse spatial modes of light, performing arbitrary unitary transformations remains a challenging task for both theoretical proposals and actual implementations. Following the idea of multi-plane light conversion, we show that it is possible to perform a broad variety of unitary operations at high quality by using only a few phase modulation planes. More importantly, we experimentally implement several high-dimensional quantum gates for up to five-dimensional states encoded in the full-field mode structure of photons. In particular, we realize cyclic and quantum Fourier transformations, known as Pauli X-gates and Hadamard H-gates, respectively, with an average visibility of more than 90%. In addition, we demonstrate near-perfect "unitarity" by means of quantum process tomography, unveiling a process purity of 99%. Last, we demonstrate the benefit of the two independent spatial degrees of freedom, i.e., azimuthal and radial, and implement a two-qubit controlled-NOT quantum operation on a single photon. Thus, our demonstrations open up new paths to implement high-dimensional quantum operations, which can be applied to various tasks in quantum communication, computation, and sensing schemes.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Austrian Academy of Sciences, University of Ottawa, Canada

Contributors: Brandt, F., Hiekkamäki, M., Bouchard, F., Huber, M., Fickler, R.

Number of pages: 10

Pages: 98-107

Publication date: 20 Feb 2020

Peer-reviewed: Yes

#### Publication information

Journal: Optica

Volume: 7

Issue number: 2

ISSN (Print): 2334-2536

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Electronic versions:

High-dimensional quantum gates 2020

DOIs:

10.1364/OPTICA.375875

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202003302959>

Source: Scopus

Source ID: 85079614867

Research output: Contribution to journal > Article > Scientific > peer-review

### **Highly efficient charge separation in model Z-scheme TiO<sub>2</sub>/TiSi<sub>2</sub>/Si photoanode by micropatterned titanium silicide interlayer**

Atomic layer deposited (ALD) TiO<sub>2</sub> is an attractive material for improving the photoactivity and chemical stability of semiconductor electrodes in artificial photosynthesis. Using photoelectrochemical (PEC) measurements, we show that an interfacial, topographically microstructured TiSi<sub>2</sub> layer inside the TiO<sub>2</sub>/Si heterojunction improves the charge carrier separation and shifts the water dissociation onset potential to more negative values. These observations are correlated with the X-ray photoelectron spectroscopy (XPS) and ultra-violet photoelectron spectroscopy (UPS) measurements, which reveal an increased band bending due to the TiSi<sub>2</sub> interlayer. Combined with the UV-Vis absorption results, the photoelectron spectroscopy measurements allow the reconstruction of the complete energy band diagram for the TiO<sub>2</sub>/TiSi<sub>2</sub>/Si heterojunction and the calculation of the valence and conduction band offsets. The energy band alignment and improvements in PEC results reveal that the charge transfer across the heterojunction follows a Z-scheme model, where the metal-like TiSi<sub>2</sub> islands act as recombination centers at the interface.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Research group: Surface Science, Physics

Contributors: Hannula, M., Ali-Löytty, H., Lahtonen, K., Saari, J., Tukiainen, A., Valden, M.

Number of pages: 9

Pages: 237-245

Publication date: 1 Aug 2019

Peer-reviewed: Yes

#### **Publication information**

Journal: Acta Materialia

Volume: 174

ISSN (Print): 1359-6454

Ratings:

Scopus rating (2019): CiteScore 13.8 SJR 3.662 SNIP 3.037

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Polymers and Plastics, Metals and Alloys

Keywords: Electrochemical characterization, Electronic band structure, Titanium dioxide, Transition metal silicides, X-ray photoelectron spectroscopy (XPS)

DOIs:

10.1016/j.actamat.2019.05.032

Source: Scopus

Source ID: 85066305210

Research output: Contribution to journal > Article > Scientific > peer-review

### **High performance corrosion resistant coatings by novel coaxial cold- and hot-wire laser cladding methods**

In the last few years, coaxial laser heads have been developed with centric wire feeding equipment, which enables the laser processing of complex-shaped objects in various applications. These newly developed laser heads are being used particularly in laser brazing experiments in the automotive industry. This study presents experimental results of using a coaxial laser head for cold- and hot-wire cladding application. The coaxial wire cladding method has significant improvements compared with the off-axis wire cladding method such as independence of the travel direction, alignment of the wire to the laser beam, and a reduced number of controlling parameters. These features are important to achieve high quality coatings. Cladding tests were conducted on mild steel with a coaxial laser wire welding head using Ni-based Inconel 625 and Thermanit 2509 super duplex stainless steel solid wires in order to determine the properties of the cladding process and the coatings deposited. The corrosion resistance of the obtained coatings was examined by long-term acetic acid salt spray (AASS) and electrochemical critical pitting temperature tests. The test results showed that by using the coaxial wire cladding method, defect-free high quality and corrosion resistant Inconel 625 and super duplex stainless steel coatings with low dilution were achieved. The average pitting temperature for Thermanit 2509 duplex coating was 75 °C in 1M NaCl solution, which was comparable to wrought 2507 duplex stainless steel. Low diluted Inconel 625 coating survived the AASS test for 2000 h without signs of corrosion.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Materials Science, Research group: Surface Engineering, Tampere University of Technology, Technology Centre Ketek Ltd.  
Contributors: Pajukoski, H., Näkki, J., Thieme, S., Tuominen, J., Nowotny, S., Vuoristo, P.  
Publication date: 2016  
Peer-reviewed: Yes  
Early online date: 8 Dec 2015

### Publication information

Journal: Journal of Laser Applications  
Volume: 28  
Issue number: 1  
Article number: 012011  
ISSN (Print): 1042-346X  
Ratings:  
Scopus rating (2016): CiteScore 2 SJR 0.673 SNIP 1.233  
Original language: English  
ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Biomedical Engineering, Instrumentation  
Keywords: coaxial wire feed, hot-wire laser cladding, Inconel 625, super duplex stainless steel  
DOIs:  
10.2351/1.4936988

### Bibliographical note

AUX=mol,"Pajukoski, H."  
Source: Scopus  
Source ID: 84950156186  
Research output: Contribution to journal > Article > Scientific > peer-review

### High-Power 1.5 $\mu\text{m}$ Tapered Distributed Bragg Reflector Laser Diodes for Eye-Safe LIDAR

A high-power InAlGaAs/InP tapered distributed Bragg reflector laser diode with narrow linewidth emission at 1.5  $\mu\text{m}$  is reported. The laser has a monolithic waveguide architecture comprising a third-order grating section for longitudinal mode selection, an index-guided gain section for lateral mode filtering, and a gain-guided tapered section for power scaling. An output power of 770 mW is reported for continuous wave operation at room temperature. In pulsed mode, the laser delivered a peak power of 4.6 W with a full width at half-maximum spectral linewidth of only 250 pm. In addition to the narrow linewidth and high-power features, the emission wavelength exhibits a temperature dependent shift of only 0.1 nm/ $^{\circ}\text{C}$ . The parameters achieved suggest that these laser diodes would enable the realization of compact LIDAR systems with improved signal-to-noise ratio, owing to the high output power and the possibility to use narrow passband filters at receiver side, which is enabled by the narrow and temperature-stable emission spectrum. The wavelength range around 1.5  $\mu\text{m}$  also enables LIDAR systems with high output powers while maintaining eye safety, ultimately leading to improved system performance.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Physics, Research group: ORC  
Contributors: Aho, A. T., Viheriälä, J., Koskinen, M., Uusitalo, T., Reuna, J., Guina, M.  
Number of pages: 4  
Pages: 1249-1252  
Publication date: 1 Oct 2020  
Peer-reviewed: Yes

### Publication information

Journal: IEEE Photonics Technology Letters  
Volume: 32  
Issue number: 19  
ISSN (Print): 1041-1135  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering  
Keywords: Diode lasers, distributed Bragg reflector, high power, LIDAR  
DOIs:  
10.1109/LPT.2020.3019845

### Bibliographical note

INT=phys,"Koskinen, Mervi"

Source: Scopus

Source ID: 85091098269

Research output: Contribution to journal › Article › Scientific › peer-review

### High-resolution coded-aperture design for compressive X-ray tomography using low resolution detectors

One of the main challenges in Computed Tomography (CT) is obtaining accurate reconstructions of the imaged object while keeping a low radiation dose in the acquisition process. In order to solve this problem, several researchers have proposed the use of compressed sensing for reducing the amount of measurements required to perform CT. This paper tackles the problem of designing high-resolution coded apertures for compressed sensing computed tomography. In contrast to previous approaches, we aim at designing apertures to be used with low-resolution detectors in order to achieve super-resolution. The proposed method iteratively improves random coded apertures using a gradient descent algorithm subject to constraints in the coherence and homogeneity of the compressive sensing matrix induced by the coded aperture. Experiments with different test sets show consistent results for different transmittances, number of shots and super-resolution factors.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Signal Processing

Contributors: Mojica, E., Pertuz, S., Arguello, H.

Pages: 103-109

Publication date: 2017

Peer-reviewed: Yes

### Publication information

Journal: Optics Communications

Volume: 404

ISSN (Print): 0030-4018

Ratings:

Scopus rating (2017): CiteScore 3.5 SJR 0.614 SNIP 0.933

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Physical and Theoretical Chemistry, Electrical and Electronic Engineering

Keywords: Coded apertures, Compressive sensing, Computed tomography, Super-resolution

DOIs:

10.1016/j.optcom.2017.06.053

Source: Scopus

Source ID: 85021667000

Research output: Contribution to journal › Article › Scientific › peer-review

### Hot spot temperature in an HTS Coil: Simulations with MIITs and finite element method

MIITs, a zero-dimensional concept to study hot spot temperature, has been previously used to estimate hot spot temperatures and quench heater delays in NbTi and Nb<sub>3</sub>Sn magnets. However, quench behavior is completely different in high-temperature superconducting (HTS) magnets due to the slow normal zone propagation velocity and the high temperature margin. Because the MIITs concept does not take into account thermal diffusion in the magnet, opposite to the finite-element method (FEM) analysis, the difference of these concepts is studied in this paper. Here, we have taken the approach to compute the hot spot temperatures for a future HTS magnet, designed to be built from REBCO Roebel cable, with MIITs and FEM simulations. The magnet protection is accomplished with a dump resistor, and the effect of quench detection threshold voltage on the hot spot temperature has been studied. Furthermore, the inductance of the magnet increases with the magnet length. Thus, there exists a maximum inductance of the magnet, which should not be exceeded to be able to protect the magnet only with a dump resistor. The hot spot temperatures with different values of inductance are also studied in this paper. Our simulations show that the hot spot temperatures computed with MIITs are from 60 to 150 K higher than those of FEM analysis. Thus, the MIITs concept seems unreliable when considering hot spot temperatures in HTS magnets protected with only dump resistors. However, the MIITs concept might be a usable tool when comparing different magnet designs. If 400 K is the upper limit for the hot spot temperature and the protection scheme includes only a dump resistor, the length of the investigated magnet can be increased to only such value that the magnet inductance is at most 50 mH.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, European Organization for Nuclear Research

Contributors: Härö, E., Stenvall, A., Van Nugteren, J., Kirby, G.  
Publication date: 1 Apr 2015  
Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 2

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Finite element method (FEM), high-temperature superconductors (HTSs), quench simulation, stability analysis, superconducting magnets

DOIs:

10.1109/TASC.2015.2396945

Source: Scopus

Source ID: 84926385685

Research output: Contribution to journal > Article > Scientific > peer-review

#### How well can we predict cluster fragmentation inside a mass spectrometer?

Fragmentation of molecular clusters inside mass spectrometers is a significant source of uncertainty in a wide range of chemical applications. We have measured the fragmentation of sulfuric acid clusters driving atmospheric new-particle formation, and developed a novel model, based on first principles calculations, capable of quantitatively predicting the extent of fragmentation.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: University of Helsinki, Beijing University of Chemical Technology, CNRS, Centre National de la Recherche Scientifique (CNRS), Universite de Bordeaux - PRES, Lab Bordelais Rech Informat, PICTURA Res Grp, UMR 5800

Contributors: Passananti, M., Zapadinsky, E., Zanca, T., Kangasluoma, J., Myllys, N., Rissanen, M. P., Kurtén, T., Ehn, M., Attoui, M., Vehkamäki, H.

Number of pages: 4

Pages: 5946-5949

Publication date: 2019

Peer-reviewed: Yes

#### Publication information

Journal: Chemical Communications

Volume: 55

Issue number: 42

ISSN (Print): 1359-7345

Ratings:

Scopus rating (2019): CiteScore 9.8 SJR 1.992 SNIP 1.144

Original language: English

ASJC Scopus subject areas: Catalysis, Electronic, Optical and Magnetic Materials, Ceramics and Composites, Chemistry(all), Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

DOIs:

10.1039/c9cc02896j

URLs:

<http://www.scopus.com/inward/record.url?scp=85065980333&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 85065980333

Research output: Contribution to journal > Article > Scientific > peer-review

#### Hyperspectral phase imaging based on denoising in complex-valued eigensubspace

A novel algorithm for reconstruction of hyperspectral 3D complex domain images (phase/amplitude) from noisy complex domain observations has been developed and studied. This algorithm starts from the SVD (singular value decomposition) analysis of the observed complex-valued data and looks for the optimal low dimension eigenspace. These eigenspace images are processed based on special non-local block-matching complex domain filters. The accuracy and quantitative advantage of the new algorithm for phase and amplitude imaging are demonstrated in simulation tests and in processing of the experimental data. It is shown that the algorithm is effective and provides reliable results even for highly noisy data.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Computing Sciences, Research group: Computational Imaging-CI, ITMO University, University of Ulm Medical Center, University of Stuttgart

Contributors: Shevkunov, I., Katkovnik, V., Claus, D., Pedrini, G., Petrov, N. V., Egiazarian, K.

Number of pages: 10

Publication date: 1 Apr 2020

Peer-reviewed: Yes

Early online date: 6 Dec 2019

### Publication information

Journal: Optics and Lasers in Engineering

Volume: 127

Article number: 105973

ISSN (Print): 0143-8166

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Mechanical Engineering, Electrical and Electronic Engineering

Keywords: Hyperspectral imaging, Noise filtering, Noise in imaging systems, Phase imaging, Singular value decomposition, Sparse representation

Electronic versions:

1-s2.0-S0143816619313491-main

DOIs:

10.1016/j.optlaseng.2019.105973

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202001101169>

Source: Scopus

Source ID: 85076060273

Research output: Contribution to journal > Article > Scientific > peer-review

### ICED - Inductively Coupled Energy Dissipater for Future High Field Accelerator Magnets

Future high field accelerator magnets, like the ones foreseen in the design study of the FCC project and for the EuCARD2 "Future Magnets" program, operate with magnetic fields in the range of  $16 < \text{times} \$ < / \text{tex} > < / \text{formula} > 20 \text{T}$ .

For such magnets the energy density is higher than in the accelerator magnets at present in operation, posing a challenge for the quench protection. Traditionally quench protection has relied on generating large normal zones in the coil by firing quench protection heaters. The increase of the coil internal resistance results in a fast current decay. This paper introduces the Inductively Coupled Energy Dissipater (ICED) system, based on low resistance loops which are inductively coupled with the coil. These loops greatly accelerate the current decay by rapidly extracting the energy from the coil, thereby lowering its peak temperature. Because of the potential reduction in stabilizer volume within the conductor, ICED may enable higher engineering current densities in the coil than with the protection relying entirely on dissipating the magnet's energy in the windings. The efficiency of ICED as a passive quench protection system is studied in this paper. We present the effect of such protection structure on the field quality during standard powering of the magnets and on the cryogenic system. We study electromagnetic forces in the loops and mechanically stable geometric locations within the magnet structure. For the proof of the concept, this system has been employed in Feather-M2 dipole demonstrator. We compare our modeling approach to results gained from a cryogenic test.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, European Organization for Nuclear Research

Contributors: Murtomäki, J. S., van Nugteren, J., Kirby, G., DeRijk, G., Rossi, L., Stenvall, A.

Publication date: Dec 2018

Peer-reviewed: Yes

Early online date: 28 May 2018

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 28

Issue number: 8

Article number: 4009015

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Accelerator magnets, Electromagnetic Induction, Heating systems, High-temperature superconductors, High-Temperature-Superconductors, Magnetomechanical effects, Resistance, Superconducting magnets, Superconducting Magnets, Windings

DOIs:

10.1109/TASC.2018.2841909

Source: Scopus

Source ID: 85047834232

Research output: Contribution to journal › Article › Scientific › peer-review

### **Identification of synchronous machine magnetization characteristics from calorimetric core-loss and no-load curve measurements**

The magnetic material characteristics of a wound-field synchronous machine are identified based on global calorimetric core-loss and no-load curve measurements. This is accomplished by solving a coupled experimental-numerical electromagnetic inverse problem, formulated to minimize the difference between a finite-element (FE) simulation-based Kriging surrogate model and the measurement results. The core-loss estimation in the FE model is based on combining a dynamic iron-loss model and a static vector Jiles-Atherton hysteresis model, whose parameters that are obtained by solving the inverse problem. The results show that reasonable hysteresis loops can be produced for a grid-supplied machine, while for an inverter-supplied machine the limitations in the FE and iron-loss models seemingly exaggerate the area of the loop. In addition, the effect of the measurement uncertainty on the inverse problem is quantitatively estimated.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Smart Energy Systems (SES), Universiteit Gent, Ghent University, Zwijnaarde, Belgium, Cairo University, Aalto University

Contributors: Rasilo, P., Abdalh, A. A. E., Belahcen, A., Arkio, A., Dupré, L.

Publication date: 1 Mar 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Magnetics

Volume: 51

Issue number: 3

Article number: 2001304

ISSN (Print): 0018-9464

Ratings:

Scopus rating (2015): CiteScore 2.8 SJR 0.575 SNIP 1.189

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Calorimetric loss measurements, electromagnetic inverse problems, iron losses, magnetic hysteresis, synchronous machines

DOIs:

10.1109/TMAG.2014.2354055

Source: Scopus

Source ID: 84928780507

Research output: Contribution to journal › Article › Scientific › peer-review

### **Importance of iron-loss modeling in simulation of wound-field synchronous machines**

Effect of hysteresis, eddy-current and excess-loss modeling on the 2-D field solution of 12.5-MW and 150-kVA wound-field synchronous machines is studied. The study is performed by comparing the differences in the solutions obtained with three different finite element formulations: one with iron losses fully included, one using only single-valued material properties, and one completely neglecting the iron losses from the solution. The electrical operating points, i.e., the terminal currents and powers are found to be only little influenced by the iron-loss model. However, the rotor eddy-current losses are found to be overestimated, if the skin effect of the eddy currents is uncoupled from the solution. Using single-valued material properties instead of hysteretic ones has a smaller effect on the rotor side, but increases the hysteresis losses in the stator. The effects on the total core losses thus depend on their distribution between the stator and the rotor. It is concluded that using single-valued material properties is reasonable in order to improve the computational performance despite the slight overestimation in the computed core losses. However, for accurate modeling of the rotor losses, the skin effect of the eddy currents should be included in the solution.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Smart Energy Systems (SES), Aalto University  
Contributors: Rasilo, P., Belahcen, A., Arkkio, A.  
Number of pages: 10  
Pages: 2495-2504  
Publication date: 2012  
Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Magnetics

Volume: 48

Issue number: 9

ISSN (Print): 0018-9464

Ratings:

Scopus rating (2012): CiteScore 3 SJR 0.769 SNIP 1.55

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Eddy currents, ferromagnetic materials, finite element methods, magnetic hysteresis, synchronous machines

DOIs:

10.1109/TMAG.2012.2195190

Source: Scopus

Source ID: 84865464767

Research output: Contribution to journal > Article > Scientific > peer-review

#### Improvements in the electromechanical properties of stretchable interconnects by locally tuning the stiffness

Recent advances in materials science and structural design have changed electronic applications from being bulky and rigid objects to small and soft products that have emerged for a wide range of applications, especially human-related products for which mechanical adoption is the key requirement. A typical stretchable application consists of small-sized, rigid IC-chips and passive components interconnected by conductive tracks on soft substrates. The early failure of such devices initiates from the rigid-soft interface due to the accumulation of stress. Therefore, special attention is needed to reduce the strain concentration at the interface. In this paper, stretchable interconnects were fabricated using a screen-printing method and surface mounted devices (SMDs) were bonded using an isotropic conductive adhesive. By partially removing material from the substrate in areas a little way from the rigid components, the stiffness is locally reduced, and this leads to an increase in the local stiffness around the SMDs and hence shields the soft-rigid interface against the stress. Materials can be removed by two different patterns. A finite element analysis and experimental data show 11%-19% improvements in single pull-up tests for the modified samples. This approach makes the electromechanical behaviour independent of encapsulation properties.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Engineering, Research group: Wireless Communications and Positioning, Research group: Laboratory for Future Electronics

Contributors: Mosallaei, M., Di Vito, D., Khorramdel, B., Mäntysalo, M.

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

Journal: Flexible and Printed Electronics

Volume: 5

Issue number: 1

Article number: 015004

ISSN (Print): 2058-8585

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: electromechanical properties, finite element (FE) analysis, printed electronics, screen-printing, strain concentration, stress distribution, stretchable electronics

DOIs:

10.1088/2058-8585/ab68ae

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202004213439>. Embargo ends: 1/03/21

Source: Scopus

Source ID: 85081953534

Research output: Contribution to journal > Article > Scientific > peer-review

### **Influence of As/group-III flux ratio on defects formation and photovoltaic performance of GaInNAs solar cells**

The correlation between the As to group III flux ratio and photovoltaic performance of GaIn<sub>0.1</sub>N<sub>0.03</sub>As solar cells fabricated by molecular beam epitaxy is systematically investigated. The results show that flux ratio has a remarkable influence on the formation of defect traps. Furthermore, the formation of defects at different flux ratios is correlating with the variation of the background doping level and the photovoltaic performance. In particular, this study reveals a linear dependency between current generation, dark saturation current, defect densities, photoluminescence peak intensity and the flux ratio. A significant increase in solar cell performance, exhibiting maximum external quantum efficiency of 90%, is obtained when As/group-III ratio is decreased close to the stoichiometric limit. For optimized growth condition, the 1 eV GaIn<sub>0.1</sub>N<sub>0.03</sub>As solar cell exhibits a short circuit current density as high as 17.9 mA/cm<sup>2</sup> calculated from the external quantum efficiency data (AM0 conditions) with 870 nm high-pass filter. This value reflects the potential of the GaInNAs cell for current matching and power generation in high efficiency solar cells incorporating three- or four- junctions.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications

Contributors: Polojärvi, V., Aho, A., Tukiainen, A., Raappana, M., Aho, T., Schramm, A., Guina, M.

Number of pages: 8

Pages: 213-220

Publication date: 1 May 2016

Peer-reviewed: Yes

#### **Publication information**

Journal: Solar Energy Materials and Solar Cells

Volume: 149

ISSN (Print): 0927-0248

Ratings:

Scopus rating (2016): CiteScore 8.8 SJR 1.599 SNIP 1.697

Original language: English

ASJC Scopus subject areas: Renewable Energy, Sustainability and the Environment, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films

Keywords: Defects, Dilute nitrides, III-V semiconductors, Material characterization, Molecular beam epitaxy, Multijunction solar cells

DOIs:

10.1016/j.solmat.2016.01.024

Source: Scopus

Source ID: 84957536411

Research output: Contribution to journal › Article › Scientific › peer-review

### **Influence of environmental conditions on EMF levels in a span of overhead transmission lines**

The paper is devoted to the investigation of electromagnetic field distribution in the vicinity of overhead transmission lines under different environmental conditions, taking into account the wire sag curve in a span. A wire state equation is utilized, which allows one to calculate stresses in the wire and sags based on the known stresses and temperatures in the initial state. The results of the electric and magnetic field distribution on sample 330 kV and 110 kV transmission lines are presented. We show that the highest electromagnetic field levels are associated with the most severe environmental conditions, resulting in the highest sag.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, LLC Soyuzenergooproekt

Contributors: Okun, O., Kravchenko, Y., Korpinen, L.

Number of pages: 9

Pages: 163-171

Publication date: 2016

Peer-reviewed: Yes

#### **Publication information**

Journal: Progress in Electromagnetics Research C

Volume: 63

ISSN (Print): 1937-8718

Ratings:

Scopus rating (2016): CiteScore 1.6 SJR 0.221 SNIP 0.597  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials  
DOIs:  
10.2528/PIERC16021106  
Source: Scopus  
Source ID: 84971219955  
Research output: Contribution to journal › Article › Scientific › peer-review

### **Influence of temperature-induced copper diffusion on degradation of selective chromium oxy-nitride solar absorber coatings**

Temperature-induced copper diffusion process and its influences on optical degradation and long-term stability of solar absorber coatings on copper substrates were investigated at intermediate temperatures of 248-500. °C. The studied absorbers were sputtered chromium oxy-nitride absorbers having tin oxide anti-reflection coatings. The absorbers were aged by means of thermal accelerated ageing studies and short-period heat treatments up to 500. °C for two hours. Ageing mechanisms and degradation of the absorbers were analysed before and after the ageing studies by optical measurements (solar absorptance with a UV/Vis/NIR spectrophotometer and thermal emittance by FTIR spectrophotometry), microstructural analysis using a field-emission scanning electron microscope (FESEM) equipped with an energy dispersive X-ray spectrometer (EDS) and a transmission electron microscope (TEM) with an EDS, composition by time-of-flight elastic recoil detection analysis (TOF-ERDA) and an X-ray photoelectron spectroscopy (XPS), and adhesion by tensile test. The relation between optical degradation and diffusion mechanisms was studied using optical modelling and simulation. The results clearly revealed the mechanism of outward copper diffusion: diffusion of copper substrate atoms into the coating and through the coating to the surface, formation of copper oxide islands on the surface of the coating, and formation of voids in the substrate surface. The relation between the diffusion mechanisms and increase in thermal emittance of the absorber surface was demonstrated.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Materials Science, Research group: Surface Engineering, Research group: Materials Characterization, University of Helsinki  
Contributors: Kotilainen, M., Honkanen, M., Mizohata, K., Vuoristo, P.  
Number of pages: 10  
Pages: 323-332  
Publication date: 2016  
Peer-reviewed: Yes

#### **Publication information**

Journal: Solar Energy Materials and Solar Cells  
Volume: 145  
ISSN (Print): 0927-0248  
Ratings:

Scopus rating (2016): CiteScore 8.8 SJR 1.599 SNIP 1.697  
Original language: English  
ASJC Scopus subject areas: Renewable Energy, Sustainability and the Environment, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films  
Keywords: Coating, Copper, Diffusion mechanisms, Solar absorber, Thermal diffusion, Void growth  
DOIs:  
10.1016/j.solmat.2015.10.034  
Source: Scopus  
Source ID: 84949090386  
Research output: Contribution to journal › Article › Scientific › peer-review

### **Influence of the P<sub>2</sub>O<sub>5</sub>/Al<sub>2</sub>O<sub>3</sub> co-doping on the local environment of erbium ions and on the 1.5 μm quantum efficiency of Er<sup>3+</sup>-borosilicate glasses**

In this paper, the absorption properties of Er<sup>3+</sup>-doped borosilicate glasses with various P<sub>2</sub>O<sub>5</sub> and Al<sub>2</sub>O<sub>3</sub> content are measured for different silica concentrations. The Judd-Ofelt parameters ( $\Omega_2$ ,  $\Omega_4$  and  $\Omega_6$ ) have been calculated in order to investigate the local environment of the rare-earth cations. The compositional changes of  $\Omega_2$  and  $\Omega_6$  are attributed to changes in the bonding between Er<sup>3+</sup> and surrounding ligand groups due to structural modifications occurring with the introduction of P<sub>2</sub>O<sub>5</sub> and Al<sub>2</sub>O<sub>3</sub>. The luminescence quantum efficiency of the  $^4I_{13/2} \rightarrow ^4I_{15/2}$  transition slightly increases with the addition of P<sub>2</sub>O<sub>5</sub> whereas it decreases with the progressive replacement of P<sub>2</sub>O<sub>5</sub> by Al<sub>2</sub>O<sub>3</sub>. We noticed that it also increases when the silica content is higher.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Frontier Photonics, Politecnico di Torino, nLIGHT Corporation, Johan Gadolin Process Chemistry Centre, Abo Akademi University  
Contributors: Bourhis, K., Boetti, N. G., Koponen, J., Milanese, D., Petit, L.  
Number of pages: 6  
Pages: 926-931  
Publication date: Mar 2014  
Peer-reviewed: Yes

#### Publication information

Journal: Optical Materials

Volume: 36

Issue number: 5

ISSN (Print): 0925-3467

Ratings:

Scopus rating (2014): CiteScore 3.8 SJR 0.721 SNIP 1.204

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Computer Science(all)

Keywords: Er doped borosilicate glasses, Judd-Ofelt parameters, Lifetime, Luminescence quantum efficiency

DOIs:

10.1016/j.optmat.2013.12.035

URLs:

<http://www.scopus.com/inward/record.url?scp=84893847084&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84893847084

Research output: Contribution to journal > Article > Scientific > peer-review

#### Influence of the phosphate glass melt on the corrosion of functional particles occurring during the preparation of glass-ceramics

We report our findings on the impact of the glass composition on the corrosion of microparticles occurring during the preparation of glass-ceramics using the direct doping method. Microparticles (MPs) with the composition  $\text{Sr}_4\text{Al}_{14}\text{O}_{25}:\text{Eu}^{2+}, \text{Dy}^{3+}$  with blue-green persistent luminescence were chosen as the changes in their spectroscopic properties can be related to the MPs' corrosion. The MPs were added in phosphate-based glasses with different compositions. When using the same doping parameters, the glass system with the composition  $90\text{NaPO}_3\text{-}10\text{Na}_2\text{O}$  (mol%) was found to be the least corrosive on the MPs whereas the glass system with the composition  $90\text{NaPO}_3\text{-}10\text{NaF}$  (mol%) is the most corrosive on the MPs probably due to their different viscosity at 575 °C, the temperature at which the MPs are added in the glass melts.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: Nanophotonics, Turun Yliopisto/Turun Biomateriaalikeskus, Laboratory of Photonics

Contributors: Ojha, N., Laihininen, T., Salminen, T., Lastusaari, M., Petit, L.

Pages: 11807-11811

Publication date: Jun 2018

Peer-reviewed: Yes

Early online date: 1 Jan 2018

#### Publication information

Journal: Ceramics International

Volume: 44

Issue number: 10

ISSN (Print): 0272-8842

Ratings:

Scopus rating (2018): CiteScore 5.2 SJR 0.888 SNIP 1.297

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Process Chemistry and Technology, Surfaces, Coatings and Films, Materials Chemistry

Keywords: Corrosion, Direct doping method, Glass melt, Phosphate glass-ceramics,  $\text{SrAlO}:\text{Eu}$ , Dy microparticles

DOIs:

10.1016/j.ceramint.2018.03.267

Source: Scopus

Source ID: 85044921933

### **Inkjet catalyst printing and electroless copper deposition for low-cost patterned microwave passive devices on paper**

A scalable, low-cost process for fabricating copper-based microwave components on flexible, paper-based substrates is demonstrated. An inkjet printer is used to deposit a catalyst-bearing solution (tailored for such printing) in a desired pattern on commercially-available, recyclable, non-toxic (Teslin®) paper. The catalyst-bearing paper is then immersed in an aqueous copper-bearing solution to allow for electroless deposition of a compact and conformal layer of copper in the inkjet-derived pattern. Meander monopole antennas comprised of such electroless-deposited copper patterns on paper exhibited comparable performance as for antennas synthesized via inkjet printing of a commercially-available silver nanoparticle ink. However, the solution-based patterning and electroless copper deposition process avoids nozzle-clogging problems and costs associated with noble metal particle-based inks. This process yields compact conductive copper layers without appreciable oxidation and without the need for an elevated temperature, post-deposition thermal treatment commonly required for noble metal particle-based ink processes. This low-cost copper patterning process is readily scalable on virtually any substrate and may be used to generate a variety of copper-based microwave devices on flexible, paper-based substrates.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, School of Electrical and Computer Engineering, Georgia Institute of Technology

Contributors: Cook, B. S., Fang, Y., Kim, S., Le, T., Goodwin, W. B., Sandhage, K. H., Tentzeris, M. M.

Number of pages: 8

Pages: 669-676

Publication date: Sep 2013

Peer-reviewed: Yes

#### **Publication information**

Journal: Electronic Materials Letters

Volume: 9

Issue number: 5

ISSN (Print): 1738-8090

Ratings:

Scopus rating (2013): CiteScore 2.7 SJR 1.219 SNIP 2.498

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Keywords: antennas, copper metallization, flexible and recyclable substrates, inkjet printed electronics, paper-bearing electronics, RF devices

DOIs:

10.1007/s13391-013-3027-0

URLs:

<http://www.scopus.com/inward/record.url?scp=84883808468&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84883808468

Research output: Contribution to journal › Article › Scientific › peer-review

### **Inkjet printing of radio frequency electronics: Design methodologies and application of novel nanotechnologies**

We discuss here the use of inkjet printing technology as an attractive alternative for the fabrication of radio frequency (RF) electronics. Inkjet printing is compared to widely used traditional methods such as wet etching and mechanical milling with discussion of the advantages and potential disadvantages afforded by the technology. Next the paper presents the current state of the art for RF printed electronics, including fundamental fabrication technologies, methodologies, and materials. Included are detailed discussions of the fabrication of foundational conductive elements, integration of external elements via low temperature bonding techniques, and enhancement strategies focusing on the addition of novel materials. We then present some current challenges related to inkjet printing, along with some exciting recent advances in materials technology seeking to overcome the current limitations and to expand the frontier of the technology. Following are multiple examples detailing the successful use of inkjet printing methods in the creation of novel RF devices, providing proof of concept and illustrating in greater detail the concepts presented in the theoretical sections.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, School of Electrical and Computer Engineering

Contributors: Le, T., Lin, Z., Vyas, R., Lakafosis, V., Yang, L., Traille, A., Tentzeris, M. M., Wong, C. P.

Publication date: 2013

Peer-reviewed: Yes

### Publication information

Journal: Journal of Electronic Packaging

Volume: 135

Issue number: 1

Article number: 011007

ISSN (Print): 1043-7398

Ratings:

Scopus rating (2013): CiteScore 2 SJR 0.43 SNIP 0.804

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials, Computer Science Applications, Electrical and Electronic Engineering

Keywords: Annealing, CNT, Conductive silver ink, Direct write, Electrical design, Flexible circuits, Graphene, Inkjet-printed electronics, Low temperature bonding, Microwave, Organic electronics, Paper-based electronics, Sensors, SOP

DOIs:

10.1115/1.4023671

URLs:

<http://www.scopus.com/inward/record.url?scp=84878547011&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84878547011

Research output: Contribution to journal > Article > Scientific > peer-review

### Instability of cuboctahedral copper clusters

Equilibrium structures of copper clusters up to 10 000 atoms are studied using molecular-dynamics and effective-medium theory. Icosahedral closed-shell clusters are most stable up to 2500 atoms and the Wulff polyhedra are favored for larger clusters. Cuboctahedral closed-shell clusters up to 2000 atoms are unstable. They undergo a nondiffusive transition to an icosahedral structure at low temperatures and melt directly above the fcc-cluster-melting temperature. The melting temperature decreases with decreasing cluster size but not as deeply as has been reported for pure metals.

### General information

Publication status: Published

MoE publication type: Not Eligible

Organisations: Jyväskylän yliopisto

Contributors: Valkealahti, S., Manninen, M.

Number of pages: 4

Pages: 9459-9462

Publication date: 1 Jan 1992

Peer-reviewed: Yes

### Publication information

Journal: Physical Review B

Volume: 45

Issue number: 16

ISSN (Print): 0163-1829

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.45.9459

Source: Scopus

Source ID: 0000550996

Research output: Contribution to journal > Article > Scientific > peer-review

### Interfacial design and structure of protein/polymer films on oxidized AlGaN surfaces

Protein detection using biologically or immunologically modified field-effect transistors (bio/immunoFETs) depends on the nanoscale structure of the polymer/protein film at sensor interfaces (Bhushan 2010 Springer Handbook of Nanotechnology 3rd edn (Heidelberg: Springer); Gupta et al 2010 The effect of interface modification on bioFET sensitivity, submitted). AlGaN-based HFETs (heterojunction FETs) are attractive platforms for many protein sensing applications due to their electrical stability in high osmolarity aqueous environments and favourable current drive capabilities. However, interfacial polymer/protein films on AlGaN, though critical to HFET protein sensor function, have not yet been fully characterized. These interfacial films are typically comprised of protein-polymer films, in which analyte-specific receptors are tethered to the sensing surface with a heterobifunctional linker molecule (often a silane molecule). Here we provide insight into the structure and tribology of silane interfaces composed of one of two different silane monomers deposited on oxidized AlGaN, and other metal oxide surfaces. We demonstrate distinct morphologies and wear properties for the interfacial films,

attributable to the specific chemistries of the silane monomers used in the films. For each specific silane monomer, film morphologies and wear are broadly consistent on multiple oxide surfaces. Differences in interfacial film morphology also drive improvements in sensitivity of the underlying HFET (coincident with, though not necessarily caused by, differences in interfacial film thickness). We present a testable model of the hypothetical differential interfacial depth distribution of protein analytes on FET sensor interfaces with distinct morphologies. Empirical validation of this model may rationalize the actual behaviour of planar immunoFETs, which has been shown to be contrary to expectations of bio/immunoFET behaviour prevalent in the literature for the last 20 years. Improved interfacial properties of bio/immunoHFETs have improved bio/immunoHFET performance: better understanding of interfaces may lead to mechanistic understanding of FET sensor properties and to clinical translation of the immunoFET platform.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Augmented Human Activities (AHA), Ohio State University, Department of Electrical and Computer Engineering

Contributors: Gupta, S. K., Wu, H. H., Kwak, K. J., Casal, P., Nicholson, T. R., Wen, X., Anisha, R., Bhushan, B., Berger, P. R., Lu, W., Brillson, L. J., Lee, S. C.

Publication date: 26 Jan 2011

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physics D: Applied Physics

Volume: 44

Issue number: 3

Article number: 34010

ISSN (Print): 0022-3727

Ratings:

Scopus rating (2011): CiteScore 4.4 SJR 1.266 SNIP 1.424

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials, Acoustics and Ultrasonics, Surfaces, Coatings and Films

DOIs:

10.1088/0022-3727/44/3/034010

Source: Scopus

Source ID: 78650639127

Research output: [Contribution to journal](#) › [Article](#) › [Scientific](#) › [peer-review](#)

#### Investigating solvent effects on aggregation behaviour, linear and nonlinear optical properties of silver nanoclusters

We herein report the solvent effects on the aggregation, linear and nonlinear optical properties of silver nanoclusters synthesised using three solvents namely; ethanol, acetone and isopropanol. The Ag clusters were characterized using UV-Visible (UV-vis) and photoluminescence (PL) spectroscopy, Fourier transform-infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS), high resolution transmission electron microscopy (HRTEM), small angle X-ray scattering (SAXS), dynamic light scattering (DLS), and open aperture Z-Scan measurements. Density functional theory (DFT) calculations at the B3PW91 level of theory, were done to compute the electric dipole, quadrupole, octapole and hexadecapole moment of mercaptosuccinic acid and mercaptosuccinic acid-Ag<sub>9</sub> cluster in three solvents. Linear optical properties show characteristic absorption profile with quantum confinement at different wavelengths for all the three clusters. The Open aperture Z-scan measurement in Ag clusters establishes the optical limiting properties which arise mostly from excited state absorption (ESA) and relatively weak saturable absorption (SA). The nonlinear optical behaviour varies within the three clusters with maximum optical limiting value obtained for the clusters synthesised using acetone. The theoretically computed hyperpolarizabilities together with z-scan measurements establish the solvent effect on the clusters and their potential applications in optical limiting devices.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, St Teresas's College, Mahatma Gandhi University, Kolkata Centre, Birla Institute of Technology & Science, Swinburne University of Technology, University of Johannesburg

Contributors: Bhaviitha, K. B., Nair, A. K., Perumbilavil, S., Joseph, S., Kala, M. S., Saha, A., Narayanan, R. A., Hameed, N., Thomas, S., Oluwafemi, O. S., Kalarikkal, N.

Number of pages: 11

Pages: 695-705

Publication date: 1 Nov 2017

Peer-reviewed: Yes

#### Publication information

Journal: Optical Materials

Volume: 73

ISSN (Print): 0925-3467

Ratings:

Scopus rating (2017): CiteScore 3.7 SJR 0.592 SNIP 1.054

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Computer Science(all), Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: Aggregation behaviour, DFT, Linear optical properties, Non linear optical properties, Silver nanoclusters, Solvent effects

DOIs:

10.1016/j.optmat.2017.09.024

Source: Scopus

Source ID: 85030173026

Research output: Contribution to journal › Article › Scientific › peer-review

### **Investigating the metallic behavior of Na clusters using site-specific polarizabilities**

A site-specific analysis scheme based on density functional theory is used to investigate the static polarizability response of Na<sub>N</sub> clusters for N up to 80. The cluster structures used in the study stem from extensive searches for the respective global minima. The analysis involves partitioning the total cluster polarizability exactly into site (or atomic) contributions; it also results in the decomposition of the polarizability into local (or dipole) and charge transfer contributions. The computed total polarizabilities are found to be in excellent agreement with recent experimental measurements up to a small overall shift. The site analysis provides clear evidence that interior atoms in sodium clusters are strongly screened from an applied external field by the charge induced at the cluster surface. In addition, cluster size trends in the local and charge transfer contributions are shown to be reproduced very well by a simple metal sphere model. The overall picture is that of clusters exhibiting metallic behavior down to the smallest sizes.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Computational Science X (CompX), Northwest University China, Central Michigan University, Argonne National Laboratory

Contributors: Ma, L., Jackson, K. A., Wang, J., Horoi, M., Jellinek, J.

Publication date: 24 Jan 2014

Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B

Volume: 89

Issue number: 3

Article number: 035429

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2014): CiteScore 7 SJR 2.762 SNIP 1.316

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1103/PhysRevB.89.035429

URLs:

<http://www.scopus.com/inward/record.url?scp=84894580248&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84894580248

Research output: Contribution to journal › Article › Scientific › peer-review

### **Investigation of long-term chemical stability of structured ZnO films in aqueous solutions of varying conditions**

Nanostructured zinc oxide, ZnO, films feature attractive functional properties, but their long-term stability needs further investigation. Here, ZnO thin films with well-aligned rod-like structure were grown on stainless steel substrate. The long-term chemical stability of the ZnO films was investigated in solutions with varying pH values (3 – 11) to enhance knowledge about the durability of films in acidic and basic environments. The solubility and stability of the films in the solutions were investigated using atomic absorption spectrophotometry, scanning electron microscopy imaging and energy-dispersive X-ray spectroscopy analyses, as well as by monitoring changes in water contact angle of the films and in the pH values of the solutions. The ZnO film was found to be most stable at highest pH value, with the amount of dissolved zinc being lowest among the studied pH values and the changes observed with other characterization methods being minor compared to the samples immersed to other solutions. At the lowest pH, the film was removed rapidly from the substrate by dissolution. In solutions featuring pH values 5 and 9, the measured pH was unstable and changed

constantly until it reached the value 7.2–7.6, i.e., until the equilibrium of different chemical species in the solution was achieved. These results are presented and discussed in this paper from the viewpoint of applicability of the ZnO films.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Materials Science, Research group: Ceramic materials, VTT Technical Research Centre of Finland

Contributors: Heinonen, S., Nikkanen, J., Huttunen-Saarivirta, E., Levänen, E.

Number of pages: 10

Pages: 410-419

Publication date: 30 Sep 2017

Peer-reviewed: Yes

#### Publication information

Journal: Thin Solid Films

Volume: 638

ISSN (Print): 0040-6090

Ratings:

Scopus rating (2017): CiteScore 3.8 SJR 0.617 SNIP 0.864

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Surfaces and Interfaces, Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

Keywords: Chemical stability, Hydrothermal synthesis, pH, Solubility, Thin film, Zinc oxide

DOIs:

10.1016/j.tsf.2017.07.055

Source: Scopus

Source ID: 85027885831

Research output: Contribution to journal › Article › Scientific › peer-review

#### Investigation of REBCO Roebel Cable Irreversible Critical Current Degradation Under Transverse Pressure

The Roebel cable utilized in High Field accelerator magnets is subject to high transversal electromagnetic forces. The conductor response to exerted pressure depends from the geometry and materials of the cable. A transverse loading test was performed for an impregnated cable in cryogenic conditions. The test revealed Roebel cable being able to withstand elevated average pressure level common to dipole magnets, when the pressure load is exerted by a stiff press tool. However, the mechanism for irreversible current degradation during the transverse loading during powering remains so far unknown. This paper focuses on finding likely failure mechanisms when a magnet is powered. The cable is wound with a glass-fiber sleeve and impregnated with epoxy. Epoxy has much lower stiffness than the coated conductor. When the cable is subjected to transverse loading, abrupt changes in cable thickness and material properties may lead to irreversible degradation of the conductor. As the tape crosses the epoxy-filled central gap region of the cable, the discontinuous change of the support stiffness generates bending strains and shear stress in the conductor. The cable is mechanically modeled. By modeling, the measured axial strain limit of the conductor is connected to transverse pressure limit of the cable.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Civil Engineering, European Organization for Nuclear Research

Contributors: Murtomäki, J. S., Kouhia, R., Stenvall, A., Bottura, L., Kirby, G., van Nugteren, J., DeRijk, G., Rossi, L.

Publication date: Jun 2018

Peer-reviewed: Yes

Early online date: 20 Apr 2018

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 28

Issue number: 4

Article number: 4802506

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Accelerator dipoles, Conductors, Critical current density (superconductivity), Degradation, Finite Element Methods, Geometry, HTS Cables, HTS Magnets, Load modeling, Strain, Superconducting cables

DOIs:

10.1109/TASC.2018.2829150

Source: Scopus

Source ID: 85045735242

Research output: Contribution to journal › Article › Scientific › peer-review

### **Iron losses, magnetoelasticity and magnetostriction in ferromagnetic steel laminations**

The interdependence of iron losses and magnetoelasticity in ferromagnetic laminations is studied by numerical simulations. For the simulations, a finite-element model for the eddy currents in the lamination is coupled to a constitutive magnetomechanical material law. We demonstrate how the experimentally apparent rate-dependency of magnetostriction partly results from the comparison of the local surface magnetostriction to the average flux density supplied through the sheet. The average flux density is a global quantity and lags behind the local surface magnetostriction due to the skin effect of the eddy currents. Accurate modeling of the skin effect also shows that in addition to the hysteresis losses, the eddy-current losses also change as a result of applied mechanical stress, contrary to some earlier discussions in the literature.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Smart Energy Systems (SES), Aalto University

Contributors: Rasilo, P., Singh, D., Belahcen, A., Arkkio, A.

Number of pages: 4

Pages: 2041-2044

Publication date: 2013

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Magnetics

Volume: 49

Issue number: 5

ISSN (Print): 0018-9464

Ratings:

Scopus rating (2013): CiteScore 2.8 SJR 0.587 SNIP 1.395

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Magnetic losses, magnetic materials, magnetomechanical effects, magnetostriction

DOIs:

10.1109/TMAG.2013.2242857

Source: Scopus

Source ID: 84877841540

Research output: Contribution to journal › Article › Scientific › peer-review

### **Irradiation promoted exchange reaction with disulfide substituents**

Exchange reaction between the primary self-assembled monolayer (SAM) on gold and potential molecular substituents capable of forming a SAM on the same substrate can be promoted by electron irradiation. Here we demonstrate that such a promoted reaction can be performed not only with thiols but with disulfides as substituents as well. This extends significantly the assortments of the suitable compounds, resulting in a broader variety of mixed SAMs and chemical patterns which can be fabricated by this technique. The kinetics of the promoted exchange reaction was studied in detail. The feasibility and practical usefulness of the approach were demonstrated by the experiments with a disulfide substituent bearing a tail group which can serve as an initiator for surface-initiated polymerization. A variety of complex polymer brush patterns was prepared using several representative polymers, relevant for biomedical research and applications, as test systems.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Integrated Technologies for Tissue Engineering Research (ITTE), Universitat Heidelberg

Contributors: Khan, M. N., Zharnikov, M.

Number of pages: 10

Pages: 14534-14543

Publication date: 18 Jul 2013

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Physical Chemistry C

Volume: 117

Issue number: 28

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2013): CiteScore 8.3 SJR 2.143 SNIP 1.432

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

10.1021/jp4006026

URLs:

<http://www.scopus.com/inward/record.url?scp=84880559790&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84880559790

Research output: Contribution to journal > Article > Scientific > peer-review

### **Laser angle-resolved photoemission as a probe of initial state $k_z$ dispersion, final-state band gaps, and spin texture of Dirac states in the Bi<sub>2</sub>Te<sub>3</sub> topological insulator**

We have obtained angle-resolved photoemission spectroscopy (ARPES) spectra from single crystals of the topological insulator material Bi<sub>2</sub>Te<sub>3</sub> using a tunable laser spectrometer. The spectra were collected for 11 different photon energies ranging from 5.57 to 6.70 eV for incident light polarized linearly along two different in-plane directions. Parallel first-principles, fully relativistic computations of photointensities were carried out using the experimental geometry within the framework of the one-step model of photoemission. A reasonable overall accord between theory and experiment is used to gain insight into how properties of the initial- and final-state band structures as well as those of the topological surface states and their spin textures are reflected in the laser-ARPES spectra. Our analysis reveals that laser-ARPES is sensitive to both the initial-state  $k_z$  dispersion and the presence of delicate gaps in the final-state electronic spectrum.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research area: Computational Physics, Research group: Spectroscopies of Complex Materials, Ames Laboratory, Iowa State University, Northeastern University

Contributors: Ärrälä, M., Hafiz, H., Mou, D., Wu, Y., Jiang, R., Riedemann, T., Lograsso, T. A., Barbiellini, B., Kaminski, A., Bansil, A., Lindroos, M.

Number of pages: 7

Publication date: 27 Oct 2016

Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B

Volume: 94

Issue number: 15

Article number: 155144

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2016): CiteScore 8.6 SJR 2.339 SNIP 1.183

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.94.155144

URLs:

<http://www.scopus.com/inward/record.url?scp=84994236456&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84994236456

Research output: Contribution to journal > Article > Scientific > peer-review

### **Light-trapping enhanced thin-film III-V quantum dot solar cells fabricated by epitaxial lift-off**

We report thin-film InAs/GaAs quantum dot (QD) solar cells with n-i-p+ deep junction structure and planar back reflector fabricated by epitaxial lift-off (ELO) of full 3-in wafers. External quantum efficiency measurements demonstrate twofold enhancement of the QD photocurrent in the ELO QD cell compared to the wafer-based QD cell. In the GaAs wavelength range, the ELO QD cell perfectly preserves the current collection efficiency of the baseline single-junction ELO cell. We demonstrate by full-wave optical simulations that integrating a micro-patterned diffraction grating in the ELO cell rear side provides more than tenfold enhancement of the near-infrared light harvesting by QDs. Experimental results are thoroughly

discussed with the help of physics-based simulations to single out the impact of QD dynamics and defects on the cell photovoltaic behavior. It is demonstrated that non radiative recombination in the QD stack is the bottleneck for the open circuit voltage (Voc) of the reported devices. More important, our theoretical calculations demonstrate that the Voc offset of 0.3 V from the QD ground state identified by Tanabe et al., 2012, from a collection of experimental data of high quality III-V QD solar cells is a reliable - albeit conservative - metric to gauge the attainable Voc and to quantify the scope for improvement by reducing non radiative recombination. Provided that material quality issues are solved, we demonstrate - by transport and rigorous electromagnetic simulations - that light-trapping enhanced thin-film cells with twenty InAs/GaAs QD layers reach efficiency higher than 28% under unconcentrated light, ambient temperature. If photon recycling can be fully exploited, 30% efficiency is deemed to be feasible.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: ORC, Research group: Nanophotonics, Politecnico di Torino, Department of Applied Health Research, Radboud University Nijmegen, f2 devices B.V.

Contributors: Cappelluti, F., Kim, D., van Eerden, M., Cédola, A. P., Aho, T., Bissels, G., Elsehrawy, F., Wu, J., Liu, H., Mulder, P., Bauhuis, G., Schermer, J., Niemi, T., Guina, M.

Pages: 83-92

Publication date: 2018

Peer-reviewed: Yes

#### Publication information

Journal: Solar Energy Materials and Solar Cells

Volume: 181

ISSN (Print): 0927-0248

Ratings:

Scopus rating (2018): CiteScore 10.2 SJR 1.62 SNIP 1.681

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Renewable Energy, Sustainability and the Environment, Surfaces, Coatings and Films

Keywords: Epitaxial lift-off, Light-trapping, Quantum dot, Solar cell, Thin-film

DOIs:

10.1016/j.solmat.2017.12.014

Source: Scopus

Source ID: 85039853836

Research output: [Contribution to journal](#) › [Article](#) › [Scientific](#) › [peer-review](#)

#### Linear and nonlinear light beam propagation in chiral nematic liquid crystal waveguides

We employ a thick layer of chiral nematic liquid crystals to demonstrate the evolution of a one-dimensional (1D) higher-order guided mode into a beam self-confined in both transverse dimensions at various wavelengths. We also report the experimental observation of higher-order modes guided by soliton-induced waveguides in chiral nematic liquid crystals.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Politechnika Warszawska, University of Warsaw, Aerosol Physics Laboratory, Nonlinear Optics and OptoElectronics Lab, University "Roma Tre"

Contributors: Laudyn, U. A., Kwaśny, M., Jung, P. S., Trippenbach, M., Assanto, G., Karpierz, M. A.

Number of pages: 3

Pages: 11-13

Publication date: 2016

Peer-reviewed: Yes

#### Publication information

Journal: Photonics Letters of Poland

Volume: 8

Issue number: 1

ISSN (Print): 2080-2242

Ratings:

Scopus rating (2016): CiteScore 0.9 SJR 0.197 SNIP 0.272

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Electronic versions:

[Linear and nonlinear light beam propagation in chiral nematic liquid crystal waveguides](#)

DOIs:

10.4302/plp.2016.1.05

URLs:

<http://urn.fi/URN:NBN:fi:tyy-201604253878>

Source: Scopus

Source ID: 84962158419

Research output: Contribution to journal > Article > Scientific > peer-review

### **Liquid crystal light valves: A versatile platform for nematicons**

We illustrate the generation and control of optical spatial solitary waves (nematicons) in liquid crystal light valves with nematic liquid crystals and a photoconductive layer. The latter allows to all-optically varying the birefringent walk-off and the extraordinary-wave refractive index, hence, the trajectory of a nematicon propagating in the thickness of the valve.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Univ Roma Tre, Roma Tre University, Dept Elect Engr, NooEL, University "Roma Tre", CNRS

Contributors: Assanto, G., Piccardi, A., Alberucci, A., Residori, S., Bertolozzo, U.

Number of pages: 3

Pages: 151-153

Publication date: 2009

Peer-reviewed: Yes

#### **Publication information**

Journal: Photonics Letters of Poland

Volume: 1

Issue number: 4

ISSN (Print): 2080-2242

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.4302/plp.2009.4.03

URLs:

<http://www.scopus.com/inward/record.url?scp=78650977780&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 78650977780

Research output: Contribution to journal > Article > Scientific > peer-review

### **Localized surface plasmon resonance in silver nanoparticles: Atomistic first-principles time-dependent density-functional theory calculations**

We observe using ab initio methods that localized surface plasmon resonances in icosahedral silver nanoparticles enter the asymptotic region already between diameters of 1 and 2 nm, converging close to the classical quasistatic limit around 3.4 eV. We base the observation on time-dependent density-functional theory simulations of the icosahedral silver clusters Ag<sub>55</sub>(1.06nm), Ag<sub>147</sub>(1.60nm), Ag<sub>309</sub>(2.14nm), and Ag<sub>561</sub>(2.68 nm). The simulation method combines the adiabatic GLLB-SC exchange-correlation functional with real time propagation in an atomic orbital basis set using the projector-augmented wave method. The method has been implemented for the electron structure code GPAW within the scope of this work. We obtain good agreement with experimental data and modeled results, including photoemission and plasmon resonance. Moreover, we can extrapolate the ab initio results to the classical quasistatically modeled icosahedral clusters.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Research group: Electronic Structure Theory, Research area: Computational Physics, Department of Physics, Chalmers University of Technology, COMP Centre of Excellence, Department of Applied Physics, Aalto University, University of Jyväskylä, Nano-Bio Spectroscopy Group and European Theoretical Spectroscopy Facility (ETSF), Universidad del País Vasco UPV/EHU, CSC-IT Center for Science Ltd.

Contributors: Kuisma, M., Sakko, A., Rossi, T. P., Larsen, A. H., Enkovaara, J., Lehtovaara, L., Rantala, T. T.

Number of pages: 8

Publication date: 24 Mar 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B

Volume: 91

Issue number: 11  
Article number: 115431  
ISSN (Print): 1098-0121  
Ratings:

Scopus rating (2015): CiteScore 6.8 SJR 2.377 SNIP 1.216

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: OPTICAL-PROPERTIES, METAL NANOPARTICLES, AG-CLUSTERS, APPROXIMATION, SIZE, SPECTROSCOPY, ENVIRONMENT, NANOSHELLS, SYSTEMS, SHAPE

DOIs:

10.1103/PhysRevB.91.115431

URLs:

<http://www.scopus.com/inward/record.url?scp=84926483236&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84926483236

Research output: Contribution to journal > Article > Scientific > peer-review

### Long-Range Observation of Exciplex Formation and Decay Mediated by One-Dimensional Bridges

We report herein unprecedented long-range observation of both formation and decay of the exciplex state in donor (D)-bridge (B)-acceptor (A) linked systems. Zinc porphyrins (ZnP) as a donor were tethered to single-walled carbon nanotube (SWNT) as an acceptor through oligo(*p*-phenylene)s (ZnP-ph<sub>*n*</sub>-SWNT) or oligo(*p*-xylene)s (ZnP-xy<sub>*n-1*</sub>-ph<sub>*1*</sub>-SWNT) with systematically varied lengths (*n* = 1-5) to address the issue. Exponential dependencies of rate constants for the exciplex formation ( $k_{\text{FEX}}$ ) and decay ( $k_{\text{DEX}}$ ) on the edge-to-edge separation distance between ZnP and SWNT through the bridges were unambiguously derived from time-resolved spectroscopies. Distance dependencies (i.e., attenuation factor,  $\beta$ ) of  $k_{\text{FEX}}$  and  $k_{\text{DEX}}$  in ZnP-ph<sub>*n*</sub>-SWNT were found to be considerably small ( $\beta = 0.10$  for  $k_{\text{FEX}}$  and  $0.12 \text{ \AA}^{-1}$  for  $k_{\text{DEX}}$ ) compared to those for charge separation and recombination ( $0.2\text{-}0.8 \text{ \AA}^{-1}$ ) in D-B-A systems with the same oligo(*p*-phenylene) bridges. The small  $\beta$  values may be associated with the exciplex state with mixed characters of charge-transfer and excited states. In parallel, the substantially nonconjugated bridge of oligo(*p*-xylene)s exhibited larger attenuation values ( $\beta = 0.12$  for  $k_{\text{FEX}}$  and  $0.14 \text{ \AA}^{-1}$  for  $k_{\text{DEX}}$ ). These results provide deep insight into the unique photodynamics of electronically strongly coupled D-B-A systems involving exciplex.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Chemistry and Bioengineering, Research group: Chemistry & Advanced Materials, Kyoto Women's University

Contributors: Baek, J., Umeyama, T., Stranius, K., Yamada, H., Tkachenko, N. V., Imahori, H.

Number of pages: 10

Pages: 13952-13961

Publication date: 29 Jun 2017

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 121

Issue number: 25

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2017): CiteScore 7.9 SJR 2.135 SNIP 1.133

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Energy(all), Surfaces, Coatings and Films, Physical and Theoretical Chemistry

DOIs:

10.1021/acs.jpcc.7b04483

Source: Scopus

Source ID: 85022231305

Research output: Contribution to journal > Article > Scientific > peer-review

### Low-temperature germanium thin films on silicon

We discuss thermal evaporation of Germanium thin films as a suitable route to realizing near-infrared detectors integrated on a Silicon platform. We study the structural properties of samples grown at various substrate temperatures by X-ray diffraction and transmission electron microscopy, showing that Ge thin films are amorphous when deposited below 225°C, mono-crystalline between 225 and 400°C, poly-crystalline above 450°C. We further investigate their optical and electrical properties using differential optical absorption spectroscopy, Hall and photocurrent measurements. Finally, with the evaporated Ge thin films we demonstrate near-infrared photodiodes with low dark current density and good responsivity at

1.55  $\mu\text{m}$ .

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Nonlinear Optics and OptoElectronics Lab, Institute IMEM-CNR

Contributors: Sorianello, V., Colace, L., Armani, N., Rossi, F., Ferrari, C., Lazzarini, L., Assanto, G.

Number of pages: 10

Pages: 856-865

Publication date: 1 Sep 2011

Peer-reviewed: Yes

#### Publication information

Journal: Optical Materials Express

Volume: 1

Issue number: 5

ISSN (Print): 2159-3930

Ratings:

Scopus rating (2011): CiteScore 0.7

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.1364/OME.1.000856

URLs:

<http://www.scopus.com/inward/record.url?scp=84862177957&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84862177957

Research output: Contribution to journal > Article > Scientific > peer-review

#### Luminescent $(\text{Er,Ho})_2\text{O}_3$ thin films by ALD to enhance the performance of silicon solar cells

We have fabricated luminescent  $(\text{Er,Ho})_2\text{O}_3$  thin films by atomic layer deposition (ALD) and studied their capability to enhance the performance of state-of-the-art single-junction c-Si bifacial solar cells. The films convert IR photons (e.g. 1523 nm) by three- and two-photon upconversion process to emit visible-light in the 400–700 nm range. When the films were coupled with solar cells, ~3% improvement in the short-circuit current density ( $620 \pm 5$  to  $638 \pm 5 \text{ mAcm}^{-2}$ ) was recorded under a simulated solar excitation equivalent to 16 suns. These findings highlight a potential of ALD for the design and fabrication of luminescent coatings for practical solar cell devices.

#### General information

Publication status: E-pub ahead of print

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: ORC, Aalto University, University of Turku

Contributors: Ghazy, A., Safdar, M., Lastusaari, M., Aho, A., Tukiainen, A., Savin, H., Guina, M., Karppinen, M.

Number of pages: 5

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

Journal: Solar Energy Materials and Solar Cells

Volume: 219

Article number: 110787

ISSN (Print): 0927-0248

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Renewable Energy, Sustainability and the Environment, Surfaces, Coatings and Films

Keywords: Atomic layer deposition, c-Si solar cell, Luminescence, Photonics, Upconversion

DOIs:

10.1016/j.solmat.2020.110787

Source: Scopus

Source ID: 85090731507

Research output: Contribution to journal > Article > Scientific > peer-review

#### Magnetic and mechanical design of a 16 T common coil dipole for FCC

EuroCirCol is a conceptual design study for a post-LHC research infrastructure based on an energy-frontier 100 TeV circular hadron collider. In the frame of the high-field accelerator magnet design work package of this study, the feasibility of a 16-T dipole in common coil configuration is being studied. This paper shows the electromagnetic design optimization

per-formed to achieve the required field quality while minimizing the superconductor volume and taking into account the input pa-rameters and assumptions of EuroCirCol study. Finite Element Models (FEM) have been used to analyze the stress distribution and deformations under the large Lorentz forces due to the very high magnetic field. Several iterations have been necessary to obtain a feasible magnet design. 3-D electromagnetic calculations are also included in this paper.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Power engineering, Research group: Modelling and superconductivity, CIEMAT

Contributors: Toral, F., Munilla, J., Salmi, T.

Publication date: 2018

Peer-reviewed: Yes

Early online date: 24 Jan 2018

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 28

Issue number: 3

Article number: 4004305

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: 16 Tesla, Accelerator magnets, FCC, high field magnets, superconducting magnets

DOIs:

10.1109/TASC.2018.2797909

Source: Scopus

Source ID: 85040982105

Research output: Contribution to journal > Article > Scientific > peer-review

#### Magnetic non-contact friction from domain wall dynamics actuated by oscillatory mechanical motion

Magnetic friction is a form of non-contact friction arising from the dissipation of energy in a magnet due to spin reorientation in a magnetic field. In this paper, we study magnetic friction in the context of micromagnetics, using our recent implementation of smooth spring-driven motion (Rissanen and Laurson 2018 Phys. Rev. E 97 053301) to simulate ring-down measurements in two setups where domain wall dynamics is induced by mechanical motion. These include a single thin film with a domain wall in an external field and a setup mimicking a magnetic cantilever tip and substrate, in which the two magnets interact through dipolar interactions. We investigate how various micromagnetic parameters influence the domain wall dynamics actuated by the oscillatory spring-driven mechanical motion and the resulting damping coefficient. Our simulations show that the magnitude of magnetic friction can be comparable to other forms of non-contact friction. For oscillation frequencies lower than those inducing excitations of the internal structure of the domain walls, the damping coefficient is found to be independent of frequency. Hence, our results obtained in the frequency range from 8-112 MHz are expected to be relevant also for typical experimental setups operating in the 100 kHz range.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research area: Computational Physics, Aalto University, COMP Centre of Excellence

Contributors: Rissanen, I., Laurson, L.

Publication date: 13 Aug 2019

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physics D: Applied Physics

Volume: 52

Issue number: 44

Article number: 445002

ISSN (Print): 0022-3727

Ratings:

Scopus rating (2019): CiteScore 5.3 SJR 0.899 SNIP 1.144

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Acoustics and Ultrasonics, Surfaces, Coatings and Films

Keywords: magnetic friction, micromagnetics, thin films

DOIs:

10.1088/1361-6463/ab351f

Source: Scopus

Source ID: 85072336407

Research output: Contribution to journal › Article › Scientific › peer-review

### **Measuring optical anisotropy in poly(3,4-ethylene dioxythiophene): poly(styrene sulfonate) films with added graphene**

Abstract Graphene is a 2D nanomaterial having a great potential for applications in electronics and optoelectronics. Composites of graphene with conducting polymers have shown high performance in practical devices and their solution-processability enables low-cost and high-throughput mass manufacturing using printing techniques. Here we measure the effect of incorporation of graphene into poly(3,4-ethylene dioxythiophene):poly(styrene sulfonate) (PEDOT:PSS) to the optical anisotropy, absorbance and conductivity of the film. Uniaxial anisotropy in PEDOT:PSS films has been thought to be caused by the spin-coating process used in fabrication. We have characterized spray- and spin-coated films using ellipsometry and total internal reflection spectroscopy, the latter especially for films too thick and uneven for ellipsometry, and show that spray-coating, similar to inkjet printing, also produces consistently anisotropic properties even in very thick and uneven films. Possible plasmonic excitations related to graphene are not seen in the films. The optical and electrical anisotropy of graphene/PEDOT:PSS enables routes to high performance devices for electronics, photonics and optoelectronics.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Automation Science and Engineering, Research area: Microsystems, Research area: Measurement Technology and Process Control, Integrated Technologies for Tissue Engineering Research (ITTE), Miktech Oy, University of Jyväskylä

Contributors: Isoniemi, T., Tuukkanen, S., Cameron, D. C., Simonen, J., Toppari, J. J.

Number of pages: 7

Pages: 317-323

Publication date: 9 Jul 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Organic Electronics

Volume: 25

ISSN (Print): 1566-1199

Ratings:

Scopus rating (2015): CiteScore 6.5 SJR 1.135 SNIP 1.071

Original language: English

ASJC Scopus subject areas: Biomaterials, Electronic, Optical and Magnetic Materials, Materials Chemistry, Electrical and Electronic Engineering, Chemistry(all), Condensed Matter Physics

Keywords: PEDOT: PSS, Graphene, Anisotropy, Spectroscopy, Conducting polymer, CARBON-NANOTUBE, ELECTRONICS, OPTOELECTRONICS, CONDUCTIVITY, TRANSPARENT, PHOTONICS, GROWTH, CELLS

Electronic versions:

Isoniemi\_OrgEle\_2015\_Anisotrophy\_of\_Pedot-Graphene\_pre-print

DOIs:

10.1016/j.orgel.2015.06.037

10.1016/j.orgel.2015.06.037

URLs:

<http://urn.fi/URN:NBN:fi:tty-201601293493>

#### **Bibliographical note**

Versio ja lupa ok 13.1.2016 /KK

EXT="Simonen, Janne"

Source: Scopus

Source ID: 84936759109

Research output: Contribution to journal › Article › Scientific › peer-review

### **Mechanical behavior of a 16 T FCC dipole magnet during a quench**

Future accelerator magnets are pushed to their limits in terms of magnetic field, mechanical strength and from the quench protection point of view. This forces the magnet designers to re-think the quench modelling. One issue that has not so far been largely explored is the mechanical behaviour of the superconducting coils during a quench. This can cause limitations to the design of high field accelerator magnets. This paper focuses on mechanical behavior in the event of a quench of a Nb3Sn 16 T dipole magnet currently developed in the framework of the EuroCirCol project in view of the

Future Circular Collider conceptual design study. The thermo-mechanical analysis is performed through finite element modeling. The analysis takes into account the Lorentz force and the thermal stress due to the non-uniform temperature distribution in the winding during a quench.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Power engineering, Research group: Modelling and superconductivity

Contributors: Zhao, J., Stenvall, A., Salmi, T., Gao, Y., Lorin, C.

Publication date: 2017

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 27

Issue number: 6

Article number: 4004407

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2017): CiteScore 2.7 SJR 0.408 SNIP 0.962

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: accelerator magnet, Computational modeling, finite element analysis, Lorentz forces, Magnetic flux, Magnetomechanical effects, Magnetosphere, Magnetostatics, quench, Stress, Superconducting magnets, thermal stress

Electronic versions:

Mechanical behavior of a 16 T FCC main dipole during a quench

DOIs:

10.1109/TASC.2017.2721974

URLs:

<http://urn.fi/URN:NBN:fi:tty-201712152379>

#### Bibliographical note

INT=eee,"Zhao, Junjie"

Source: Scopus

Source ID: 85021962608

Research output: Contribution to journal > Article > Scientific > peer-review

#### Mechanical characterization of pore-graded bioactive glass scaffolds produced by robocasting

Since the discovery of 45S5 Bioglass<sup>®</sup> by Larry Hench, bioactive glasses have been widely studied as bone substitute materials and, in more recent years, have also shown great promise for producing three-dimensional scaffolds. The development of additive manufacturing techniques and their application in bone tissue engineering allows the design and fabrication of complex structures with controlled porosity. However, achieving strong and mechanically-reliable bioactive glass scaffolds is still a great challenge. Furthermore, there is a relative paucity of studies reporting an exhaustive assessment of other mechanical properties than compressive strength of glass-derived scaffolds. This research work aimed at determining key mechanical properties of silicate SiO<sub>2</sub>-Na<sub>2</sub>O-K<sub>2</sub>O-MgO-CaO-P<sub>2</sub>O<sub>5</sub> glass scaffolds fabricated by robocasting and exhibiting a porosity gradient. When tested in compression, these scaffolds had a strength of 6 MPa, a Young's modulus around 340 MPa, a fracture energy of 93 kJ/m<sup>3</sup> and a Weibull modulus of 3, which provides a quantification of the scaffold reliability and reproducibility. Robocasting was a suitable manufacturing method to obtain structures with favorable porosity and mechanical properties comparable to those of the human cancellous bone, which is fundamental regarding osteointegration of bone implants.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: BioMediTech, Politecnico di Torino, McGill University

Contributors: Barberi, J., Nommeots-Nomm, A., Fiume, E., Verné, E., Massera, J., Baino, F.

Number of pages: 8

Pages: 140-147

Publication date: 2019

Peer-reviewed: Yes

#### Publication information

Journal: Biomedical Glasses

Volume: 5  
Issue number: 1  
ISSN (Print): 2299-3932  
Ratings:

Scopus rating (2019): CiteScore 2.9 SJR 0.39 SNIP 1.056

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Surfaces, Coatings and Films, Materials Chemistry

Keywords: Bioactive glass, Mechanical properties, Robocasting, Scaffold

Electronic versions:

[Biomedical Glasses] Mechanical characterization of pore-graded bioactive glass scaffolds produced by robocasting

DOIs:

10.1515/bglass-2019-0012

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202002031763>

### Bibliographical note

EXT="Nommeots-Nomm, Amy"

Source: Scopus

Source ID: 85078096149

Research output: Contribution to journal › Article › Scientific › peer-review

### Mechanical Effects of the Nonuniform Current Distribution on HTS Coils for Accelerators Wound With REBCO Roebel Cable

Future high-energy accelerators will need very high magnetic fields in the range of 20 T. The EuCARD-2 WP10 Future Magnets collaboration is aiming at testing HTS-based Roebel cables in an accelerator magnet. The demonstrator should produce around 17 T, when inserted into the 100-mm aperture of Feather-M2 13-T outsert magnet. HTS Roebel cables are assembled from meander-shaped REBCO-coated conductor tapes. In comparison with fair level of uniformity of current distribution in cables made out of round Nb-Ti or Nb<sub>3</sub>Sn strands, current distribution within the coils wound from Roebel cables is highly nonhomogeneous. It results in nonuniform electromagnetic force distribution over the cable that could damage the very thin REBCO superconducting layer. This paper focuses on the numerical models to describe the effect of the nonhomogeneous current distribution on stress distribution in the demonstrator magnet designed for the EuCARD-2 project. Preliminary results indicate that the impregnation bonding between the cable glass fiber insulation and layer-to-layer insulation plays a significant role in the pressure distribution at the cable edges. The stress levels are safe for Roebel cables. Assuming fully bonded connection at the interface, the stresses around the edges are reduced by a large factor.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research group: Modelling and superconductivity, European Organization for Nuclear Research, University of Twente

Contributors: Murtomaki, J. S., Van Nugteren, J., Kirby, G., Rossi, L., Ruuskanen, J., Stenvall, A.

Publication date: 1 Jun 2017

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 27

Issue number: 4

Article number: 4100405

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2017): CiteScore 2.7 SJR 0.408 SNIP 0.962

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Accelerator dipoles, HTS magnets, Mechanical engineering, Superconducting magnets

DOIs:

10.1109/TASC.2017.2665882

Source: Scopus

Source ID: 85017606692

Research output: Contribution to journal › Article › Scientific › peer-review

### **Mechanical stress analysis during a quench in CLIQ protected 16 T dipole magnets designed for the future circular collider**

Protecting the magnets in case of a quench is a challenge for the 16 T superconducting dipole magnets presently designed for the 100 TeV: Future Circular Collider (FCC). These magnets are driven to the foreseen technological limits in terms of critical current, mechanical strength and quench protection. The magnets are protected with CLIQ (Coupling-Loss Induced Quench) system, which is a recently developed quench protection method based on discharging a capacitor bank across part of the winding. The oscillation of the magnet currents and the dissipation of the high stored energy into the windings cause electrodynamic forces and thermal stresses, which may need to be considered in the magnet mechanical design. This paper focuses on mechanical stress analysis during a quench of the 16 T cos- $\theta$  and block type dipole magnets. A finite element model allowed studying the stress due to the non-uniform temperature and current distribution in the superconducting coils. Two different CLIQ configurations were considered for the cos- $\theta$  design and one for the block type magnet. The analyses of the mechanical behavior of two magnets during a quench without or with hot spot turn were separately carried out. The simulation results show that the stress related to a quench should be considered when designing a high field magnet.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research group: Modelling and superconductivity, Lanzhou University, European Organization for Nuclear Research, Laboratorio Acceleratori e Superconduttività Applicata, French Atomic Energy Commission (CEA) Saclay, Università degli Studi di Milano

Contributors: Zhao, J., Prioli, M., Stenvall, A., Salmi, T., Gao, Y., Caiffi, B., Lorin, C., Marinozzi, V., Farinon, S., Sorbi, M.

Number of pages: 8

Pages: 27-34

Publication date: 15 Jul 2018

Peer-reviewed: Yes

#### **Publication information**

Journal: Physica C: Superconductivity and its Applications

Volume: 550

ISSN (Print): 0921-4534

Ratings:

Scopus rating (2018): CiteScore 2.7 SJR 0.463 SNIP 0.922

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Energy Engineering and Power Technology, Electrical and Electronic Engineering

Keywords: Accelerator magnet, CLIQ protection system, Finite element analysis, Lorentz forces, Quench, Thermal stress  
DOIs:

10.1016/j.physc.2018.04.003

Source: Scopus

Source ID: 85045717268

Research output: Contribution to journal > Article > Scientific > peer-review

### **Membrane bound COMT isoform is an interfacial enzyme: General mechanism and new drug design paradigm**

The enzyme catechol-O-methyltransferase (COMT) has water soluble (S-COMT) and membrane associated (MB-COMT), bitopic, isoforms. Of these MB-COMT is a drug target in relation to the treatment of Parkinson's disease. Using a combination of computational and experimental protocols, we have determined the substrate selection mechanism specific to MB-COMT. We show: (1) substrates with preferred affinity for MB-COMT over S-COMT orient in the membrane in a fashion conducive to catalysis from the membrane surface and (2) binding of COMT to its cofactor ADOMET induces conformational change that drives the catalytic surface of the protein to the membrane surface, where the substrates and  $Mg^{2+}$  ions, required for catalysis, are found. Bioinformatics analysis reveals evidence of this mechanism in other proteins, including several existing drug targets. The development of new COMT inhibitors with preferential affinity for MB-COMT over S-COMT is now possible and insight of broader relevance, into the function of bitopic enzymes, is provided.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Institute of Organic Chemistry and Biochemistry, Academy of Sciences of the Czech Republic, Universite de Geneve

Contributors: Magarkar, A., Parkkila, P., Viitala, T., Lajunen, T., Mobarak, E., Licari, G., Cramariuc, O., Vauthey, E., Róg, T., Bunker, A.

Number of pages: 4

Pages: 3440-3443

Publication date: 11 Apr 2018

Peer-reviewed: Yes

#### Publication information

Journal: Chemical Communications

Volume: 54

Issue number: 28

ISSN (Print): 1359-7345

Ratings:

Scopus rating (2018): CiteScore 11.6 SJR 2.177 SNIP 1.145

Original language: English

ASJC Scopus subject areas: Catalysis, Electronic, Optical and Magnetic Materials, Ceramics and Composites, Chemistry(all), Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

DOIs:

10.1039/c8cc00221e

Source: Scopus

Source ID: 85044968200

Research output: Contribution to journal › Article › Scientific › peer-review

#### Micro-Raman characterization of Germanium thin films evaporated on various substrates

We perform an extensive micro-Raman analysis of Germanium thin films physically evaporated on several substrates including silicon, silicon oxide and glass. We investigate the dependence of crystal quality on thin film deposition parameters such as substrate temperature and growth rate. We also study the continuous transitional change of the material structure from amorphous to crystalline phases. Ge films obtained by this simple and low cost technique are a viable solution towards the realization of virtual substrates and devices.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, University "Roma Tre", Nonlinear Optics and OptoElectronics Lab, Universit Degli Studi dell'Aquila

Contributors: Sorianello, V., Colace, L., Assanto, G., Nardone, M.

Number of pages: 4

Pages: 492-495

Publication date: Apr 2011

Peer-reviewed: Yes

#### Publication information

Journal: Microelectronic Engineering

Volume: 88

Issue number: 4

ISSN (Print): 0167-9317

Ratings:

Scopus rating (2011): CiteScore 2.8 SJR 0.813 SNIP 1.148

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Atomic and Molecular Physics, and Optics, Condensed Matter Physics

Keywords: Germanium, Raman characterization, Thin films

DOIs:

10.1016/j.mee.2010.10.028

URLs:

<http://www.scopus.com/inward/record.url?scp=79751538206&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79751538206

Research output: Contribution to journal › Article › Scientific › peer-review

#### Mining tailings as raw materials for reaction-sintered aluminosilicate ceramics: Effect of mineralogical composition on microstructure and properties

This paper presents studies on the utilization of aluminosilicate-based mining tailings as raw materials for mullite-based ceramics. Based on the 3:2 stoichiometric composition, mullite was synthesised by reactive sintering with a series of powder mixtures with alumina additions. X-ray diffractometry and scanning electron microscopy analyses revealed that, at the specific mineralogical composition, mullite structure formed surrounded by an amorphous glass phase in reaction-sintered powder mixtures. Results demonstrated that the chemical and mineralogical composition of mining tailings do have an effect on mullite formation possibilities and, only with the particular mineralogical composition, the mullite formation is possible regardless of the correct Al:Si ratio in tailings. Physical and mechanical properties of the formed ceramics were defined, showing comparable values to 3:2 mullite reference. Mullite structure formation enables a better

thermal resistance up to above 1450 °C of the formed tailings-based ceramics compared to other aluminosilicates, reflecting their utilization potential for refractory ceramic applications.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Materials Science, Research group: Materials Characterization, VTT Technical Research Centre of Finland, Geologian tutkimuskeskus

Contributors: Karhu, M., Lagerbom, J., Solismaa, S., Honkanen, M., Ismailov, A., Räisänen, M. L., Huttunen-Saarivirta, E., Levänen, E., Kivikytö-Reponen, P.

Pages: 4840-4848

Publication date: Mar 2019

Peer-reviewed: Yes

Early online date: 2018

#### Publication information

Journal: Ceramics International

Volume: 45

Issue number: 4

ISSN (Print): 0272-8842

Ratings:

Scopus rating (2019): CiteScore 6.1 SJR 0.891 SNIP 1.31

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Process Chemistry and Technology, Surfaces, Coatings and Films, Materials Chemistry

Keywords: Mining tailings, Mullite, Reaction sintering, Refractory ceramics, Utilization

DOIs:

10.1016/j.ceramint.2018.11.180

#### Bibliographical note

EXT="Lagerbom, Juha"

Source: Scopus

Source ID: 85057276435

Research output: Contribution to journal > Article > Scientific > peer-review

#### Modification of Surface States of Hematite-Based Photoanodes by Submonolayer of TiO<sub>2</sub> for Enhanced Solar Water Splitting

Surface states are inherently involved with photoelectrochemical (PEC) solar fuel production; some of them are beneficial and participate in the surface reactions, but some act as recombination centers and therefore limit the PEC efficiency. Surface treatments have been applied to modify the surface states, but interrelated effects of the treatments on both types of surface states have not been properly considered. This research examines the modification of the surface states on hematite-based photoanodes by atomic layer deposition of submonolayer amount of TiO<sub>2</sub> and by postannealing treatments. Our results show that the postannealing causes diffusion of Ti deeper into the hematite surface layers, which leads to an increased saturation photocurrent and an anodic shift in the photocurrent onset potential. Without postannealing, the separate TiO<sub>2</sub> phase on the hematite surface results in a second intermediate surface state and delayed charge carrier dynamics, i.e., passivation of the recombination surface states. It is evident by these results that the intermediate surface states observed with impedance spectroscopy in a PEC cell are directly involved in the surface reaction and not with the recombination surface states observed with ultrafast (picoseconds-nanoseconds) transient absorption spectroscopy in air. These results open new optimization strategies to control the beneficial and detrimental surface states independently.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Research group: Surface Science, Physics, Materials Science and Environmental Engineering, Chemistry and Advanced Materials Group

Contributors: Palmolahti, L., Ali-Löytty, H., Khan, R., Saari, J., Tkachenko, N. V., Valden, M.

Number of pages: 8

Pages: 13094-13101

Publication date: 2020

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 124

Issue number: 24  
ISSN (Print): 1932-7447  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Energy(all), Physical and Theoretical Chemistry, Surfaces, Coatings and Films  
Electronic versions:  
Modification of Surface States 2020  
DOIs:  
10.1021/acs.jpcc.0c00798  
URLs:  
<http://urn.fi/URN:NBN:fi:tuni-202008246609>  
Source: Scopus  
Source ID: 85088902594  
Research output: Contribution to journal > Article > Scientific > peer-review

### **Morphology evolution of PS-b-PDMS block copolymer and its hierarchical directed self-assembly on block copolymer templates**

Cylinder-forming polystyrene-block-polydimethylsiloxane (PS-b-PDMS, 27.2k-b-11.7k, SD39) block copolymer having a total molecular weight of  $39 \text{ kg mol}^{-1}$  was exploited to achieve in-plane morphologies of lines, dots and antidots. Brush-free self-assembly of the SD39 on silicon substrates was investigated using solvents that were PS or PDMS selective, neutral and non-solvents based on their Hansen solubility parameters. The different morphologies were achieved with annealing times ranging from 10 min to 1 h at room temperature. The SD39 patterns were used as an etch mask for transferring the pattern into the underlying substrate. Directed self-assembly and hierarchical directed self-assembly on block copolymer templates for confinement of dots was successfully demonstrated. The strategy for achieving multiple morphologies using one BCP by mere choice of the annealing solvents on unmodified substrates provides a simplified method for surface nanopatterning, templated growth of nanomaterials and nanofabrication.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Photonics, Danmarks Tekniske Universitet, DTU Informatik, Trinity College Dublin, Laboratory of Photonics  
Contributors: Rasappa, S., Schulte, L., Borah, D., Hulkkonen, H., Ndoni, S., Salminen, T., Sentharamaikanan, R., Morris, M. A., Niemi, T.  
Number of pages: 7  
Pages: 1-7  
Publication date: 15 May 2018  
Peer-reviewed: Yes

#### **Publication information**

Journal: Microelectronic Engineering  
Volume: 192  
ISSN (Print): 0167-9317  
Ratings:  
Scopus rating (2018): CiteScore 4.2 SJR 0.561 SNIP 0.958  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Condensed Matter Physics, Surfaces, Coatings and Films, Electrical and Electronic Engineering  
Keywords: Block copolymer, Hansen solubility, Hierarchical self-assembly, Selective solvent  
DOIs:  
10.1016/j.mee.2018.02.002  
Source: Scopus  
Source ID: 85041706803  
Research output: Contribution to journal > Article > Scientific > peer-review

### **Multisoliton complexes in fiber lasers**

The formation of stationary and non-stationary pulse groups is regularly observed in multiple pulse soliton fiber lasers. The environment developed in this study for the flexible investigation of this phenomenon is based on the cavity comprising a semiconductor saturable absorber mirror (SESAM) with complex dynamics of absorption recovery and all-fiber dispersion management. The detailed experimental and theoretical considerations show that multiple pulsing in fiber systems offers numerous embodiments ranging from stationary bound states to chaotic bunches. The pulse interaction through the dispersive waves was found to produce a principal impact on the bound state formation. The stability and transformation of stationary bound states and bunch propagation have been also addressed. (C) 2014 Elsevier Inc. All rights reserved.

#### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Research group: Ultrafast and intense lasers, Optoelectronics Research Centre, Frontier Photonics, Ulyanovsk State Univ  
Contributors: Korobko, D. A., Gumenyuk, R., Zolotovskii, I. O., Okhotnikov, O. G.  
Number of pages: 17  
Pages: 593-609  
Publication date: Dec 2014  
Peer-reviewed: Yes

#### Publication information

Journal: Optical Fiber Technology  
Volume: 20  
Issue number: 6  
ISSN (Print): 1068-5200  
Ratings:

Scopus rating (2014): CiteScore 2.7 SJR 0.776 SNIP 1.317

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: Mode-locked fiber laser, Temporal solitons, Soliton dynamics, Nonlinear optics, Bound soliton pair, MODE-LOCKED LASERS, SATURABLE ABSORBER MIRRORS, BOUND SOLITONS, DISSIPATIVE SOLITONS, CAVITY DISPERSION, PULSE GENERATION, STATES, RAINS, PERTURBATIONS, PROPAGATION

DOIs:

10.1016/j.yofte.2014.08.011

#### Bibliographical note

Invited Paper  
Contribution: organisation=orc,FACT1=1  
Portfolio EDEND: 2014-11-11  
Publisher name: Academic Press

Source: researchoutputwizard

Source ID: 759

Research output: Contribution to journal › Article › Scientific › peer-review

#### Multistep Bloch-line-mediated Walker breakdown in ferromagnetic strips

A well-known feature of magnetic field driven dynamics of domain walls in ferromagnets is the existence of a threshold driving force at which the internal magnetization of the domain wall starts to precess - a phenomenon known as the Walker breakdown - resulting in an abrupt drop of the domain-wall propagation velocity. Here, we report on micromagnetic simulations of magnetic field driven domain-wall dynamics in thin ferromagnetic strips with perpendicular magnetic anisotropy which demonstrate that in wide enough strips Walker breakdown is a multistep process: It consists of several distinct velocity drops separated by short linear parts of the velocity vs field curve. These features originate from the repeated nucleation, propagation, and annihilation of an increasing number of Bloch lines within the domain wall as the driving field magnitude is increased. This mechanism arises due to magnetostatic effects breaking the symmetry between the two ends of the domain wall.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Physics, Aalto University, COMP Centre of Excellence, Computational Physics Laboratory  
Contributors: Hütner, J., Herranen, T., Laurson, L.  
Publication date: 24 May 2019  
Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B  
Volume: 99  
Issue number: 17  
Article number: 174427  
ISSN (Print): 2469-9950  
Ratings:

Scopus rating (2019): SJR 1.811 SNIP 1.025

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.99.174427

Source: Scopus

Source ID: 85066395811

### **Narrow-linewidth 780 nm DFB lasers fabricated using nanoimprint lithography**

The paper presents narrow-linewidth 780 nm edgeemitting semiconductor DFB lasers fabricated without regrowth using UV-nanoimprinted surface gratings. The thirdorder laterally-coupled ridge-waveguide surface gratings enable single mode operation, excellent spectral purity (40-55 dB side mode suppression ratio and 10 kHz linewidth) and good lightcurrent-voltage characteristics in continuous wave operation (~112 mA threshold current, ~1.55 V opening voltage and 28.9 mW output power from one facet at 300 mA current for 2.4 mm long devices), which are vital in various applications, such as rubidium spectroscopy and atomic clock pumping. The low fabrication costs, high throughput, structural flexibility and high device yield make the fabrication method fully compatible with large scale mass production, enabling the fabrication of low-cost miniaturized modules.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics

Contributors: Virtanen, H., Uusitalo, T., Karjalainen, M., Ranta, S., Viheriala, J., Dumitrescu, M.

Pages: 51-54

Publication date: 2018

Peer-reviewed: Yes

Early online date: 9 Nov 2017

#### **Publication information**

Journal: IEEE Photonics Technology Letters

Volume: 30

Issue number: 1

ISSN (Print): 1041-1135

Ratings:

Scopus rating (2018): CiteScore 5.4 SJR 0.991 SNIP 1.272

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: DFB laser, Gratings, Laser modes, Measurement by laser beam, narrow linewidth, Optical device fabrication, Optical interferometry, Surface emitting lasers, surface gratings, UV-nanoimprint lithography

DOIs:

10.1109/LPT.2017.2772337

Source: Scopus

Source ID: 85034223754

Research output: Contribution to journal › Article › Scientific › peer-review

### **Near-infrared photodetectors in evaporated ge: Characterization and TCAD simulations**

Thermal evaporation of germanium (Ge) on silicon (Si) has proved to be a suitable technique for the fabrication of high responsivity, low-cost, near-infrared pn detectors. Such results rely on low-temperature diffusion of n-type dopants. The corresponding transport phenomena are quite involved and cannot be described by standard models for pn junctions because of rather large defect concentration density in the Ge layer. In this paper, we report on fabrication, characterization, and simulation of defected Ge on Si photodiodes. For the simulations, we developed a technology computer aided design model and hereby demonstrate its ability to reproduce the measured optoelectronic characteristics of the devices.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, University "Roma Tre", Univ Roma Tre, Roma Tre University, Dept Elect Engn, NooEL

Contributors: Sorianello, V., De Iacovo, A., Colace, L., Assanto, G.

Number of pages: 6

Pages: 1995-2000

Publication date: 2013

Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Electron Devices

Volume: 60

Issue number: 6

Article number: 6515586

ISSN (Print): 0018-9383

Ratings:

Scopus rating (2013): CiteScore 4.7 SJR 1.393 SNIP 1.744

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Doping, near-infrared photodetectors, silicon germanium, technology computer aided design (TCAD), thermal evaporation

DOIs:

10.1109/TED.2013.2259241

URLs:

<http://www.scopus.com/inward/record.url?scp=84878127050&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84878127050

Research output: Contribution to journal › Article › Scientific › peer-review

### **Near-surface defect profiling with slow positrons: Argon-sputtered Al(110)**

We report on slow-positron measurements of atomic defect distribution near a solid surface. Defects are produced by argon-ion bombardment of an Al(110) surface in ultrahigh vacuum. Defect profiles have a typical width of 1525 Å and contain a broader tail extending to 50100 Å. The defect density at the outermost atomic layers saturates at high argon fluences to a few atomic percent, depending on sputtering conditions. Defect production rate at >1 keV Ar<sup>+</sup> energies is typically 15 vacancy-interstitial pairs per incident ion. Molecular-dynamics simulations of the collision cascade predict similar defect distributions.

#### **General information**

Publication status: Published

MoE publication type: Not Eligible

Organisations: Laboratory of Physics, Jyväskylän yliopisto, Helsinki University of Technology, Aalto University

Contributors: Vehanen, A., Mäkinen, J., Hautajarvi, P., Huomo, H., Lahtinen, J., Nieminen, R. M., Valkealahti, S.

Number of pages: 3

Pages: 7561-7563

Publication date: 1 Jan 1985

Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B

Volume: 32

Issue number: 11

ISSN (Print): 0163-1829

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.32.7561

Source: Scopus

Source ID: 25044463128

Research output: Contribution to journal › Article › Scientific › peer-review

### **Near-threshold high spin amplification in a 1300 nm GaInNAs spin laser**

Using continuous-wave optical pumping of a spin-VCSEL at room temperature, we find high spin amplification of the pump close to threshold within the communications wavelength window, here at 1300 nm. This facilitates a strong switch from left to right circularly polarised light emission, which has potential applications in polarisation encoding for data communications. We use a simple spin flip model to fit the experimental results and discuss the VCSEL parameters that affect this amplification.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: ORC, Research group: Semiconductor Technology and Applications, University of Essex, University of Bristol

Contributors: Cemlyn, B., Adams, M., Harbord, E., Li, N., Henning, I. D., Oulton, R., Korpijärvi, V. M., Guina, M.

Publication date: 1 Aug 2018

Peer-reviewed: Yes

#### **Publication information**

Journal: Semiconductor Science and Technology

Volume: 33  
Issue number: 9  
Article number: 094005  
ISSN (Print): 0268-1242  
Ratings:

Scopus rating (2018): CiteScore 4 SJR 0.744 SNIP 1.014

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering, Materials Chemistry

Keywords: spin amplification, spin laser, spin VCSEL

Electronic versions:

Cemlyn\_2018\_Semicond.\_Sci.\_Technol.\_33\_094005

DOIs:

10.1088/1361-6641/aad42e

URLs:

<http://urn.fi/URN:NBN:fi:ty-201810162400>

Source: Scopus

Source ID: 85053167963

Research output: Contribution to journal > Article > Scientific > peer-review

### **Non-destructive and wireless monitoring of biodegradable polymers**

A method for monitoring changes in biodegradable polymers during hydrolysis is proposed. This wireless and non-destructive method is based on inductively coupled passive resonance sensors embedded in the polymer shell. In this study, we prepared specimens using two poly(lactide-co-glycolide) copolymers possessing different degradation profiles. The copolymer embedded sensors were immersed in buffer solution and their resonance features were compared with periodically performed conventional polymer characterization methods. A clear difference was noticed in the wirelessly measured signals between the two tested copolymer materials. Also the reference methods showed clear differences between the degradation profiles of the copolymers. The wirelessly measured signals are likely to correlate to the structural changes in the materials during the hydrolysis. In the future, this technique could be used in the laboratory to provide easy-to-access in situ information about the polymers. Even the state of biodegradable polymer implants could be wirelessly monitored.

### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Faculty of Biomedical Sciences and Engineering, Research area: Microsystems, Research group: Sensor Technology and Biomeasurements (STB), Research group: Biomaterials and Tissue Engineering Group, BioMediTech

Contributors: Salpavaara, T., Hänninen, A., Antniemi, A., Lekkala, J., Kellomäki, M.

Pages: 1018-1025

Publication date: 2017

Peer-reviewed: Yes

### **Publication information**

Journal: Sensors and Actuators B: Chemical

Volume: 251

ISSN (Print): 0925-4005

Ratings:

Scopus rating (2017): CiteScore 9.3 SJR 1.406 SNIP 1.453

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Instrumentation, Condensed Matter Physics, Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry, Electrical and Electronic Engineering

Keywords: Biodegradable polymers, Passive resonance sensor, Poly(lactide-co-glycolide), Telemetry, Wireless monitoring

Electronic versions:

non\_destructive\_and\_wireless\_2018. Embargo ended: 25/07/19

DOIs:

10.1016/j.snb.2017.05.116

URLs:

<http://urn.fi/URN:NBN:fi:tuni-201910234047>

Source: Scopus

Source ID: 85020132649

Research output: Contribution to journal > Article > Scientific > peer-review

### **Nonlinear optical activity effects in complex anisotropic three-dimensional media**

We perform numerical modelling of nonlinear optical (NLO) microscopy of complex anisotropic three-dimensional (3D) media using the uncoupled dipole approximation. The modelling is applied to 3D biological microstructures resembling collagen fibers and multilamellar vesicles. The results elucidate how nonlinear optical activity effects, such as secondharmonic generation circular dichroism, can arise from 3D morphological chirality, in addition to molecular level chirality. We also show how thirdharmonic generation circular dichroism could act as a contrast mechanism for visualizing local structural ordering in 3D anisotropic materials.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Tampere University of Technology, Research area: Optics, Research group: Nonlinear Optics, Frontier Photonics, Aalto University, National Taiwan University, Molecular Imaging Center, COMP Centre of Excellence, Department of Applied Physics, Aalto University

Contributors: Huttunen, M. J., Partanen, M., Bautista, G., Chu, S., Kauranen, M.

Number of pages: 11

Pages: 11-21

Publication date: 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Optical Materials Express

Volume: 5

Issue number: 1

ISSN (Print): 2159-3930

Ratings:

Scopus rating (2015): CiteScore 5.1 SJR 1.34 SNIP 1.335

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.1364/OME.5.000011

URLs:

<http://www.scopus.com/inward/record.url?scp=84920996741&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84920996741

Research output: Contribution to journal > Article > Scientific > peer-review

### **Nonlocal soliton scattering in random potentials**

We experimentally investigate the transport behaviour of nonlocal spatial optical solitons when launched in and interacting with propagation-invariant random potentials. The solitons are generated in nematic liquid crystals; the randomness is created by suitably engineered illumination of planar voltage-biased cells equipped with a photosensitive wall. We find that the fluctuations follow a super-diffusive trend, with the mean square displacement lowering for decreasing spatial correlation of the noise.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, University "Roma Tre", CNRS, Nonlinear Optics and OptoElectronics Lab, Optics Laboratory, Department of Physics, Tampere University of Technology

Contributors: Piccardi, A., Residori, S., Assanto, G.

Number of pages: 5

Publication date: 1 Jul 2016

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Optics

Volume: 18

Issue number: 7

Article number: 07LT01

ISSN (Print): 2040-8978

Ratings:

Scopus rating (2016): CiteScore 3.4 SJR 0.715 SNIP 0.829

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials

Keywords: liquid crystals, nematicons, random potential, scattering, spatial solitons

DOIs:

10.1088/2040-8978/18/7/07LT01

Source: Scopus

Source ID: 84978954030

Research output: Contribution to journal › Article › Scientific › peer-review

### Novel borosilicate bioactive scaffolds with persistent luminescence

Persistent luminescent amorphous borosilicate scaffolds were successfully prepared, for the first time, with a porosity of >70% using the burn-off technique. The persistent luminescence was obtained by adding the  $\text{SrAl}_2\text{O}_4:\text{Eu}^{2+},\text{Dy}^{3+}$  microparticles: i) in the glass melt or ii) in the glass crushed into powder prior to the sintering. The scaffolds prepared by adding the microparticles in the glass melt exhibits lower persistent luminescence and a slower reaction rate in simulated body fluid than the scaffolds prepared by adding the microparticles in the glass powder due to the release of strontium from the microparticles into the glass during the glass melting.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: BioMediTech, Research group: Biomaterials and Tissue Engineering Group, Physics, Research group: Photonics Glasses, Turun yliopisto

Contributors: Del Cerro, P. R., Teittinen, H., Norrbo, I., Lastusaari, M., Massera, J., Petit, L.

Number of pages: 9

Pages: 1-9

Publication date: 2020

Peer-reviewed: Yes

### Publication information

Journal: Biomedical Glasses

Volume: 6

Issue number: 1

ISSN (Print): 2299-3932

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Surfaces, Coatings and Films, Materials Chemistry

Keywords: Borosilicate glasses, Direct particle doping method, Dy microparticles, In-vitro testing, Persistent luminescence, Scaffold,  $\text{SrAlO:Eu}$

Electronic versions:

Novel borosilicate bioactive scaffolds 2020

DOIs:

10.1515/bglass-2020-0001

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202008066397>

### Bibliographical note

INT=phys,"Del Cerro, Paloma Roldan"

INT=bmte,"Teittinen, Henriikka"

Source: Scopus

Source ID: 85085038962

Research output: Contribution to journal › Article › Scientific › peer-review

### Novel oxyfluorophosphate glasses and glass-ceramics

Effect of  $\text{CaF}_2$  addition at the expense of  $\text{CaO}$  on the thermal, physical, optical and structural properties of glasses in the  $\text{NaPO}_3\text{-CaO}$  system was studied. The glasses were prepared by the conventional melt quenching method. For each glass, the thermal properties were studied by differential thermal analysis (DTA) and the optical properties by UV-Vis-NIR spectroscopy. The changes in the glass structure induced by the progressive replacement of  $\text{CaO}$  by  $\text{CaF}_2$  were investigated using IR and Raman spectroscopies. The glasses were heat treated at 20 °C above their respective glass transition temperature for 17 h to form nuclei and then at their peak crystallization temperature for 1 h to grow the nuclei into crystals. An increase in the  $\text{CaF}_2$  content increased the polymerization of the phosphate network leading to shift of the band gap to lower wavelength and reduced the crystallization tendency of the glasses. At least two crystalline phases precipitated in all the investigated glasses, the composition of which depended on the  $\text{CaF}_2$  content. Finally, bulk crystallization was suspected to occur in the oxyfluorophosphate glasses.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Abo Akademi University, University of Turku  
Contributors: Cui, S., Massera, J., Lastusaari, M., Hupa, L., Petit, L.  
Number of pages: 5  
Pages: 40-44  
Publication date: 1 Aug 2016  
Peer-reviewed: Yes

#### Publication information

Journal: Journal of Non-Crystalline Solids

Volume: 445-446

ISSN (Print): 0022-3093

Ratings:

Scopus rating (2016): CiteScore 3.5 SJR 0.685 SNIP 1.154

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Ceramics and Composites, Electronic, Optical and Magnetic Materials, Materials Chemistry

Keywords: Crystallization, Fluorophosphate glasses and glass-ceramics, Raman and IR spectroscopies, XRD

DOIs:

10.1016/j.jnoncrysol.2016.05.005

Source: Scopus

Source ID: 84969872500

Research output: Contribution to journal › Article › Scientific › peer-review

#### Observation of cavity structures in composite metamaterials

We investigated the cavity structure by the deformation of a unit cell of a Composite Metamaterial (CMM) structure. We considered different cavity structures with different resonance frequencies and Q-factors. We observed the Q-factor of the cavity resonance as 108 for a CMM based single cavity wherein the cavity structure is a closed ring structure. We investigated the reduced photon lifetime and observed that at the cavity resonance, the effective group velocity was reduced by a factor of 20 for a CMM based single cavity compared to the electromagnetic waves propagating in free space. Since the unit cells of metamaterials are much smaller than the operation wavelength, subwavelength localization is possible within these metamaterial cavity structures. We found that the electromagnetic field is localized into a region of  $\lambda/8$ , where  $\lambda$  is the cavity resonance wavelength. Subsequently, we brought two cavities together with an intercavity distance of two metamaterial unit cells and then investigated the transmission spectrum of CMM based interacting 2-cavity system. Finally, using the tight-binding picture we observed the normalized group velocity corresponding to the coupled cavity structure.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Nanotechnology Research Center, Bilkent University

Contributors: Caglayan, H., Özbay, E.

Publication date: 2010

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Nanophotonics

Volume: 4

Issue number: 1

Article number: 041790

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: cavity, coupled cavity, localization, metamaterials

DOIs:

10.1117/1.3475763

URLs:

<http://www.scopus.com/inward/record.url?scp=80455156087&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Caglayan, Humeyra"

Source: Scopus

Source ID: 80455156087

Research output: Contribution to journal › Article › Scientific › peer-review

### Observation of off-axis directional beaming via subwavelength asymmetric metallic gratings

It is possible to obtain enhanced and directional beams using subwavelength metallic structures. However, the enhanced beams throughout such structures are only directed towards the propagation direction. In this study, we design the output surface gratings asymmetrically in order to steer the beaming angle. We use a metallic structure with a subwavelength slit ( $\lambda/10$ ) and grating periods of 14 mm and 22 mm on different sides of the output surface. We demonstrate off-axis directional beaming in the microwave regime with an FWHM of  $10^\circ$  with a beaming angle of  $15^\circ$ . The beaming angle can be changed by arranging the grating periods of the output surface of the metallic structure.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Bilkent University, Harvard University  
Contributors: Caglayan, H., Bulu, I., Ozbay, E.  
Publication date: 2009  
Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physics D: Applied Physics  
Volume: 42  
Issue number: 4  
Article number: 045105  
ISSN (Print): 0022-3727  
Ratings:

Scopus rating (2009): SJR 1.269 SNIP 1.326

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Acoustics and Ultrasonics, Condensed Matter Physics

DOIs:

10.1088/0022-3727/42/4/045105

URLs:

<http://www.scopus.com/inward/record.url?scp=67650075571&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Caglayan, H."

Source: Scopus

Source ID: 67650075571

Research output: Contribution to journal > Article > Scientific > peer-review

### Observation of PT-symmetric quantum interference

A common wisdom in quantum mechanics is that the Hamiltonian has to be Hermitian in order to ensure a real eigenvalue spectrum. Yet, parity-time (PT)-symmetric Hamiltonians are sufficient for real eigenvalues and therefore constitute a complex extension of quantum mechanics beyond the constraints of Hermiticity. However, as only single-particle or classical wave physics has been exploited so far, an experimental demonstration of the true quantum nature of PT symmetry has been elusive. In our work, we demonstrate two-particle quantum interference in a PT-symmetric system. We employ integrated photonic waveguides to reveal that the quantum dynamics of indistinguishable photons shows strongly counterintuitive features. To substantiate our experimental data, we analytically solve the quantum master equation using Lie algebra methods. The ideas and results presented here pave the way for non-local PT-symmetric quantum mechanics as a novel building block for future quantum devices.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Physics, Universität Rostock, Albert  
Contributors: Klauck, F., Teuber, L., Ornigotti, M., Heinrich, M., Scheel, S., Szameit, A.  
Publication date: 16 Sep 2019  
Peer-reviewed: Yes

#### Publication information

Journal: Nature Photonics  
ISSN (Print): 1749-4885  
Ratings:

Scopus rating (2019): CiteScore 58.3 SJR 13.614 SNIP 7.931

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

DOIs:

10.1038/s41566-019-0517-0

Source: Scopus

Source ID: 85073826086

Research output: Contribution to journal > Article > Scientific > peer-review

### **Observation of unusual metal-semiconductor interaction and metal-induced gap states at an oxide-semiconductor interface: The case of epitaxial BaO/Ge(100) junction**

Oxidation of semiconductor surfaces is known to cause defect states at oxide-semiconductor interfaces of various devices. In contrast, effects of the semiconductor interaction with non-oxygen elements at such junctions are still unclear. We present evidence for the interrelationship between a metal (non-oxygen)-semiconductor reaction and formation of the band-gap defect states at a buried oxide-semiconductor interface by investigating well-defined epitaxial BaO/Ge(100) junctions with high-resolution synchrotron-radiation photoelectron spectroscopy. The states that arise from the Ba-Ge interaction lead to Fermi-level pinning at 0.40eV above the valence band maximum, while the defect-free BaO/Ge(100) interface has a flat band structure.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics, Department of Physics and Astronomy, University of Turku, Russian Academy of Sciences, University of Turku, Turun Yliopisto/Turun Biomateriaalikeskus

Contributors: Kuzmin, M., Laukkanen, P., Yasir, M., Mäkelä, J., Tuominen, M., Dahl, J., Punkkinen, M. P. J., Kokko, K., Hedman, H. P., Moon, J., Punkkinen, R., Polojärvi, V., Korpjärvi, V. M., Guina, M.

Publication date: 20 Oct 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B

Volume: 92

Issue number: 16

Article number: 165311

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2015): CiteScore 6.8 SJR 2.377 SNIP 1.216

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1103/PhysRevB.92.165311

URLs:

<http://www.scopus.com/inward/record.url?scp=84944790567&partnerID=8YFLogxK> (Link to publication in Scopus)

#### **Bibliographical note**

EXT="Kokko, K."

EXT="Laukkanen, P."

EXT="Kuzmin, M."

Source: Scopus

Source ID: 84944790567

Research output: Contribution to journal > Article > Scientific > peer-review

### **On the limit of superhydrophobicity: Defining the minimum amount of TiO<sub>2</sub> nanoparticle coating**

Fabrication of superhydrophobic surfaces in large scale has been in high interest for several years, also titanium oxide nanostructures having been applied for the purpose. Optimizing the amount and structure of the TiO<sub>2</sub> material in the coating will play a key role when considering upscaling. Here, we take a look at fabricating the superhydrophobic surface in a one-step roll-to-roll pilot scale process by depositing TiO<sub>2</sub> nanoparticles from a Liquid Flame Spray onto a moving paperboard substrate. In order to find the minimum amount of nanomaterial still sufficient for creating superhydrophobicity, we varied nanoparticle production rate, flame distance from the substrate and line speed. Since the deposited amount of material sideways from the flame path was seen to decrease gradually, spatial analysis enabled us to consistently determine the minimum amount of TiO<sub>2</sub> nanoparticles on the substrate needed to achieve superhydrophobicity. Amount as low as 20-30 mg m<sup>-2</sup> of TiO<sub>2</sub> nanoparticles was observed to be sufficient. The scanning electron microscopy revealed that at this amount, the surface was covered with nanoparticles only partially, but still sufficiently to create a hierarchical structure to affect wetting significantly. Based on XPS analysis, it became apparent that TiO<sub>2</sub> gathers hydrocarbons on the surface to develop the surface chemistry towards hydrophobic, but below the critical amount of TiO<sub>2</sub> nanoparticles, the chemistry could not enable superhydrophobicity anymore. While varying the deposited amount of TiO<sub>2</sub>, besides the local spatial variance of the coating amount, also the overall yield was studied. Within the text matrix, a yield up to 44% was achieved. In conclusion, superhydrophobicity was achieved at all tested line speeds (50 to 300 m min<sup>-1</sup>), even if the

amount of TiO<sub>2</sub> varied significantly (20 to 230 mg m<sup>-2</sup>).

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: Aerosol Synthesis, Research area: Aerosol Physics, Materials Science, Packaging Technology Research Team, Physics at Interfaces, Max Planck Institute for Polymer Research, Bioscience and Materials/Surface, RISE Research Institutes of Sweden AB, Finnish Environment Institute, Abo Akad Univ, Abo Akademi University, Dept Phys, AGH University of Science and Technology, University of Eastern Finland

Contributors: Haapanen, J., Aromaa, M., Teisala, H., Juuti, P., Tuominen, M., Sillanpää, M., Stepien, M., Saarinen, J. J., Toivakka, M., Kuusipalo, J., Mäkelä, J. M.

Publication date: 2019

Peer-reviewed: Yes

Early online date: 5 Dec 2018

#### Publication information

Journal: Materials Research Express

Volume: 6

Issue number: 3

Article number: 035004

ISSN (Print): 2053-1591

Ratings:

Scopus rating (2019): CiteScore 1.5 SJR 0.365 SNIP 0.661

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Surfaces, Coatings and Films, Polymers and Plastics, Metals and Alloys

Keywords: liquid flame spray, nanocoatings, nanoparticles, superhydrophobic, TiO, titanium dioxide, wetting

DOIs:

10.1088/2053-1591/aaf2ee

Source: Scopus

Source ID: 85059238010

Research output: Contribution to journal > Article > Scientific > peer-review

#### Open Material Property Library With Native Simulation Tool Integrations - MASTO

Reliable material property data is crucial for trustworthy simulations throughout different areas of engineering. Special care must be taken when materials at extreme conditions are under study. Superconductors and devices assembled from superconductors and other materials, like superconducting magnets, are often operated at such extreme conditions: at low temperatures under high magnetic fields and stresses. Typically, some library or database is used for getting the data. We have started to develop a database for storing all kind of material property data online called Open Material Property Library With Native Simulation Tool Integrations -- MASTO. Data can also depend on other data and it can be versioned to guarantee permanent access. Guiding idea in MASTO is to build easy-to-use integration for various programming languages, modelling frameworks and simulation software. Currently, a full-fledged integration is built for Matlab to allow users to fetch and use data with one-liners. In this paper we briefly review some of the material property databases commonly used in superconductor modelling, present a case study showing how selection of the material property data can influence the simulation results, and introduce the principal ideas behind MASTO. This work serves as the reference document for citing MASTO when it is used in simulations.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering

Contributors: Stenvall, A., Lahtinen, V.

Publication date: 2018

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Data models, Databases, experimental data, Libraries, Material properties, material property database, NIST, numerical modelling, simulations, Superconducting magnets, Temperature

DOIs:

10.1109/TASC.2018.2799850

Source: Scopus

Source ID: 85041392089

Research output: Contribution to journal › Article › Scientific › peer-review

### Optical power monitors in Ge monolithically integrated on SOI chips

We report on the fabrication and operation of optical power monitors monolithically integrated on silicon-on-insulator optical chips. The devices consist of near-infrared waveguide pn heterojunction photodiodes in evaporated germanium. The low temperature growth of Ge is compatible with silicon waveguide technology. The photodetectors exhibit typical responsivities of 10-30 mA/W; the power monitors are used with front-end trans-impedance amplifiers based on commercially available operational amplifiers and can operate with optical signals as small as 10 nW, with errors below 0.2% and 2% at 1 and 0.1  $\mu$ W, respectively.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, University "Roma Tre", Nonlinear Optics and OptoElectronics Lab

Contributors: Colace, L., Sorianello, V., Romagnoli, M., Socci, L., Assanto, G.

Number of pages: 4

Pages: 514-517

Publication date: Apr 2011

Peer-reviewed: Yes

#### Publication information

Journal: Microelectronic Engineering

Volume: 88

Issue number: 4

ISSN (Print): 0167-9317

Ratings:

Scopus rating (2011): CiteScore 2.8 SJR 0.813 SNIP 1.148

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Atomic and Molecular Physics, and Optics, Condensed Matter Physics

Keywords: Germanium, Integrated optoelectronics, Photodetectors, Powermonitor, Silicon-on-insulator

DOIs:

10.1016/j.mee.2010.10.033

URLs:

<http://www.scopus.com/inward/record.url?scp=79751538504&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79751538504

Research output: Contribution to journal › Article › Scientific › peer-review

### Optical properties of GaAs<sub>1-x</sub>Bi<sub>x</sub>/GaAs quantum well structures grown by molecular beam epitaxy on (100) and (311)B GaAs substrates

In this work, the electronic bandstructure of GaAs<sub>1-x</sub>Bi<sub>x</sub>/GaAs single quantum well (QW) samples grown by molecular beam epitaxy is investigated by photomodulated reflectance (PR) measurements as a function of Bi content ( $0.0065 \leq x \leq 0.0215$ ) and substrate orientation. The Bi composition is determined via simulation of high-resolution x-ray diffraction measurement and is found to be maximized in the 2.15%Bi and 2.1%Bi samples grown on (100) and (311)B GaAs substrates. However, the simulations indicate that the Bi composition is not only limited in the GaAsBi QW layer but extends out of the GaAsBi QW towards the GaAs barrier and forms a GaAsBi epilayer. PR spectra are fitted with the third derivative function form (TDFF) to identify the optical transition energies. We analyze the TDFF results by considering strain-induced modification on the conduction band (CB) and splitting of the valence band (VB) due to its interaction with the localized Bi level and VB interaction. The PR measurements confirm the existence of a GaAsBi epilayer via observed optical transitions that belong to GaAsBi layers with various Bi compositions. It is found that both Bi composition and substrate orientation have strong effects on the PR signal. Comparison between TDFF and calculated optical transition energies provides a bandgap reduction of 92 meV/%Bi and 36 meV/%Bi and an interaction strength of the isolated Bi atoms with host GaAs valence band ( $C_{BiM}$ ) of 1.7 eV and 0.9 eV for (100) and (311)B GaAs substrates, respectively.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: ORC, Adana Science and Technology University, Istanbul University, University of Cukurova, University of Nottingham, Universidade Federal de São Carlos, Leibniz Institute for Crystal Growth

Contributors: Gunes, M., Ukelge, M. O., Donmez, O., Erol, A., Gumus, C., Alghamdi, H., Galeti, H. V., Henini, M., Schmidbauer, M., Hilska, J., Puustinen, J., Guina, M.  
Publication date: 13 Nov 2018  
Peer-reviewed: Yes

#### Publication information

Journal: Semiconductor Science and Technology

Volume: 33

Issue number: 12

Article number: 124015

ISSN (Print): 0268-1242

Ratings:

Scopus rating (2018): CiteScore 4 SJR 0.744 SNIP 1.014

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering, Materials Chemistry

Keywords: high-index substrate, oriented GaAsBi, photomodulated reflectance, strained quantum well, type I band line-up  
DOIs:

10.1088/1361-6641/aaea2e

Source: Scopus

Source ID: 85057810892

Research output: Contribution to journal > Article > Scientific > peer-review

#### Optimization of an E3SPreSSO Energy-Extraction System for High-Field Superconducting Magnets

High-temperature superconducting magnets (HTS) suffer from slow quench propagation and have in large fraction high thermal margin. Due to the high thermal margin, quench protection systems (QPS) based on initiating large normal zones, with, e.g., quench protection heaters or CLIQ, are not effective with HTS, and energy extraction is needed. In large magnets, energy extraction with a single dump is not effective and new solutions are looked for. Recently, a concept E 3SPreSSO for HTS magnet protection has been presented in the scope of European project EuCARD-2. E 3 SPReSSO utilizes a series-connected bifilar HTS or LTS coil. In this work, we present a methodology to design QPS based on E 3 SPReSSO for HTS magnets. Then, we utilize this methodology to design and analyze the suitability of such QPS for a 20 T HTS accelerator dipole.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering

Contributors: Ruuskanen, J., Stenvall, A., Van Nugteren, J., Lahtinen, V.

Publication date: 1 Apr 2018

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 28

Issue number: 3

Article number: 4700805

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Accelerator magnets, HTS cables, modeling, quench protection

DOIs:

10.1109/TASC.2018.2794457

#### Bibliographical note

INT=eee,"Van Nugteren, Jeroen"

Source: Scopus

Source ID: 85041649824

Research output: Contribution to journal > Article > Scientific > peer-review

#### Optimization of convectively cooled heat sinks

Many factors of heat sink, such as its size and mass, component locations, number of fins, and fan power affect heat transfer. Owing to the opposite effects of these factors on heat sink maximum temperature, we have now a multi-objective

optimization problem. A typical optimization case consists of hundreds of heat sink temperature field evaluations, which would be impractical to do with CFD. Instead, we propose to combine analytical results of convection and numerical solution of conduction to address these so-called conjugated heat transfer problems. We solve heat conduction in a solid numerically using the finite volume method and tackle convection with the analytical equation of forced convection in a parallel plate channel. This model is suitable for forced and natural convection heat sinks, and we have verified its validity by comparing its results to measured data and CFD calculations. We use the model to improve two industrial examples, using a multi-objective version of the particle swarm optimization (PSO) algorithm. The first example is a forced convection heat sink composed of nine heat generating components at the base plate, and the other is a natural convection case with two components. In both cases, mass is minimized; the other criterion is maximum temperature for the forced convection case and heat sink outer volume for the natural convection case. Our method is many orders of magnitude faster than CFD. Additionally, we provide some LES results of pin fins with natural convection for further use in similar optimizations.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Chemistry and Bioengineering, Research group: Bio- and Circular Economy, Mechanical Engineering and Industrial Systems

Contributors: Lampio, K., Karvinen, R.

Pages: 473-479

Publication date: 2017

Peer-reviewed: Yes

#### Publication information

Journal: Microelectronics Reliability

Volume: 79

ISSN (Print): 0026-2714

Ratings:

Scopus rating (2017): CiteScore 2.6 SJR 0.388 SNIP 0.907

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Condensed Matter Physics, Safety, Risk, Reliability and Quality, Surfaces, Coatings and Films, Electrical and Electronic Engineering

Keywords: Fin array, Forced convection, Heat sink, Multi-objective optimization, Natural convection, Pin fins

DOIs:

10.1016/j.microrel.2017.06.011

Source: Scopus

Source ID: 85020690970

Research output: Contribution to journal > Article > Scientific > peer-review

#### Paraxial light beams in structured anisotropic media

We discuss the paraxial approximation for optical waves propagating in a uniaxial anisotropic medium inhomogeneously twisted on the plane normal to the wave vector, with the latter being parallel to one of the two principal axes normal to the optic axis. Such geometry implies a continuous power transfer between the ordinary and extraordinary components, regardless of the input beam polarization. We pinpoint that this peculiar feature, generalizable to any inhomogeneous linear birefringent material, strongly affects the application of the paraxial approximation due to the simultaneous presence of two different phase velocities. We eventually show that a local coordinate transformation permits a correct application of the paraxial approximation.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: Nonlinear Optics, Univ Porto, Universidade do Porto, Fac Med, Dept Med Imaging

Contributors: Jisha, C. P., Alberucci, A.

Number of pages: 6

Pages: 2019-2024

Publication date: 1 Nov 2017

Peer-reviewed: Yes

#### Publication information

Journal: Journal of the Optical Society of America A: Optics and Image Science, and Vision

Volume: 34

Issue number: 11

ISSN (Print): 1084-7529

Ratings:

Scopus rating (2017): CiteScore 3.5 SJR 0.687 SNIP 1.098

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Computer Vision and Pattern Recognition

DOIs:

10.1364/JOSAA.34.002019

Source: Scopus

Source ID: 85033368214

Research output: Contribution to journal › Article › Scientific › peer-review

### **Passive resonance sensor based method for monitoring particle suspensions**

Control of particle suspensions is needed in several modern industrial processes. A reason for the difficulty in this task has been the lack of a fast and reliable measurement. In this study, we tested the measurement of particle suspension by using a method based on a passive resonance sensor. The relative amounts of dispersing agent and aluminium oxide in the suspension were varied. The studied method yielded signals which depended on the complex permittivity of the suspension. The results indicated that we were able to measure information that can be used as feedback for the suspension preparation process. In addition, the tested instrumentation was simple and robust and thus this method may allow online measurements directly from the industrial processes.

### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Automation Science and Engineering, Research area: Microsystems, Research area: Measurement Technology and Process Control, Department of Materials Science, Research group: Ceramic materials, Engineering materials science and solutions (EMASS), Integrated Technologies for Tissue Engineering Research (ITTE), Smart Energy Systems (SES)

Contributors: Salpavaara, T., Järveläinen, M., Seppälä, S., Yli-Hallila, T., Verho, J., Vilkkö, M., Lekkala, J., Levänen, E.

Number of pages: 7

Pages: 324-330

Publication date: 8 Jun 2015

Peer-reviewed: Yes

### **Publication information**

Journal: Sensors and Actuators B: Chemical

Volume: 219

ISSN (Print): 0925-4005

Ratings:

Scopus rating (2015): CiteScore 7.4 SJR 1.225 SNIP 1.486

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials, Metals and Alloys, Surfaces, Coatings and Films, Materials Chemistry, Instrumentation

Keywords: Complex permittivity, Inductive coupling, Passive resonance sensor, Slurry, Suspension

DOIs:

10.1016/j.snb.2015.04.121

URLs:

<http://www.scopus.com/inward/record.url?scp=84930646590&partnerID=8YFLogxK> (Link to publication in Scopus)

### **Bibliographical note**

ORG=ase,0.5

ORG=mol,0.5

Source: Scopus

Source ID: 84930646590

Research output: Contribution to journal › Article › Scientific › peer-review

### **Perfect magnetic mirror and simple perfect absorber in the visible spectrum**

Known experimental artificial magnetic conductors for terahertz and optical frequencies are formed by arrays of nanoparticles of various shapes. In this paper, we show that artificial magnetic conductors for the visible spectrum can be realized as simple, effectively quasistatic resonating structures, where the effective inductance is due to the magnetic flux inside a uniform metal substrate, and the effective capacitance is due to electric polarization of a thin uniform dielectric cover. To illustrate the main potential application of artificial magnetic conductors, we concentrate on the perfect-absorption regime, achieved by adjusting the loss factor of the artificial magnetic conductor to match its real input impedance to free space. We provide approximate analytical design formulas and introduce a simple equivalent circuit to explain the physical mechanism of emulation of magnetic response and perfect absorption of light. A prototype of a nearly perfect absorber for optical (from green to ultraviolet) frequencies is designed and experimentally tested. The results confirm the theoretical predictions and show polarization insensitivity and angular independence of response in a wide

range of incidence angles.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics, Aalto University, University of Texas at Austin

Contributors: Valagiannopoulos, C. A., Tukiainen, A., Aho, T., Niemi, T., Guina, M., Tretyakov, S. A., Simovski, C. R.

Publication date: 11 Mar 2015

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 91

Issue number: 11

Article number: 115305

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2015): CiteScore 6.8 SJR 2.377 SNIP 1.216

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1103/PhysRevB.91.115305

Source: Scopus

Source ID: 84926444192

Research output: Contribution to journal > Article > Scientific > peer-review

#### Performance enhancement of the RFID EPC Gen2 protocol by exploiting collision re-recovery

Maximizing the Radio Frequency Identification (RFID) performance is one of the main challenges in application domains, such as logistics and supply chain management, where the undesired effect of Tag collisions can significantly degrade the speed of the inventory process. The dominating UHF EPC Class-1 Generation-2 (EPC Gen2) protocol only specifies collision avoidance algorithms but makes no provision for collision resolution. In this paper, performance enhancement of the EPC Gen2 standard exploiting Tag collision recovery is demonstrated, for the first time, in real time with measurements. Three simple and effective approaches to handle successful Tag acknowledgments of recovered collided packets are proposed and implemented on a software-defined Reader and programmable Tags. The attained benefits over the conventional EPC Gen2 MAC scheme are significant: the throughput per time slot is increased by 72% while the overall time required to inventory the Tag population is reduced by 26%. The effectiveness of the proposed approach and the validity of the achieved results are confirmed by the good agreement with simulations reported in the literature.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Sensing Systems for Wireless Medicine (MediSense), Università del Salento, Georgia Institute of Technology, School of Electrical and Computer Engineering

Contributors: De Donno, D., Tarricone, L., Catarinucci, L., Lakafosis, V., Tentzeris, M. M.

Number of pages: 20

Pages: 53-72

Publication date: 2012

Peer-reviewed: Yes

#### Publication information

Journal: Progress in Electromagnetics Research B

Issue number: 43

ISSN (Print): 1937-6472

Ratings:

Scopus rating (2012): CiteScore 3.6 SJR 0.51 SNIP 1.216

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

URLs:

<http://www.scopus.com/inward/record.url?scp=84866454701&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84866454701

Research output: Contribution to journal > Article > Scientific > peer-review

### Phosphate glasses with blue persistent luminescence prepared using the direct doping method

Phosphate glasses with the composition  $(90\text{NaPO}_3-(10-x)\text{Na}_2\text{O}-x\text{NaF})$  (mol%) with  $x = 0$  and  $10$  were prepared with blue persistent luminescence (PeL) using direct particles doping method. Commercial  $\text{CaAl}_2\text{O}_4:\text{Eu}^{2+}, \text{Nd}^{3+}$  microparticles (MPs) with blue PeL were added in the glass melt at a lower temperature than the melting temperature. The PeL properties of the glasses were related to the diffusion of Al from the MPs to the glass occurring during the glass preparation, which was found to depend on the temperature at which the MPs are added in the melt and also on the time before casting the melt after adding the MPs. The glass with  $x = 0$  can be prepared with homogeneous PeL if the MPs are added at  $575\text{ }^\circ\text{C}$ . This  $T_{\text{doping}}$  temperature can be reduced to  $550\text{ }^\circ\text{C}$  by replacing  $\text{Na}_2\text{O}$  by NaF in the glass.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Turun Yliopisto/Turun Biomateriaalikeskus

Contributors: Ojha, N., Tuomisto, M., Lastusaari, M., Petit, L.

Pages: 151-156

Publication date: Jan 2019

Peer-reviewed: Yes

Early online date: 1 Jan 2018

#### Publication information

Journal: Optical Materials

Volume: 87

ISSN (Print): 0925-3467

Ratings:

Scopus rating (2019): CiteScore 4.4 SJR 0.594 SNIP 1.068

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Computer Science(all), Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: CaAlO:Eu,Nd microparticles, Corrosion, Fluorophosphate glass, Persistent luminescence

DOIs:

10.1016/j.optmat.2018.03.063

Source: Scopus

Source ID: 85044951460

Research output: Contribution to journal > Article > Scientific > peer-review

### Photocatalytic and antibacterial properties of ZnO films with different surface topographies on stainless steel substrate

Zinc oxide films with three types of topographies: needle-like and hexagonal rods and flakes, were prepared by hydrothermal synthesis on stainless steel substrates to investigate their photocatalytic and antibacterial properties. The photocatalytic activity was measured with a methylene blue (MB) discoloration test, whereas a method using bioluminescent whole cell bacterial biosensors enabling the constant monitoring of the amount of living cells on the surfaces was used here to study the antibacterial properties. The results showed that photocatalytic activity was clearly influenced by the surface area, which is in turn dependent on the topography. Moreover, it was found that all the examined films decreased notably the amount of *Staphylococcus aureus* and *Escherichia coli* on the surfaces. Despite significant differences in the surface areas of the studied samples that led to different zinc dissolution rate in aqueous environment, no notable differences in antibacterial activity between the films with different morphologies could be detected. These results are presented and discussed in this paper.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Materials Science, Research group: Ceramic materials, Department of Chemistry and Bioengineering, Research group: Industrial Bioengineering and Applied Organic Chemistry, VTT Technical Research Centre of Finland

Contributors: Heinonen, S., Kannisto, M., Nikkanen, J., Huttunen-Saarivirta, E., Karp, M., Levänen, E.

Number of pages: 8

Pages: 842-849

Publication date: 1 Oct 2016

Peer-reviewed: Yes

#### Publication information

Journal: Thin Solid Films

Volume: 616

ISSN (Print): 0040-6090

Ratings:

Scopus rating (2016): CiteScore 3.7 SJR 0.639 SNIP 0.863

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Surfaces and Interfaces, Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

Keywords: Antibacterial, Biosensor cell, Hydrothermal synthesis, Photocatalytic activity, Zinc oxide

DOIs:

10.1016/j.tsf.2016.10.002

URLs:

<http://www.scopus.com/inward/record.url?scp=84991648557&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84991648557

Research output: Contribution to journal > Article > Scientific > peer-review

### **Photoinduced bending upon pulsed irradiation in azobenzene-containing crosslinked liquid-crystalline polymers**

We have investigated the photoresponsive behavior of homogeneously aligned low-azobenzene-concentration crosslinked liquid-crystalline polymers. We compared the thermal contraction and photocontraction of the films, and show that upon UV irradiation, they bend efficiently towards the actinic light source. The photoinduced bending is studied both under continuous-wave irradiation and irradiation with nanosecond pulses. Pulsed irradiation revealed that the photomechanical response can take place within sub-millisecond time scale, and that even a single laser pulse can cause the sample to bend.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Tokyo Institute of Technology, Aalto University, Chuo University

Contributors: Shimamura, A., Priimagi, A., Mamiya, J. I., Kinoshita, M., Ikeda, T., Shishido, A.

Number of pages: 9

Pages: 405-413

Publication date: Sep 2011

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Nonlinear Optical Physics and Materials

Volume: 20

Issue number: 4

ISSN (Print): 0218-8635

Ratings:

Scopus rating (2011): CiteScore 0.8 SJR 0.245 SNIP 0.207

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Physics and Astronomy (miscellaneous)

Keywords: Azobenzene, Liquid crystal, Photocontraction, Photomobile materials, Pulsed irradiation

DOIs:

10.1142/S0218863511006200

URLs:

<http://www.scopus.com/inward/record.url?scp=84861871012&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84861871012

Research output: Contribution to journal > Article > Scientific > peer-review

### **Photoinduced Electron Injection from Zinc Phthalocyanines into Zinc Oxide Nanorods: Aggregation Effects**

Phthalocyanines (Pc) are well-known light-harvesting compounds. However, despite the tremendous efforts on phthalocyanine synthesis, the achieved energy conversion efficiencies for Pc-based dye-sensitized solar cells are moderate. To cast light on the factors reducing the conversion efficiency, we have undertaken a time-resolved spectroscopy study of the primary photoinduced reactions at a semiconductor-Pc interface. ZnO nanorods were chosen as a model semiconductor substrate with enhanced specific surface area. The use of a nanostructured oxide surface allows to extend the semiconductor-dye interface with a hole transporting layer (spiro-MeOTAD) in a controlled way, making the studied system closer to a solid-state dye-sensitized solar cell. Four zinc phthalocyanines are compared in this study. The compounds are equipped with bulky peripheral groups designed to reduce the self-aggregation of the Pcs. Almost no signs of aggregation can be observed from the absorption spectra of the Pcs assembled on a ZnO surface. Nevertheless, the time-resolved spectroscopy indicates that there are inter-Pc charge separation-recombination processes in the time frame of 1-100 ps. This may reduce the electron injection efficiency into the ZnO by more than 50%, pointing out to a remaining aggregation effect. Surprisingly, the electron injection time does not correlate with the length of the linker

connecting the Pc to ZnO. A correlation between the electron injection time and the "bulkiness" of the peripheral groups was observed. This correlation is further discussed with the use of computational modeling of the Pc arrangements on the ZnO surface. (Figure Presented).

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Chemistry and Bioengineering, Research group: Chemistry & Advanced Materials, Instituto Madrileño de Estudios Avanzados (IMDEA)-Nanociencia, Universidad Autónoma de Madrid, Mersin University, South-Ukrainian National Pedagogical University

Contributors: Virkki, K., Hakola, H., Urbani, M., Tejerina, L., Ince, M., Martínez-Díaz, M. V., Torres, T., Golovanova, V., Golovanov, V., Tkachenko, N. V.

Number of pages: 12

Pages: 9594-9605

Publication date: 4 May 2017

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 121

Issue number: 17

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2017): CiteScore 7.9 SJR 2.135 SNIP 1.133

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Energy(all), Surfaces, Coatings and Films, Physical and Theoretical Chemistry

DOIs:

10.1021/acs.jpcc.7b01562

Source: Scopus

Source ID: 85020915273

Research output: Contribution to journal > Article > Scientific > peer-review

#### Photoinduced Electron Transfer in CdSe/ZnS Quantum Dot-Fullerene Hybrids

Photoinduced electron transfer (ET) in CdSe/ZnS core-shell quantum dot (QD) - fullerene (COOH-C<sub>60</sub>) hybrids was studied by the means of time-resolved emission and absorption spectroscopy techniques. A series of four QDs with emission in the range 540-630 nm was employed to investigate the dependence of the electron transfer rate on the QD size. Emission of the QDs is quenched upon hybrid formation, and the quenching mechanism is identified as photoinduced electron transfer from the QD to the fullerene moiety due to the fullerene anion signature observed in transient absorption. In order to obtain quantitative information on the ET reaction, several kinetic data analysis techniques were used, including a conventional multiexponential fitting and a maximum entropy method for emission decay analysis, as well as a distributed decay model based on the Poisson distribution of fullerenes in the hybrids. The latter gradually simplifies the interpretation of the transient absorption spectra and indicates that the spectra of QD cations are essentially similar to those of neutral QDs, differing only by a minor decrease in the intensity and broadening. Furthermore, only a minor decrease in the ET rate with the increasing QD size was observed, the time constants being in the range 100-200 ps for all studied QDs. The charge recombination is extended to 10 ns or longer for all hybrids.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Department of Chemistry and Bioengineering, Research group: Supramolecular photochemistry

Contributors: Virkki, K., Demir, S., Lemmetyinen, H., Tkachenko, N. V.

Number of pages: 12

Pages: 17561-17572

Publication date: 23 Jul 2015

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 119

Issue number: 31

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2015): CiteScore 7.9 SJR 1.886 SNIP 1.246

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

10.1021/acs.jpcc.5b04251

### Bibliographical note

INT=keb,"Demir, Sinem"

Source: Scopus

Source ID: 84938703282

Research output: Contribution to journal > Article > Scientific > peer-review

### Photoinduced surface patterning of azobenzene-containing supramolecular dendrons, dendrimers and dendronized polymers

Ionic complexes of azobenzenes and dendritic structures are shown to exhibit efficient light-induced mass transport upon irradiation with a light interference pattern. Surface-relief gratings (SRGs) with modulation depths of up to 550 nm were successfully inscribed. We compare the SRG formation in three generations of supramolecular dendrons, dendrimers, and dendronized polymers and demonstrate that the grating formation process is destructed by the existence of self-assembled structures as well as by overly large size of the dendronic complexes.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, COMP Centre of Excellence, Department of Applied Physics, Aalto University, Aalto University, Universit'e de Lorraine/CNRS, HCI e 486.1

Contributors: Vapaavuori, J., Priimagi, A., Soininen, A. J., Canilho, N., Kasëmi, E., Ruokolainen, J., Kaivola, M., Ikkala, O.

Number of pages: 12

Pages: 711-722

Publication date: 2013

Peer-reviewed: Yes

### Publication information

Journal: Optical Materials Express

Volume: 3

Issue number: 6

ISSN (Print): 2159-3930

Ratings:

Scopus rating (2013): CiteScore 3.8 SJR 1.757 SNIP 2.34

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.1364/OME.3.000711

URLs:

<http://www.scopus.com/inward/record.url?scp=84880408720&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84880408720

Research output: Contribution to journal > Article > Scientific > peer-review

### Photophysical properties of porphyrin dimer-single-walled carbon nanotube linked systems

Porphyrin dimers were covalently grafted onto electron-accepting single-walled carbon nanotube (SWNT) sidewalls by direct aryl radical addition reaction with an m-or p-phenylene linker with the help of p-p interaction between the porphyrins. A splitting of the porphyrin Soret band and DFT calculations supported the selective formation of the porphyrin dimers on the sidewall of SWNTs. Photoexcitation of the porphyrin dimers on the SWNT resulted in the formation of the exciplex state, which directly decayed to the ground state without yielding the complete charge-separated state. Lifetimes of the porphyrin dimer-SWNT exciplex were longer than that of a porphyrin monomer-SWNT exciplex due to the stabilization by p-electron interaction over two porphyrin rings. In addition, the weaker electronic coupling through the meta-linkage than the para-one may be responsible for the exciplex lifetime of the porphyrin dimer-SWNT with the m-phenylene linker (49 ps) longer than that with the p-phenylene one (24 ps). The results obtained here provide the basic information on the effect of the donor dimerization on the photodynamic behavior of the exciplex state in donor-acceptor linked systems. [Figure presented]

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Chemistry and Bioengineering, Research group: Chemistry & Advanced Materials, Kyoto Women's University

Contributors: Baek, J., Umeyama, T., Mizuno, S., Tkachenko, N. V., Imahori, H.

Publication date: 2017

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 121

Issue number: 39

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2017): CiteScore 7.9 SJR 2.135 SNIP 1.133

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Energy(all), Physical and Theoretical Chemistry, Surfaces, Coatings and Films

DOIs:

10.1021/acs.jpcc.7b08594

Source: Scopus

Source ID: 85032629899

Research output: Contribution to journal > Article > Scientific > peer-review

#### Photovoltaic properties of low-bandgap (0.7–0.9eV) lattice-matched GaInNAsSb solar junctions grown by molecular beam epitaxy on GaAs

We demonstrate single junction GaInNAsSb solar cells with high nitrogen content, i.e. in the range of 5–8%, and bandgap energies close to 0.7 eV grown by molecular beam epitaxy. A good crystalline quality is demonstrated for the entire range of N concentrations. An average external quantum efficiency of 0.45 is demonstrated for GaInNAsSb solar cell with 6.2% N exhibiting a bandgap of 0.78 eV (no antireflection coatings has been applied). The internal quantum efficiency for the cell is 0.65 at  $E_g + 0.2$  eV. The solar cells exhibited bandgap-voltage offsets between 0.55 V (for N = 5.3%) and 0.66 V (for N = 7.9%). When used in a six-junction solar cell architecture under AM1.5D illumination, the estimated short-circuit current density corresponding to the 0.78 eV cell is  $8.2 \text{ mA/cm}^2$ . Furthermore, using the parameters obtained for the GaInNAsSb junction with 6.2% N, we have estimated that such six-junction solar cell architecture could realistically attain an efficiency of over 50% at 1000 suns concentration.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: ORC, Research group: Nanophotonics, Microscopy Center

Contributors: Isoaho, R., Aho, A., Tukiainen, A., Aho, T., Raappana, M., Salminen, T., Reuna, J., Guina, M.

Number of pages: 6

Pages: 198-203

Publication date: 15 Jun 2019

Peer-reviewed: Yes

#### Publication information

Journal: Solar Energy Materials and Solar Cells

Volume: 195

ISSN (Print): 0927-0248

Ratings:

Scopus rating (2019): CiteScore 11.6 SJR 1.827 SNIP 1.799

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Renewable Energy, Sustainability and the Environment, Surfaces, Coatings and Films

Keywords: Dilute nitrides, GaInNAsSb, Molecular beam epitaxy, Multijunction solar cells

DOIs:

10.1016/j.solmat.2019.02.030

URLs:

<http://www.scopus.com/inward/record.url?scp=85062810786&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 85062810786

Research output: Contribution to journal > Article > Scientific > peer-review

#### Physics and applications of photonic crystals

In this article, we investigate how the photonic band gaps and the variety of band dispersions of photonic crystals can be utilized for various applications and how they further give rise to completely novel optical phenomena. The enhancement

of spontaneous emission through coupled cavity waveguides in a one-dimensional silicon nitride photonic microcrystal is investigated. We then present the highly directive radiation from sources embedded in two-dimensional photonic crystals. The manifestation of novel and intriguing optical properties of photonic crystals are exemplified experimentally by the negative refraction and the focusing of electromagnetic waves through a photonic crystal slab with subwavelength resolution.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Bilkent University  
Contributors: Ozbay, E., Bulu, I., Aydin, K., Caglayan, H., Guven, K.  
Number of pages: 9  
Pages: 87-95  
Publication date: Oct 2004  
Peer-reviewed: Yes

#### Publication information

Journal: Photonics and Nanostructures - Fundamentals and Applications  
Volume: 2  
Issue number: 2  
ISSN (Print): 1569-4410  
Ratings:  
Scopus rating (2004): SJR 1.381 SNIP 1.278  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Condensed Matter Physics, Hardware and Architecture, Electrical and Electronic Engineering  
Keywords: Coupled cavity waveguide, Left-handed material, Negative refraction, Photonic crystal, Spontaneous emission  
DOIs:  
10.1016/j.photonics.2004.08.001  
URLs:  
<http://www.scopus.com/inward/record.url?scp=4544365267&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Caglayan, Humeyra"  
Source: Scopus  
Source ID: 4544365267  
Research output: Contribution to journal > Article > Scientific > peer-review

#### Physisorption of benzene on a tin dioxide surface: Van der Waals interaction

An adsorption study of the benzene molecule on SnO<sub>2</sub> (110) surfaces with the density functional theory is extended to include the van der Waals interaction. We compare adsorption onto two model surfaces of SnO<sub>2</sub>, oxygen rich (stoichiometric) and oxygen poor (reduced), considered as limiting cases of varying oxygen abundance. With the chosen van der Waals approach it is found that on the stoichiometric surface, where binding has both a covalent nature and an ionic nature, with the addition of the van der Waals interaction the adsorption energy becomes somewhat stronger. However, on the reduced surface, where binding was earlier predicted to be more physisorptionlike by using a standard generalized gradient approximation (GGA) approach, the van der Waals interaction increases the adsorption energy by a larger factor. Furthermore, three different local-density approximation and GGA functionals are compared, as corrected with the van der Waals scheme. It is found that the correction brings those three to reasonably similar descriptions of adsorption on both surfaces. © 2012 American Physical Society.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Physics  
Contributors: Viitala, M., Kuisma, M., Rantala, T. T.  
Number of pages: 5  
Pages: 1-5  
Publication date: 8 Feb 2012  
Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B  
Volume: 85  
Issue number: 8  
Article number: 085412

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2012): CiteScore 6.6 SJR 3.173 SNIP 1.391

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1103/PhysRevB.85.085412

URLs:

<http://www.scopus.com/inward/record.url?scp=84857764768&partnerID=8YFLogxK> (Link to publication in Scopus)

### **Bibliographical note**

Contribution: organisation=fys,FACT1=1<br/>Publisher name: American Physical Society, APS

Source: researchoutputwizard

Source ID: 5539

Research output: Contribution to journal > Article > Scientific > peer-review

### **Piezoresistive natural rubber-multiwall carbon nanotube nanocomposite for sensor applications**

We explore, both experimentally and theoretically, the possibility to use a composite of natural rubber (NR) and multiwall carbon nanotubes (MWCNT) as a piezoresistive tensile sensor. As an essentially new feature relative to the previous work, we have performed a systematic study of the mechanism of the piezoresistance at large deformations in a wide range of MWCNT concentrations and crosslinking degrees of the host rubber material. In qualitative agreement with the previous work, the conductivity of the unstrained NR/MWCNT nanocomposite is shown to be adequately described by the percolation theory with the critical exponent evaluated to  $\sim 2.31$ . Varying tensile stress-induced strains in the composite has been shown to result in a non-linear electrical response that cannot be described by simple modifications of the percolation theory. In order to explain the observed non-linear dependence of the resistance  $R$  of the composite on the strain  $\epsilon$ , we have developed a scaling theory that relates this resistance to the structural changes in the conducting MWCNT network caused by deforming the host NR. Based on the obtained results, we discuss the ways of using the highly stretchable conductive elastomer composites as an efficient piezoresistive tensile sensor.

### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Materials Science, Rubber Technology Centre, Indian Institute of Technology Kharagpur, Vodafone Department of Mobile Communications Systems, University of Münster, Leibniz-Institut für Polymerforschung Dresden E.V.

Contributors: Selvan, N. T., Eshwaran, S. B., Das, A., Stöckelhuber, K. W., Wießner, S., Pötschke, P., Nando, G. B., Chervanyov, A. I., Heinrich, G.

Number of pages: 12

Pages: 102-113

Publication date: 1 Mar 2016

Peer-reviewed: Yes

### **Publication information**

Journal: Sensors and Actuators, A: Physical

Volume: 239

ISSN (Print): 0924-4247

Ratings:

Scopus rating (2016): CiteScore 4.8 SJR 0.787 SNIP 1.619

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Instrumentation, Condensed Matter Physics, Surfaces, Coatings and Films, Metals and Alloys, Electrical and Electronic Engineering

Keywords: Sensor rubber filler strain nano-composite conductivity

DOIs:

10.1016/j.sna.2016.01.004

Source: Scopus

Source ID: 84955467512

Research output: Contribution to journal > Article > Scientific > peer-review

### **Plasma etch technologies for the development of ultra-small feature size transistor devices**

The advances in information and communication technologies have been largely predicated around the increases in computer processor power derived from the constant miniaturization (and consequent higher density) of individual transistors. Transistor design has been largely unchanged for many years and progress has been around scaling of the basic CMOS device. Scaling has been enabled by photolithography improvements (i.e. patterning) and secondary processing such as deposition, implantation, planarization, etc. Perhaps the most important of the secondary processes is the plasma etch methodology whereby the pattern created by lithography is 'transferred' to the surface via a selective etch

to remove exposed material. However, plasma etch technologies face challenges as scaling continues. Maintaining absolute fidelity in pattern transfer at sub-16 nm dimensions will require advances in plasma technology (plasma sources, chamber design, etc) and chemistry (etch gases, flows, interactions with substrates, etc). In this paper, we illustrate some of these challenges by discussing the formation of ultra-small device structures from the directed self-assembly of block copolymers (BCPs) where nanopatterns are formed from the micro-phase separation of the system. The polymer pattern is transferred by a double etch procedure where one block is selectively removed and the remaining block acts as a resist pattern for silicon pattern transfer. Data are presented which shows that highly regular nanowire patterns of feature size below 20 nm can be created using etch optimization techniques and in this paper we demonstrate generation of crystalline silicon nanowire arrays with feature sizes below 8 nm. BCP techniques are demonstrated to be applicable from these ultra-small feature sizes to 40 nm dimensions. Etch profiles show rounding effects because etch selectivity in these nanoscale resist patterns is limited and the resist thickness rather low. The nanoscale nature of the topography generated also places high demands on developing new etch processes.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Trinity College Dublin, University College Cork

Contributors: Borah, D., Shaw, M. T., Rasappa, S., Farrell, R. A., O'Mahony, C., Faulkner, C. M., Bosea, M., Gleeson, P., Holmes, J. D., Morris, M. A.

Publication date: 4 May 2011

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physics D: Applied Physics

Volume: 44

Issue number: 17

Article number: 174012

ISSN (Print): 0022-3727

Ratings:

Scopus rating (2011): CiteScore 4.4 SJR 1.266 SNIP 1.424

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Acoustics and Ultrasonics, Surfaces, Coatings and Films

DOIs:

10.1088/0022-3727/44/17/174012

URLs:

<http://www.scopus.com/inward/record.url?scp=79954607730&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79954607730

Research output: Contribution to journal › Article › Scientific › peer-review

#### Plasmon lifetime enhancement in a bright-dark mode coupled system

Metallic nanoparticles can localize the incident light to hot spots as plasmon oscillations, where the intensity can be enhanced by up to four orders of magnitude. Even though the lifetime of plasmons is typically short, it can be increased via interactions with quantum emitters, e.g., spaser nanolasers. However, molecules can bleach in days. Here, we study the lifetime enhancement of plasmon excitations due to the coupling with longer-lifetime dark plasmon modes. We apply an analytical model based on harmonic oscillators to demonstrate that a coupled system of bright and dark plasmon modes decays more slowly than the bright mode alone. Furthermore, exact solutions of the three-dimensional Maxwell equations, i.e., finite-difference time domain, demonstrate that the lifetime of the coupled system significantly increases at the hot spot, which is not predictable by far-field response. The decay of the overall energy of such a coupled system, which can be extracted from experimental absorption measurements, is substantially different from the decay of the hot spot field. This observation enlightens the plasmonic applications in which the hot spot intensity enables the detection of the optical responses.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Hacettepe University, Middle East Technical University

Contributors: Yildiz, B. C., Bek, A., Tasgin, M. E.

Number of pages: 8

Publication date: 16 Jan 2020

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 101  
Issue number: 3  
Article number: 035416  
ISSN (Print): 2469-9950  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
DOIs:  
10.1103/PhysRevB.101.035416  
Source: Scopus  
Source ID: 85078332332  
Research output: Contribution to journal › Article › Scientific › peer-review

## **Polymer stabilization enhances the orientational optical nonlinearity of oligothiophene-doped nematic liquid crystals**

### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Frontier Photonics, Tokyo Institute of Technology, Aalto University  
Contributors: Aihara, Y., Kinoshita, M., Wang, J., Mamiya, J. I., Priimagi, A., Shishido, A.  
Number of pages: 5  
Pages: 787-791  
Publication date: Nov 2013  
Peer-reviewed: Yes

### **Publication information**

Journal: Advanced Optical Materials  
Volume: 1  
Issue number: 11  
ISSN (Print): 2195-1071  
Ratings:  
Scopus rating (2013): CiteScore 0.9  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics  
Keywords: Liquid crystals, Nonlinear optics, Oligothiophenes, Optical nonlinearity, Polymer stabilization  
DOIs:  
10.1002/adom.201300326  
URLs:  
<http://www.scopus.com/inward/record.url?scp=84888056420&partnerID=8YFLogxK> (Link to publication in Scopus)  
Source: Scopus  
Source ID: 84888056420  
Research output: Contribution to journal › Article › Scientific › peer-review

## **Power loss mechanisms in n-type modulation-doped AlGaAs/GaAsBi quantum well heterostructures**

We report on the power loss mechanisms of hot electrons in as-grown and annealed n-type modulation-doped  $\text{Al}_{0.15}\text{Ga}_{0.85}\text{As}/\text{GaAs}_{1-x}\text{Bi}_x$  ( $x = 0$  and  $0.04$ ) quantum well structures considering acoustic phonon interactions via the deformation potential (non-polar) and piezoelectric (polar) scatterings. The two-dimensional (2D) electron gas is heated by applying various electric fields under a steady-state magnetic field, and the effect of the applied electric field on the Shubnikov de Haas (SdH) oscillations is analyzed to investigate the power loss mechanism. The temperature of hot electrons ( $T_e$ ) has been obtained by comparing the lattice temperature and applied electric field dependencies of the SdH oscillation amplitude. The hot electron temperature is almost the same for both Bi-free and Bi-containing samples except for the sample annealed at a higher temperature ( $700^\circ\text{C}$ ) than the growth temperature of GaAsBi. The electron temperature dependence of power loss is analyzed using current theoretical analytic models derived for 2D semiconductors. We find that energy relaxation occurs in the intermediate temperature regime, including mixing of piezoelectric and deformation potential scattering. The power loss of hot electrons is found to be proportional to  $(T_e - T_L)^\gamma$  with  $\gamma$  in the range from 2.4 to 4.2, which indicates that the hot electron relaxation is due to acoustic phonon scatterings via unscreened deformation potential and piezoelectric scattering. It is found that deformation potential scattering is dominant over piezoelectric scattering in the Bi-free sample, while the incorporation of Bi into the GaAs lattice makes these processes comparable. After thermal annealing at lower than growth temperature ( $350^\circ\text{C}$ ), the scattering mechanism switches from deformation potential to piezoelectric scattering. After thermal annealing at higher than growth temperature ( $700^\circ\text{C}$ ), the theoretical model does not fit to the experimental results due to degradation of the sample.

### **General information**

Publication status: Published  
MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: ORC, Istanbul University, Eskişehir Technical University (ESTU)  
Contributors: Donmez, O., Aydin, M., Ardali, Yildirim, S., Tıraş, E., Erol, A., Puustinen, J., Hilska, J., Guina, M.  
Publication date: 2020  
Peer-reviewed: Yes

#### Publication information

Journal: Semiconductor Science and Technology

Volume: 35

Issue number: 9

Article number: 095038

ISSN (Print): 0268-1242

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering, Materials Chemistry

Keywords: acoustic phonon scattering, energy relaxation, hot electron in GaAsBi, n-type modulation doped GaAsBi quantum well, power loss

DOIs:

10.1088/1361-6641/ab94d9

Source: Scopus

Source ID: 85090446844

Research output: Contribution to journal › Article › Scientific › peer-review

#### Precipitate formation in aluminium alloys: Multi-scale modelling approach

Ternary Al–Mg–Si alloys have been modelled based on a multi-scale approach that spans across atomistic and mesoscale models and uses theoretically determined parameters. First, a cluster expansion model for total energy has been trained for atomistic configurations (FCC lattice) based on the data from density functional simulations of electronic structure. Free energy curves as a function of solute (Mg, Si) concentrations and disorder have been obtained by using this parameterisation together with meta-dynamics Monte Carlo sampling. In addition, free energy data, surface tensions as well as strain energy using the linear elasticity theory have been collected to be combined for a mesoscale phase-field model. The application of this approach shows that the formation of a layered MgSi phase, with (100) planes, is a particularly stable solute aggregation motif within the Al host matrix. Moreover, the phase-field model demonstrates that the preferred shape of the MgSi precipitates is needle-like (in FCC), and they can act as precursors for the important and well-known  $\beta''$ -type precipitates which are formed by translating one Mg column by a 1/2 lattice vector. The results provide theoretical evidence that the solute aggregation into needle-like MgSi domains (precipitates) is an inherent property of Al–Mg–Si alloys, and that it takes place even without the presence of vacancies which is a precondition for the eventual formation  $\beta''$  precipitates.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: Materials and Molecular Modeling, Norwegian Univ. of Sci. and Technol.

Contributors: Kleiven, D., Akola, J.

Number of pages: 9

Pages: 123-131

Publication date: 15 Aug 2020

Peer-reviewed: Yes

#### Publication information

Journal: Acta Materialia

Volume: 195

ISSN (Print): 1359-6454

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Polymers and Plastics, Metals and Alloys

Keywords: Aluminium alloys, Cluster expansion, Multi-scale modelling, Nucleation, Phase-field

Electronic versions:

Precipitate formation in aluminium alloys 2020

DOIs:

10.1016/j.actamat.2020.05.050

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202007026306>

Source: Scopus

Source ID: 85086074670

Research output: Contribution to journal › Article › Scientific › peer-review

### **Preparation of water-based carbon nanotube inks and application in the inkjet printing of carbon nanotube gas sensors**

Water-based carbon nanotube (CNT) is highly desirable for inkjet printing devices due to its environmentally benign and low-cost features. To improve the dispersion of CNT in water, oxygen-containing functional groups are introduced into the surface of CNT via an acid oxidation process. The CNT-based gas sensor is fabricated by inkjet printing, which shows a high sensitivity toward NO<sub>2</sub>. The application of inkjet-printed CNT in a printed RF antenna for wireless sensing is also discussed.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering, Georgia Tech Research Institute, Chinese University of Hong Kong

Contributors: Lin, Z., Le, T., Song, X., Yao, Y., Li, Z., Moon, K. S., Tentzeris, M. M., Wong, C. P.

Publication date: 2013

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Electronic Packaging

Volume: 135

Issue number: 1

Article number: 011001

ISSN (Print): 1043-7398

Ratings:

Scopus rating (2013): CiteScore 2 SJR 0.43 SNIP 0.804

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials, Computer Science Applications, Electrical and Electronic Engineering

Keywords: Carbon Nanotube, Inkjet Printing, Nanotechnology, Water-Based Ink, Wireless Gas Sensor

DOIs:

10.1115/1.4023758

URLs:

<http://www.scopus.com/inward/record.url?scp=84878587853&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84878587853

Research output: Contribution to journal › Article › Scientific › peer-review

### **Printable and flexible macroporous organosilica film with high protein adsorption capacity**

An approach for creating a flexible and macroporous silsesquioxane film using phase separation method is described. The porous film was prepared by a simple coating method where sol-gel solution containing polyacrylic acid (PAA) and 1,6-bis(trimethoxysilyl)hexane in water was applied on boehmite silica coated polymethylmethacrylate (PMMA) film. After drying, the water soluble PAA template was removed by washing the film with water revealing the porous film. With certain ratios of PAA and water, fully co-continuous pore system with open surface was obtained. Porous films with 3-4 μm thickness were found to be highly flexible. The biocompatibility of the porous film was tested by immobilizing a high affinity biotin-binding chimeric avidin (ChiAVD(I117Y)) into the porous matrix. The porous film was found to adsorb higher amounts of functional chimeric avidin compared to the pure PMMA film or a boehmite silica coated PMMA film.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Multi-scaled biodata analysis and modelling (MultiBAM), Univ of Oulu, VTT Technical Research Centre of Finland, School of Management (JKK)

Contributors: Heikkinen, J. J., Kivimäki, L., Hytönen, V. P., Kulomaa, M. S., Hormi, O. E. O.

Number of pages: 4

Pages: 1934-1937

Publication date: 1 Jan 2012

Peer-reviewed: Yes

#### **Publication information**

Journal: Thin Solid Films

Volume: 520

Issue number: 6

ISSN (Print): 0040-6090

Ratings:

Scopus rating (2012): CiteScore 3.3 SJR 0.897 SNIP 1.153

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Surfaces and Interfaces, Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

Keywords: Flexible coatings, Phase separation, Porous films, Printable coatings, Protein immobilization, Sol-gel  
DOIs:

10.1016/j.tsf.2011.09.041

URLs:

<http://www.scopus.com/inward/record.url?scp=84855940396&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84855940396

Research output: Contribution to journal > Article > Scientific > peer-review

### Programming Photoresponse in Liquid Crystal Polymer Actuators with Laser Projector

A versatile, laser-projector-based method is demonstrated for programming alignment patterns into monolithic films of liquid crystal polymer networks. Complex images can be photopatterned into the polymer films with sub-100  $\mu\text{m}$  resolution, using relatively short exposure times. The method is further used to devise both photochemically and photothermally driven actuators that can undergo distinct light-induced shape changes, dictated by the programmed alignment patterns. Deformation modes such as buckling and coiling, as well as miniature robotic devices such as a gripper and a light-responsive octopod, are demonstrated. The reported technique enables easy and cost-effective programmable actuation with relatively high throughput, thus significantly facilitating the design and realization of functional soft robotic actuators.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Chemistry and Bioengineering, Research group: Chemistry & Advanced Materials, University of Warsaw

Contributors: Wani, O. M., Zeng, H., Wasylczyk, P., Priimagi, A.

Publication date: 2018

Peer-reviewed: Yes

Early online date: 2017

#### Publication information

Journal: Advanced Optical Materials

Volume: 6

Issue number: 1

Article number: 1700949

ISSN (Print): 2195-1071

Ratings:

Scopus rating (2018): CiteScore 10.2 SJR 2.711 SNIP 1.6

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Keywords: Azobenzene, Laser projectors, Liquid crystal, Patterning, Photoactuation, Photoalignment

Electronic versions:

Wani\_AOM\_Final\_revised\_GOA. Embargo ended: 4/12/18

DOIs:

10.1002/adom.201700949

URLs:

<http://urn.fi/URN:NBN:fi:tty-201901111061>

Source: Scopus

Source ID: 85037631675

Research output: Contribution to journal > Article > Scientific > peer-review

### Progress on HL-LHC Nb<sub>3</sub>Sn Magnets

The high-luminosity Large Hadron Collider (HL-LHC) project aims at allowing to increase the collisions in the LHC by a factor of ten in the decade 2025-2035. One essential element is the superconducting magnet around the interaction region points, where the large aperture magnets will be installed to allow to further reduce the beam size in the interaction point. The core of this upgrade is the Nb<sub>3</sub>Sn triplet, made up of 150-mm aperture quadrupoles in the range of 7-8 m. The project is being shared between the European Organization for Nuclear Research and the US Accelerator Upgrade Program, based on the same design, and on the two strand technologies. The project is ending the short model phase, and entering the prototype construction. We will report on the main results of the short model program, including the quench performance and field quality. A second important element is the 11 T dipole that replaces a standard dipole making space for additional collimators. The magnet is also ending the model development and entering the prototype phase. A critical point in the design of this magnet is the large current density, allowing increase of the field from 8 to 11 T with the same

coil cross section as in the LHC dipoles. This is also the first two-in-one Nb<sub>3</sub>Sn magnet developed so far. We will report the main results on the test and the critical aspects.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Power engineering, Research group: Modelling and superconductivity, European Organization for Nuclear Research, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory

Contributors: Todesco, E., Annarella, M., Ambrosio, G., Apollinari, G., Ballarino, A., Bajas, H., Bajko, M., Bordini, B., Bossert, R., Bottura, L., Cavanna, E., Cheng, D., Chlachidze, G., De Rijk, G., Dimarco, J., Ferracin, P., Fleiter, J., Guinchard, M., Hafalia, A., Holik, E., Izquierdo Bermudez, S., Lackner, F., Marchevsky, M., Loeffler, C., Nobrega, A., Perez, J. C., Prestemon, S., Ravaoli, E., Rossi, L., Sabbi, G., Salmi, T., Savary, F., Schmalzle, J., Stoynev, S., Strauss, T., Tartaglia, M., Vallone, G., Velez, G., Wanderer, P., Wang, X., Willering, G., Yu, M.

Publication date: 1 Jun 2018

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 28

Issue number: 4

Article number: 4008809

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: niobium-tin, superconducting coils, Superconducting magnets, type II superconductors

DOIs:

10.1109/TASC.2018.2830703

Source: Scopus

Source ID: 85046361406

Research output: Contribution to journal > Article > Scientific > peer-review

### Properties of nematicons in low-birefringence nematic liquid crystals

We investigate a nonlinear self-focusing and nematicon generation in low birefringence nematic liquid crystals (NLCs), where  $\Delta n \approx 0.04$ . Nematicons are obtained for larger optical powers but they are more stable than in NLCs with standard birefringence, of the order of  $\Delta n \approx 0.2$ . Moreover, in low-birefringent NLCs, polarization components exchange energy in a nonlinear regime. Such behaviour is not observed in typical NLCs, where ordinary and extraordinary waves tend to propagate independently due to large walk off. The results of our experimental test are also compared with numerical simulations, using a fully vectorial BPM. Calculations and experimental results are in good qualitative and quantitative agreement.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Politechnika Warszawska, University "Roma Tre", Nonlinear Optics and OptoElectronics Lab

Contributors: Kwaśny, M., Laudyn, U. A., Sala, F. A., Piccardi, A., Alberucci, A., Karpierz, M. A., Assanto, G.

Number of pages: 3

Pages: 8-10

Publication date: 2013

Peer-reviewed: Yes

### Publication information

Journal: Photonics Letters of Poland

Volume: 5

Issue number: 1

Ratings:

Scopus rating (2013): CiteScore 1.8 SJR 0.349 SNIP 0.723

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.4302/plp.2013.1.04

Source: Scopus

Source ID: 84875728984

Research output: Contribution to journal > Article > Scientific > peer-review

### Protection Heater Design Validation for the LARP Magnets Using Thermal Imaging

Protection heaters are essential elements of a quench protection scheme for high-field accelerator magnets. Various heater designs fabricated by LARP and CERN have been already tested in the LARP high-field quadrupole HQ and presently being built into the coils of the high-field quadrupole MQXF. In order to compare the heat flow characteristics and thermal diffusion timescales of different heater designs, we powered heaters of two different geometries in ambient conditions and imaged the resulting thermal distributions using a high-sensitivity thermal video camera. We observed a peculiar spatial periodicity in the temperature distribution maps potentially linked to the structure of the underlying cable. Two-dimensional numerical simulation of heat diffusion and spatial heat distribution have been conducted, and the results of simulation and experiment have been compared. Imaging revealed hot spots due to a current concentration around high curvature points of heater strip of varying cross sections and visualized thermal effects of various interlayer structural defects. Thermal imaging can become a future quality control tool for the MQXF coil heaters.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Lawrence Berkeley National Laboratory, Fermi National Accelerator Laboratory, European Center for Nuclear Physics

Contributors: Marchevisky, M., Turqueti, M., Cheng, D. W., Felice, H., Sabbi, G., Salmi, T., Stenvall, A., Chlachidze, G., Ambrosio, G., Ferracin, P., Izquierdo Bermudez, S., Perez, J. C., Todesco, E.

Publication date: 1 Jun 2016

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 26

Issue number: 4

Article number: 4003605

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2016): CiteScore 2.6 SJR 0.398 SNIP 1.132

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Quench Protection, Superconducting Magnets, Thermal Imaging

DOIs:

10.1109/TASC.2016.2530161

Source: Scopus

Source ID: 84964335731

Research output: Contribution to journal > Article > Scientific > peer-review

### Quench Protection Study of the Eurocircol 16 T $\cos\theta$ Dipole for the Future Circular Collider (FCC)

After Large Hadron Collider will be turned off, a new, more energetic machine will be needed in order to explore unknown regions of the high-energy physics. For this reason, the project Future Circular Collider (FCC) has started, with the goal of developing a 100-km-circumference collider of 50 TeV proton beams. The Eurocircol collaboration is part of the FCC study under the European Community leadership, and it aims to develop a conceptual design of FCC till 2019. One of the main targets is to design a bending dipole able to reach 16 T operation magnetic field, in order to accomplish the size and energy constraints. Such a magnetic field can be reached using Nb<sub>3</sub>Sn conductors. One option under exploration is the  $\cos\theta$  dipole, by INFN of Milano and Genova. Because of the high stored energy and the large current densities due to the conductor performances, quench protection is one of the most challenging aspects of the design. In this paper, the quench protection of the  $\cos\theta$  design is presented. A standard quench protection study is accompanied by a less conservative study which includes ac effects on the power dissipation inside the coils and on the magnet inductance, in order to not exclude preventively more convenient designs, and to develop a more performing magnet as possible.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Power engineering, Research group: Modelling and superconductivity, Università degli Studi di Milano, Istituto Nazionale Di Fisica Nucleare, Frascati

Contributors: Marinozzi, V., Bellomo, G., Caiffi, B., Fabbricatore, P., Farinon, S., Salmi, T., Sorbi, M., Stenvall, A., Volpini, G.

Publication date: 1 Jun 2017

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 27

Issue number: 4

Article number: 4702505

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2017): CiteScore 2.7 SJR 0.408 SNIP 0.962

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: accelerator dipoles, Quench protection, superconducting magnets

DOIs:

10.1109/TASC.2017.2656156

Source: Scopus

Source ID: 85014850365

Research output: Contribution to journal › Article › Scientific › peer-review

### Quench Protection Study of the Updated MQXF for the LHC Luminosity Upgrade (HiLumi LHC)

In 2023, the LHC luminosity will be increased, aiming at reaching 3000 fb<sup>-1</sup> integrated over ten years. To obtain this target, new Nb<sub>3</sub>Sn low-β quadrupoles (MQXF) have been designed for the interaction regions. These magnets present a very large aperture (150 mm, to be compared with the 70 mm of the present NbTi quadrupoles) and a very large stored energy density (120 MJ/m<sup>3</sup>). For these reasons, quench protection is one of the most challenging aspects of the design of these magnets. In fact, protection studies of a previous design showed that the simulated hot spot temperature was very close to the maximum allowed limit of 350 K; this challenge motivated improvements in the current discharge modeling, taking into account the so-called dynamic effects on the apparent magnet inductance. Moreover, quench heaters design has been studied to be going into more details. In this paper, a protection study of the updated MQXF is presented, benefitting from the experience gained by studying the previous design. A study of the voltages between turns in the magnet is also presented during both normal operation and most important failure scenarios.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, Laboratorio Acceleratori e Superconduttività Applicata, Fermi National Accelerator Laboratory, CERN

Contributors: Marinozzi, V., Ambrosio, G., Ferracin, P., Izquierdo Bermudez, S., Rysti, J., Salmi, T., Sorbi, M., Todesco, E.

Publication date: 1 Jun 2016

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 26

Issue number: 4

Article number: 4001805

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2016): CiteScore 2.6 SJR 0.398 SNIP 1.132

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Niobium compounds, quench protection, superconducting accelerators

DOIs:

10.1109/TASC.2016.2523548

Source: Scopus

Source ID: 84962420401

Research output: Contribution to journal › Article › Scientific › peer-review

### Radiation properties of sources inside photonic crystals

In this work, we have experimentally studied the emission of radiation from a monopole source embedded in a photonic crystal. We have demonstrated the enhancement of radiation at the band edges and at the cavity modes including coupled cavity modes. Moreover, we have shown that the emission of radiation from a source depends on the group velocities of the modes and on the electric field intensities of the modes at the source location.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Bilkent University  
Contributors: Bulu, I., Caglayan, H., Ozbay, E.  
Publication date: 15 May 2003  
Peer-reviewed: Yes

### Publication information

Journal: Physical Review B - Condensed Matter and Materials Physics  
Volume: 67  
Issue number: 20  
ISSN (Print): 1098-0121  
Ratings:  
Scopus rating (2003): SJR 2.184 SNIP 1.245  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
DOIs:  
10.1103/PhysRevB.67.205103  
URLs:  
<http://www.scopus.com/inward/record.url?scp=0037826783&partnerID=8YFLogxK> (Link to publication in Scopus)

### Bibliographical note

EXT="Caglayan, Humeyra"  
Source: Scopus  
Source ID: 0037826783  
Research output: Contribution to journal > Article > Scientific > peer-review

### Rapid and facile synthesis of graphene oxide quantum dots with good linear and nonlinear optical properties

We herein report a rapid and effective method for the synthesis of graphene oxide quantum dots (GOQDs) with excellent linear and nonlinear optical properties. The GOQDs were prepared by chemical cutting of graphite oxide and characterized using Fourier transform infrared spectroscopy, X-ray diffraction, UV-Vis absorption spectroscopy, Raman spectroscopy and transmission electron microscopy. The Commission International de l'Éclairage 1931 chromaticity coordinates for GOQDs ( $x = 0.21$ ,  $y = 0.23$ ) demonstrated that highly pure blue-light emission was achieved upon 330 nm excitation wavelength. Optical nonlinearity measurements conducted at 532 nm using 5 ns laser pulses indicated saturable absorption behavior, which tends to the onset of reverse saturable absorption as the input light fluence was increased.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Physics, Research group: Nonlinear Optics, Research area: Optics, Mahatma Gandhi University, University of Johannesburg, Ultra-Fast and Nonlinear Optical Lab, Raman Research Institute, St Teresas's College  
Contributors: Sakho, E. H. M., Oluwafemi, O. S., Perumbilavil, S., Philip, R., Kala, M. S., Thomas, S., Kalarikkal, N.  
Pages: 10926-10933  
Publication date: 2016  
Peer-reviewed: Yes

### Publication information

Journal: Journal of Materials Science: Materials in Electronics  
Volume: 27  
Issue number: 10  
ISSN (Print): 0957-4522  
Ratings:  
Scopus rating (2016): CiteScore 2.6 SJR 0.469 SNIP 0.802  
Original language: English  
ASJC Scopus subject areas: Condensed Matter Physics, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering  
DOIs:  
10.1007/s10854-016-5204-z  
Source: Scopus  
Source ID: 84975307980  
Research output: Contribution to journal > Article > Scientific > peer-review

### **Rapid and sensitive detection of norovirus antibodies in human serum with a bilayer interferometry biosensor**

Here, we describe the use of a bilayer interferometry biosensor for the fast and sensitive detection of virus-specific antibodies from human serum samples. Norovirus-like particles and norovirus P-particles were used to functionalise the biosensor tip. The detection of antibodies directly from serum samples was challenging, but the addition of a metal chelator (DAB) combined with an anti-human horseradish peroxidase-tagged antibody enabled enhanced detection of virus-specific antibodies in serum dilutions up to 1:100,000. Bilayer interferometry provides results faster than an ELISA, with results in as little as 10-20 min when using pre-functionalised sensors. Therefore, bilayer interferometry combined with DAB enhancement offers an attractive method for quick and sensitive quantification of biomolecules from complicated sample matrices.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Multi-scaled biodata analysis and modelling (MultiBAM), Fimlab Laboratories Ltd

Contributors: Auer, S., Koho, T., Uusi-Kerttula, H., Vesikari, T., Blazevic, V., Hytönen, V. P.

Number of pages: 8

Pages: 507-514

Publication date: 31 Dec 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Sensors and Actuators B: Chemical

Volume: 221

ISSN (Print): 0925-4005

Ratings:

Scopus rating (2015): CiteScore 7.4 SJR 1.225 SNIP 1.486

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials, Metals and Alloys, Surfaces, Coatings and Films, Materials Chemistry, Instrumentation

Keywords: Bilayer interferometry, Fast diagnostics, Non-labelled detection, Norovirus, P-particles, Virus-like particles (VLPs)

DOIs:

10.1016/j.snb.2015.06.088

URLs:

<http://www.scopus.com/inward/record.url?scp=84956972181&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84956972181

Research output: Contribution to journal > Article > Scientific > peer-review

### **Rational design of a printable, highly conductive silicone-based electrically conductive adhesive for stretchable radio-frequency antennas**

Stretchable radio-frequency electronics are gaining popularity as a result of the increased functionality they gain through their flexible nature, impossible within the confines of rigid and planar substrates. One approach to fabricating stretchable antennas is to embed stretchable or flowable conductive materials, such as conductive polymers, conductive polymer composites, and liquid metal alloys as stretchable conduction lines. However, these conductive materials face many challenges, such as low electrical conductivity under mechanical deformation and delamination from substrates. In the present study, a silicone-based electrically conductive adhesive (silo-ECA) is developed that have a conductivity of  $1.51 \times 10^4 \text{ S cm}^{-1}$  and can maintain conductivity above  $1.11 \times 10^3 \text{ S cm}^{-1}$ , even at a large strain of 240%. By using the stretchable silo- ECAs as a conductor pattern and pure silicone elastomers as a base substrate, stretchable antennas can be fabricated by stencil printing or soft-lithography. The resulting antenna's resonant frequency is tunable over a wide range by mechanical modulation. This fabrication method is low-cost, can support large-scale production, has high reliability over a wide temperature range, and eliminates the concerns of leaking or delamination between conductor and substrate experienced in previously reported micro-fluidic antennas.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Chinese University of Hong Kong

Contributors: Li, Z., Le, T., Wu, Z., Yao, Y., Li, L., Tentzeris, M., Moon, K. S., Wong, C. P.

Number of pages: 7

Pages: 464-470

Publication date: 21 Jan 2015

Peer-reviewed: Yes

### Publication information

Journal: Advanced Functional Materials

Volume: 25

Issue number: 3

ISSN (Print): 1616-301X

Ratings:

Scopus rating (2015): CiteScore 20.4 SJR 4.859 SNIP 2.439

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Condensed Matter Physics, Electrochemistry

DOIs:

10.1002/adfm.201403275

URLs:

<http://www.scopus.com/inward/record.url?scp=84920994935&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84920994935

Research output: Contribution to journal › Article › Scientific › peer-review

### Realization of Free-Space Long-Distance Self-Healing Bessel Beams

A new approach for generating long-distance self-healing Bessel beams, which is based on a ring-shaped (annular) lens and a spherical lens in 4f-configuration, is reported. With this, diffraction-free light evolution of a zeroth order Bessel beam over several meters is shown and available scaling opportunities that surpass current technologies by far are discussed. Furthermore, it is demonstrated how this setup can be adapted to create Bessel beam superpositions, realizing the longest ever reported optical conveyor beam and helicon beam, respectively. Last, the self-healing capabilities of the beams are tested against strong opaque and non-opaque scatterers, which again emphasizes the great potential of this new method.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Friedrich-Schiller-University Jena, UMR 6174, Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Vacom GmbH, Institute of Applied Physics, Institut für Physik, Universität Rostock, Albert

Contributors: Vetter, C., Steinkopf, R., Bergner, K., Ornigotti, M., Nolte, S., Gross, H., Szameit, A.

Publication date: 1 Oct 2019

Peer-reviewed: Yes

### Publication information

Journal: Laser and Photonics Reviews

Volume: 13

Issue number: 10

Article number: 1900103

ISSN (Print): 1863-8880

Ratings:

Scopus rating (2019): CiteScore 16.9 SJR 4.014 SNIP 2.903

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Condensed Matter Physics

Keywords: beam-shaping, Bessel-beams, laser-technology, self-healing, telecommunication

Electronic versions:

Vetter\_et\_al-2019-Laser\_&\_Photonics\_Reviews

DOIs:

10.1002/lpor.201900103

URLs:

<http://urn.fi/URN:NBN:fi:tuni-201911055743>

Source: Scopus

Source ID: 85073597306

Research output: Contribution to journal › Article › Scientific › peer-review

### Real-time full-field characterization of transient dissipative soliton dynamics in a mode-locked laser

Dissipative solitons are remarkably localized states of a physical system that arise from the dynamical balance between nonlinearity, dispersion and environmental energy exchange. They are the most universal form of soliton that can exist, and are seen in far-from-equilibrium systems in many fields, including chemistry, biology and physics. There has been

particular interest in studying their properties in mode-locked lasers, but experiments have been limited by the inability to track the dynamical soliton evolution in real time. Here, we use simultaneous dispersive Fourier transform and time-lens measurements to completely characterize the spectral and temporal evolution of ultrashort dissipative solitons as their dynamics pass through a transient unstable regime with complex break-up and collisions before stabilization. Further insight is obtained from reconstruction of the soliton amplitude and phase and calculation of the corresponding complex-valued eigenvalue spectrum. These findings show how real-time measurements provide new insights into ultrafast transient dynamics in optics.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, UMR 6174

Contributors: Ryczkowski, P., Närhi, M., Billet, C., Merolla, J. M., Genty, G., Dudley, J. M.

Number of pages: 7

Pages: 221–227

Publication date: 2018

Peer-reviewed: Yes

Early online date: 5 Mar 2018

#### Publication information

Journal: Nature Photonics

Volume: 12

ISSN (Print): 1749-4885

Ratings:

Scopus rating (2018): CiteScore 59.9 SJR 13.456 SNIP 8.761

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

DOIs:

10.1038/s41566-018-0106-7

Source: Scopus

Source ID: 85042848951

Research output: Contribution to journal > Article > Scientific > peer-review

#### Refraction of nonlinear light beams in nematic liquid crystals

We use modulation theory to analyze the interaction of optical solitons and vortices with a dielectric interface between two regions of nematic liquid crystals. In the analysis we consider the role of nonlocality, anisotropy and nonlinear reorientation and compare modulation theory results with numerical results. Upon interacting with the interface, nematicons undergo transverse distortion but remain stable and eventually return to a steady state, whereas vortices experience an enhanced instability and can break up into bright beams or solitary waves.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Nonlinear Optics and OptoElectronics Lab, University of Edinburgh

Contributors: Assanto, G., Smyth, N. F., Xia, W.

Publication date: Sep 2012

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Nonlinear Optical Physics and Materials

Volume: 21

Issue number: 3

Article number: 1250033

ISSN (Print): 0218-8635

Ratings:

Scopus rating (2012): CiteScore 0.9 SJR 0.299 SNIP 0.324

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Physics and Astronomy (miscellaneous)

Keywords: Liquid crystal, modulation theory, nematicon, refraction, soliton

DOIs:

10.1142/S0218863512500336

URLs:

<http://www.scopus.com/inward/record.url?scp=84871342982&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84871342982

Research output: Contribution to journal › Article › Scientific › peer-review

### Relaxation behavior of densified sodium aluminoborate glass

In this work, we study the relaxation behavior of a densified sodium aluminoborate glass by means of coupled Raman spectroscopy, Brillouin spectroscopy, and differential scanning calorimetry analyses. First, we show that the changes in elastic properties upon densification are largely associated with structural modifications in the glass network at short- and medium-range orders. Then, the evolution of the structural and elastic properties of the densified glass has been monitored in situ in the coupled DSC-Brillouin-Raman setup during isothermal annealing at different temperatures below the glass transition temperature. The stretched exponential function is found to well describe the observed relaxation kinetics, however, the stretching factor  $\beta$  varies non-monotonically with temperature. In contrast, the Arrhenius behavior of the characteristic decay times is deduced by lifetime distribution analysis, revealing three different relaxation processes with typical activation energies of  $170\pm 25$ ,  $200\pm 5$ , and  $280\pm 15$  kJ/mol. The relative contributions of these processes to the overall relaxation kinetics are found to vary with the temperature as well as the type of parameter considered (structural, elastic, or thermal), and hence, the relaxation kinetics cannot be properly understood using the stretched exponent function. The possible origins of the different relaxation processes are discussed.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Aalborg University, University of Erlangen-Nuremberg

Contributors: Veber, A., Smedskjaer, M., de Ligny, D.

Number of pages: 15

Pages: 153-167

Publication date: 1 Oct 2020

Peer-reviewed: Yes

#### Publication information

Journal: Acta Materialia

Volume: 198

ISSN (Print): 1359-6454

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Polymers and Plastics, Metals and Alloys

Keywords: Brillouin spectroscopy, Densified glass, Kinetics, Raman spectroscopy, Relaxation

DOIs:

10.1016/j.actamat.2020.07.068

Source: Scopus

Source ID: 85089428372

Research output: Contribution to journal › Article › Scientific › peer-review

### Residual stress development in cold sprayed Al, Cu and Ti coatings

Residual stresses play an important role in the formation and performance of thermal spray coatings. A curvature-based approach where the substrate-coating system deflection and temperature are monitored throughout the coating deposition process was used to determine residual stress formation during cold spray deposition of Al, Cu and Ti coatings. The effect of substrate material (carbon steel, stainless steel and aluminium) and substrate pre-treatment (normal grit blasting, grit blasting with the cold spray system and grinding for carbon steel substrate) were studied for all coating materials with optimized deposition parameters. Mainly compressive stresses were expected because of the nature of cold spraying, but also neutral as well as tensile stresses were formed for studied coatings. The magnitudes of the residual stresses were mainly dependent on the substrate/coating material combination, but the surface preparation was also found to have an effect on the final stress stage of the coating.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Engineering materials science and solutions (EMASS), VTT Technical Research Centre of Finland, Universitat Autònoma de Barcelona, Spain

Contributors: Suhonen, T., Varis, T., Dosta, S., Torrell, M., Guilemany, J. M.

Number of pages: 9

Pages: 6329-6337

Publication date: Oct 2013

Peer-reviewed: Yes

#### Publication information

Journal: Acta Materialia  
Volume: 61  
Issue number: 17  
ISSN (Print): 1359-6454  
Ratings:

Scopus rating (2013): CiteScore 7.3 SJR 3.238 SNIP 2.66

Original language: English

ASJC Scopus subject areas: Ceramics and Composites, Metals and Alloys, Polymers and Plastics, Electronic, Optical and Magnetic Materials

Keywords: Aluminium, Cold spraying, Copper, Residual stresses, Titanium

DOIs:

10.1016/j.actamat.2013.06.033

URLs:

<http://www.scopus.com/inward/record.url?scp=84883740617&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84883740617

Research output: Contribution to journal > Article > Scientific > peer-review

### **Resolving unoccupied electronic states with laser ARPES in bismuth-based cuprate superconductors**

Angle-resolved photoemission spectroscopy (ARPES) is typically used to study only the occupied electronic band structure of a material. Here we use laser-based ARPES to observe a feature in bismuth-based superconductors that, in contrast, is related to the unoccupied states. Specifically, we observe a dispersive suppression of intensity cutting across the valence band, which, when compared with relativistic one-step calculations, can be traced to two final-state gaps in the bands 6 eV above the Fermi level. This finding opens up possibilities to bring the ultrahigh momentum resolution of existing laser-ARPES instruments to the unoccupied electron states. For cases where the final-state gap is not the object of study, we find that its effects can be made to vanish under certain experimental conditions.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research group: Spectroscopies of Complex Materials, Computational Science X (CompX), Stanford University, California, Materials Sciences Division, Lawrence Berkeley National Laboratory, Northeastern University, Tohoku University, Department of Engineering and Applied Sciences, Sophia University, Electronics and Photonics Research Institute, National Institute of Advanced Industrial Science and Technology

Contributors: Miller, T. L., Årrälä, M., Smallwood, C. L., Zhang, W., Hafiz, H., Barbiellini, B., Kurashima, K., Adachi, T., Koike, Y., Eisaki, H., Lindroos, M., Bansil, A., Lee, D. H., Lanzara, A.

Number of pages: 5

Publication date: 13 Feb 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B

Volume: 91

Issue number: 8

Article number: 085109

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2015): CiteScore 6.8 SJR 2.377 SNIP 1.216

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1103/PhysRevB.91.085109

URLs:

<http://www.scopus.com/inward/record.url?scp=84922879533&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84922879533

Research output: Contribution to journal > Article > Scientific > peer-review

### **Restoring Integral Images from Focal Stacks Using Compressed Sensing Techniques**

This paper contains an original development of the compressed sensing technique for restoring integral images from a number of observed 2D images. The proposed data acquisition uses a conventional camera equipped with a horizontal 1D mask placed in the pupil plane of the lens. The compressed sensing style algorithm developed is based on a sparsity hypothesis imposed on 2D cross sections of the light field.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Signal Processing, Universidad de la Laguna, University of Connecticut  
Contributors: Trujillo-Sevilla, J. M., Katkovnik, V., Javidi, B., Rodríguez-Ramos, J. M.  
Number of pages: 6  
Pages: 701-706  
Publication date: 1 Jul 2016  
Peer-reviewed: Yes

### Publication information

Journal: Journal of Display Technology  
Volume: 12  
Issue number: 7  
ISSN (Print): 1551-319X  
Ratings:  
Scopus rating (2016): CiteScore 3.6 SJR 0.672 SNIP 1.209  
Original language: English  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
Keywords: Compressed sensing, focal stack, integral imaging  
DOIs:  
10.1109/JDT.2016.2522922  
Source: Scopus  
Source ID: 84976358976  
Research output: Contribution to journal > Article > Scientific > peer-review

### Reversible photodoping of TiO<sub>2</sub> nanoparticles

Observations on strong photochromic effect of crystalline TiO<sub>2</sub> quantum dots (mean size  $\approx$  4 nm) are presented. The synthesized quantum dots consist of irregularly shaped anatase TiO<sub>2</sub> nanoparticles (NPs) and are dispersed in butanol (8 % by mass). Obtained NPs exhibit a dramatic photo-response to UV light, enabling effective transmittance modulation in a broad wavelength range extending from visible to near-infrared region, and even the thermal black body radiation regime beyond 10  $\mu$ m. The exceptional photo-response is attributed to hole-scavenging by butanol, TiO<sub>2</sub> self-reduction, injection of electrons to the conduction band, and consequent localized surface plasmon resonances in NPs. Observed optical effect is reversible and the initial high transmittance state can be restored simply by exposing the NPs to air. Applied NP synthesis route is economic and can be easily scaled for applications such as smart window technologies.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Photonics, Research group: Surface Science, Univ Tartu, University of Tartu, University of Tartu Institute of Physics, Inst Phys, University of Tartu  
Contributors: Joost, U., Sutka, A., Oja, M., Smits, K., Doebelin, N., Loot, A., Järvekülg, M., Hirsimäki, M., Valden, M., Nommiste, E.  
Pages: 8968-8974  
Publication date: 26 Dec 2018  
Peer-reviewed: Yes  
Early online date: 10 Dec 2018

### Publication information

Journal: Chemistry of Materials  
Volume: 30  
Issue number: 24  
ISSN (Print): 0897-4756  
Ratings:  
Scopus rating (2018): CiteScore 16.4 SJR 4.224 SNIP 1.797  
Original language: English  
ASJC Scopus subject areas: Inorganic Chemistry, Materials Chemistry, Surfaces and Interfaces, Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
Keywords: tio2, nano, nanoparticle, photochromic, anatase, light, photonics, functional  
Electronic versions:  
Accepted uncorrected version of the manuscript with supplementary information. Embargo ended: 10/12/19  
DOIs:  
10.1021/acs.chemmater.8b04813

URLs:

<http://urn.fi/URN:NBN:fi:tyy-201812142858>. Embargo ended: 10/12/19

### Bibliographical note

INT=fot,"Joost, Urmás"

Research output: Contribution to journal > Article > Scientific > peer-review

### RF measurements to pinpoint defects in inkjet-printed, thermally and mechanically stressed coplanar waveguides

In this work 10-GHz-band RF measurement and microscopy characterizations were performed on thermally and mechanically long-term-stressed coplanar waveguides (CPW) to observe electrical and mechanical degradation in 1-mm-thick PPO/PPE polymer substrates with inkjet-printed Ag conductors. The structure contained two different CPW geometries in a total of 18 samples with 250/270  $\mu\text{m}$  line widths/gaps and 670/180  $\mu\text{m}$  line widths/gaps. A reliability test was carried out with three sets. In set #1 three 250  $\mu\text{m}$  and three 670  $\mu\text{m}$  lines were stored in room temperature conditions and used as a reference. In set #2 six samples were thermally cycled (TC) for 10,000 cycles, and in set #3 six samples were thermally cycled and bent with 6 mm and 8 mm bending diameters. Thermal stressing was done by cycling the samples in a thermal cycling test chamber operating at 0/100  $^{\circ}\text{C}$  with 15-minutes rise, fall, and dwell times, resulting in a one-hour cycle. The samples were analyzed during cycling breaks using a vector network analyzer (VNA). In addition to optical microscopy, field emission scanning electron microscopy (FESEM) and atomic force microscopy (AFM) imaging were used to mechanically characterize the structures. The results showed that the line width of 670  $\mu\text{m}$  had better signal performance and better long-term reliability than the line width of 250  $\mu\text{m}$ . In this study, the average limit for proper RF operation was 2500 thermal cycles with both line geometries. The wide CPW lines provided more stable characteristics than the narrow CPW lines for the whole 10,000-cycle duration of the test, combined with repeated bending with a maximum bending radius of 6 mm. A phenomenon of nanoparticle silver protruding from cracks in the print of the bent samples was observed, as well as fracturing of the silver print in the CPW lines.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Microelectronics Research, University of Oulu, Tampere University of Applied Sciences

Contributors: Myllymäki, S., Putaala, J., Hannu, J., Kunnari, E., Mäntysalo, M.

Number of pages: 9

Pages: 142-150

Publication date: 1 Oct 2016

Peer-reviewed: Yes

### Publication information

Journal: Microelectronics Reliability

Volume: 65

ISSN (Print): 0026-2714

Ratings:

Scopus rating (2016): CiteScore 2.6 SJR 0.447 SNIP 0.991

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Condensed Matter Physics, Safety, Risk, Reliability and Quality, Surfaces, Coatings and Films, Electrical and Electronic Engineering

DOIs:

10.1016/j.microrel.2016.08.021

### Bibliographical note

EXT="Kunnari, Esa"

EXT="Myllymäki, Sami"

Source: Scopus

Source ID: 84992618636

Research output: Contribution to journal > Article > Scientific > peer-review

### Roadmap on optical rogue waves and extreme events

The pioneering paper 'Optical rogue waves' by Solli et al (2007 Nature 450 1054) started the new subfield in optics. This work launched a great deal of activity on this novel subject. As a result, the initial concept has expanded and has been enriched by new ideas. Various approaches have been suggested since then. A fresh look at the older results and new discoveries has been undertaken, stimulated by the concept of 'optical rogue waves'. Presently, there may not be a unique view on how this new scientific term should be used and developed. There is nothing surprising when the opinion of the experts diverge in any new field of research. After all, rogue waves may appear for a multiplicity of reasons and not necessarily only in optical fibers and not only in the process of supercontinuum generation. We know by now that rogue waves may be generated by lasers, appear in wide aperture cavities, in plasmas and in a variety of other optical systems.

Theorists, in turn, have suggested many other situations when rogue waves may be observed. The strict definition of a rogue wave is still an open question. For example, it has been suggested that it is defined as 'an optical pulse whose amplitude or intensity is much higher than that of the surrounding pulses'. This definition (as suggested by a peer reviewer) is clear at the intuitive level and can be easily extended to the case of spatial beams although additional clarifications are still needed. An extended definition has been presented earlier by N Akhmediev and E Pelinovsky (2010 Eur. Phys. J. Spec. Top. 185 1-4). Discussions along these lines are always useful and all new approaches stimulate research and encourage discoveries of new phenomena. Despite the potentially existing disagreements, the scientific terms 'optical rogue waves' and 'extreme events' do exist. Therefore coordination of our efforts in either unifying the concept or in introducing alternative definitions must be continued. From this point of view, a number of the scientists who work in this area of research have come together to present their research in a single review article that will greatly benefit all interested parties of this research direction. Whether the authors of this 'roadmap' have similar views or different from the original concept, the potential reader of the review will enrich their knowledge by encountering most of the existing views on the subject. Previously, a special issue on optical rogue waves (2013 J. Opt. 15 060201) was successful in achieving this goal but over two years have passed and more material has been published in this quickly emerging subject. Thus, it is time for a roadmap that may stimulate and encourage further research.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Australian National University, Université de Bourgogne Franche-Comté, Università degli Studi di Brescia, Texas A and M University at Qatar, Shunde Polytechnic, Xi'an Jiaotong University, CSIC - Instituto de Óptica Daza de Valdés (IO), CRPP, Universidad Adolfo Ibáñez, Université libre de Bruxelles (ULB), Vrije Universiteit Brussel, Université Lille 1, Université de Franche-Comté, Leibniz-Universität Hannover, Weierstrass-Institut für Angewandte Analysis und Stochastik, Max Born Institute, Universitat Politècnica de Catalunya, The University of Auckland, Dodd-Walls Centre for Photonic and Quantum Technologies, CNRS, CNR-INO

Contributors: Akhmediev, N., Kibler, B., Baronio, F., Belić, M., Zhong, W. P., Zhang, Y., Chang, W., Soto-Crespo, J. M., Vouzas, P., Grelu, P., Lecaplain, C., Hammani, K., Rica, S., Picozzi, A., Tlidi, M., Panajotov, K., Mussot, A., Bendahmane, A., Szriftgiser, P., Genty, G., Dudley, J., Kudlinski, A., Demircan, A., Morgner, U., Amiraranashvili, S., Bree, C., Steinmeyer, G., Masoller, C., Broderick, N. G. R., Runge, A. F. J., Erkintalo, M., Residori, S., Bertolozzo, U., Arecchi, F. T., Wabnitz, S., Tiofack, C. G., Coulibaly, S., Taki, M.

Publication date: 1 Jun 2016

Peer-reviewed: Yes

### Publication information

Journal: Journal of Optics

Volume: 18

Issue number: 6

Article number: 063001

ISSN (Print): 2040-8978

Ratings:

Scopus rating (2016): CiteScore 3.4 SJR 0.715 SNIP 0.829

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials

Keywords: extreme events, nonlinear optics, rogue waves

DOIs:

10.1088/2040-8978/18/6/063001

### Bibliographical note

EXT="Steinmeyer, Günter"

EXT="Erkintalo, Miro"

Source: Scopus

Source ID: 84975818584

Research output: Contribution to journal > Article > Scientific > peer-review

### Scalar diffraction field calculation from curved surfaces via Gaussian beam decomposition

We introduce a local signal decomposition method for the analysis of three-dimensional (3D) diffraction fields involving curved surfaces. We decompose a given field on a two-dimensional curved surface into a sum of properly shifted and modulated Gaussian-shaped elementary signals. Then we write the 3D diffraction field as a sum of Gaussian beams, each of which corresponds to a modulated Gaussian window function on the curved surface. The Gaussian beams are propagated according to a derived approximate expression that is based on the Rayleigh-Sommerfeld diffraction model. We assume that the given curved surface is smooth enough that the Gaussian window functions on it can be treated as written on planar patches. For the surfaces that satisfy this assumption, the simulation results show that the proposed method produces quite accurate 3D field solutions.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Signal Processing Research Community (SPRC), Bilkent University  
Contributors: Şahin, E., Onural, L.  
Number of pages: 11  
Pages: 1459-1469  
Publication date: 1 Jul 2012  
Peer-reviewed: Yes

#### Publication information

Journal: Journal of the Optical Society of America A: Optics Image Science and Vision

Volume: 29

Issue number: 7

ISSN (Print): 1084-7529

Ratings:

Scopus rating (2012): CiteScore 3.2 SJR 1.065 SNIP 1.198

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Computer Vision and Pattern Recognition

DOIs:

10.1364/JOSAA.29.001459

URLs:

<http://www.scopus.com/inward/record.url?scp=84863743776&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84863743776

Research output: Contribution to journal › Article › Scientific › peer-review

#### Segregation of iron losses from rotational field measurements and application to electrical machine

This paper presents a methodology for identifying a novel iron loss model and segregating the different loss components from measurements on a single-sheet tester with alternating and rotating fields. The eddy-current losses are first extracted with a 1-D numerical approach and the hysteresis and excess losses are then estimated with an analytical method that allows the separation of alternating and rotational hysteresis as well as excess losses. The elaborated iron loss model can be applied in case of distorted flux density and on a wide range of frequencies. The identified model is further applied in the time-stepping computation of an induction motor in the view of better estimation and segregation of iron losses. The results of no-load simulations at different voltage levels are in good agreement with the measured ones. All of the presented computations and models were validated experimentally.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Smart Energy Systems (SES), Aalto University

Contributors: Belahcen, A., Rasilo, P., Arkkio, A.

Publication date: Feb 2014

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Magnetics

Volume: 50

Issue number: 2

Article number: 7022104

ISSN (Print): 0018-9464

Ratings:

Scopus rating (2014): CiteScore 2.7 SJR 0.696 SNIP 1.45

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Electric machines, electromagnetic analysis, loss measurement, magnetic losses, magnetic materials

DOIs:

10.1109/TMAG.2013.2284606

Source: Scopus

Source ID: 84900613868

Research output: Contribution to journal › Article › Scientific › peer-review

#### Self-alignment in the stacking of microchips with mist-induced water droplets

This paper reports a novel and versatile water droplet self-alignment technique where the water is delivered in mist form onto the assembly site. The droplet forming process has been carefully investigated using machine vision, where each

individual droplet on the microchip surface can be identified and the volume per surface area can be calibrated at a specific time. The result reveals that the volume of water droplets on the assembly surface grows linearly as a function of time. Self-alignment based on the mist-induced droplets has been studied, where a robotic microgripper is used to deliver the microchips on the assembly site. The paper also investigates the maximum tolerance of the initial placement error in stacking SU-8 chips  $200 \times 200 \times 70 \mu\text{m}$  in size, and the possibility of stacking two SU-8 chips of different dimensions using the proposed self-alignment technique. Moreover, self-alignment of chips on hydrophilic/hydrophobic patterns covered by mist-induced water droplets has been studied. The experimental results indicate that this novel self-alignment technique is very promising. Furthermore, a statistical model has been used to validate the experimental results.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Integrated Technologies for Tissue Engineering Research (ITTE), Aalto University, Department of Automation and Systems Technology

Contributors: Chang, B., Sariola, V., Jääskeläinen, M., Zhou, Q.

Publication date: Jan 2011

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Micromechanics and Microengineering

Volume: 21

Issue number: 1

Article number: 015016

ISSN (Print): 0960-1317

Ratings:

Scopus rating (2011): CiteScore 4 SJR 1.036 SNIP 1.442

Original language: English

ASJC Scopus subject areas: Mechanical Engineering, Electrical and Electronic Engineering, Mechanics of Materials, Electronic, Optical and Magnetic Materials

DOIs:

10.1088/0960-1317/21/1/015016

URLs:

<http://www.scopus.com/inward/record.url?scp=78651517828&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 78651517828

Research output: Contribution to journal > Article > Scientific > peer-review

#### Self-alignment of RFID dies on four-pad patterns with water droplet for sparse self-assembly

This paper reports an in-depth study of a water-droplet-assisted self-alignment technique that self-aligns radio frequency identification (RFID) dies on four-pad patterns. The segmented structure of four hydrophilic pads on a hydrophobic substrate brings freedom to the design of the electrical functionality and the surface functionality. The paper investigates the influence of the key parameters that may affect the self-alignment in theory and experiment. The theoretical model justifies that RFID dies can be reliably aligned on the segmented four-pad pattern even when the initial placement error is as large as 50% of the size of the die and the gap between the four pads is about 10% of the size of the die. A method has been introduced to estimate the sufficient droplet volume for self-alignment. A series of experiments have been carried out to verify the results of the model. The experiments indicate that the self-alignment between the  $730 \times 730 \mu\text{m}$  RFID dies and the pattern occurs reliably when the releasing bias between the RFID die and antenna is less than  $400 \mu\text{m}$  for patterns with 50 and  $100 \mu\text{m}$  gaps, and successful self-alignment is possible even with greater bias of  $500 \mu\text{m}$ .

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Integrated Technologies for Tissue Engineering Research (ITTE), Aalto University, Department of Automation and Systems Technology

Contributors: Chang, B., Routa, I., Sariola, V., Zhou, Q.

Publication date: Sep 2011

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Micromechanics and Microengineering

Volume: 21

Issue number: 9

Article number: 095024

ISSN (Print): 0960-1317

Ratings:

Scopus rating (2011): CiteScore 4 SJR 1.036 SNIP 1.442

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials, Mechanical Engineering, Electrical and Electronic Engineering

DOIs:

10.1088/0960-1317/21/9/095024

URLs:

<http://www.scopus.com/inward/record.url?scp=80052254281&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 80052254281

Research output: Contribution to journal > Article > Scientific > peer-review

### **Self-orienting liquid crystal doped with polymer-azo-dye complex**

We investigate into a new type of liquid crystal (LC) heterogeneous system that contains hydrogen-bonded polymer-azo-dye complexes at a low concentration. The suspension shows a unique selforienting property and a spontaneous anchoring transition from planar to homeotropic alignment on a rubbed polyimide surface. We suggest a simple polymer adsorption model to explain the universal homeotropic orienting property. The complex-doped LC suspension can be used as a new liquid crystalline material that does not require any additional alignment processing or treatment.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Aalto University, COMP Centre of Excellence, Department of Applied Physics, Aalto University

Contributors: Ouskova, E., Vapaavuori, J., Kaivola, M.

Number of pages: 8

Pages: 1463-1470

Publication date: 1 Dec 2011

Peer-reviewed: Yes

#### **Publication information**

Journal: Optical Materials Express

Volume: 1

Issue number: 8

ISSN (Print): 2159-3930

Ratings:

Scopus rating (2011): CiteScore 0.7

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

URLs:

<http://www.scopus.com/inward/record.url?scp=84862203301&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84862203301

Research output: Contribution to journal > Article > Scientific > peer-review

### **Semantics of HTS AC Loss Modeling: Theories, Models, and Experiments**

Computer-Assisted modeling is an essential approach to design new devices. It speeds up the process from the initial idea to an actual device and saves resources by reducing the number of built prototypes. This is also a significant practical motivator behind scientific research in contemporary high-Temperature superconductor (HTS) ac loss modeling. However, in the scientific literature in this field, consistent practices about modeling terminology have not been established. Then, it is up to the reader to decide, what is the true intent and meaning of the authors. Consequently, the interpretation of such literature might be very much reader dependent. An inseparable part of the whole modeling process is the development of modeling approaches and numerical methods and comparing the predictions obtained via modeling to experimentally achieved results. It is commonplace to discuss the accuracy of modeling results or the validation of a model. In this article, we discuss the terminology related to theories, models, and experiments in the context of HTS ac loss modeling. We discuss the recursive nature of theories and models in this context, discuss the compatibility of discrete formulations of physics utilized in our field with the corresponding continuum description, and interpret the perceived meaning of validation of a self-consistent model, shedding light on the relationships between theories, models, and measurements. We present our view on understanding these relations in the familiar context of ac losses in HTS, studying case examples through simulations and literature. As a result, we end this article with four conjectures describing our views.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Engineering  
Contributors: Lahtinen, V., Stenvall, A.  
Publication date: 1 Aug 2020  
Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity  
Volume: 30  
Issue number: 5  
Article number: 5900809  
ISSN (Print): 1051-8223  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering  
Keywords: AC losses, experiment, high-Temperature superconductors (HTS), model, modeling, theory  
DOIs:  
10.1109/TASC.2020.2976619  
Source: Scopus  
Source ID: 85082393173  
Research output: Contribution to journal › Article › Scientific › peer-review

#### Sensitivity Analysis of Inverse Thermal Modeling to Determine Power Losses in Electrical Machines

Inverse analysis is a known mathematical approach, which has been used to solve physical problems of a particular nature. Nevertheless, it has seldom been applied directly for loss reconstruction of electrical machines. This paper aims to verify the accuracy of an inverse methodology used in mapping power loss distribution in an induction motor. Conjugate gradient method is used to iteratively find the unique inverse solution when simulated temperature measurement data are available. Realistic measurement situations are considered and the measurement errors corresponding to thermographic measurements and temperature sensor measurements are used to generate simulated numerical measurement data. An accurate 2-D finite-element thermal model of a 37 kW cage induction motor serves as the forward solution. The inverse model's objective is to map the power loss density in the motor accurately from noisy temperature measurements made on the motor housing's outer surface. Furthermore, the sensitivity of the adopted inverse methodology to variations in the number of available measurements is also considered. Filtering the applied noise to acceptable ranges is shown to improve the inverse mapping results.

#### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Electrical Energy Engineering, Aalto University  
Contributors: Nair, D. G., Rasilo, P., Arkkio, A.  
Publication date: Nov 2018  
Peer-reviewed: Yes  
Early online date: 23 Jul 2018

#### Publication information

Journal: IEEE Transactions on Magnetics  
Volume: 54  
Issue number: 11  
Article number: 8109405  
ISSN (Print): 0018-9464  
Ratings:  
Scopus rating (2018): CiteScore 3.1 SJR 0.539 SNIP 1.019  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering  
Keywords: Heat transfer, Heating systems, induction motor, Induction motors, inverse problems, Loss measurement, Noise measurement, Stator windings, Temperature measurement  
Electronic versions:  
Nair2018  
DOIs:  
10.1109/TMAG.2018.2853084  
URLs:  
<http://urn.fi/URN:NBN:fi:ty-201808092058>  
Source: Scopus  
Source ID: 85050587914  
Research output: Contribution to journal › Article › Scientific › peer-review

### Silver sulfide nanoclusters and the superatom model

The superatom model of electron-shell closings has been widely used to explain the stability of noble-metal nanoclusters of few nanometers, including thiolate-protected Au and Ag nanoclusters. The presence of core sulfur atoms in silver sulfide (Ag-S) nanoclusters renders them a class of clusters with distinctive properties as compared to typical noble-metal clusters. Here, it is natural to ask whether the superatom model is still applicable for the Ag-S nanoclusters with mixed metal and nonmetal core atoms. To address this question, we applied density functional simulations to analyze a series of Ag-S nanoclusters:  $\text{Ag}_{14}\text{S}(\text{SPh})_{12}(\text{PPh}_3)_8$ ,  $\text{Ag}_{14}(\text{SC}_6\text{H}_3\text{F}_2)_{12}(\text{PPh}_3)_8$ ,  $\text{Ag}_{70}\text{S}_{16}(\text{SPh})_{34}(\text{PhCO}_2)_4(\text{triphos})_4$ , and  $[\text{Ag}_{123}\text{S}_{35}(\text{StBu})_{50}]^{3+}$ . We observed that superatomic orbitals are still present in the conduction band of these Ag-S clusters where the cluster cores comprise mostly silver atoms. Our Bader charge analysis illustrates that thiolates play a significant role in withdrawing charge (electron density) from the core Ag atoms. The simulated optical absorption properties of the selected Ag-S clusters reflect the substantial band gaps associated with typical molecular orbitals on both sides. Apart from  $\text{Ag}_{14}\text{S}(\text{SPh})_{12}(\text{PPh}_3)_8$ , which has a central sulfur atom in the cluster core, superatomic orbitals of the Ag-S clusters can have contributions for individual transitions in the conduction band.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research group: Materials and Molecular Modeling, Computational Science X (CompX), University of Jyväskylä, Departments of Physics and Chemistry

Contributors: Goh, J., Malola, S., Häkkinen, H., Akola, J.

Number of pages: 8

Pages: 1583-1590

Publication date: 22 Jan 2015

Peer-reviewed: Yes

### Publication information

Journal: Journal of Physical Chemistry C

Volume: 119

Issue number: 3

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2015): CiteScore 7.9 SJR 1.886 SNIP 1.246

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

10.1021/jp511037x

URLs:

<http://www.scopus.com/inward/record.url?scp=84921476515&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84921476515

Research output: Contribution to journal > Article > Scientific > peer-review

### Simulation of cluster growth using a lattice gas model

Lattice gas models have been used to study the growth of icosahedral and fcc clusters. The simulations include adsorption, desorption, and diffusion of atoms to the nearest and next nearest lattice sites. A general survey of cluster growth is given from a diffusion dominated low pressure case to the adsorption dominated high pressure case. In general, clusters seem to grow monotonically without spending longer times at any cluster size. Compact clusters are observed only close to the limits of low and high pressures, and the growth is controlled either by diffusion or adsorption, accordingly. Both of these mechanisms can produce layer by layer type growth. When the layer by layer growth takes place only along (111) surfaces in fcc clusters, a regular pattern is obtained in the abundance spectrum. This has the same frequency as the octahedral growth, even though the individual clusters are not perfect octahedra.

### General information

Publication status: Published

MoE publication type: Not Eligible

Organisations: Jyväskylän yliopisto, Niels Bohr Institute

Contributors: Valkealahti, S., Manninen, M.

Number of pages: 11

Pages: 17564-17574

Publication date: 1 Jan 1994

Peer-reviewed: Yes

### Publication information

Journal: Physical Review B

Volume: 50

Issue number: 23

ISSN (Print): 0163-1829

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.50.17564

Source: Scopus

Source ID: 0042150691

Research output: Contribution to journal › Article › Scientific › peer-review

### Simulation studies of DFB laser longitudinal structures for narrow linewidth emission

The paper presents simulation studies targeting high-power narrow-linewidth emission from semiconductor distributed feedback (DFB) lasers. The studies contain analytic and numerical calculations of emission linewidth, side mode suppression ratio and output power for DFB lasers without phase shifts and with  $1 \times \lambda/4$  and  $2 \times \lambda/8$  phase shifts, taking into account the grating and facets reflectivities, the randomness of the spontaneous emission and the longitudinal photon and carrier density distributions in the laser cavity. Single device structural parameter optimization is generally associated with a trade-off between achieving a narrow linewidth and a high output power. Correlated optimization of multiple structural parameters enables the evaluation of achievable ranges of narrow linewidth and high power combinations. Devices with long cavities and low grating coupling coefficients,  $\kappa$  (keeping  $\kappa L$  values below the levels that promote re-broadening), with AR-coated facets and with a distributed phase-shift have the flattest longitudinal photon and carrier density distributions. This flatness enables stable single-longitudinal-mode operation with high side-mode-suppression ratio up to high injection current densities, which facilitates narrow linewidths and high output powers. The results reported in the paper indicate that Master-Oscillator Power-Amplifier laser structures are needed for achieving W-level high-powers with sub-MHz linewidths because most single-cavity DFB laser structural variations that reduce the linewidth also limit the achievable output power in single-mode operation.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: Semiconductor Technology and Applications

Contributors: Virtanen, H., Uusitalo, T., Dumitrescu, M.

Number of pages: 13

Publication date: 23 Mar 2017

Peer-reviewed: Yes

### Publication information

Journal: Optical and Quantum Electronics

Volume: 49

Issue number: 4

Article number: 160

ISSN (Print): 0306-8919

Ratings:

Scopus rating (2017): CiteScore 1.8 SJR 0.353 SNIP 0.631

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: Distributed feedback laser, High power, Narrow linewidth

Electronic versions:

2017-simulation-studies-springer. Embargo ended: 23/03/18

DOIs:

10.1007/s11082-017-0993-8

URLs:

<http://urn.fi/URN:NBN:fi:tty-201712152382>. Embargo ended: 23/03/18

Source: Scopus

Source ID: 85016097411

Research output: Contribution to journal › Article › Scientific › peer-review

### Single-source multibattery solar charger: Case study and implementation issues

In this paper, design process and functionality of a portable single-panel dual-battery solar charger prototype are presented, achieving energy density of  $571 \text{Whkg}^{-1}$  during a typical 3-day infantry mission. The device may instantaneously charge up to two Li-ion MR-2791 batteries, supporting plug-and-play operation. The system consists of a lightweight custom solar panel, based on 20% efficient monocrystalline photovoltaics, and an intelligent power processing

module. The panel contains eight transparent polymer-encapsulated and camouflaged series-connected six solar cell packs with antiparallel diodes, allowing partial shading operation. The power processing module consists of two synchronous current-mode-controlled buck converters, digital signal processor, and a microcontroller, supporting both maximum power point tracking of the solar panel with partial shading detection and multimode charging of Li-ion packs while instantaneously communicating with the batteries. Power management algorithmic design is presented, based on ensuring system stability while supporting the required operation modes. System implementation stages and underlying issues are thoroughly discussed, and utilized hardware components are presented in detail. Experimental results of system testing under real outdoor conditions are presented to demonstrate the device functionality and energy yield capabilities.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Power engineering, Smart Energy Systems (SES), Hybrid Energy Sources Laboratory

Contributors: Gadelovits, S., Sitbon, M., Suntio, T., Kuperman, A.

Number of pages: 13

Pages: 1916-1928

Publication date: 25 Nov 2015

Peer-reviewed: Yes

### Publication information

Journal: Progress in Photovoltaics: Research and Applications

Volume: 23

Issue number: 12

ISSN (Print): 1062-7995

Ratings:

Scopus rating (2015): CiteScore 15.3 SJR 2.724 SNIP 3.409

Original language: English

ASJC Scopus subject areas: Renewable Energy, Sustainability and the Environment, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Energy density, Li-ion battery, Partial shading, Portable system, Solar charger

DOIs:

10.1002/pip.2591

URLs:

<http://www.scopus.com/inward/record.url?scp=84922287176&partnerID=8YFLogxK> (Link to publication in Scopus)

Research output: Contribution to journal > Article > Scientific > peer-review

### Soft graphoepitaxy for large area directed self-assembly of polystyrene-block-poly(dimethylsiloxane) block copolymer on nanopatterned POSS substrates fabricated by nanoimprint lithography

Polyhedral oligomeric silsesquioxane (POSS) derivatives have been successfully employed as substrates for graphoepitaxial directed self-assembly (DSA) of block copolymers (BCPs). Tailored POSS materials of tuned surface chemistry are subject to nanoimprint lithography (NIL) resulting in topographically patterned substrates with dimensions commensurate with the BCP block length. A cylinder forming polystyrene-block-polydimethylsiloxane (PS-b-PDMS) BCP is synthesized by sequential living anionic polymerization of styrene and hexamethylcyclotrisiloxane. The patterned POSS materials provide a surface chemistry and topography for DSA of this BCP and after solvent annealing the BCP shows well-ordered microphase segregation. The orientation of the PDMS cylinders to the substrate plane could be controlled within the trench walls by the choice of the POSS materials. The BCP patterns are successfully used as on-chip etch mask to transfer the pattern to underlying silicon substrate. This soft graphoepitaxy method shows highly promising results as a means to generate lithographic quality patterns by nonconventional methods and could be applied to both hard and soft substrates. The methodology might have application in several fields including device and interconnect fabrication, nanoimprint lithography stamp production, nanofluidic devices, lab-on-chip, or in other technologies requiring simple nanodimensional patterns. A methodology for fabricating highly ordered silicon nanostructures at a substrate is reported using nanoimprint lithography imprinted polyhedral oligomeric silsesquioxane (POSS) substrates for graphoepitaxial directed self-assembly (DSA) of block copolymer (BCP). The patterned POSS materials provide a surface chemistry and topography for DSA of a cylinder forming polystyrene-block-polydimethylsiloxane BCP with well-ordered microphase segregation upon solvent annealing.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Trinity College Dublin, University College Cork, Tyndall National Institute at National University of Ireland, Cork, Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), Laboratoire des Technologies de la Microelectronique (CNRS), Profactor GmbH, University Campus-Dourouti

Contributors: Borah, D., Rasappa, S., Salaun, M., Zellsman, M., Lorret, O., Lontos, G., Ntetsikas, K., Avgeropoulos, A., Morris, M. A.

Number of pages: 8  
Pages: 3425-3432  
Publication date: 1 Jun 2015  
Peer-reviewed: Yes

#### Publication information

Journal: Advanced Functional Materials  
Volume: 25

Issue number: 22  
ISSN (Print): 1616-301X

Ratings:

Scopus rating (2015): CiteScore 20.4 SJR 4.859 SNIP 2.439

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Condensed Matter Physics, Electrochemistry

Keywords: block copolymer, directed self-assembly, nanoimprint lithography, pattern transfer, polyhedral oligomeric silsesquioxane (POSS)

DOIs:

10.1002/adfm.201500100

URLs:

<http://www.scopus.com/inward/record.url?scp=84930932614&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84930932614

Research output: Contribution to journal › Article › Scientific › peer-review

#### Solar Irradiation Independent Expression for Photovoltaic Generator Maximum Power Line

In order to enhance maximum power point tracking (MPPT) speed of photovoltaic generators (PVGs) upon fast irradiation changes, maximum power line (MPL)-based control is often used. MPL is a curve, linking all possible MPP coordinates for a given temperature. In the literature so far, PVG MPL was either assumed linear, which is inaccurate for all irradiation levels, or possessed photocurrent dependence, requiring real-time estimation of the latter. In this letter, an irradiation-independent explicit expression for PVG MPL is derived, valid for all practical irradiation levels, thus allowing real-time implementation without the need of photocurrent estimation.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research group: Power electronics

Contributors: Kolesnik, S., Sitbon, M., Lineykin, S., Batzelis, E., Papathanassiou, S., Suntio, T., Kuperman, A.

Pages: 1416-1420

Publication date: 2017

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Journal of Photovoltaics

Volume: 7

Issue number: 5

ISSN (Print): 2156-3381

Ratings:

Scopus rating (2017): CiteScore 7.9 SJR 1.214 SNIP 1.499

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Equivalent circuits, Estimation, maximum power line (MPL), Maximum power point tracking (MPPT), Multiprotocol label switching, Photoconductivity, photovoltaic generator (PVG), Photovoltaic systems, Radiation effects, single diode model

Electronic versions:

JPV\_2016\_1

DOIs:

10.1109/JPHOTOV.2017.2713404

URLs:

<http://urn.fi/URN:NBN:fi:ty-201802141241>

Source: Scopus

Source ID: 85023754880

Research output: Contribution to journal › Article › Scientific › peer-review

### **Soliton enhancement of spontaneous symmetry breaking**

Spontaneous symmetry breaking (SSB) occurs when noise triggers an initially symmetric system to evolve toward one of its nonsymmetric states. Topological and optical SSB involve material reconfiguration/transition and light propagation/distribution in time or space, respectively. In anisotropic optical media, light beam propagation and distribution of the optic axis can be linked, thereby connecting topological and optical SSB. Using nonlinear soft matter, namely uniaxial liquid crystals, we report on simultaneous topological and optical SSB, showing that spatial solitons enhance the noise-driven transition of the medium from a symmetric to an asymmetric configuration, while acquiring a power-dependent transverse velocity in either of two specular directions with respect to the initial wavevector. Solitons enhance SSB by further distorting the optic axis distribution through nonlinear reorientation, resulting in power-tunable walk-off as well as hysteresis in beam refraction versus angle of incidence.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research group: Nonlinear Optics, Frontier Photonics, University "Roma Tre", University of Southampton, United Kingdom

Contributors: Alberucci, A., Piccardi, A., Kravets, N., Buchnev, O., Assanto, G.

Number of pages: 7

Pages: 783-789

Publication date: 2015

Peer-reviewed: Yes

#### **Publication information**

Journal: Optica

Volume: 2

Issue number: 9

ISSN (Print): 2334-2536

Ratings:

Scopus rating (2015): CiteScore 3.5 SJR 4.539 SNIP 2.629

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials

Keywords: Bistability, Instabilities and chaos, Liquid crystals, Nonlinear optics, Self-action effects, Spatial solitons, Transverse effects in

DOIs:

10.1364/OPTICA.2.000783

URLs:

<http://www.scopus.com/inward/record.url?scp=84941123130&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84941123130

Research output: Contribution to journal > Article > Scientific > peer-review

### **Stable blue phase polymeric Langmuir-Schaefer films based on unsymmetrical hydroxyalkadiynyl N-arylcarbamate derivatives**

Unsymmetrical diynes containing N-arylcarbamate groups in the hydrophobic part and hydroxymethylene groups in the hydrophilic part of the molecules were synthesized and studied. The Langmuir monolayer formation process was followed by Brewster angle microscopy (BAM). The Langmuir-Schaefer monolayer films, transferred on solid substrates (quartz or Si), were investigated by absorption spectroscopy and atomic force microscopy (AFM). Four substances had 2 methylene groups in the hydrophilic part of the molecule (n) and 4 or 5 of these groups in the hydrophobic part (m). At the same time the aryl substituent had a hydrogen atom or a MeO group in the p-position of the benzene ring. After 20 min of UV irradiation the initially colorless monomeric films of all four compounds turned into stable blue phase polymeric films. The blue phase is unusual for alcoholic diacetylene derivatives. The BAM and AFM measurements demonstrated higher homogeneity of the films with a MeO group in the aryl substituent in comparison to the molecules with a hydrogen atom. The reasons for these different structural organizations as well as potential applications of stable blue phase polydiacetylene thin films are discussed.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Chemistry and Bioengineering, Research group: Chemistry & Advanced Materials, A. M. Prokhorov General Physics Institute, Russian Academy of Sciences, Åbo Akademi University, St. Petersburg State University, Russian Academy of Science

Contributors: Alekseev, A., Ihalainen, P., Ivanov, A., Domnin, I., Rosqvist, E., Lemmetyinen, H., Vuorimaa-Laukkanen, E., Peltonen, J., Vyaz'min, S.

Number of pages: 11  
Pages: 108-118  
Publication date: 2018  
Peer-reviewed: Yes  
Early online date: 10 Oct 2017

#### Publication information

Journal: Thin Solid Films  
Volume: 645  
ISSN (Print): 0040-6090  
Ratings:

Scopus rating (2018): CiteScore 3.6 SJR 0.531 SNIP 0.837

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Surfaces and Interfaces, Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

Keywords: Absorption spectroscopy, Blue phase polydiacetylenes, Brewster angle microscopy, Langmuir-Schaefer film, Photopolymerization

DOIs:

10.1016/j.tsf.2017.10.018

#### Bibliographical note

EXT="Alekseev, Alexander"

Source: Scopus

Source ID: 85032302551

Research output: Contribution to journal > Article > Scientific > peer-review

#### Statistical analysis of E-jet print parameter effects on Ag-nanoparticle ink droplet size

In this paper, we have studied the print parameter effects on electrohydrodynamic inkjet (E-jet) resolution using statistical analysis. In order to make the E-jet manufacturing process feasible, the effect of printing parameters on the ejected droplet size must be modelled and optimized. To this end, there exist two approaches: parameter effects can be modelled using theoretical calculations or they can be generated directly from empirical data using statistical analysis. The first option has been explored by multiple research groups, whereas the latter has received less interest. In this article, the effect of printing parameters on the width of AC-pulsed E-jet deposited Ag-nanoparticle ink droplets are investigated using design of experiments (DoE) approach and statistical analysis. As a result, a statistical model for deposited droplet width is generated using four print parameters (print height, bias voltage, peak voltage and frequency) as predictors. The model can predict 94.24% of the measured width variation with a standard deviation of 1.05  $\mu\text{m}$ .

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electronics and Communications Engineering, Research group: Laboratory for Future Electronics,

Research group: Wireless Communications and Positioning

Contributors: Laurila, M. M., Khorramdel, B., Dastpak, A., Mäntysalo, M.

Publication date: 2 Aug 2017

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Micromechanics and Microengineering

Volume: 27

Issue number: 9

Article number: 095005

ISSN (Print): 0960-1317

Ratings:

Scopus rating (2017): CiteScore 3.7 SJR 0.554 SNIP 1.015

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials, Mechanical Engineering, Electrical and Electronic Engineering

Keywords: design of experiments, E-jet, printed electronics, statistical analysis

Electronic versions:

Statistical analysis of E-jet print parameter effects on Ag-nanoparticle... Embargo ended: 2/10/18

DOIs:

10.1088/1361-6439/aa7a71

URLs:

<http://urn.fi/URN:NBN:fi:tty-201712202436>. Embargo ended: 2/08/18

### Bibliographical note

INT=elt,"Dastpak, A."

Source: Scopus

Source ID: 85028383527

Research output: Contribution to journal › Article › Scientific › peer-review

### Status of the Demonstrator Magnets for the EuCARD-2 Future Magnets Project

EuCARD-2 is a project partly supported by FP7 European Commission aiming at exploring accelerator magnet technology for 20-T dipole operating field. The EuCARD-2 collaboration is liaising with similar programs for high-field magnets in the U.S. and Japan. EuCARD-2 focuses, through the work package 10 'future magnets,' on the development of a 10-kA-class superconducting high-current-density cable suitable for accelerator magnets, for a 5-T stand-alone dipole of 40-mm bore and about 1-m length. After stand-alone testing, the magnet will be inserted in a large bore background dipole, 10-18 T. This paper reports on the design and development of models, which are called Feather0, wound with REBCO Roebel cable. Based on aligned block design to take advantage of the anisotropy of the REBCO tapes, Feather0 is a precursor of Feather2, which should reach the project goals in 2016. Feather0 is planned to be tested both in stand alone and as an insert mounted in the CERN Fresca facility providing 10-T background field. The progress of other designs pursued in the collaboration, one based on classical  $\cos \theta$  layout with Roebel cable and the other based on coil block with stacked tape cable, will be also reported.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, European Organization for Nuclear Research, Grenoble Institute of Technology, University of Twente, French Atomic Energy Commission (CEA) Saclay, Karlsruhe Institute of Technology, Institute for Technical Physics, Germany, Universite de Geneve, Bruker HTS, Istituto Nazionale Di Fisica Nucleare, Frascati, University of Southampton, United Kingdom, Danish Institute of Technology  
Contributors: Kirby, G., Rossi, L., Badel, A., Bajko, M., Ballarino, A., Bottura, L., Dhalle, M., Durante, M., Fazilleau, P., Fleiter, J., Goldacker, W., Härö, E., Himbele, J., Kario, A., Langeslag, S., Lorin, C., Murtzomaki, J., Van Nugteren, J., De Rijk, G., Salmi, T., Senatore, C., Stenvall, A., Tixador, P., Usoskin, A., Volpini, G., Yang, Y., Zangenberg, N.

Publication date: 1 Apr 2016

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 26

Issue number: 3

Article number: 4003307

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2016): CiteScore 2.6 SJR 0.398 SNIP 1.132

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Accelerators magnets, CLIQ, EuCARD-2, future magnets, higher-temperature-superconductors, superconducting magnets

DOIs:

10.1109/TASC.2016.2528544

Source: Scopus

Source ID: 84963812427

Research output: Contribution to journal › Article › Scientific › peer-review

### Stimuli-Responsive Materials Based on Interpenetrating Polymer Liquid Crystal Hydrogels

Stimuli-responsive materials based on interpenetrating liquid crystal-hydrogel polymer networks are fabricated. These materials consist of a cholesteric liquid crystalline network that reflects color and an interwoven poly(acrylic acid) network that provides a humidity and pH response. The volume change in the cross-linked hydrogel polymer results in a dimensional alteration in the cholesteric network as well, which, in turn, leads to a color change yielding a dual-responsive photonic material. Furthermore a patterned coating having responsive and static interpenetrating polymer network areas is produced that changes both its surface topography and color.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Eindhoven University of Technology, School of Mathematical Sciences

Contributors: Stumpel, J. E., Gil, E. R., Spoelstra, A. B., Bastiaansen, C. W. M., Broer, D. J., Schenning, A. P. H. J.

Pages: 3314–3320  
Publication date: 2015  
Peer-reviewed: Yes

#### Publication information

Journal: Advanced Functional Materials

Volume: 25

Issue number: 22

ISSN (Print): 1616-301X

Ratings:

Scopus rating (2015): CiteScore 20.4 SJR 4.859 SNIP 2.439

Original language: English

ASJC Scopus subject areas: Biomaterials, Electrochemistry, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Cholesteric liquid crystals, Hydrogels, Interpenetrating polymer networks, Photonic materials, Smart materials

DOIs:

10.1002/adfm.201500745

URLs:

<http://www.scopus.com/inward/record.url?scp=84928138667&partnerID=8YFLogxK> (Link to publication in Scopus)

Research output: Contribution to journal › Article › Scientific › peer-review

#### Strand and cable R&D for fast cycled magnets at CERN

Fast cycled superconducting magnets (FCM's) are an option of interest for the long-term consolidation and upgrade plan of the LHC accelerator complex. In the past two years we have conducted an R&D targeted at investigating the feasibility, operational issues and economical advantage of FCM's in the range of 2 T bore field, continuously cycled at 1 Hz. In this paper we report the main results on the development of strands and cables suitable for this application, providing details on the strands tested and the cable manufacturing and performance.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: European Organization for Nuclear Research, BNG, Lawrence Berkeley National Laboratory

Contributors: Bottura, L., Bonasia, A., Borgnolutti, F., Gaertner, W., Le Naour, S., Oberli, L., Peiro, G., Richter, D., Salmi, T., Sikler, G., Willering, G.

Number of pages: 5

Pages: 2354-2358

Publication date: Jun 2011

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 21

Issue number: 3 PART 2

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2011): CiteScore 1.8 SJR 0.368 SNIP 1.062

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: AC loss, Superconducting accelerator magnets, Superconducting cables, Superconducting filaments and wires

DOIs:

10.1109/TASC.2011.2105236

Source: Scopus

Source ID: 79957900922

Research output: Contribution to journal › Article › Scientific › peer-review

#### Structural and Electrical Characterization of Solution-Processed Electrodes for Piezoelectric Polymer Film Sensors

Solution-processable graphene and carbon nanotube-based electrode materials were used here to provide electrodes on flexible piezoelectric polyvinylidene fluoride sensors. Piezoelectric sensitivity measurements, image-based analysis, adhesion tests, and sheet resistance measurements

were applied to these printable sensors to rigorously analyze their performance and structure. The printable sensors showed electrical performance similar to metallized sensors, whereas the adhesion of the solution-processed materials to the substrate is not as high as that of the evaporated metal films. This also affects the measured sensor sensitivity values. The measurements based on optical images were found to be a promising method to capture detailed information about the electrode surface structure.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: Department of Automation Science and Engineering, Research area: Microsystems, Research area: Measurement Technology and Process Control  
Contributors: Rajala, S., Mettänen, M., Tuukkanen, S.  
Number of pages: 8  
Pages: 1692-1699  
Publication date: 15 Mar 2016  
Peer-reviewed: Yes

### Publication information

Journal: IEEE Sensors Journal  
Volume: 16  
Issue number: 6  
ISSN (Print): 1530-437X  
Ratings:  
Scopus rating (2016): CiteScore 4.4 SJR 0.654 SNIP 1.697  
Original language: English  
ASJC Scopus subject areas: Biomedical Engineering, Electronic, Optical and Magnetic Materials, Surfaces and Interfaces  
Keywords: Printed electrodes, image analysis, measurement, piezoelectric films, piezoelectric transducers, SHEAR-STRESS MEASUREMENTS, GRAPHENE, PVDF  
Electronic versions:  
Rajala\_Mettänen\_IEEE\_2015\_PVDF-sensors\_self-archive  
DOIs:  
10.1109/JSEN.2015.2504956  
URLs:  
<http://urn.fi/URN:NBN:fi:ty-201603173660>  
Source: Bibtex  
Source ID: urn:baf47c637d585669f900add29c0f9bc  
Research output: Contribution to journal > Article > Scientific > peer-review

### Structure and in vitro dissolution of Mg and Sr containing borosilicate bioactive glasses for bone tissue engineering

Borosilicate bioactive glasses are promising for bone tissue engineering. The objective was to assess the impact of magnesium and/or strontium, when substituted for calcium on the glasses' thermal and dissolution properties. Both Mg and Sr substitution appeared to enhance the hot forming domain, i.e. the ability to hot process (sinter, draw fibres) without adverse crystallization. Structural analysis indicated that substitution of MgO and/or SrO for CaO results in changes in the  $BO_3/BO_4$  ratio as well as in the ratio between bridging and non-bridging oxygen atoms in the silicate structure. Additionally, a  $de$ -shielding effect was noticed when  $Ca_2$ , Mg and Sr are present together in the glass network, possibly owing to  $PO_4^{3-}$  charge-balanced preferentially by  $Na^+$ . The Mg and/or Sr substitution resulted in a lower ion release in simulated body fluid and delayed formation of hydroxyapatite. However, once this layer formed it consisted of a Mg/Sr-substituted apatite. This work highlights the effect of combined ionic substitutions on bioactive glass structure and properties.

### General information

Publication status: Published  
MoE publication type: A1 Journal article-refereed  
Organisations: BioMediTech, Research group: Biomaterials and Tissue Engineering Group, Friedrich-Schiller-University Jena, Universite de Rennes  
Contributors: Tainio, J. M., Salazar, D. A. A., Nommeots-Nomm, A., Roiland, C., Bureau, B., Neuville, D. R., Brauer, D. S., Massera, J.  
Number of pages: 10  
Publication date: 1 Apr 2020  
Peer-reviewed: Yes

### Publication information

Journal: Journal of Non-Crystalline Solids  
Volume: 533  
Article number: 119893  
ISSN (Print): 0022-3093  
Original language: English  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Condensed Matter Physics, Materials Chemistry  
Keywords: Bioactive glasses, Borosilicate glasses, In vitro dissolution, Structural properties, Tissue engineering  
DOIs:

10.1016/j.jnoncrysol.2020.119893

Source: Scopus

Source ID: 85078095947

Research output: Contribution to journal > Article > Scientific > peer-review

### Study of quench protection for the Nb<sub>3</sub>Sn low-β quadrupole for the LHC luminosity upgrade (HiLumi-LHC)

The HiLumi program is aiming to develop and build new Nb<sub>3</sub>Sn, high-field (12 T), and large-aperture (150 mm) superconducting quadrupoles, which will be inserted in the LHC interaction regions and will provide the final focusing of the beam, in the program of luminosity upgrade. The quench protection of these magnets is one of the most challenging aspects, mainly because of the large value of the magnet inductance (160 mH for the configuration with two 8-m-long magnets in series), of the large value of the stored magnetic energy density in the coils (0.12 J/mm<sup>3</sup>, a factor 2 larger than in the conventional NbTi quadrupoles) and of the use of Nb<sub>3</sub>Sn as a conductor, which has never been used for large accelerator magnets. Previous works have demonstrated that a 'standard' conservative analysis, assuming quench heaters only on the coils' outer layer, gives high hot-spot temperature, close to the design limit (350 K). In this paper, a new study of quench protection is presented. The benefic effects of large dl/dt during the discharge and other dynamic effects are discussed together with options for having a partial coverage of the inner layer by quench heaters. The analysis is validated by experimental data from RD Nb<sub>3</sub>Sn quadrupole magnets.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Università degli Studi di Milano, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, European Organization for Nuclear Research

Contributors: Marinozzi, V., Ambrosio, G., Bellomo, G., Chlachidze, G., Felice, H., Marchevsky, M., Salmi, T., Sorbi, M., Todesco, E.

Publication date: 1 Jun 2015

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 3

Article number: 4002905

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Niobium compounds, quench protection, superconducting accelerators

DOIs:

10.1109/TASC.2014.2383435

Source: Scopus

Source ID: 84922823312

Research output: Contribution to journal > Article > Scientific > peer-review

### Sub-100 ps monolithic diamond Raman laser emitting at 573 nm

We report a compact and efficient picosecond diamond Raman laser at 573 nm wavelength. The laser consists of a 0.5 mm thick single-crystal synthetic diamond coated to form a plane-plane laser resonator, and pumped at 532 nm by a frequency-doubled Q-switched microchip laser system. The pump delivers 85 ps pulses at 100 kHz repetition rate at a maximum average power of 500 mW. We demonstrate 1st Stokes emission from the diamond Raman laser with maximum power of 175 mW, corresponding to a conversion efficiency of 47%; and a pulse duration of 71 ps. Substantial pulse shortening is obtained by proper adjustment of the pump spot diameter on the diamond sample. A minimum pulse duration of 39 ps is reported for a conversion efficiency of 36%; and 150 mW output power. The simplicity of the architecture makes the system highly appealing as a yellow picosecond laser source.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Research group: ORC, University of Strathclyde

Contributors: Nikkinen, J., Savitski, V., Reilly, S., Dziechciarzyk, L., Härkönen, A., Kemp, A., Guina, M.

Pages: 981-984

Publication date: 2018

Peer-reviewed: Yes

Early online date: 13 Feb 2018

### Publication information

Journal: IEEE Photonics Technology Letters

Volume: 30

Issue number: 11

ISSN (Print): 1041-1135

Ratings:

Scopus rating (2018): CiteScore 5.4 SJR 0.991 SNIP 1.272

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: Diamond, Diamond Raman lasers, Laser excitation, Lenses, Microchip lasers, Power generation, Pulsed lasers, Pump lasers, Q-switched lasers, Raman lasers, Stimulated emission, Visible lasers

DOIs:

10.1109/LPT.2018.2806183

Source: Scopus

Source ID: 85042062344

Research output: Contribution to journal › Article › Scientific › peer-review

### Sub-microwatt direct laser writing of fluorescent gold nanoclusters in polymer films

We report on the micro-patterning of fluorescent gold nanoclusters embedded in polyvinyl alcohol film using a low-cost continuous-wave laser. We show that the formation of gold nanoclusters requires low-level laser irradiation ( $<100$  W/cm<sup>2</sup>), corresponding to a sub-microwatt focused beam. This low-intensity requirement enables substantially higher speed and cost-effective light patterning process. As a result of using only small intensities during gold nanoclusters production, no microscopic topological changes were observed in the polymer film. This class of gold nanoclusters potentially finds application in high-speed authenticity marking and similar labeling applications.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research group: Applied Optics

Contributors: Bitarafan, M. H., Suomala, S., Toivonen, J.

Number of pages: 11

Pages: 138-148

Publication date: 2020

Peer-reviewed: Yes

### Publication information

Journal: Optical Materials Express

Volume: 10

Issue number: 1

ISSN (Print): 2159-3930

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.1364/OME.381901

### Bibliographical note

INT=phys,"Bitarafan, Mohammad H."

INT=phys,"Suomala, Sofia"

Source: Scopus

Source ID: 85079045790

Research output: Contribution to journal › Article › Scientific › peer-review

### Suitability of bundle approximation in AC loss analysis of NbTi wires: Simulations and experiment

Multifilamentary NbTi wires for ac applications are manufactured by embedding filament bundles into a metal matrix. In this stage of the manufacturing process, it is possible to affect the layout of the cross section and to choose whether to use few large or many small bundles in order to achieve a certain amount of filaments. All in all, up to 100 000 filaments are attainable for wire having the diameter of 1 mm. In this paper, ac loss measurements in external magnetic field on differently stacked NbTi samples are described. The measurements were performed in a LHe-cooled cryostat. The amplitude of the external field was varied between 250 mT and 3 T at frequencies of 0.02 and 0.12 Hz. We discuss possibilities to simulate the losses with finite element method. In particular, we concentrate on the filament bundle approximation and the possibilities to exploit it in the research and development process of new NbTi wires. In this approach, the filament bundles are considered as a homogenous mixture of matrix and superconducting filaments.

According to the results, the bundle approximation greatly overestimates the losses. Furthermore, it should not be used for comparing, e.g., two wire structures where one has bundles of different size than the other. However, when considering how to situate the bundles on the cross section to achieve minimal ac loss, the bundle approximation can be a useful tool.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, University of Twente

Contributors: Lyly, M., Krooshoop, E., Lübkeermann, R., Wessel, S., Stenvall, A., Dhalle, M., Mikkonen, R.

Publication date: 1 Jun 2015

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 3

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: AC loss, finite-element method (FEM), measurements, multifilamentary, NbTi, numerical modeling

DOIs:

10.1109/TASC.2014.2376184

Source: Scopus

Source ID: 84923303181

Research output: Contribution to journal > Article > Scientific > peer-review

#### Suitability of Different Quench Protection Methods for a 16 T Block-Type Nb<sub>3</sub>Sn Accelerator Dipole Magnet

Within the future circular collider study, a 100-km long circular hadron collider is being designed for 100 TeV center-of-mass collision energies. The design of the 16 T Nb<sub>3</sub>Sn bending dipole magnets is carried out within the EuroCirCol collaboration. Three different type of dipole designs have been developed, each aiming to be as compact as possible, accounting for the design criteria. Quench protection a critical aspect of the magnet design and potentially limits the magnet compactness. The EuroCirCol magnets were designed assuming a protection system with significantly improved efficiency compared to the present LHC dipole protection. In this paper, we consider present state-of-the-art quench protection technologies, such as quench heaters and CLIQ, and apply them into the designed 16 T Block-type dipole. Two different simulation models are used to estimate the magnet hotspot temperature and voltages after a quench and consequently estimate the suitability of the different methods.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Electromagnetics, European Organization for Nuclear Research, Istituto Nazionale Di Fisica Nucleare, Frascati

Contributors: Salmi, T., Prioli, M., Stenvall, A., Ruuskanen, J., Verweij, A. P., Auchmann, B., Marinozzi, V.

Publication date: 1 Jun 2017

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 27

Issue number: 4

Article number: 4702305

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2017): CiteScore 2.7 SJR 0.408 SNIP 0.962

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: CLIQ, hotspot temperature, quench protection heaters, quench simulation, Superconducting magnets

Electronic versions:

Salmi\_ASC2016\_paper\_Final\_090117

DOIs:

10.1109/TASC.2017.2651386

URLs:

<http://urn.fi/URN:NBN:fi:tyy-201712152394>

Source: Scopus

Source ID: 85015258090

Research output: Contribution to journal › Article › Scientific › peer-review

### Superatom Model for Ag-S Nanocluster with Delocalized Electrons

Several Ag-S nanoclusters where the cluster core comprises mixed metal (main component) and sulfur atoms show superatomic orbitals in the conduction band edge. However, there are no superatomic states, i.e., delocalized electrons, in the valence band, and the clusters in question can be labeled as “zerovalent”. We show here an example of an Ag-S cluster which fulfills the superatom model and has delocalized electrons: The recently synthesized and characterized  $[\text{Ag}_62\text{S}_{12}(\text{StBu})_{32}]^{2+}$  cluster has four delocalized valence electrons based on a simple counting rule, and we compare it to the zerovalent cluster  $[\text{Ag}_62\text{S}_{13}(\text{StBu})_{32}]^{4+}$ . Our electronic structure analysis confirms the existence of superatomic states in the valence and conduction bands, but the locations of these states do not agree completely with the conventional prediction based on the spherical Jellium model.  $[\text{Ag}_62\text{S}_{12}(\text{StBu})_{32}]^{2+}$  displays the 1S2 electronic shell closure at the Fermi energy instead of the 1S21P2 configuration as suggested by its electron count. This shift of energy levels and electron shell closing has been introduced by the core-shell structure of the cluster. Our optical absorption simulation can reproduce the features observed in the experiments, and we assign these features to the transitions involving superatomic states within the conduction band.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research group: Materials and Molecular Modeling, Computational Science X (CompX), COMP Centre of Excellence, Department of Applied Physics, Aalto University

Contributors: Goh, J. Q., Akola, J.

Number of pages: 8

Pages: 21165-21172

Publication date: 10 Sep 2015

Peer-reviewed: Yes

Early online date: 19 Aug 2015

### Publication information

Journal: Journal of Physical Chemistry C

Volume: 119

Issue number: 36

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2015): CiteScore 7.9 SJR 1.886 SNIP 1.246

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

[10.1021/acs.jpcc.5b05824](https://doi.org/10.1021/acs.jpcc.5b05824)

URLs:

<http://www.scopus.com/inward/record.url?scp=84941254956&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84941254956

Research output: Contribution to journal › Article › Scientific › peer-review

### Supercontinuum generation as a signal amplifier

Supercontinuum white-light generation in optical fibers is a process that is known for its extreme sensitivity toward fluctuations of the input pulses, giving rise to a strong amplification of input noise. Such noise amplification has been recognized as a detrimental effect that prevents compression of the broad white-light spectra into a few-cycle pulse. Here, we show that the same effect can be exploited to amplify and recover faint modulation signals to an extent that seems impossible with any electronic method. We experimentally demonstrate the deterministic amplification of faint amplitude modulation signals by up to 60 dB. As we show from numerical simulations, this amplification process arises from the interaction dynamics between solitons and dispersive radiation in the fiber. The resulting all-optic signal restoration provides a new photonic building block that enables signal processing at virtually unlimited processing speeds.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Department of Physics, Research area: Optics, Research group: Nonlinear Fiber Optics, Frontier Photonics

Contributors: Orsila, L., Sand, J., Närhi, M., Genty, G., Steinmeyer, G.  
Number of pages: 8  
Pages: 757-764  
Publication date: 2015  
Peer-reviewed: Yes

#### Publication information

Journal: Optica  
Volume: 2  
Issue number: 8  
ISSN (Print): 2334-2536  
Ratings:

Scopus rating (2015): CiteScore 3.5 SJR 4.539 SNIP 2.629

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials

Keywords: Nonlinear optics, fibers, Ultrafast nonlinear optics, Ultrafast processing

DOIs:

10.1364/OPTICA.2.000757

URLs:

<http://www.scopus.com/inward/record.url?scp=84941207046&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

ORG=orc,0.6

ORG=fys,0.4

Source: Scopus

Source ID: 84941207046

Research output: Contribution to journal > Article > Scientific > peer-review

#### Superfluid weight and Berezinskii-Kosterlitz-Thouless transition temperature of twisted bilayer graphene

We study superconductivity of twisted bilayer graphene with local and nonlocal attractive interactions. We obtain the superfluid weight and Berezinskii-Kosterlitz-Thouless (BKT) transition temperature for microscopic tight-binding and low-energy continuum models. We predict qualitative differences between local and nonlocal interaction schemes which could be distinguished experimentally. In the flat-band limit where the pair potential exceeds the band width we show that the superfluid weight and BKT temperature are determined by multiband processes and quantum geometry of the band.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Aalto University, University of Jyväskylä

Contributors: Julku, A., Peltonen, T. J., Liang, L., Heikkilä, T. T., Törmä, P.

Publication date: 1 Feb 2020

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 101

Issue number: 6

Article number: 060505

ISSN (Print): 2469-9950

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.101.060505

#### Bibliographical note

INT=phys,"Liang, L."

Source: Scopus

Source ID: 85082866595

Research output: Contribution to journal > Article > Scientific > peer-review

#### Surface-induced charge state conversion of nitrogen-vacancy defects in nanodiamonds

We present a study of the charge state conversion of single nitrogen-vacancy (NV) defects hosted in nanodiamonds (NDs). We first show that the proportion of negatively charged NV<sup>-</sup> defects, with respect to its neutral counterpart NV<sup>0</sup>, decreases with the size of the ND. We then propose a simple model based on a layer of electron traps located at the ND surface which is in good agreement with the recorded statistics. By using thermal oxidation to remove the shell of

amorphous carbon around the NDs, we demonstrate a significant increase in the proportion of NV<sup>-</sup> defects in 10 nm NDs. These results are invaluable for further understanding, control, and use of the unique properties of negatively charged NV defects in diamond.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Ecole Polytechnique de Montreal, Canada, Laboratoire de Photonique Quantique et Moléculaire-ENS Cachan, Laboratoire de Physique de la Matière Condensée-Ecole Polytechnique-CNRS, CEA/CNG, UMR CNRS 8537, UMR CNRS 7643, Ecole Polytechnique, LIST, Diamond Sensors Laboratory, Laboratoire de Physique des Interfaces et Couches Minces, UMR CNRS 7647, Academia Sinica, Institute of Atomic and Molecular Sciences Academia Sinica Taiwan

Contributors: Rondin, L., Dantelle, G., Slablab, A., Grosshans, F., Treussart, F., Bergonzo, P., Perruchas, S., Gacoin, T., Chaigneau, M., Chang, H. C., Jacques, V., Roch, J. F.

Publication date: 28 Sep 2010

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 82

Issue number: 11

Article number: 115449

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2010): SJR 3.318 SNIP 1.457

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1103/PhysRevB.82.115449

Source: Scopus

Source ID: 77957722876

Research output: Contribution to journal > Article > Scientific > peer-review

#### Surface-relief gratings and stable birefringence inscribed using light of broad spectral range in supramolecular polymer-bisazobenzene complexes

We report on phenol-pyridine hydrogen-bonded supramolecular polymer-azobenzene complexes made from a newly designed polar bisazobenzene chromophore. Because of the substitution with a polar nitro group, the chromophore possesses an extremely broad absorption band, spanning from near-UV up to 650 nm. Moreover, the inclusion of two methoxy groups to the central benzene ring prevents excessive chromophore-chromophore intermolecular interactions and provides advantageous size-related properties. Together, these features of the prepared photoresponsive polymer materials enable efficient inscription of (i) photoinduced birefringence with outstanding stability at various chromophore concentrations and (ii) surface-relief grating formation over a wide range of writing wavelengths from 405 to 633 nm. The photoresponsive behavior is compared to that of Disperse Yellow 7-based supramolecular complexes.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Department of Applied Physics, Aalto University, Tokyo Institute of Technology, University of Bristol

Contributors: Koskela, J. E., Vapaavuori, J., Hautala, J., Priimagi, A., Faul, C. F. J., Kaivola, M., Ras, R. H. A.

Number of pages: 8

Pages: 2363-2370

Publication date: 26 Jan 2012

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Physical Chemistry C

Volume: 116

Issue number: 3

ISSN (Print): 1932-7447

Ratings:

Scopus rating (2012): CiteScore 8 SJR 2.529 SNIP 1.461

Original language: English

ASJC Scopus subject areas: Physical and Theoretical Chemistry, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Energy(all)

DOIs:

10.1021/jp210706n

URLs:

<http://www.scopus.com/inward/record.url?scp=84856360260&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84856360260

Research output: [Contribution to journal](#) › [Article](#) › [Scientific](#) › [peer-review](#)

### **Symmetry-broken electronic structure and uniaxial Fermi surface nesting of untwinned CaFe<sub>2</sub>As<sub>2</sub>**

We used angle-resolved photoemission spectroscopy to make direct measurements of the electronic structure of the untwinned uniaxial state of CaFe<sub>2</sub>As<sub>2</sub>, the parent compound of an iron-based superconductor. The very small photon beam size, combined with the relatively large single-domain area on the crystal surfaces, allowed us to obtain the intrinsic symmetry-broken dispersions and Fermi surface (FS) geometries along the orthogonal Fe-Fe bond directions without any mechanical or magnetic detwinning processes. Comparing the optimized local density approximation calculations, an orbital-dependent band shifting is introduced to obtain better agreement, which is consistent with the development of orbital ordering. More interestingly, unidirectional straight and flat FS segments are observed near the zone center, which indicates the existence of a unidirectional charge density wave order. Our results indicate strong electronic anisotropy in CaFe<sub>2</sub>As<sub>2</sub> and put strong constraints on theories for the iron-pnictide system.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Computational Science X (CompX), Los Alamos National Laboratory, University of Science and Technology of China, Lawrence Berkeley National Laboratory, Northeastern University, University of Colorado at Boulder  
Contributors: Wang, Q., Sun, Z., Rotenberg, E., Ronning, F., Bauer, E. D., Lin, H., Markiewicz, R. S., Lindroos, M., Barbiellini, B., Bansil, A., Dessau, D. S.

Publication date: 26 Dec 2013

Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B

Volume: 88

Issue number: 23

Article number: 235125

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2013): CiteScore 6.9 SJR 2.813 SNIP 1.32

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.88.235125

URLs:

<http://www.scopus.com/inward/record.url?scp=84892419860&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84892419860

Research output: [Contribution to journal](#) › [Article](#) › [Scientific](#) › [peer-review](#)

### **Temporal ghost imaging using wavelength conversion and two-color detection**

Ghost imaging constructs an image by correlating two signals: one that interacts with an object but possesses no spatial information, and the other that contains spatial information but does not interact with the object. Ghost imaging can be extended into the time domain by using laser intensity fluctuations to reconstruct an unknown time-varying pattern, but this requires the measurement of laser fluctuations on ultrafast timescales, a significant limitation at wavelengths where ultrafast detectors are not available. We overcome this by using wavelength conversion to shift the probe laser into a spectral region where ultrafast detectors are available, and we apply this technique to image a temporal object at 2  $\mu\text{m}$ . Our results demonstrate that temporal correlation information can be transferred to an arbitrary spectral region, opening possibilities for ultrafast ghost imaging at new wavelengths.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, University of Electronic Science and Technology of China, UMR 6174, Ita-Suomen yliopisto

Contributors: Wu, H., Ryczkowski, P., Friberg, A. T., Dudley, J. M., Genty, G.

Number of pages: 5

Pages: 902-906

Publication date: 20 Jul 2019

Peer-reviewed: Yes

### Publication information

Journal: Optica

Volume: 6

Issue number: 7

ISSN (Print): 2334-2536

Ratings:

Scopus rating (2019): CiteScore 18.1 SJR 5.6 SNIP 3.375

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

DOIs:

10.1364/OPTICA.6.000902

### Bibliographical note

INT=phys,"Wu, Han"

Source: Scopus

Source ID: 85071154886

Research output: Contribution to journal > Article > Scientific > peer-review

### Test results of the LARP HQ02b magnet at 1.9 K

The HQ magnet is a 120-mm aperture, 1-m-long Nb<sub>3</sub>Sn quadrupole developed by the LARP collaboration in the framework of the High-Luminosity LHC project. A first series of coils was assembled and tested in five assemblies of the HQ01 series. The HQ01e model achieved a maximum gradient of 170 T/m at 4.5 K at LBNL in 2010-2011 and reached 184 T/m at 1.9 K at CERN in 2012. A new series of coils incorporating major design changes was fabricated for the HQ02 series. The first model, HQ02a, was tested at Fermilab where it reached 98% of the short sample limit at 4.5 K with a gradient of 182 T/m in 2013. However, the full training of the coils at 1.9 K could not be performed due to a current limit of 15 kA. Following this test, the azimuthal coil pre-load was increased by about 30 MPa and an additional current lead was installed at the electrical center of the magnet for quench protection studies. The test name of this magnet changed to HQ02b. In 2014, HQ02b was then shipped to CERN as the first opportunity for full training at 1.9 K. In this paper, we present a comprehensive summary of the HQ02 test results including: magnet training at 1.9 K with increased preload; quench origin and propagation; and ramp rate dependence. A series of powering tests was also performed to assess changes in magnet performance with a gradual increase of the MIITs. We also present the results of quench protection studies using different setting for detection, heater coverage, energy extraction and the coupling-loss induced quench (CLIQ) system.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, European Organization for Nuclear Research, CERN, Conseil Européen pour la Recherche Nucléaire, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, Brookhaven National Laboratory, University of Twente

Contributors: Bajas, H., Ambrosio, G., Anerella, M., Bajko, M., Bossert, R., Bottura, L., Caspi, S., Cheng, D., Chiuchiolo, A., Chlachidze, G., Dietderich, D., Felice, H., Ferracin, P., Fevrier, J., Ghosh, A., Giloux, C., Godeke, A., Hafalia, A. R., Marchevsky, M., Ravaioli, E., Sabbi, G. L., Salmi, T., Schmalzle, J., Todesco, E., Wanderer, P., Wang, X., Yu, M.

Publication date: 1 Jun 2015

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 3

Article number: 4003306

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Niobium-tin, quadrupole magnet, Superconducting coils

DOIs:

10.1109/TASC.2014.2378375

URLs:

<http://www.scopus.com/inward/record.url?scp=84924028983&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84924028983

Research output: Contribution to journal › Article › Scientific › peer-review

### Test Results of the LARP Nb<sub>3</sub>Sn Quadrupole HQ03a

The U.S. LHC Accelerator Research Program (LARP) has been developing Nb<sub>3</sub>Sn quadrupoles of increasing performance for the high-luminosity upgrade of the large hadron collider. The 120-mm aperture high-field quadrupole (HQ) models are the last step in the RD phase supporting the development of the new IR Quadrupoles (MQXF). Three series of HQ coils were fabricated and assembled in a shell-based support structure, progressively optimizing the design and fabrication process. The final set of coils consistently applied the optimized design solutions and was assembled in the HQ03a model. This paper reports a summary of the HQ03a test results, including training, mechanical performance, field quality, and quench studies.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Fermi National Accelerator Laboratory, Brookhaven National Laboratory, European Organization for Nuclear Research, Lawrence Berkeley National Laboratory

Contributors: DiMarco, J., Ambrosio, G., Anerella, M., Bajas, H., Chlachidze, G., Borgnolutti, F., Bossert, R., Cheng, D., Dietderich, D., Felice, H., Holik, T., Pan, H., Ferracin, P., Ghosh, A., Godeke, A., Hafalia, A. R., Marchevsky, M., Orris, D., Ravaioli, E., Sabbi, G., Salmi, T., Schmalzle, J., Stoynev, S., Strauss, T., Sylvester, C., Tartaglia, M., Todesco, E., Wanderer, P., Wang, X., Yu, M.

Publication date: 1 Jun 2016

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 26

Issue number: 4

Article number: 4005105

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2016): CiteScore 2.6 SJR 0.398 SNIP 1.132

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: High field accelerator magnets, NbSn

DOIs:

10.1109/TASC.2016.2528283

Source: Scopus

Source ID: 84971631243

Research output: Contribution to journal › Article › Scientific › peer-review

### The 16 T Dipole Development Program for FCC

A key challenge for a future circular collider (FCC) with centre-of-mass energy of 100 TeV and a circumference in the range of 100 km is the development of high-field superconducting accelerator magnets, capable of providing a 16 T dipolar field of accelerator quality in a 50 mm aperture. This paper summarizes the strategy and actions being undertaken in the framework of the FCC 16 T Magnet Technology Program and the Work Package 5 of the EuroCirCol.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, Research area: Power engineering, Research group: Modelling and superconductivity, European Organization for Nuclear Research, Istituto Nazionale Di Fisica Nucleare, Frascati, University of Twente, French Atomic Energy Commission (CEA) Saclay, Environment and Technology, KEK, Universite de Geneve

Contributors: Tommasini, D., Auchmann, B., Bajas, H., Bajko, M., Ballarino, A., Bellomo, G., Benedikt, M., Bermudez, S. I., Bordini, B., Bottura, L., Buzio, M., Dhalle, M., Durante, M., De Rijk, G., Fabbriatore, P., Farinon, S., Ferracin, P., Gao, P., Lackner, F., Lorin, C., Marinozzi, V., Martinez, T., Munilla, J., Ogitsu, T., Ortwein, R., Perez, J., Prioli, M., Rifflet, J. M., Rochepault, E., Russenschuck, S., Salmi, T., Savary, F., Schoerling, D., Segreti, M., Senatore, C., Sorbi, M., Stenvall, A., Todesco, E., Toral, F., Verweij, A. P., Volpini, G., Wessel, S., Wolf, F.

Publication date: 1 Jun 2017

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 27

Issue number: 4

Article number: 4000405

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2017): CiteScore 2.7 SJR 0.408 SNIP 0.962

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: 16 T, FCC, NbSn, superconducting

DOIs:

10.1109/TASC.2016.2634600

Source: Scopus

Source ID: 85012994421

Research output: Contribution to journal > Article > Scientific > peer-review

### The effect of carbon and nickel additions on the precursor synthesis of Cr<sub>3</sub>C<sub>2</sub>-Ni nanopowder

Decreasing crystal size to nanoscale is a proven method to enhance material properties. In this study, nanosize Cr<sub>3</sub>C<sub>2</sub> and Cr<sub>3</sub>C<sub>2</sub>-Ni were synthesized and the reaction sequence was studied. Aqueous precursors using only water-soluble raw materials with varying carbon contents and a nickel addition were spray-dried. Glycine was used as a carbon source and chromium acetate hydroxide as a chromium source in the precursor solutions. Nickel nitrate hexahydrate was introduced as a nickel source to yield a metallic binder into the carbide nanopowder. Resulting powders were heat-treated to identify an applicable precursor composition producing the targeted Cr<sub>3</sub>C<sub>2</sub> phase with crystal size of tens of nanometers. Thermal synthesis tests of the precursor powders to yield Cr<sub>3</sub>C<sub>2</sub> took place at a temperature between 900 and 1300 °C under an Argon atmosphere. The synthesis of nanosize Cr<sub>3</sub>C<sub>2</sub>-Ni powder was successful at 1000 °C in 30 min, in a case of the best precursor. In order to produce the carbide phase with no residual oxide traces, relative carbon load has to be 48 wt%, while the stoichiometric amount of carbon in Cr<sub>3</sub>C<sub>2</sub> is 13 wt%. When also introducing the nickel source into the precursor, an even higher carbon load was required. The carbon surplus needed to enable the Cr<sub>3</sub>C<sub>2</sub> synthesis attributes to the non-homogeneity of the precursor composition. The chemical synthesis starting from water-soluble raw materials is a promising way of preparing nanosize Cr<sub>3</sub>C<sub>2</sub>-Ni with the targeted phase configuration.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Materials Science, Research group: Materials Characterization, VTT Technical Research Centre of Finland

Contributors: Kaunisto, K., Kotilainen, M., Karhu, M., Lagerbom, J., Vuorinen, T., Honkanen, M., Vippola, M., Turunen, E.

Pages: 9338-9346

Publication date: 1 Jun 2018

Peer-reviewed: Yes

Early online date: 2018

### Publication information

Journal: Ceramics International

Volume: 44

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ISSN (Print): 0272-8842

Ratings:

Scopus rating (2018): CiteScore 5.2 SJR 0.888 SNIP 1.297

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Process Chemistry and Technology, Surfaces, Coatings and Films, Materials Chemistry

Keywords: A. Nanosize CrC synthesis, A. Powders: chemical preparation, B. Grain size, D. Carbides, E. Wear parts

DOIs:

10.1016/j.ceramint.2018.02.146

### Bibliographical note

EXT="Vuorinen, Tommi"

EXT="Lagerbom, Juha"

EXT="Kaunisto, Kimmo"

Source: Scopus

Source ID: 85042300396

Research output: Contribution to journal > Article > Scientific > peer-review

### **The effects of laser patterning 10CeTZP-Al<sub>2</sub>O<sub>3</sub> nanocomposite disc surfaces: Osseous differentiation and cellular arrangement in vitro**

Customized square grid arrangements of different groove depths (1.0, 1.5 and 3.0 µm) and separations (10 and 30 µm) were successfully laser patterned, using a nanosecond pulsed fibre laser, on the surface of 10 mol% ceria-stabilized zirconia and alumina (10CeTZP-Al<sub>2</sub>O<sub>3</sub>) nanocomposite discs (diameter: 10 mm; thickness: 1.5 mm). The patterned surfaces and the in vitro biological response of osteoblasts (SAOS-2) towards them were thoroughly analysed. In terms of composition, the laser treatment was found to cause superficial monoclinic-tetragonal zirconia phase transformation and alumina evaporation. In vitro, the most effective grid configuration for osseous differentiation was found to be 1.5 µm groove depth and 10 µm groove separation, and confocal microscopy revealed that the cells show a tendency to be sorted as groove depth increases. It is thought that custom-made patterns could be produced to guide cell attachment in vivo, which could favour implant integration and reduce healing time.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Materials Science, Mechanical Engineering and Industrial Systems, Nanoker Research, Universidad de Oviedo

Contributors: Goyos-Ball, L., Prado, C., Díaz, R., Fernández, E., Ismailov, A., Kumpulainen, T., Levänen, E., Torrecillas, R., Fernández, A.

Pages: 9472-9478

Publication date: Jun 2018

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Early online date: 2018

#### **Publication information**

Journal: Ceramics International

Volume: 44

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ISSN (Print): 0272-8842

Ratings:

Scopus rating (2018): CiteScore 5.2 SJR 0.888 SNIP 1.297

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Process Chemistry and Technology, Surfaces, Coatings and Films, Materials Chemistry

Keywords: Alumina, Cellular arrangement, Ceramic nanocomposite, Laser patterning, Osseous differentiation, Zirconia  
DOIs:

10.1016/j.ceramint.2018.02.164

Source: Scopus

Source ID: 85042621677

Research output: Contribution to journal › Article › Scientific › peer-review

### **The EuCARD-2 future magnets European collaboration for accelerator-quality HTS magnets**

EuCARD-2 is a project supported by FP7-European Commission that includes, inter alia, a work-package (WP10) called "Future Magnets." This project is part of the long term development that CERN is launching to explore magnet technology at 16 T to 20 T dipole operating field, within the scope of a study on Future Circular Colliders. The EuCARD2 collaboration is closely liaising with similar programs for high field accelerator magnets in the USA and Japan. The main focus of EuCARD2 WP10 is the development of a 10 kA-class superconducting, high current density cable suitable for accelerator magnets. The cable will be used to wind a stand-alone magnet 500 mm long and with an aperture of 40 mm. This magnet should yield 5 T, when stand-alone, and will enable to reach a 15 to 18 T dipole field by placing it in a large bore background dipole of 12-15 T. REBCO based Roebel cables is the baseline. Various magnet configurations with HTS tapes are under investigation and also use of Bi-2212 round wire based cables is considered. The paper presents the structure of the collaboration and describes the main choices made in the first year of the program, which has a breadth of five to six years of which four are covered by the FP7 frame.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics, European Organization for Nuclear Research, University of Southampton, Istituto Nazionale Di Fisica Nucleare, Frascati, CERN, Conseil Européen pour la Recherche Nucleaire, Accelerator and Technology Sector, Institut Polytechnique de Grenoble, University of Twente, CEA, Institute of Research into the Fundamental Laws of the Universe (IRFU), Karlsruhe Institute of Technology, Departement de Physique de la Matière Condensée (DPMC), University of Geneva, Bruker HTS GmbH, Istituto Nazionale di Fisica Nucleare (INFN), Laboratorio Acceleratori e Superconduttività Applicata (LASA), Danish Institute of Technology

Contributors: Rossi, L., Badel, A., Bajko, M., Ballarino, A., Bottura, L., Dhallé, M. M. J., Durante, M., Fazilleau, P., Fleiter, J., Goldacker, W., Härö, E., Kario, A., Kirby, G., Lorin, C., Van Nugteren, J., De Rijk, G., Salmi, T., Senatore, C., Stenvall, A., Tixador, P., Usoskin, A., Volpini, G., Yang, Y., Zangenberg, N.

Publication date: 1 Jun 2015

Peer-reviewed: Yes

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 3

Article number: 4001007

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Accelerators Magnets, Eucard2, Future Magnets, High-temperature superconductors, Superconducting Magnets

DOIs:

10.1109/TASC.2014.2364215

URLs:

<http://www.scopus.com/inward/record.url?scp=84920911143&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84920911143

Research output: Contribution to journal › Article › Scientific › peer-review

#### The EuCARD2 Future Magnets Program for particle accelerator high field dipoles: review of results and next steps

The EuCARD2 collaboration aims at the development of a 10 kA-class superconducting, high current density cable suitable for accelerator magnets, to be tested in small coils and magnets capable to deliver 3-5 T when energized in stand-alone mode, and 15-18 T when inserted in a 12-13 T background magnet. REBCO tape, assembled in a Roebel cable, was selected as conductor. The developed REBCO tape has reached a record engineering critical current density, at 4.2 K and 18 T of 956 A/mm<sup>2</sup>. Roebel cable carried up to 13 kA at 20K when tested in a small coil (FeatherM0.4). Then a first dipole magnet, wound with two low grade Roebel cables of 25 m each, was assembled and tested. The dipole reached the short sample critical current of 6 kA generating more than 3 T central field at about 5.7 K, with indications of good current transfer among cable strands and of relatively soft transition. The construction of a costheta dipole is also discussed. Eucard2 is reaching its objective and is continuing with the H2020-ARIES program aiming at doubling the Je at 20 T to obtain 6 T as standalone and 18 T as insert in a high field facility.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, European Organization for Nuclear Research, CNRS Centre National de la Recherche Scientifique, Universite de Geneve, Istituto Nazionale Di Fisica Nucleare, Frascati, University of Twente, IRFM, Institut de Recherche sur les Lois Fondamentales de l'Univers, Karlsruhe Institute of Technology, Institute for Technical Physics, Germany, Karlsruhe Institute for Technology, Geneva University Hospital, Institut NÉEL, University of Southampton, United Kingdom, Danish Technological Institute

Contributors: Rossi, L., Badel, A., Bajas, H., Bajko, M., Ballarino, A., Barth, C., Betz, U., Bottura, L., Broggi, F., Chiuchiolo, A., Dhalle, M., Durante, M., Fazilleau, P., Fleiter, J., Gao, P., Goldacker, W., Kario, A., Kirby, G., Lorin, C., Murtomaeki, J. S., van Nugteren, J., Petrone, C., DeRijk, G., Senatore, C., Statera, M., Stenvall, A., Tixador, P., Yang, Y., Usoskin, A., Zangenberg, N.

Publication date: Apr 2018

Peer-reviewed: Yes

Early online date: 22 Dec 2017

#### Publication information

Journal: IEEE Transactions on Applied Superconductivity

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Issue number: 3

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Accelerator Magnets, Coils, Collaboration, Conductors, Critical current density (superconductivity), High-temperature superconductors, HTS conductor, HTS dipoles, Superconducting magnets

DOIs:

10.1109/TASC.2017.2784357

Source: Scopus

Source ID: 85039777831

Research output: Contribution to journal › Article › Scientific › peer-review

### The Impact of Protection Heater Delays Distribution on the Hotspot Temperature in a High-Field Accelerator Magnet

Quench protection is one of the challenges in the development of high-field superconducting magnets for future particle accelerators, such as the High-Energy and High-Luminosity LHC. The protection of the accelerator magnets up to now has relied on protection heaters to spread the normal zone across the winding, thus increasing the magnet resistance. The design of the protection heaters layout largely deals with the optimal positioning of the available heater energy on the coil surface. The aim is to quickly bring a large fraction of the winding to resistive state and induce a fast current discharge. Since the coil consists of different field regions, different approaches for heater energy distribution can be considered. Possible optimization criteria can be, for example, the minimum average delay in all the coils, the minimum first delay, or the minimum last delay. In this paper, we present a study of the impact of heater delay distribution on the resulting current decay and hotspot temperature. We use our newly developed current decay model to simulate the magnet current decay rate for different heater designs. We consider the case of the LARP-CERN MQXF magnet, being developed for the LHC luminosity upgrade.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics

Contributors: Salmi, T., Stenvall, A.

Publication date: 1 Jun 2016

Peer-reviewed: Yes

#### Publication information

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Volume: 26

Issue number: 4

Article number: 4001405

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2016): CiteScore 2.6 SJR 0.398 SNIP 1.132

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: Heater delays, hotspot temperature, protection heaters, quench protection, superconducting magnets

DOIs:

10.1109/TASC.2016.2517238

Source: Scopus

Source ID: 84962385287

Research output: Contribution to journal › Article › Scientific › peer-review

### Theoretical studies of structural properties of the high- $T_c$ superconductor $Y_1Ba_2Cu_3O_{7-x}$

Structural properties of the high temperature oxide superconductor  $Y_1Ba_2Cu_3O_{7-gc}$  have been studied by static lattice simulation methods. Empirical (ionic) potentials, derived on the basis of experimental data, are used to describe the basic structural properties of the superconductive oxides. Several potential models, with different location of the extra charge for the  $O_7$  compound, have been tested with respect to experimental lattice parameters. Fair parametrizations have been found in almost all cases, but they are usually valid only for a specific oxygen content. However, potential models, consistent both for  $O_6$  and  $O_7$ , have been found. We present the best of our ionic models, where, in  $O_7$ , two thirds of the holes are distributed in the sheet-site oxygens and one third in oxygens between the sheet and chain planes.

#### General information

Publication status: Published

MoE publication type: Not Eligible

Organisations: Brookhaven National Laboratory

Contributors: Valkealahti, S., Welch, D. O.

Number of pages: 2

Pages: 540-541

Publication date: 1 Jan 1989

Peer-reviewed: Yes

### Publication information

Journal: Physica C: Superconductivity and its Applications

Volume: 162-164

Issue number: PART 1

ISSN (Print): 0921-4534

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Energy Engineering and Power Technology, Electrical and Electronic Engineering

DOIs:

10.1016/0921-4534(89)91145-3

Source: Scopus

Source ID: 0024887115

Research output: Contribution to journal › Article › Scientific › peer-review

### The red, purple and blue modifications of polymeric unsymmetrical hydroxyalkadiynyl-N-arylcarbamate derivatives in Langmuir-Schaefer films

Solid topochemical photopolymerization (STP) of Langmuir-Schaefer films of a new class of unsymmetrical diynes, containing N-arylcarbamate groups in the hydrophobic part and hydroxymethylene groups in the hydrophilic part of the molecules was examined. In addition, the monomeric Langmuir monolayer formation was studied by Brewster angle microscopy and the surface morphology of monomer and polymer films on solid substrates were studied by scanning electron microscopy and atomic force microscopy. Three phases of polydiacetylene (PDA) (red, purple and blue) were observed after UV-light polymerization of above-mentioned films of alcohol diacetylene (DA) derivatives. The substitution of MeO group in the aryl ring substituent by hydrogen atom and the variation of the methylene group number in the hydrophobic part from 5 to 6 changed significantly the result of STP: instead of blue phase PDA observed for diynes with MeO group, the red phase PDA was observed for DA with H-atom from the very beginning of diyne film UV irradiation. For two other diynilic N-arylcarbamates of identical chemical structures except of the substituents in the aryl ring of hydrophobic parts of the molecules, no changes in the efficiency of polymerization or the position and shape of absorption bands were observed. This indicated the formation of the purple phase PDA. For these molecules, the number of methylene groups in hydrophobic and hydrophilic parts of the molecules was 9 and 2, respectively.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Chemistry and Bioengineering, Research group: Supramolecular photochemistry, A. M. Prokhorov General Physics Institute, Russian Academy of Sciences, Åbo Akademi University, St. Petersburg State University, NRC Kurchatov Institute, Russian Acad Sci, Russian Academy of Sciences, Kotelnikov Inst Radio Engn & Elect  
Contributors: Alekseev, A., Ihalainen, P., Ivanov, A., Domnin, I., Klechkovskaya, V., Orekhov, A., Lemmetyinen, H., Vuorimaa-Laukkanen, E., Peltonen, J., Vyaz'min, S.

Number of pages: 9

Pages: 463-471

Publication date: 1 Aug 2016

Peer-reviewed: Yes

### Publication information

Journal: Thin Solid Films

Volume: 612

ISSN (Print): 0040-6090

Ratings:

Scopus rating (2016): CiteScore 3.7 SJR 0.639 SNIP 0.863

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Materials Chemistry, Metals and Alloys, Surfaces, Coatings and Films, Surfaces and Interfaces

Keywords: Langmuir monolayer, Langmuir-Schaefer film, Polydiacetylenes with urethane group, Solid topochemical photopolymerization

DOIs:

10.1016/j.tsf.2016.06.044

### Bibliographical note

EXT="Alekseev, Alexander"

Source: Scopus

Source ID: 84976884439

Research output: Contribution to journal › Article › Scientific › peer-review

### **Thermal effects on the Wigner localization and Friedel oscillations in many-electron nanowires**

Thermal effects on the total charge density are studied for a one-dimensional correlated quantum dot by means of the path integral Monte Carlo method. The competition between Friedel and Wigner oscillations at zero temperature is driven by the ratio between the interaction of electronic strength and the kinetic energy of electrons. At the onset of the formation of a Wigner molecule, we show that thermal enhancement of Wigner oscillations occurs in a range of temperatures, which can be observed in the electron density. We further show that low-temperature Friedel oscillations may change to Wigner oscillations upon an increase in the temperature.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, CNR-SPIN, University of Würzburg

Contributors: Kylänpää, I., Cavaliere, F., Ziani, N. T., Sasseti, M., Räsänen, E.

Publication date: 13 Sep 2016

Peer-reviewed: Yes

#### **Publication information**

Journal: Physical Review B

Volume: 94

Issue number: 11

Article number: 115417

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2016): CiteScore 8.6 SJR 2.339 SNIP 1.183

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.94.115417

Source: Scopus

Source ID: 84990960683

Research output: Contribution to journal > Article > Scientific > peer-review

### **Thermal evaporation of Ge on Si for near infrared detectors: Material and device characterization**

Using a low-temperature process, we thermally evaporated Ge thin films on Si substrates and investigated both structural and electrical properties of samples grown at various temperatures. The characterization included X-ray diffraction, atomic force microscopy and Hall measurements and aimed at determining a suitable temperature range in terms of crystal quality and transport properties. Finally, we employed Ge films on Si to fabricate near infrared photodiodes and test them in terms of dark current and responsivity.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, University "Roma Tre", Nonlinear Optics and OptoElectronics Lab, Centro S3, Institute IMEM-CNR

Contributors: Sorianello, V., Colace, L., Assanto, G., Notargiacomo, A., Armani, N., Rossi, F., Ferrari, C.

Number of pages: 4

Pages: 526-529

Publication date: Apr 2011

Peer-reviewed: Yes

#### **Publication information**

Journal: Microelectronic Engineering

Volume: 88

Issue number: 4

ISSN (Print): 0167-9317

Ratings:

Scopus rating (2011): CiteScore 2.8 SJR 0.813 SNIP 1.148

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Atomic and Molecular Physics, and Optics, Condensed Matter Physics

Keywords: Germanium, Photodetectors, Thermal evaporation

DOIs:

10.1016/j.mee.2010.09.024

URLs:

<http://www.scopus.com/inward/record.url?scp=79751530052&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79751530052

Research output: Contribution to journal › Article › Scientific › peer-review

### **Thermally evaporated single-crystal Germanium on Silicon**

Using conventional and polarization-dependent Raman spectroscopy we investigate the structural properties of Germanium films thermally evaporated on Silicon under various conditions. The analysis suggests that the Ge films can be crystalline, amorphous and poly-oriented, depending on the substrate temperature. We use both comparison with Raman spectra of Ge films grown on amorphous substrates and polarization-dependent Raman measurements to demonstrate that in the 250-450 °C interval, crystalline Ge films are epitaxial. This result is validated by means of large angle X-ray diffraction measurements. We employ these films to fabricate and characterize near infrared heterojunction photodiodes that exhibit high responsivities and low dark current densities.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, University "Roma Tre", Università dell'Aquila, Nonlinear Optics and OptoElectronics Lab

Contributors: Sorianello, V., Colace, L., Nardone, M., Assanto, G.

Number of pages: 4

Pages: 8037-8040

Publication date: 1 Sep 2011

Peer-reviewed: Yes

#### **Publication information**

Journal: Thin Solid Films

Volume: 519

Issue number: 22

ISSN (Print): 0040-6090

Ratings:

Scopus rating (2011): CiteScore 3.4 SJR 0.995 SNIP 1.323

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Materials Chemistry, Metals and Alloys, Surfaces, Coatings and Films, Surfaces and Interfaces

Keywords: Germanium, Near infrared, Photodetectors, Raman characterization, Thermal evaporation

DOIs:

10.1016/j.tsf.2011.06.023

URLs:

<http://www.scopus.com/inward/record.url?scp=80052110605&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 80052110605

Research output: Contribution to journal › Article › Scientific › peer-review

### **Thermal, structural and optical properties of Er<sup>3+</sup> doped phosphate glasses containing silver nanoparticles**

The melt-quenching method is employed to prepare the amorphous phosphate glasses containing silver nanoparticles (Ag NPs). The structural characteristics of phosphate glasses were investigated by X-ray diffraction, thermal analysis, transmission electron microscopy, UV-Vis spectroscopy, Raman, and infrared spectroscopy. The transmission electron microscopic images confirm the presence of spherical silver NPs having an average diameter in the range of 20-40 nm. The EDX analysis spectrum shows the presence of Ag element. Important structural changes induced by the Ag<sub>2</sub>CO<sub>3</sub> addition to the phosphate glass, Raman- and IR-spectroscopic studies were carried out in order to correlate the variations in the glass properties with variations of the glass structure. The surface plasmon resonance (SPR) peak of silver nanoparticles embedded in Er<sup>3+</sup> doped phosphate glass is evidenced at ~403 nm. From the absorption spectra, the optical band gap is found to decrease with the increase of Ag NPs' concentration. All the obtained results in the present study were reported and discussed in detail.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Physical Chemistry Laboratory of Mineral Materials and Their Applications, National Center of Research in Materials Science, Åbo Akademi

Contributors: Soltani, I., Hraiech, S., Horchani-Naifer, K., Massera, J., Petit, L., Férid, M.

Number of pages: 7  
Pages: 67-73  
Publication date: 15 Apr 2016  
Peer-reviewed: Yes

#### Publication information

Journal: Journal of Non-Crystalline Solids  
Volume: 438  
ISSN (Print): 0022-3093  
Ratings:

Scopus rating (2016): CiteScore 3.5 SJR 0.685 SNIP 1.154

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Ceramics and Composites, Electronic, Optical and Magnetic Materials, Materials Chemistry

Keywords: FTIR and Raman spectra, Phosphate glasses, Silver nanoparticles (Ag NPs), Thermal stability  
DOIs:

10.1016/j.jnoncrysol.2015.12.022

#### Bibliographical note

EXT="Petit, L."

Source: Scopus

Source ID: 84960866255

Research output: Contribution to journal > Article > Scientific > peer-review

#### The sensitivity of random polymer brush-lamellar polystyrene-b-polymethylmethacrylate block copolymer systems to process conditions

The use of random copolymer brushes (polystyrene- r-polymethylmethacrylate - PS- r-PMMA) to 'neutralise' substrate surfaces and ordain perpendicular orientation of the microphase separated lamellae in symmetric polystyrene- b-polymethylmethacrylate (PS- b-PMMA) block copolymers (BCPs) is well known. However, less well known is how the brushes interact with both the substrate and the BCP, and how this might change during thermal processing. A detailed study of changes in these films for different brush and diblock PS- b-PMMA molecular weights is reported here. In general, self-assembly and pattern formation is altered little, and a range of brush molecular weights are seen to be effective. However, on extended anneal times, the microphase separated films can undergo dimension changes and loss of order. This process is not related to any complex microphase separation dynamics but rather a degradation of methacrylate components in the film. The data suggest that care must be taken in interpretation of structural changes in these systems as being due to BCP only effects.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Tyndall National Institute at National University of Ireland, Cork, Materials Chemistry and Analysis Group, University College Cork, Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), Trinity College Dublin, Leixlip Co.

Contributors: Borah, D., Rasappa, S., Senthamaraiannan, R., Shaw, M. T., Holmes, J. D., Morris, M. A.

Number of pages: 11

Pages: 192-202

Publication date: 1 Mar 2013

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Colloid and Interface Science

Volume: 393

Issue number: 1

ISSN (Print): 0021-9797

Ratings:

Scopus rating (2013): CiteScore 6.1 SJR 1.195 SNIP 1.437

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Surfaces, Coatings and Films, Colloid and Surface Chemistry

Keywords: Microphase separation, Polymer brush, Polystyrene-b-polymethylmethacrylate, Polystyrene-r-polymethylmethacrylate, Surface morphology

DOIs:

10.1016/j.jcis.2012.10.070

URLs:

<http://www.scopus.com/inward/record.url?scp=84873060382&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84873060382

Research output: Contribution to journal › Article › Scientific › peer-review

### Third order nonlinear optical response of TTF-based molecular corners

Comparative study of the nonlinear optical response of pyrrolo-tetrathiafulvalene polygons has been carried out. These materials are of great importance for photonics, because they can be used as building blocks for more complicated molecular systems like rotaxanes, catenanes which are promising candidates for opto-electronic applications like optical computing, optical switching etc. During this work the third order nonlinear susceptibility ( $\chi^{(3)}$ ) has been determined by the Degenerate Four Wave Mixing experiment, while the imaginary part of the  $\chi^{(3)}$ , which is related with the nonlinear absorption was determined by "open-aperture" Z-scan measurements. Moreover measurements have been carried out in order to provide information about the optical limiting efficiency of the materials. High  $\chi^{(3)}$  has been found reaching  $2.30 \times 10^{-21} \text{ m}^2/\text{V}^2$ , corresponding to second order hyperpolarizability  $\gamma$  values of about  $6.5 \times 10^{-45} \text{ m}^5/\text{V}^2$ .

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, CNRS, Centre National de la Recherche Scientifique (CNRS), Universite de Bordeaux - PRES, Lab Bordelais Rech Informat, PICTURA Res Grp, UMR 5800, Univ Angers, Centre National de la Recherche Scientifique (CNRS), University of Nantes Angers Le Mans, University of Angers, CNRS UMR 6200, Inst Sci & Technol Mol Angers, LUNAM Université, Laboratoire MOLTECH-Anjou

Contributors: Iliopoulos, K., Czaplicki, R., Ouazzani, H. E., Balandier, J., Chas, M., Goeb, S., Sallé, M., Gindre, D., Sahraoui, B.

Number of pages: 8

Pages: 205-212

Publication date: 2012

Peer-reviewed: Yes

#### Publication information

Journal: Nonlinear Optics, Quantum Optics

Volume: 43

Issue number: 1-4

ISSN (Print): 1543-0537

Ratings:

Scopus rating (2012): CiteScore 0.7 SJR 0.211 SNIP 0.272

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Statistical and Nonlinear Physics, Instrumentation , Computer Science(all), Electronic, Optical and Magnetic Materials

Keywords: Degenerate four wave mixing (DFWM), Nonlinear optical response, TTF derivatives, Z-scan

URLs:

<http://www.scopus.com/inward/record.url?scp=84862149419&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84862149419

Research output: Contribution to journal › Article › Scientific › peer-review

### Three-color vector nematicon

Light localization via reorientation in nematic liquid crystals supports multi-component optical spatial solitons, i.e., vector nematicons. By launching three optical beams of different wavelengths and the same input polarization in a bias-free planar cell, we demonstrate a three-color vector nematicon which is self-trapped thanks to its incoherent nature.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, Politechnika Warszawska, Univ Roma Tre, Roma Tre University, Dept Elect Engrn, NooEL, University "Roma Tre", Aerosol Physics Laboratory

Contributors: Laudyn, U. A., Kwaśny, M., Karpierz, M. A., Assanto, G.

Number of pages: 3

Pages: 36-38

Publication date: 2017

Peer-reviewed: Yes

#### Publication information

Journal: Photonics Letters of Poland

Volume: 9

Issue number: 2

ISSN (Print): 2080-2242

Ratings:

Scopus rating (2017): CiteScore 0.9 SJR 0.25 SNIP 0.446

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Electronic versions:

718-2839-1-PB

DOIs:

10.4302/plp.v9i2.718

URLs:

<http://urn.fi/URN:NBN:fi:tty-201708071660>

Source: Scopus

Source ID: 85021814168

Research output: Contribution to journal › Article › Scientific › peer-review

### **Towards REBCO 20T+ Dipoles for Accelerators**

ReBCO High Temperature Superconducting (HTS) coated conductor tapes are a promising candidate for pushing the magnetic fields in accelerator magnets well beyond 20 T. They are capable of very high current densities in intense applied magnetic field, have a very high thermal stability, can withstand high transverse pressures and allow operation in 20 to 30 K helium gas flow, potentially reducing operating cost significantly. During the EuCARD2 program significant developments have been made in terms of coil design, manufacturing and testing. Now that EuCARD2 has come to an end, CERN and collaborators are initiating a new program to continue the development of HTS accelerator magnets. This paper presents our initial thoughts on the conceptual design of a 20 T+ accelerator magnet, using the results and technologies from EuCARD2 combined with some new ideas. The paper discusses the options available for the cross-sectional layout, the use of a hybrid configurations including Aligned Block, the design of the coil-ends and dual aperture configurations. Also discussed is the quench protection of the magnets. Due to the high thermal stability of the conductor and high energy densities it will be required to explore an entirely new approach.

### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Electrical Energy Engineering, European Organization for Nuclear Research

Contributors: van Nugteren, J., Kirby, G., Murtomaki, J., DeRijk, G., Rossi, L., Stenvall, A.

Publication date: Jun 2018

Peer-reviewed: Yes

Early online date: 27 Mar 2018

### **Publication information**

Journal: IEEE Transactions on Applied Superconductivity

Volume: 28

Issue number: 4

Article number: 4008509

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2018): CiteScore 2.9 SJR 0.406 SNIP 0.987

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Electrical and Electronic Engineering

Keywords: Accelerator Dipoles, Accelerator magnets, Conductors, Current density, High-temperature superconductors, HTS Magnets, Magnet Stability, Magnet Structure, Perpendicular magnetic anisotropy, Quench Protection, Superconducting magnets

DOIs:

10.1109/TASC.2018.2820177

Source: Scopus

Source ID: 85044849023

Research output: Contribution to journal › Article › Scientific › peer-review

### **Towards universal enrichment nanocoating for IR-ATR waveguides**

Polymer multilayered nanocoating capable of concentrating various chemical substances at IR-ATR waveguide surfaces is described. The coating affinity to an analyte played a pivotal role in sensitivity enhancement of the IR-ATR measurements, since the unmodified waveguide did not show any analyte detection.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Frontier Photonics, Clemson University, School of Materials Science and Engineering/COMSET, University of Delaware, Massachusetts Institute of Technology

Contributors: Giammarco, J., Zdyrko, B., Petit, L., Musgraves, J. D., Hu, J., Agarwal, A., Kimerling, L., Richardson, K., Luzinov, I.

Number of pages: 3

Pages: 9104-9106

Publication date: 28 Aug 2011

Peer-reviewed: Yes

### Publication information

Journal: Chemical Communications

Volume: 47

Issue number: 32

ISSN (Print): 1359-7345

Ratings:

Scopus rating (2011): CiteScore 7.9 SJR 2.889 SNIP 1.326

Original language: English

ASJC Scopus subject areas: Catalysis, Electronic, Optical and Magnetic Materials, Ceramics and Composites, Chemistry(all), Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

DOIs:

10.1039/c1cc12780b

URLs:

<http://www.scopus.com/inward/record.url?scp=79961012632&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79961012632

Research output: Contribution to journal › Article › Scientific › peer-review

### Transmission, refraction, and focusing properties of labyrinth based left-handed metamaterials

In this present article, we studied the transmission, refraction and focusing properties of one, two and three dimensional labyrinth based left-handed metamaterials. We demonstrated that the proper periodic arrangement of labyrinth structures and wires results in left-handed transmission. By using a two dimensional labyrinth based left-handed slab, it is shown that it is possible to image the field emitted from source in sub-wavelength detail. Moreover, we demonstrated the focusing and negative refraction of electromagnetic waves by a three dimensional labyrinth based left-handed slab.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Nanotechnology Research Center

Contributors: Özbay, E., Bulu, I., Caglayan, H.

Number of pages: 9

Pages: 1202-1210

Publication date: Apr 2007

Peer-reviewed: Yes

### Publication information

Journal: Physica Status Solidi (B) Basic Research

Volume: 244

Issue number: 4

ISSN (Print): 0370-1972

Ratings:

Scopus rating (2007): SJR 0.871 SNIP 0.721

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1002/pssb.200674507

URLs:

<http://www.scopus.com/inward/record.url?scp=34247328206&partnerID=8YFLogxK> (Link to publication in Scopus)

### Bibliographical note

EXT="Caglayan, Humeyra"

Source: Scopus

### Transparent Yb<sup>3+</sup> doped phosphate glass-ceramics

Yb<sup>3+</sup> doped oxyfluorophosphate glasses with the composition (98.75) [90NaPO<sub>3</sub>-(10-x) Na<sub>2</sub>O-xNaF] - 1.25Yb<sub>2</sub>O<sub>3</sub> (in mol%) with x = 0, 2.5, 5, 7.5 and 10 were prepared using a standard melting process. The progressive replacement of Na<sub>2</sub>O by NaF leads to an increase in the number of Q<sup>2</sup> units at the expense of the Q<sup>1</sup> units. This increase in the polymerization of the glass network leads to a shift of the optical band gap to lower wavelength, to a slight increase in the intensity of the emission at 1000 nm and more importantly to a change in the glass crystallization process. Indeed, both surface and bulk crystallization were observed in the glass with x = 0 while surface crystallization only occurs when NaF is added in the phosphate network. The heat treatment leads to the precipitation of at least three crystalline phases: as x increases, the NaPO<sub>3</sub> phase grows at the expense of Na<sub>5</sub>P<sub>3</sub>O<sub>10</sub>. All glasses precipitate the Yb containing crystal, NaYbP<sub>2</sub>O<sub>7</sub> which leads to an increase in the intensity of the emission at 1000 nm compared to the emission at 975 nm. We show for the first time to the best of our knowledge that transparent Yb<sup>3+</sup> doped phosphate glass-ceramics can be obtained within this glass system when free of NaF.

#### General information

Publication status: E-pub ahead of print

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Fondazione LINKS – Leading Innovation & Knowledge for Society, CNRS, Université de Bordeaux, ICMCB

Contributors: Hongisto, M., Veber, A., Boetti, N. G., Danto, S., Jubera, V., Petit, L.

Publication date: 1 Jan 2020

Peer-reviewed: Yes

#### Publication information

Journal: Ceramics International

ISSN (Print): 0272-8842

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Process Chemistry and Technology, Surfaces, Coatings and Films, Materials Chemistry

Keywords: Glass-ceramic, Luminescence, Phosphate glass, XRD, Yb

DOIs:

10.1016/j.ceramint.2020.01.121

Source: Scopus

Source ID: 85077933290

Research output: Contribution to journal › Article › Scientific › peer-review

### Transverse deformation of a lamellar TiAl alloy at high temperature by in situ microcompression

The distribution of strain in hard mode oriented lamellar stacks of the two-phase  $\gamma$ -TiAl/ $\alpha_2$ -Ti<sub>3</sub>Al alloy Ti-45Al-2Nb-2Mn (at.%) - 0.8 vol% TiB<sub>2</sub> was measured at several temperatures up to 633 °C by in situ micropillar compression, complemented by electron backscatter diffraction orientation mapping and digital image correlation strain mapping of a thermally stable surface Pt speckle pattern. Post-mortem transmission electron microscopy further identified the finest scale deformation structures. It was found that slip and twinning transverse to the lamellae operates within discreet bands that zigzag across the lamellar structure. The shear strain within each band is approximately constant across the pillar width. This is inconsistent with current energetic models for transverse twin formation in  $\gamma$ -TiAl, which assume independent, non-interacting twins. This is explained using a mathematical formulation for the stress required to operate this transverse mechanical twinning as a function of strain. This study has elucidated how the multi-scale combination of several transverse twinning systems on different {111} planes in  $\gamma$ -TiAl lamellae can relieve the elastic stresses generated at a lamellar interface by the primary (highest Schmid factor) twinning system. It is thought that the facilitation of this mechanism will promote the ductilisation of lamellar  $\gamma$ -TiAl alloys. This is crucial for an increased damage tolerance and ease of component manufacture, leading to a more widespread use of  $\gamma$ -TiAl alloys.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Materials Science, University of Cambridge, Swiss Federal Laboratories for Materials Science and Technology

Contributors: Edwards, T. E. J., Di Gioacchino, F., Goodfellow, A. J., Mohanty, G., Wehrs, J., Michler, J., Clegg, W. J.

Number of pages: 15

Pages: 85-99

Publication date: 1 Mar 2019

Peer-reviewed: Yes

Early online date: 27 Nov 2018

### Publication information

Journal: Acta Materialia

Volume: 166

ISSN (Print): 1359-6454

Ratings:

Scopus rating (2019): CiteScore 13.8 SJR 3.662 SNIP 3.037

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Ceramics and Composites, Polymers and Plastics, Metals and Alloys

Keywords: Deformation twinning, Digital image correlation, Electron backscattering diffraction (EBSD), Scanning transmission electron microscopy, Titanium aluminide polysynthetically twinned crystal (PST)

DOIs:

10.1016/j.actamat.2018.11.050

Source: Scopus

Source ID: 85058779138

Research output: Contribution to journal > Article > Scientific > peer-review

### Tuneable topological domain wall states in engineered atomic chains

Topological modes in one- and two-dimensional systems have been proposed for numerous applications utilizing their exotic electronic responses. The 1D, zero-energy, topologically protected end modes can be realized in structures implementing the Su–Schrieffer–Heeger (SSH) model. While the edge modes in the SSH model are at exactly the mid-gap energy, other paradigmatic 1D models such as trimer and coupled dimer chains have non-zero energy boundary states. However, these structures have not been realized in an atomically tuneable system that would allow explicit control of the edge modes. Here, we demonstrate atomically controlled trimer and coupled dimer chains realized using chlorine vacancies in the  $c(2 \times 2)$  adsorption layer on Cu(100). This system allows wide tuneability of the domain wall modes that we experimentally demonstrate using low-temperature scanning tunneling microscopy (STM).

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research area: Computational Physics, Aalto University, Helsinki Institute of Physics, Max-Planck-Institut für Festkörperforschung

Contributors: Huda, M. N., Kezilebieke, S., Ojanen, T., Drost, R., Liljeroth, P.

Number of pages: 5

Publication date: 2020

Peer-reviewed: Yes

### Publication information

Journal: npj Quantum Materials

Volume: 5

Issue number: 1

Article number: 17

ISSN (Print): 2397-4648

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Electronic versions:

Tuneable topological domain wall states 2020

DOIs:

10.1038/s41535-020-0219-3

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202004153241>

Source: Scopus

Source ID: 85081728975

Research output: Contribution to journal > Article > Scientific > peer-review

### Tuning electronic properties of graphene heterostructures by amorphous-to-crystalline phase transitions

The remarkable ability of phase change materials (PCM) to switch between amorphous and crystalline states on a nanosecond time scale could provide new opportunities for graphene engineering. We have used density functional calculations to investigate the structures and electronic properties of heterostructures of thin amorphous and crystalline films of the PCM GeTe (16 Å thick) and Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub> (20 Å) between graphene layers. The interaction between graphene and PCM is very weak, charge transfer is negligible, and the structures of the chalcogenide films differ little from those of bulk phases. A crystalline GeTe (111) layer induces a band gap opening of 80 meV at the Dirac point. This effect is absent for the amorphous film, but the Fermi energy shifts down along the Dirac cone by -60 meV. Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub> shows similar features, although inherent disorder in the crystalline rocksalt structure reduces the contrast in band structure from that in the amorphous structure. These features originate in charge polarization within the crystalline films, which show

electromechanical response (piezoelectricity) upon compression, and show that the electronic properties of graphene structures can be tuned by inducing ultrafast structural transitions within the chalcogenide layers. Graphene can also be used to manipulate the structural state of the PCM layer and its electronic and optical properties.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research area: Computational Physics, Research group: Materials and Molecular Modeling, COMP Centre of Excellence, Aalto University, Molecular Foundry, Lawrence Berkeley National Laboratory, Forschungszentrum Jülich (FZJ)

Contributors: Kulju, S., Akola, J., Prendergast, D., Jones, R. O.

Number of pages: 8

Publication date: 31 May 2016

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 93

Issue number: 19

Article number: 195443

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2016): CiteScore 8.6 SJR 2.339 SNIP 1.183

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1103/PhysRevB.93.195443

Source: Scopus

Source ID: 84973352747

Research output: Contribution to journal > Article > Scientific > peer-review

#### Two cations, two mechanisms: Interactions of sodium and calcium with zwitterionic lipid membranes

Adsorption of metal cations onto a cellular membrane changes its properties, such as interactions with charged moieties or the propensity for membrane fusion. It is, however, unclear whether cells can regulate ion adsorption and the related functions via locally adjusting their membrane composition. We employed fluorescence techniques and computer simulations to determine how the presence of cholesterol - a key molecule inducing membrane heterogeneity - affects the adsorption of sodium and calcium onto zwitterionic phosphatidylcholine bilayers. We found that the transient adsorption of sodium is dependent on the number of phosphatidylcholine head groups, while the strong surface binding of calcium is determined by the available surface area of the membrane. Cholesterol thus does not affect sodium adsorption and only plays an indirect role in modulating the adsorption of calcium by increasing the total surface area of the membrane. These observations also indicate how lateral lipid heterogeneity can regulate various ion-induced processes including adsorption of peripheral proteins, nanoparticles, and other molecules onto membranes.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, University of Helsinki, J. Heyrovský Institute of Physical Chemistry, Institute of Organic Chemistry and Biochemistry, Academy of Sciences of the Czech Republic

Contributors: Javanainen, M., Melcrová, A., Magarkar, A., Jurkiewicz, P., Hof, M., Jungwirth, P., Martinez-Seara, H.

Number of pages: 4

Pages: 5380-5383

Publication date: 2017

Peer-reviewed: Yes

#### Publication information

Journal: Chemical Communications

Volume: 53

Issue number: 39

ISSN (Print): 1359-7345

Ratings:

Scopus rating (2017): CiteScore 11.9 SJR 2.555 SNIP 1.127

Original language: English

ASJC Scopus subject areas: Catalysis, Electronic, Optical and Magnetic Materials, Ceramics and Composites, Chemistry(all), Surfaces, Coatings and Films, Metals and Alloys, Materials Chemistry

Electronic versions:

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DOIs:

10.1039/c7cc02208e

URLs:

<http://urn.fi/URN:NBN:fi:tty-201712202418>

Source: Scopus

Source ID: 85021689400

Research output: Contribution to journal > Article > Scientific > peer-review

### Two-time coherence of pulse trains and the integrated degree of temporal coherence

We examine the temporal coherence properties of trains of nonidentical short optical pulses in the framework of the second-order coherence theory of nonstationary light. Considering Michelson's interferometric measurement of temporal coherence, we demonstrate that time-resolved interferograms reveal the full two-time temporal coherence function of the partially coherent pulse train. We also show that the result given by the time-integrated Michelson interferogram equals the true degree of temporal coherence only when the pulse train is quasistationary, i.e., the coherence time is a small fraction of the pulse duration. True two-time and integrated coherence functions produced by specific models representing perturbed trains of mode-locked pulses and supercontinuum pulse trains produced in nonlinear fibers are illustrated.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research group: Nonlinear Fiber Optics, Research area: Optics, Frontier Photonics, Ita-Suomen yliopisto, Institute of Photonics

Contributors: Dutta, R., Friberg, A. T., Genty, G., Turunen, J.

Number of pages: 7

Pages: 1631-1637

Publication date: 2015

Peer-reviewed: Yes

#### Publication information

Journal: Journal of the Optical Society of America A: Optics Image Science and Vision

Volume: 32

Issue number: 9

ISSN (Print): 1084-7529

Ratings:

Scopus rating (2015): CiteScore 3.4 SJR 0.918 SNIP 1.103

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Computer Vision and Pattern Recognition

DOIs:

10.1364/JOSAA.32.001631

URLs:

<http://www.scopus.com/inward/record.url?scp=84943414423&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84943414423

Research output: Contribution to journal > Article > Scientific > peer-review

### Ultrahigh-pressure form of Si O<sub>2</sub> glass with dense pyrite-type crystalline homology

High-pressure synthesis of denser glass has been a longstanding interest in condensed-matter physics and materials science because of its potentially broad industrial application. Nevertheless, understanding its nature under extreme pressures has yet to be clarified due to experimental and theoretical challenges. Here we reveal the formation of OSi<sub>4</sub> tetraclusters associated with that of SiO<sub>7</sub> polyhedra in SiO<sub>2</sub> glass under ultrahigh pressures to 200 gigapascal confirmed both experimentally and theoretically. Persistent homology analyses with molecular dynamics simulations found increased packing fraction of atoms whose topological diagram at ultrahigh pressures is similar to a pyrite-type crystalline phase, although the formation of tetraclusters is prohibited in the crystalline phase. This critical difference would be caused by the potential structural tolerance in the glass for distortion of oxygen clusters. Furthermore, an expanded electronic band gap demonstrates that chemical bonds survive at ultrahigh pressure. This opens up the synthesis of topologically disordered dense oxide glasses.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Physics, Research area: Computational Physics, Research group: Materials and Molecular Modeling, HCl e 486.1, Tohoku University, National Institute for Materials Science (NIMS), Japan Synchrotron Radiation Research

Institute, Japan Advanced Institute of Science and Technology, Japan Science and Technology Agency, Tokyo University of Science, Norwegian Univ. of Sci. and Technol., University of Tokyo, Waseda University, National Institute of Advanced Industrial Science and Technology, Research and Services Division of Materials Data and Integrated System (MaDIS) NIMS, Kyoto Women's University, RIKEN Center for Integrative Medical Sciences, Aalto University, COMP Centre of Excellence, Department of Applied Physics, Aalto University, Division of Electrical Engineering and Computer Science, Kanazawa University

Contributors: Murakami, M., Kohara, S., Kitamura, N., Akola, J., Inoue, H., Hirata, A., Hiraoka, Y., Onodera, Y., Obayashi, I., Kalikka, J., Hirao, N., Musso, T., Foster, A. S., Idemoto, Y., Sakata, O., Ohishi, Y.

Publication date: 29 Jan 2019

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 99

Issue number: 4

Article number: 045153

ISSN (Print): 2469-9950

Ratings:

Scopus rating (2019): SJR 1.811 SNIP 1.025

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics

DOIs:

10.1103/PhysRevB.99.045153

#### Bibliographical note

EXT="Foster, A. S."

Source: Scopus

Source ID: 85060951368

Research output: Contribution to journal > Article > Scientific > peer-review

#### Unveiling and controlling the electronic structure of oxidized semiconductor surfaces: Crystalline oxidized InSb(100)(1 × 2)-O: Crystalline oxidized InSb(100)(1 × 2)-O

The exothermic nature of oxidation causes nearly all semiconductor applications in various fields like electronics, medicine, photonics, and sensor technology to acquire an oxidized semiconductor surface part during the application manufacturing. The significance of understanding and controlling the atomic scale properties of oxidized semiconductor surfaces is expected to increase even further with the development of nanoscale semiconductor crystals. The nature of oxidized semiconductor layers is, however, hard to predict and characterize as they are usually buried and amorphous. To shed light on these issues, we pursue a different approach based on oxidized III-V semiconductor layers that are crystalline. We present a comprehensive characterization of oxidized crystalline InSb(100)(1×2)-O layers by ab initio calculations, photoelectron spectroscopy, scanning tunneling microscopy, and spectroscopy, and demonstrate the electronic band structures of different oxidized phases of the semiconductor, which elucidate the previous contradictory semiconductor-oxidation effects. At 0.5 monolayer (ML) oxidation, oxygen atoms tend to occupy subsurface Sb sites, leading to metallic states in the semiconductor band gap, which arise from top dimers. When the oxidation is increased to the 1.0-2.0 ML concentration, oxygen occupies also interstitial sites, and the insulating band structure without gap states is stabilized with unusual occupied In dangling bonds. In contrast, the 2.5-3.0 ML oxide phases undergo significant changes toward a less ordered structure. The findings suggest a methodology for manipulating the electronic structure of oxidized semiconductor layers. © 2014 American Physical Society.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Frontier Photonics, Turun Yliopisto/Turun Biomateriaalikeskus, Department of Physics and Astronomy, University of Turku, Lunds Universitet / Lunds Tekniska Högskola, Russian Academy of Sciences, Tampere University of Technology

Contributors: Lång, J. J. K., Punkkinen, M. P. J., Tuominen, M., Hedman, H. P., Vähä-Heikkilä, M., Polojärvi, V., Salmi, J., Korpjärvi, V. M., Schulte, K., Kuzmin, M., Punkkinen, R., Laukkanen, P., Guina, M., Kokko, K.

Number of pages: 9

Pages: 1-9

Publication date: 29 Jul 2014

Peer-reviewed: Yes

#### Publication information

Journal: Physical Review B

Volume: 90

Issue number: 4

Article number: 045312

ISSN (Print): 1098-0121

Ratings:

Scopus rating (2014): CiteScore 7 SJR 2.762 SNIP 1.316

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

DOIs:

10.1103/PhysRevB.90.045312

URLs:

<http://www.scopus.com/inward/record.url?scp=84905484394&partnerID=8YFLogxK> (Link to publication in Scopus)

### Bibliographical note

Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2015-01-12<br/>Publisher name: American Physical Society

Source: researchoutputwizard

Source ID: 883

Research output: Contribution to journal > Article > Scientific > peer-review

### Utilizing triangular mesh with MMEV to study hysteresis losses of round superconductors obeying critical state model

Nature's minimum energy principle formulated in minimum magnetic energy variation (MMEV) and coupled with the Bean's critical state model (CSM) has resulted in feasible tools to model hysteresis losses in superconductors. These tools have been applied for single wires as well as for multi-turn coils in two-dimensional modelling domains. However, so far the discretization of the modelling domain has always relied on regular rectangular meshes. Therefore, the mesh representation of round filaments suffers from large discretization error if the mesh is not refined considerably more than triangular meshing would need. In this paper, we study the utilisation of triangular mesh in such a hysteresis loss modelling tool. We present the required extension to the already available knowledge that is needed to implement such a modelling tool. With our home-brewed tool, we study the convergence of the simulated transport current losses in the cross-section of a round wire represented with triangular and rectangular meshes of different types and of different densities. According to the results, triangular meshing is considerably more efficient than rectangular meshing for simulating transport current losses in the investigated situation.

### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electrical Engineering, Research area: Electromagnetics

Contributors: Ruuskanen, J., Stenvall, A., Lahtinen, V.

Publication date: 1 Jun 2015

Peer-reviewed: Yes

### Publication information

Journal: IEEE Transactions on Applied Superconductivity

Volume: 25

Issue number: 3

Article number: 8200405

ISSN (Print): 1051-8223

Ratings:

Scopus rating (2015): CiteScore 2.5 SJR 0.403 SNIP 1.046

Original language: English

ASJC Scopus subject areas: Electrical and Electronic Engineering, Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: critical state model, hysteresis losses, minimum magnetic energy variation, Numerical modelling

DOIs:

10.1109/TASC.2014.2365408

Source: Scopus

Source ID: 84921532493

Research output: Contribution to journal > Article > Scientific > peer-review

### Very high dose electron irradiation effects on photoluminescence from GaInNAs/GaAs quantum wells grown by molecular beam epitaxy

The effects of 7 MeV electron irradiation at very high doses of  $2 \times 10^{17}$  and  $1.5 \times 10^{18}$  electrons/cm<sup>2</sup> and subsequent rapid thermal annealing on photoluminescence from a strain-compensated GaInAsN/GaAsN/GaAs quantum well structure are investigated. A large additional blueshift of photoluminescence has been observed from the lower-dose irradiated sample as compared to the non-irradiated one when annealed after the irradiation. This additional blueshift will become considerably reduced by an ageing effect, which occurs already at room temperature. The mechanism causing the additional blueshift of photoluminescence and its reduction is qualitatively assigned to metastable complex defects

promoted by electron irradiation in the nitrogen containing layers. No such additional blueshift of photoluminescence under the thermal treatment has been observed in the higher-dose irradiated sample.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Photonics, National Institute for Research and Development in Microtechnologies Romania, Faculty of Exact Sciences and Engineering, Hyperion University

Contributors: Pavelescu, E. M., Bălțățeanu, N., Spănulescu, S. I., Arola, E.

Number of pages: 5

Pages: 361-365

Publication date: 1 Feb 2017

Peer-reviewed: Yes

#### Publication information

Journal: Optical Materials

Volume: 64

ISSN (Print): 0925-3467

Ratings:

Scopus rating (2017): CiteScore 3.7 SJR 0.592 SNIP 1.054

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Computer Science(all), Atomic and Molecular Physics, and Optics, Electrical and Electronic Engineering

Keywords: Dilute nitrides, Electron irradiation, Photoluminescence

DOIs:

10.1016/j.optmat.2016.12.007

#### Bibliographical note

EXT="Pavelescu, E. M."

Source: Scopus

Source ID: 85008334984

Research output: Contribution to journal › Article › Scientific › peer-review

#### Vortex stabilization by means of spatial solitons in nonlocal media

We investigate how optical vortices, which tend to be azimuthally unstable in local nonlinear materials, can be stabilized by a copropagating coaxial spatial solitary wave in nonlocal, nonlinear media. We focus on the formation of nonlinear vortex-soliton vector beams in reorientational soft matter, namely nematic liquid crystals, and report on experimental results, as well as numerical simulations.

#### General information

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics

Contributors: Izdebskaya, Y., Krolikowski, W., Smyth, N. F., Assanto, G.

Publication date: 1 May 2016

Peer-reviewed: Yes

#### Publication information

Journal: Journal of Optics

Volume: 18

Issue number: 5

Article number: 054006

ISSN (Print): 2040-8978

Ratings:

Scopus rating (2016): CiteScore 3.4 SJR 0.715 SNIP 0.829

Original language: English

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials

Keywords: liquid crystals, optical vortex, self-action effects, spatial solitons

DOIs:

10.1088/2040-8978/18/5/054006

Source: Scopus

Source ID: 84969245814

Research output: Contribution to journal › Article › Scientific › peer-review

### **Wetting hysteresis induced by temperature changes: Supercooled water on hydrophobic surfaces**

The state and stability of supercooled water on (super)hydrophobic surfaces is crucial for low temperature applications and it will affect anti-icing and de-icing properties. Surface characteristics such as topography and chemistry are expected to affect wetting hysteresis during temperature cycling experiments, and also the freezing delay of supercooled water. We utilized stochastically rough wood surfaces that were further modified to render them hydrophobic or superhydrophobic. Liquid flame spraying (LFS) was utilized to create a multi-scale roughness by depositing titanium dioxide nanoparticles. The coating was subsequently made non-polar by applying a thin plasma polymer layer. As flat reference samples modified silica surfaces with similar chemistries were utilized. With these substrates we test the hypothesis that superhydrophobic surfaces also should retard ice formation. Wetting hysteresis was evaluated using contact angle measurements during a freeze-thaw cycle from room temperature to freezing occurrence at  $-7\text{ }^{\circ}\text{C}$ , and then back to room temperature. Further, the delay in freezing of supercooled water droplets was studied at temperatures of  $-4\text{ }^{\circ}\text{C}$  and  $-7\text{ }^{\circ}\text{C}$ . The hysteresis in contact angle observed during a cooling-heating cycle is found to be small on flat hydrophobic surfaces. However, significant changes in contact angles during a cooling-heating cycle are observed on the rough surfaces, with a higher contact angle observed on cooling compared to during the subsequent heating. Condensation and subsequent frost formation at sub-zero temperatures induce the hysteresis. The freezing delay data show that the flat surface is more efficient in enhancing the freezing delay than the rougher surfaces, which can be rationalized considering heterogeneous nucleation theory. Thus, our data suggests that molecular flat surfaces, rather than rough superhydrophobic surfaces, are beneficial for retarding ice formation under conditions that allow condensation and frost formation to occur.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Physics, Research area: Aerosol Physics, Research group: Aerosol Synthesis, KTH Royal Institute of Technology, Surface and Corrosion Science, SP Technical Research Institute of Sweden, Department of Civil and Architectural Engineering, Nanostructure Physics

Contributors: Heydari, G., Sedighi Moghaddam, M., Tuominen, M., Fielden, M., Haapanen, J., Mäkelä, J. M., Claesson, P. M.

Number of pages: 13

Pages: 21-33

Publication date: 15 Apr 2016

Peer-reviewed: Yes

#### **Publication information**

Journal: Journal of Colloid and Interface Science

Volume: 468

ISSN (Print): 0021-9797

Ratings:

Scopus rating (2016): CiteScore 7.2 SJR 1.156 SNIP 1.277

Original language: English

ASJC Scopus subject areas: Surfaces, Coatings and Films, Electronic, Optical and Magnetic Materials, Biomaterials, Colloid and Surface Chemistry

Keywords: Contact angle, Hydrophobization, Liquid flame spray (LFS), Morphology, Multi-scale roughness, Plasma polymerization, Supercooled water, Superhydrophobicity, Wetting hysteresis, Wood

DOIs:

10.1016/j.jcis.2016.01.040

Source: Scopus

Source ID: 84955276633

Research output: Contribution to journal > Article > Scientific > peer-review

### **Toward Graphene-Based Passive UHF RFID Textile Tags: A Reliability Study**

This paper discusses the fabrication, wireless performance, and reliability of graphene-based passive ultrahigh-frequency radio-frequency identification (RFID) tags on a fabric substrate. The conductive ink comprising functionalized graphene nanoplatelets is deposited directly on a cotton fabric substrate to fabricate the tag antennas. After attaching the chips, the tag performance is evaluated through wireless tag measurements before and after high-humidity conditions, bending, and stretching. Initially, the peak read range of the tag is about 1.6 m, which increases to 3.2 m in 100% humidity conditions. Additionally, after drying, the performance of the tag returns back to normal. In a bending test, the read range of a bent tag decreases below 1 m. Furthermore, the read range of the tag in a nonbended state gradually decreases and is about 1.1 m after 100 bending cycles. According to our measurements, stretching has a serious detrimental effect on these tags and they cannot be considered stretchable. However, these initial results show that this low-cost and eco-friendly graphene RFID tag has a remarkable and unique response to moisture and high reliability in harsh bending conditions. Overall, it also has a strong potential to be used in future wearable sensor applications.

#### **General information**

Publication status: Published

MoE publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group  
Contributors: Akbari, M., Virkki, J., Sydänheimo, L., Ukkonen, L.  
Number of pages: 3  
Pages: 429-431  
Publication date: 1 Sep 2016  
Peer-reviewed: Yes

#### **Publication information**

Journal: IEEE Transactions on Device and Materials Reliability

Volume: 16

Issue number: 3

ISSN (Print): 1530-4388

Ratings:

Scopus rating (2016): CiteScore 3.5 SJR 0.444 SNIP 1.273

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Safety, Risk, Reliability and Quality, Electrical and Electronic Engineering

Keywords: Bending, graphene, humidity, radio-frequency identification (RFID), reliability, stretching, wearable antennas

DOIs:

10.1109/TDMR.2016.2582261

Source: Scopus

Source ID: 84986587064

Research output: Contribution to journal › Letter › Scientific › peer-review

#### **Nonlinear optics applications: In memory of George I. Stegeman**

##### **General information**

Publication status: Published

MoE publication type: B1 Article in a scientific magazine

Organisations: Department of Physics, Aerosol Physics Laboratory, Nonlinear Optics and OptoElectronics Lab, University "Roma Tre"

Contributors: Assanto, G.

Number of pages: 1

Pages: 1

Publication date: 2016

Peer-reviewed: No

##### **Publication information**

Journal: Photonics Letters of Poland

Volume: 8

Issue number: 1

ISSN (Print): 2080-2242

Ratings:

Scopus rating (2016): CiteScore 0.9 SJR 0.197 SNIP 0.272

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Electronic versions:

Assanto - Nonlinear Optics Applications

DOIs:

10.4302/plp.2016.1.01

URLs:

<http://urn.fi/URN:NBN:fi:tty-201604253876>

Source: Scopus

Source ID: 84962141630

Research output: Contribution to journal › Editorial › Scientific

#### **Novel optical and photonic devices based on 2D materials: Feature issue introduction**

Since the isolation of graphene in 2004, two-dimensional (2D) materials with unique optical and electronic properties have attracted a wide interest and tremendous research, opening some promising applications in electronics, photonics and optoelectronics. This feature issue is aimed to capture the current state-of-the-art, new trends and directions in 2D-material-based optical and photonic devices, and seven research articles are collected in this issue.

### General information

Publication status: Published

MoE publication type: B1 Article in a scientific magazine

Organisations: Physics, Research group: Metaplasmonics, Xiamen University, Monash University, Swinburne University of Technology, Shenzhen University

Contributors: Luo, Z., Bao, Q., Caglayan, H., Jia, B., Zhang, H.

Number of pages: 2

Pages: 1344-1345

Publication date: 2020

Peer-reviewed: No

### Publication information

Journal: Optical Materials Express

Volume: 10

Issue number: 6

ISSN (Print): 2159-3930

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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.1364/OME.396413

Source: Scopus

Source ID: 85085860812

Research output: Contribution to journal › Editorial › Scientific

### Special Issue: Mid-infrared optical materials and their device applications

The mid-infrared (mid-IR, 2 to 10  $\mu\text{m}$ ) is a technologically important spectral regime for sensing, imaging, and communications. In the past few years, there has been a surge of interest in novel mid-IR optical materials as well as their device implementations to address the increasing demands from these applications. The 22 papers in this feature issue represent a diverse cross-section of the latest technological advances in this field, spanning mid-IR light generation, propagation, manipulation, and detection functions in free-space, fiber, and planar platforms. In terms of material systems, semiconductors, glasses, plasmonic metals, as well as nanostructures specifically engineered for the mid-IR band, are all extensively covered. We hope that the readers will enjoy the kaleidoscopic view of the burgeoning field of mid-IR optics and photonics through this feature issue.

### General information

Publication status: Published

MoE publication type: C2 Edited books

Organisations: Physics, Research group: Photonics Glasses, Massachusetts Institute of Technology, University of Wisconsin-Madison, The Aerospace Corporation, Jet Propulsion Laboratory, California Institute of Technology

Contributors: Hu, J. (ed.), Mawst, L. (ed.), Moss, S. (ed.), Petit, L. (ed.), Ting, D. (ed.)

Publication date: 2018

Peer-reviewed: Yes

### Publication information

Journal: Optical Materials Express

Volume: 8

Issue number: 7

ISSN (Print): 2159-3930

Ratings:

Scopus rating (2018): CiteScore 5 SJR 0.886 SNIP 1.045

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Source: Scopus

Source ID: 85070797189

Research output: Contribution to journal › Special issue › Scientific › peer-review

### Special Issue: Novel Optical and Photonic Devices based on 2D Materials

Since the isolation of graphene in 2004, two-dimensional (2D) materials with unique optical and electronic properties have attracted a wide interest and tremendous research, opening some promising applications in electronics, photonics and optoelectronics. This feature issue is aimed to capture the current state-of-the art, new trends and directions in 2D-material-based optical and photonic devices, and seven research articles are collected in this issue.

### General information

Publication status: Published

MoE publication type: C2 Edited books

Organisations: Physics, Research group: Metaplasmonics, Xiamen University, Monash University, Swinburne University of Technology, Shenzhen University

Contributors: Luo, Z. (ed.), Bao, Q. (ed.), Caglayan, H. (ed.), Jia, B. (ed.), Zhang, H. (ed.)

Publication date: 2020

Peer-reviewed: Yes

### Publication information

Journal: Optical Materials Express

Volume: 10

Issue number: 6

ISSN (Print): 2159-3930

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Research output: Contribution to journal › Special issue › Scientific › peer-review

### Coherence of Supercontinuum Light

Supercontinuum (SC) light fields are characterized by broadband spectra that may extend from ultraviolet to near-infrared. Such SC fields can be generated by nonlinear processes in solid-state bulk media and liquids, or in optical fibers. In the latter case, SC pulse trains with high spatial coherence can be produced, which however may feature widely different spectral and temporal properties depending on the excitation conditions. In this review, we consider the coherence properties of SC pulses using the second-order coherence theory of nonstationary light. We begin with an overview of SC generation and explain how different nonlinear processes give rise to variable coherence properties. After a brief review of the coherence theory of nonstationary light, we show how second-order correlation functions in both time and frequency domains can be constructed from numerical simulations of ensembles of individual pulses. Two types of convenient modal representations of these correlation functions are presented, and a connection to the widely used "first-order" spectral coherence function is made. We then consider several interferometric techniques that have been used to measure this first-order coherence function, and discuss methods for experimental determination of the second-order correlations. Finally, some conclusions are drawn and certain as-yet unresolved questions regarding the coherence of SC are outlined.

### General information

Publication status: Published

MoE publication type: A3 Part of a book or another research book

Organisations: Department of Physics, Research group: Nonlinear Fiber Optics, Research area: Optics

Contributors: Genty, G., Friberg, A. T., Turunen, J.

Publication date: 2016

### Host publication information

Title of host publication: Progress in Optics

Volume: 61

Publisher: Elsevier

ISBN (Print): 978-0-12-804699-9

### Publication series

Name: Progress in Optics

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ASJC Scopus subject areas: Surfaces and Interfaces, Electronic, Optical and Magnetic Materials

Keywords: Coherence, Interferometry, Modes, Pulses, Supercontinuum

DOIs:

10.1016/bs.po.2015.10.002

### Bibliographical note

JUFOID=65575

Source: Scopus

Source ID: 84960194642

Research output: Chapter in Book/Report/Conference proceeding › Chapter › Scientific › peer-review

### 1180nm VECSEL with 50 W output power

We report on the development of a high-power vertical-external-cavity surface-emitting laser (VECSEL) emitting around 1180 nm. The laser emitted 50 W of output power when the mount of the gain chip was cooled to -15°C. The output power was measured using a 97% reflective cavity end-mirror. The VECSEL was arranged to form an I-shaped cavity with a length of ~100 mm; the gain chip and a curved dielectric mirror (RoC=150) acting as cavity end mirrors. The gain chip was grown by molecular beam epitaxy (MBE) and incorporated 10 GaInAs/GaAs quantum wells. For efficient heat extraction, the chip was capillary bonded to a diamond heat spreader which was attached to a TEC-cooled copper mount. The maximum optical-to-optical conversion efficiency of 28% was achieved for 42 W of output power and -15°C mount temperature.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics

Contributors: Kantola, E., Leinonen, T., Ranta, S., Tavast, M., Penttinen, J., Guina, M.

Publication date: 2015

### Host publication information

Title of host publication: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 9349

Publisher: SPIE

Article number: 93490U

ISBN (Print): 9781628414394

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: continuous wave, frequency doubling, heat management, high power, infrared, power scaling, SDL, VECSEL  
DOIs:

10.1117/12.2079480

Source: Scopus

Source ID: 84925666801

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### 13.5 A 0.35-to-2.6GHz multilevel outphasing transmitter with a digital interpolating phase modulator enabling up to 400MHz instantaneous bandwidth

Advanced wireless radio standards set stringent requirements on the bandwidth, frequency range and reconfigurability of base-station transmitters. Recently, the outphasing concept has shown promise of wide bandwidth while taking advantage of process scaling with extensive exploitation of rail-to-rail signaling. Recent outphasing transmitter designs have often focused on power-amplifier (PA) and power-combiner implementations while omitting the phase modulator [1,2].

Moreover, previously reported transmitters with integrated digital phase modulators have only shown bandwidths up to 40MHz [3,4], although 133MHz has been demonstrated at 10GHz carrier frequency utilizing phase modulators based on conventional IQ-DACs [5]. Thus, digital-intensive outphasing transmitters capable of modulation with hundreds of MHz bandwidth at existing cellular frequency bands have not yet been published. To address the aforementioned challenge, this paper introduces a multilevel outphasing transmitter with four amplitude levels, including the first prototype implementation based on the digital interpolating phase modulator concept [6]. The transmitter is targeted for 5G picocell base stations and has been verified to operate with instantaneous bandwidth up to 400MHz. In addition, the developed phase modulator eliminates the need for complex on-chip frequency synthesizers by introducing digital carrier frequency generation, demonstrated between 0.35 and 2.6GHz, while utilizing a single 1.8GHz reference clock.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Aalto University, Nokia

Contributors: Kosunen, M., Lemberg, J., Martelius, M., Roverato, E., Nieminen, T., Englund, M., Stadius, K., Anttila, L., Pallonen, J., Valkama, M., Ryyänänen, J.

Number of pages: 2

Pages: 224-225

Publication date: 2 Mar 2017

### Host publication information

Title of host publication: 2017 IEEE International Solid-State Circuits Conference, ISSCC 2017

Publisher: IEEE

ISBN (Electronic): 9781509037575

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Electronic versions:

13.5 A 0.35-to-2.6GHz multilevel outphasing transmitter 2017

DOIs:

10.1109/ISSCC.2017.7870342

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202002041818>

Source: Scopus

Source ID: 85016293062

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### 1.3 $\mu$ m U-bend traveling wave SOA devices for high efficiency coupling to silicon photonics

We present a U-bend design for traveling wave III-V gain devices, such as semiconductor optical amplifiers and laser diodes. The design greatly simplifies the butt-coupling between the III-V chip and silicon-on-insulator photonic circuit by bringing the I/O ports on one facet. This removes the need for precise dimension control otherwise required for 2-side coupling, therefore increasing the yield of mounted devices towards 100%. The design, fabrication and characterization of the U-bend device based on Euler bend geometry is presented. The losses for a bend with a minimum bending radius of 83  $\mu$ m are 1.1 dB. In addition, we present an analysis comparing the yield and coupling losses of the traditionally cleaved devices with the results that the Euler bend approach enable, with the final conclusion that the yield is improved by several times while the losses are decreased by several dB.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, VTT Technical Research Centre of Finland

Contributors: Viheriälä, J., Tuorila, H., Zia, N., Cherchi, M., Aalto, T., Guina, M.

Publication date: 2019

#### Host publication information

Title of host publication: Silicon Photonics XIV

Publisher: SPIE, IEEE

Editors: Reed, G. T., Knights, A. P.

Article number: 109230E

ISBN (Electronic): 9781510624887

#### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 10923

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Coupling losses, Hybrid integration, III-V, Semiconductor optical amplifiers, Silicon-on-insulator

DOIs:

10.1117/12.2505935

#### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85065404814

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### 1.55- $\mu$ m wavelength wafer-fused OP-VECSELs in flip-chip configuration

Optically-pumped vertical external cavity surface emitting lasers (VECSELs) based on flip-chip gain mirrors emitting at the 1.55- $\mu$ m wavelength range are reported. The gain mirrors employ wafer-fused InAlGaAs/InP quantum well heterostructures and GaAs/AlAs distributed Bragg reflectors, which were incorporated in a linear and a V-cavity configurations. A maximum output power of 3.65 W was achieved for a heatsink temperature of 11°C and employing a 2.2% output coupler. The laser exhibited circular beam profiles for the full emission power range. The demonstration represents more than 10-fold increase of the output power compared to state-of-the-art flip-chip VECSELs previously demonstrated at the 1.55- $\mu$ m wavelength range, and opens a new perspective for developing practical VECSEL-based laser system for applications such as LIDAR, spectroscopy, communications and distributed sensing.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, CRPP, LakeDiamond SA

Contributors: Mereuta, A., Nechay, K., Caliman, A., Suruceanu, G., Gallo, P., Guina, M., Kapon, E.

Publication date: 2019

#### Host publication information

Title of host publication: Vertical External Cavity Surface Emitting Lasers (VECSELs) IX

Publisher: SPIE, IEEE

Editor: Keller, U.

Article number: 1090103

ISBN (Electronic): 9781510624443

### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 10901

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Optically-pumped VECSELs, Semiconductor lasers, Wafer-Fusion

DOIs:

10.1117/12.2508342

### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85066636665

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### 2-volt Solution-Processed, Indium Oxide ( $\text{In}_2\text{O}_3$ ) Thin Film Transistors on flexible Kapton

Semiconductor devices based upon silicon have powered the modern electronics revolution through advanced manufacturing processes. However, the requirement of high temperatures to create crystalline silicon devices has restricted its use in a number of new applications, such as printed and flexible electronics. Thus, developments with high mobility solution-processable metal oxides, surpassing  $\alpha$ -Si in many instances, is opening a new era for flexible and wearable electronics. However, high operating voltages and relatively high deposition temperatures required for metal oxides remain impediments for the flexible devices. Here, the fabrication of low operating voltage, flexible thin film transistors (TFT) using a solution processed indium oxide ( $\text{In}_2\text{O}_3$ ) channel material with room temperature deposited anodized high- $\kappa$  aluminum oxide ( $\text{Al}_2\text{O}_3$ ) for gate dielectrics are reported. The flexible TFTs operates at low voltage  $V_{ds}$  of 2 V, with threshold voltage  $V_{th}$  0.42 V, on/off ratio  $10^3$  and subthreshold swing (SS) 420 mV/dec. The electron mobility ( $\mu$ ), extracted from the saturation regime, is  $2.85 \text{ cm}^2/\text{V}\cdot\text{s}$  and transconductance, gm, is  $38 \mu\text{S}$ .

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electrical Engineering, Research group: Laboratory for Future Electronics, Ohio State University

Contributors: Bhalerao, S. R., Lupo, D., Berger, P. R.

Number of pages: 3

Publication date: 1 Aug 2019

### Host publication information

Title of host publication: 2019 IEEE International Flexible Electronics Technology Conference, IFETC 2019

Publisher: IEEE

ISBN (Electronic): 9781728117782

ASJC Scopus subject areas: Electrical and Electronic Engineering, Mechanics of Materials, Electronic, Optical and Magnetic Materials, Hardware and Architecture

DOIs:

10.1109/IFETC46817.2019.9073721

Source: Scopus

Source ID: 85084666179

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### 405-nm pumped $\text{Ce}^{3+}$ -doped silica fiber for broadband fluorescence from cyan to red

A pure Ce-doped silica fiber is fabricated using modified chemical vapor deposition (MCVD) technique. Fluorescence characteristics of a Ce-doped silica fiber are experimentally investigated with continuous wave pumping from 440 nm to 405 nm. Best pump absorption and broad fluorescence spectrum is observed for  $\sim 405$  nm laser. Next, the detailed analysis of spectral response as a function of pump power and fiber length is performed. It is observed that a-10dB spectral width of  $\sim 280$  nm can be easily achieved with different combinations of the fiber length and pump power. Lastly, we present, for the first time to the best of our knowledge, a broadband fluorescence spectrum with-10dB spectral width of 301 nm, spanning from  $\sim 517.36$  nm to  $\sim 818$  nm, from such fibers with non-UV pump lasers.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Aston University, Fiber Optics Research Center of the Russian Academy of Sciences, Russian Academy of Sciences

Contributors: Yadav, A., Chichkov, N. B., Gumenyuk, R., Zherebtsov, E., Melkumov, M. A., Yashkov, M. V., Dianov, E. M., Rafailov, E. U.

Publication date: 2019

#### Host publication information

Title of host publication: Optical Components and Materials XVI

Publisher: SPIE, IEEE

Editors: Dignonnet, M. J. F., Jiang, S.

Article number: 1091406

ISBN (Electronic): 9781510624702

#### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 10914

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Broadband spectrum, Ce-doped fiber, Ce-ion, Rare earth doped

DOIs:

10.1117/12.2509599

#### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85066046508

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### 73-fs SESAM mode-locked Tm,Ho:CNGG laser at 2061 nm

Tm,Ho co-doped disordered calcium niobium gallium garnet (CNGG) crystals are investigated as a novel gain medium for mode-locked lasers near 2  $\mu\text{m}$ . With a GaSb-based semiconductor saturable absorber mirror (SESAM) and chirped mirrors for dispersion compensation such a laser is mode-locked at a repetition rate of 89.3 MHz. For a 5% output coupler, a maximum average output power of 157 mW is obtained with a pulse duration of 170 fs (28-nm broad spectrum centered at 2.075  $\mu\text{m}$ , leading to a time-bandwidth product of 0.331). With a 0.5% output coupler, 73-fs pulses are generated at 2.061  $\mu\text{m}$  with a spectral width of 62 nm (time-bandwidth product of 0.320) and an average output power of 36 mW.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: ORC, Physics, Max Born Institute, Ruhr-Universität Bochum, Jiangsu Normal University, China Academy of Engineering Physics, Hefei Institutes of Physical Sciences Chinese Academy of Sciences, Université de Caen Normandie, Universitat Rovira i Virgili, Fujian Institute of Research on the Structure of Matter

Contributors: Wang, Y., Zhao, Y., Pan, Z., Suomalainen, S., Härkönen, A., Guina, M., Griebner, U., Wang, L., Loiko, P., Mateos, X., Chen, W., Petrov, V.

Publication date: 2020

#### Host publication information

Title of host publication: Solid State Lasers XXIX : Technology and Devices

Publisher: SPIE

Editors: Clarkson, W. A., Shori, R. K.

Article number: 1125929

ISBN (Print): 9781510632813

ISBN (Electronic): 9781510632820

#### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 11259

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Disordered garnets, Femtosecond pulses, Holmium lasers, Mode-locked lasers, Semiconductor saturable absorber mirror (SESAM), Solid-state lasers, Thulium lasers

DOIs:

10.1117/12.2548180

#### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85085246577

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Action recognition using the 3D dense microblock difference

This paper describes a framework for action recognition which aims to recognize the goals and activities of one or more human from a series of observations. We propose an approach for the human action recognition based on the 3D dense micro-block difference. The proposed algorithm is a two-stage procedure: (a) image preprocessing using a 3D Gabor filter and (b) a descriptor calculation using 3D dense micro-block difference with SVM classifier. At the first step, an efficient spatial computational scheme designed for the convolution with a bank of 3D Gabor filters is present. This filter intensifies motion using a convolution for a set of 3D patches and arbitrarily-oriented anisotropic Gaussian. For preprocessed frames, we calculate the local features such as 3D dense micro-block difference (3D DMD), which capture the local structure from the image patches at high scales. This approach is processing the small 3D blocks with different scales from frames which capture the microstructure from it. The proposed image representation is combined with fisher vector method and linear SVM classifier. We evaluate the proposed approach on the UCF50, HMDB51 and UCF101 databases. Experimental results demonstrate the effectiveness of the proposed approach on video with a stochastic textures background with comparisons of the state-of-The-Art methods.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Signal Processing, Don State Technical University, Moscow State University of Technology 'Stankin', Beijing Jiaotong University

Contributors: Voronin, V., Pismenskova, M., Zelensky, A., Cen, Y., Nadykto, A., Egiazarian, K.

Publication date: 2018

### Host publication information

Title of host publication: Counterterrorism, Crime Fighting, Forensics, and Surveillance Technologies II

Publisher: SPIE

Article number: 1080200

ISBN (Electronic): 9781510621879

### Publication series

Name: Proceedings of SPIE

Volume: 10802

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: 3D Gabor filter., Action recognition, Micro-block difference, Texture

DOIs:

10.1117/12.2326801

### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85057423236

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Advancements in Solution Processable Devices using Metal Oxides For Printed Internet-of-Things Objects

Internet-of-things (IoT) objects are expected to exceed 75 billion objects by 2020, and a large part of the expansion is expected to be at a finer granularity than existing silicon-based IoT objects (i.e. tablets and cell phones) can deliver [1]. Currently, placing a room light or a thermostat on the internet for remote control is considered progressive. However, if printed electronics can achieve performance increases, then IoT objects could be affixed to almost anything, such as coffee creamer cartons, cereal boxes, or that missing sock. Each of these IoT objects could be driving a sensor, perhaps position, temperature or pressure, essentially a multitude of applications. In order for IoT objects to emulate a simple postage stamp, with self-powering from energy scavenging and local energy storage, all housed in a non-toxic flexible form factor, advances in solution processable devices need to occur.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electrical Engineering, Ohio State University, Wayne State University

Contributors: Berger, P. R., Li, M., Mattei, R. M., Niang, M. A., Talisa, N., Tripepi, M., Harris, B., Bhalerao, S. R., Chowdhury, E. A., Winter, C. H., Lupo, D.

Number of pages: 3

Pages: 160-162  
Publication date: 1 Mar 2019

#### Host publication information

Title of host publication: 2019 Electron Devices Technology and Manufacturing Conference, EDTM 2019  
Publisher: IEEE  
ISBN (Electronic): 9781538665084  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Instrumentation, Hardware and Architecture  
Keywords: ALD, CMOS and SOI, energy scavenging, IoT, low-power electronics, Manufacturing, NDR, tunnel diodes  
DOIs:  
10.1109/EDTM.2019.8731322  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### Advances in implantable and wearable antennas for wireless brain-machine interface systems

The goal of brain-machine interface (BMI) is to convert thought into action and sensation into perception. This novel technology holds the potential to revolutionize healthcare and neurorehabilitation. A major challenge in translating BMIs to the patient population is the lack of clinically viable implantable devices that will last a lifetime. To achieve this, wirelessly addressable battery-free implants are a must: there can be no transcranial feedthrough for wires or batteries which require replacement.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Berkeley, Electrical Engineering Department, University of California, Los Angeles (UCLA)  
Contributors: Moradi, E., Koski, K., Björninen, T., Muller, R., Ledochowitsch, P., Sydänheimo, L., Alon, E., Maharbiz, M. M., Rabaey, J. M., Ukkonen, L., Rahmat-Samii, Y.  
Publication date: 16 Oct 2014

#### Host publication information

Title of host publication: 2014 United States National Committee of URSI National Radio Science Meeting, USNC-URSI NRSM 2014  
Publisher: Institute of Electrical and Electronics Engineers Inc.  
Article number: 6928137  
ISBN (Electronic): 9781479931200  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials  
DOIs:  
10.1109/USNC-URSI-NRSM.2014.6928137  
URLs:  
<http://www.scopus.com/inward/record.url?scp=84911469214&partnerID=8YFLogxK> (Link to publication in Scopus)  
Source: Scopus  
Source ID: 84911469214  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### A genetic algorithm for scheduling tasks onto dynamically reconfigurable hardware

In this paper, a genetic algorithm (GA) for scheduling tasks onto dynamically reconfigurable devices is presented. The scheduling problem is NP-hard and more complicated than multiprocessor scheduling, because both the task allocation and the configurations need to be carefully managed. The approach has been validated with a number of random task graphs. The results show that the GA approach has good convergence and it is in average 8.6% better than a list-based scheduler for large task graphs of various sizes.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Digitaali- ja tietokonetekniikka, VTT Technical Research Centre of Finland  
Contributors: Qu, Y., Soininen, J. P., Nurmi, J.  
Number of pages: 4  
Pages: 161-164  
Publication date: 2007

#### Host publication information

Title of host publication: 2007 IEEE International Symposium on Circuits and Systems  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering  
DOIs:

10.1109/ISCAS.2007.378246

Source: Scopus

Source ID: 34548816463

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **A hand-held immaterial volumetric display**

We have created an ultralight, movable, "immaterial" fogscreen. It is based on the fogscreen mid-air imaging technology. The hand-held unit is roughly the size and weight of an ordinary toaster. If the screen is tracked, it can be swept in the air to create mid-air slices of volumetric objects, or to show augmented reality (AR) content on top of real objects. Interfacing devices and methodologies, such as hand and gesture trackers, camera-based trackers and object recognition, can make the screen interactive. The user can easily interact with any physical object or virtual information, as the screen is permeable. Any real objects can be seen through the screen, instead of e.g., through a video-based augmented reality screen. It creates a mixed reality setup where both the real world object and the augmented reality content can be viewed and interacted with simultaneously. The hand-held mid-air screen can be used e.g., as a novel collaborating or classroom tool for individual students or small groups.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Augmented Human Activities (AHA), University of Tampere

Contributors: Sand, A., Rakkolainen, I.

Publication date: 2014

### **Host publication information**

Title of host publication: Proceedings of SPIE-IS and T Electronic Imaging - Stereoscopic Displays and Applications XXV

Volume: 9011

Publisher: SPIE

Article number: 90110Q

ISBN (Print): 9780819499288

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: display technology, Fog screen, mixed reality, volumetric, walk-through screen

DOIs:

10.1117/12.2035280

URLs:

<http://www.scopus.com/inward/record.url?scp=84901008644&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84901008644

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **All-fiber, high-power, picosecond Yb double clad tapered fiber amplifier**

We demonstrate picosecond all-fiber system utilizing Yb-doped tapered power amplifier. The system is capable of producing 6 ps pulses with average power of 60 W and peak power of 0.4 MW. © 2014 IEEE.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: Ultrafast and intense lasers, Optoelectronics Research Centre, Tampere University of Technology, Frontier Photonics, Optoelectronics Research Centre, Tampere University of Technology, Institute of Radio Engineering and Electronics, Russian Academy of Sciences (IRE RAS), Russian Academy of Sciences

Contributors: Gumenyuk, R., Filippov, V., Vorotinskii, A., Okhotnikov, O. G., Chamorovskii, Y., Golant, K.

Publication date: 2014

### **Host publication information**

Title of host publication: Proceedings - 2014 International Conference Laser Optics, LO 2014

Publisher: IEEE

Article number: 6886471

ISBN (Print): 978-1-4799-3884-1

ISBN (Electronic): 978-1-4799-3885-8

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Keywords: fiber amplifier, mode-locked fiber laser, Yb-doped tapered fiber

DOIs:

10.1109/LO.2014.6886471

URLs:

<http://www.scopus.com/inward/record.url?scp=84906987381&partnerID=8YFLogxK> (Link to publication in Scopus)

#### **Bibliographical note**

Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-09-30<br/>Publisher name: IEEE

Source: researchoutputwizard

Source ID: 378

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### **Alpha radiation induced luminescence in solar blind spectral region**

Intense luminescence in the solar blind spectral region is produced by modifying the gas atmosphere around an alpha emitter. This enables standoff detection of alpha radiation under daylight conditions.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Photonics, Helsinki Institute of Physics

Contributors: Kerst, T., Toivonen, J.

Publication date: 2018

#### **Host publication information**

Title of host publication: CLEO : Applications and Technology, CLEO\_AT 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

Electronic versions:

[alpha\\_radiation\\_induced\\_luminescence\\_in\\_solar\\_blind\\_spectral\\_region](#)

DOIs:

10.1364/CLEO\_AT.2018.ATh4O.8

URLs:

<http://urn.fi/URN:NBN:fi:tty-201908232002>

Source: Scopus

Source ID: 85049133557

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### **A membrane external-cavity surface-emitting laser (MECSEL) with emission around 825 nm**

A MECSEL emitting around 825nm is reported. With a tuning range from 807nm to 840 nm, the MECSEL extends the coverage of high beam quality semiconductor based lasers in the short 8XXnm region and opens new perspectives for scanning ground-based water-vapor differential absorption lidar. 1.4W maximum output power has been achieved at room temperature operation and at 12.5W absorbed power using a 532 nm emitting pump laser. The beam quality has been investigated by  $M^2$  measurements at different pump power. The effect from a growing pump mode and thermal lensing has been observed as the beam divergence angle decreases and the beam waist radius enlargens with increasing pump power.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Research group: ORC

Contributors: Phung, H. M., Kahle, H., Penttinen, J., Rajala, P., Ranta, S., Guina, M.

Publication date: 2020

#### **Host publication information**

Title of host publication: Vertical External Cavity Surface Emitting Lasers (VECSELs) X

Publisher: SPIE

Editor: Hastie, J. E.

Article number: 112630H

ISBN (Print): 9781510632899

ISBN (Electronic): 9781510632905

#### **Publication series**

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 11263

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: GaInAsP, MECSEL, Semiconductor laser, Short 8XXnm region, SiC heatspreaders, Thermal lensing, VECSEL  
DOIs:

10.1117/12.2545980

#### **Bibliographical note**

INT=phys,"Rajala, Patrik"

jufoid=71479

Source: Scopus

Source ID: 85082694209

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### **A method for predicting DCT-based denoising efficiency for grayscale images corrupted by AWGN and additive spatially correlated noise**

Results of denoising based on discrete cosine transform for a wide class of images corrupted by additive noise are obtained. Three types of noise are analyzed: additive white Gaussian noise and additive spatially correlated Gaussian noise with middle and high correlation levels. TID2013 image database and some additional images are taken as test images. Conventional DCT filter and BM3D are used as denoising techniques. Denoising efficiency is described by PSNR and PSNR-HVS-M metrics. Within hard-thresholding denoising mechanism, DCT-spectrum coefficient statistics are used to characterize images and, subsequently, denoising efficiency for them. Results of denoising efficiency are fitted for such statistics and efficient approximations are obtained. It is shown that the obtained approximations provide high accuracy of prediction of denoising efficiency.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), National Aerospace University

Contributors: Rubel, A. S., Lukin, V. V., Egiazarian, K.

Publication date: 2015

#### **Host publication information**

Title of host publication: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 9399

Publisher: SPIE

Article number: 93990P

ISBN (Print): 9781628414899

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: DCT and BM3D filter, Denoising, Fitting, Grayscale images, Prediction

DOIs:

10.1117/12.2082533

Source: Scopus

Source ID: 84928473717

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### **A multi-band WCDMA SAW-less receivers with frequency selective feedback loop**

For frequency division duplex (FDD) wide band code division multiple access (WCDMA) system, transmit (TX) signal leakage at the receiver input degrades the receiver performance. Previously, to cancel the TX leakage, a frequency selective feedback was proposed, but it had the unpredictable feedback loop characteristic due to the uncertainty of the duplexer impedance. This paper proposes a new method to achieve a predictable feedback loop characteristic. In addition, to achieve the TX leakage cancellation for multi-band, a local oscillator (LO) phase shift technique is also presented. The proposed receiver which was composed of high- and low-band LNAs and mixers, the TX canceller, and the LO shifter was implemented using 0.18- $\mu\text{m}$  CMOS process and is under fabrication. Simulation results met the required specifications which were delivered from the WCDMA specifications.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology

Contributors: Beck, S., Kim, S. T., Lim, K., Tentzeris, M. M., Laskar, J.

Publication date: 2011

#### Host publication information

Title of host publication: 54th IEEE International Midwest Symposium on Circuits and Systems, MWSCAS 2011

Article number: 6026387

ISBN (Print): 9781612848570

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/MWSCAS.2011.6026387

URLs:

<http://www.scopus.com/inward/record.url?scp=80053630391&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 80053630391

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### Anisotropic ultra-large mode area Yb-doped tapered double clad fiber for ultrafast amplifiers

The anisotropic ytterbium doped tapered double clad fiber with 95  $\mu\text{m}$  mode field diameter is experimentally demonstrated. The high power picosecond master oscillator - power amplifier with 70 W average power pulses is developed.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Ampliconyx Ltd, Institute of Radio Engineering and Electronics of the Russian Academy of Sciences, St. Petersburg State Polytechnical University

Contributors: Filippov, V., Noronen, T., Gumenyuk, R., Chamorovskii, Y., Golant, K., Odnoblyudov, M.

Publication date: 2017

#### Host publication information

Title of host publication: Advanced Solid State Lasers 2017 : Nagoya, Aichi Japan 1–5 October 2017

Volume: Part F75-ASSL 2017

Publisher: The Optical Society; OSA

Article number: JTu2A.51

ISBN (Electronic): 978-0-9600380-7-7

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/ASSL.2017.JTu2A.51

Source: Scopus

Source ID: 85039147555

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### A novel 3-D printed loop antenna using flexible NinjaFlex material for wearable and IoT applications

A stretchable, flexible loop antenna working at 2.4GHz ISM band was fabricated by the additive manufacturing (AM) 3-D printing technology. NinjaFlex, a flexible 3-D printable material was utilized for the first time as a 3-D hemi-sphere substrate for the loop antenna. A 3-D printer based on the Fused Diffusion Modelling (FDM) technology was employed to 3-D print the substrate material. The resonance frequency of the antenna shifts in response to the applied force which makes the configuration suitable for the wireless strain sensing application. The proposed antenna was designed for wearable electronics application such as health monitoring earrings. Hence it was designed in such a way that it maintains the Specific Absorption Rate (SAR) of the human head tissues within the assigned standard limits when placed near human replicating head. The proposed antenna system could be useful in the additively manufactured wearable packaging and IoT applications.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology

Contributors: Nate, K., Tentzeris, M. M.

Number of pages: 4

Pages: 171-174

Publication date: 3 Dec 2015

#### Host publication information

Title of host publication: 2015 IEEE 24th Conference on Electrical Performance of Electronic Packaging and Systems, EPEPS 2015

Publisher: Institute of Electrical and Electronics Engineers Inc.

Article number: 7347155

ISBN (Electronic): 9781479936410

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: 2.4 GHz ISM, 3-D Printer, Additive Manufacturing, Flexible, Strain Sensor, Wearable, Wireless Sensor

DOIs:

10.1109/EPEPS.2015.7347155

URLs:

<http://www.scopus.com/inward/record.url?scp=84962784378&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84962784378

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **A novel strain sensor based on 3D printing technology and 3D antenna design**

The additive manufacturing technique of 3D printing has become increasingly popular for time-consuming and complex designs. Due to the special mechanical properties of commercial NinjaFlex filament [1] and in-house-made electrically conductive adhesives (ECAs) [2], there is great potential for the 3D printed RF applications, such as strain sensors and flexible, wearable RF devices. This paper presents the flexible 3D printed strain sensor, as a 3D dipole antenna of ECA stretchable conductor on 3D printed Ninjaflex filament.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, School of Electrical and Computer Engineering, Georgia Institute of Technology, Zhejiang University

Contributors: Le, T., Song, B., Liu, Q., Bahr, R. A., Moscato, S., Wong, C. P., Tentzeris, M. M.

Number of pages: 6

Pages: 981-986

Publication date: 15 Jul 2015

#### **Host publication information**

Title of host publication: 2015 IEEE 65th Electronic Components and Technology Conference, ECTC 2015

Volume: 2015-July

Publisher: Institute of Electrical and Electronics Engineers Inc.

Article number: 7159714

ISBN (Electronic): 9781479986095

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: 3D antenna, 3D printing, flexible electronics, material characterization, NinjaFlex, RF, stretchable

DOIs:

10.1109/ECTC.2015.7159714

URLs:

<http://www.scopus.com/inward/record.url?scp=84942099400&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84942099400

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Antenna design considerations for far field and near field wireless body-centric systems**

In this paper we analyze the design and realization of wearable and implantable antennas meant for wireless body-centric systems. Studied wearable antennas exploit electro-textiles, including embroidered textiles and conductive fabrics, for the light-weight and transparent integration with daily clothing. We also present mm-sized implantable loop antennas that are capable of providing electromagnetic power to implant devices from an external on-body loop antenna through near field inductive link.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Electrical Engineering Department, University of California, Los Angeles (UCLA), University of California, Los Angeles

Contributors: Moradi, E., Koski, K., Hasani, M., Rahmat-Samii, Y., Ukkonen, L.

Number of pages: 2

Pages: 59-60

Publication date: 2 Mar 2015

#### **Host publication information**

Title of host publication: ICCEM 2015 - 2015 IEEE International Conference on Computational Electromagnetics  
Publisher: The Institute of Electrical and Electronics Engineers, Inc.  
Article number: 7052555  
ISBN (Print): 9781479962815  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Computational Theory and Mathematics  
DOIs:  
10.1109/COMPTEM.2015.7052555  
Source: Scopus  
Source ID: 84926322598  
Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **A perceptual quality metric for high-definition stereoscopic 3D video**

The use of 3D video is growing in several fields such as entertainment, military simulations, medical applications. However, the process of recording, transmitting, and processing 3D video is prone to errors thus producing artifacts that may affect the perceived quality. Nowadays a challenging task is the definition of a new metric able to predict the perceived quality with low computational complexity in order to be used in real-time applications. The research in this field is very active due to the complexity of the analysis of the influence of stereoscopic cues. In this paper we present a novel stereoscopic metric based on the combination of relevant features able to predict the subjective quality rating in a more accurate way.

#### **General information**

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Department of Signal Processing, Research group: 3D MEDIA, Signal Processing Research Community (SPRC), Universita' degli Studi Roma TRE  
Contributors: Battisti, F., Carli, M., Stramacci, A., Boev, A., Gotchev, A.  
Publication date: 2015

#### **Host publication information**

Title of host publication: Image Processing: Algorithms and Systems XIII  
Publisher: SPIE  
Article number: 939916  
ISBN (Print): 9781628414899

#### **Publication series**

Name: SPIE Conference Proceedings  
Volume: 9399  
ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics  
Keywords: Quality metric, Stereoscopic 3D video, Video transmission  
Electronic versions:  
Batisti\_SPIE\_2015  
DOIs:  
10.1117/12.2086901  
URLs:  
<http://urn.fi/URN:NBN:fi:tty-201606134242>  
Source: Scopus  
Source ID: 84928485494  
Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Artificial intelligence yesterday, today and tomorrow**

Artificial Intelligence (AI) is one of the current emerging technologies. In the history of computing AI has been in the similar role earlier - almost every decade since the 1950s, when the programming language Lisp was invented and used to implement self-modifying applications. The second time that AI was described as one of the frontier technologies was in the 1970s, when Expert Systems (ES) were developed. A decade later AI was again at the forefront when the Japanese government initiated its research and development effort to develop an AI-based computer architecture called the Fifth Generation Computer System (FGCS). Currently in the 2010s, AI is again on the frontier in the form of (self-)learning systems manifesting in robot applications, smart hubs, intelligent data analytics, etc. What is the reason for the cyclic reincarnation of AI? This paper gives a brief description of the history of AI and also answers the question above. The current AI "cycle" has the capability to change the world in many ways. In the context of the CE conference, it is important to understand the changes it will cause in education, the skills expected in different professions, and in society at large.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Computing Sciences, Tallinn University of Technology, University of Lapland, Computer Science Institute

Contributors: Jaakkola, H., Henno, J., Mäkelä, J., Thalheim, B.

Number of pages: 8

Pages: 860-867

Publication date: 1 May 2019

### Host publication information

Title of host publication: 2019 42nd International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2019 - Proceedings

Publisher: IEEE

Editors: Skala, K., Car, Z., Pale, P., Huljenic, D., Janjic, M., Koracic, M., Sruc, V., Ribaric, S., Grbac, T. G., Butkovic, Z., Cicin-Sain, M., Skvorc, D., Mauher, M., Babic, S., Gros, S., Vrdoljak, B., Tijan, E.

ISBN (Electronic): 9789532330984

ASJC Scopus subject areas: Computer Networks and Communications, Hardware and Architecture, Information Systems, Energy Engineering and Power Technology, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Artificial Intelligence, Computer, Computer-supported decision-making, Deep learning, Education, Emerging technology, Expert Systems, Fifth Generation Computer, Frontier technology, Learning, Lisp, Prolog

DOIs:

10.23919/MIPRO.2019.8756913

URLs:

[http://docs.mipro-proceedings.com/proceedings/mipro\\_2019\\_proceedings.pdf](http://docs.mipro-proceedings.com/proceedings/mipro_2019_proceedings.pdf)

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### ATM switch for 2.488 Gbit/s CATV network on FPGA with a high-throughput buffering architecture

This paper presents an ATM switch with a high-throughput buffering architecture and a new performance measurement system. The switch has been designed for multiplexing and routing Digital Video Broadcasting (DVB) services over 2.488 Gbits/s Asynchronous Transfer Mode (ATM) Cable TV (CATV) backbone network. The buffering architecture is based on a crossbar switch with internal buffering but it also has features of shared memory and output buffered switches. In addition to the buffering architecture the high throughput of this switch is based on an adaptive arbitration algorithm that is used to schedule the transfers of the cells from the cross-point buffers to the output buffers. This adaptive algorithm, which is a combination of Round Robin (RR) and Longest Queue First Served (LQFS) algorithms, provides starvation free service for the buffers with a small cell loss rate. Due to the internal buffering it was possible to use distributed arbitration that can easier achieve a high operation rate than one centralized arbiter. This paper also shows a quick and easy way of analyzing the performance of the presented ATM switch architecture. The high throughput of the switch has also been verified using a new method of measuring the probability distribution of the filling of the buffers of the switch. Additionally this paper deals with a few implementation aspects, since the control logic and the internally buffered crossbar are implemented on a Field Programmable Gate Array (FPGA) circuit.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Teleste Corporation

Contributors: Kariniemi, H., Nurmi, J., Fagerlund, P., Liitola, J., Alinikula, J.

Publication date: 2002

### Host publication information

Title of host publication: Midwest Symposium on Circuits and Systems

Volume: 2

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/MWSCAS.2002.1186814

Source: Scopus

Source ID: 0036979380

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### A Two-Stage LNA Design for 28GHz Band of 5G on 45nm CMOS

The proposed low noise amplifier (LNA) is specified to operate near 28GHz, i.e. within modern 5G bandwidths. The amplifier consists of two stages, a common-gate and a modified common-drain stage. Individual consideration of stages is followed by design of the whole amplifier, the layout design and extraction of parasitics. The post-layout design results show the gain of more than 15dB and noise figure (NF) of 3.2dB using only 5mW of power. Both input and output return losses are better than 10dB at the centre frequency. The limited voltage headroom of the second stage does not allow to

obtain 1dB compression point (OP1dB) better than -10dBm. The design results are comparable to that found in recent LNA publications.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electrical Engineering, Research group: RF Integrated Circuits, Research group: Wireless Communications and Positioning, University of Alberta

Contributors: Järvenhaara, J., Filanovsky, I. M., Nevalainen, I., Tchamov, N. T.

Number of pages: 5

Pages: 957-961

Publication date: 2020

#### Host publication information

Title of host publication: 2020 IEEE 63rd International Midwest Symposium on Circuits and Systems, MWSCAS 2020 - Proceedings

Publisher: IEEE

ISBN (Print): 978-1-7281-8059-5

ISBN (Electronic): 9781538629161

#### Publication series

Name: Midwest Symposium on Circuits and Systems

ISSN (Print): 1548-3746

ISSN (Electronic): 1558-3899

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: 45 nm CMOS, 5G bandwidth, Low Noise Amplifier, White's follower

DOIs:

10.1109/MWSCAS48704.2020.9184697

#### Bibliographical note

EXT="Filanovsky, I. M."

INT=elen,"Nevalainen, I."

Source: Scopus

Source ID: 85090590809

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Back Reflector with Diffractive Gratings for Light-Trapping in Thin-Film III-V Solar Cells

We report on the development of light-trapping architectures applied to thin-film solar cells. In particular, we focus on enhancing the absorption at 1-eV spectral range for dilute nitride and quantum dot materials and report on the influence of planar back reflectors on the photovoltaic properties. Moreover, we discuss the properties of polymer diffraction gratings with enhanced light-trapping capability pointing to advantageous properties of pyramidal gratings. In order to understand the suitability of these polymer grating architectures for space applications, we have performed an electron irradiation study (1 MeV) revealing the absence of reflectance changes up to doses of  $1 \times 10^{15} \text{ e-/cm}^2$ .

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Research group: ORC, Politecnico di Torino

Contributors: Aho, T., Tukiainen, A., Elsehrawy, F., Ranta, S., Raappana, M., Aho, A., Isoaho, R., Cappelluti, F., Guina, M.

Number of pages: 4

Publication date: 2019

#### Host publication information

Title of host publication: 2019 European Space Power Conference (ESPC)

Publisher: IEEE

ISBN (Print): 978-1-7281-2127-7

ISBN (Electronic): 978-1-7281-2126-0

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Renewable Energy, Sustainability and the Environment

Keywords: Solar Cell, Semiconducting III-V Materials

DOIs:

10.1109/ESPC47532.2019.9049262

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Backscattering-based wireless communication and power transfer to small biomedical implants**

In this paper and presentation, we will focus on different aspects of backscattering-based wireless communication and power transfer to small biomedical implants. We will present three different antenna topologies for data and power transfer through tissue, in vitro and in vivo studies on implantable intracranial pressure (ICP) sensors and give insight and analysis on wireless link reliability in tissue environment. We will also present radio frequency identification (RFID)-based implant platform and communication method. Moreover, we will focus on differences and challenges of in vivo environment compared to laboratory phantoms and tissue models. In our studies, different types of implantable antennas have been tested to investigate reliability, accuracy and sensitivity of the brain implants: A hybrid near field-far field system with a piezoresistive sensor for ICP monitoring [2], [4], a UHF band split-ring resonator system [3] and LC tank based miniature implantable antenna [5]. This paper will present these implant antennas and wireless power transfer in tissue environment present in human head.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: BioMediTech, Research group: Wireless Identification and Sensing Systems Research Group

Contributors: Ukkonen, L., Sydänheimo, L., Ma, S., Björninen, T.

Publication date: 2020

#### **Host publication information**

Title of host publication: Microfluidics, BioMEMS, and Medical Microsystems XVIII

Publisher: SPIE

Editors: Gray, B. L., Becker, H.

Article number: 112350A

ISBN (Print): 9781510632332

ISBN (Electronic): 9781510632349

#### **Publication series**

Name: Progress in Biomedical Optics and Imaging - Proceedings of SPIE

Volume: 11235

ISSN (Print): 1605-7422

ISSN (Electronic): 2410-9045

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Atomic and Molecular Physics, and Optics, Radiology Nuclear Medicine and imaging

Keywords: implant antennas, Wireless biomedical implants, wireless power transfer

DOIs:

10.1117/12.2552183

#### **Bibliographical note**

jufoid=65546

Source: Scopus

Source ID: 85082726318

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Benchmarking of several disparity estimation algorithms for light field processing**

A number of high-quality depth imaged-based rendering (DIBR) pipelines have been developed to reconstruct a 3D scene from several images taken from known camera viewpoints. Due to the specific limitations of each technique, their output is prone to artifacts. Therefore, the quality cannot be ensured. To improve the quality of the most critical and challenging image areas, an exhaustive comparison is required. In this paper, we consider three questions of benchmarking the quality performance of eight DIBR techniques on light fields: First, how does the density of original input views affect the quality of the rendered novel views? Second, how does disparity range between adjacent input views impact the quality? Third, how does each technique behave for different object properties? We compared and evaluated the results visually as well as quantitatively (PSNR, SSIM, AD, and VDP2). The results show some techniques outperform others in different disparity ranges. The results also indicate using more views not necessarily results in visually higher quality for all critical image areas. Finally, we have shown a comparison for different scene's complexity such as non-Lambertian objects.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Computing Sciences, Moving Picture Technologies

Contributors: Zakeri, F. S., Bätz, M., Jaschke, T., Keinert, J., Chuchvara, A.

Publication date: 2019

#### **Host publication information**

Title of host publication: Fourteenth International Conference on Quality Control by Artificial Vision

Publisher: SPIE, IEEE

Editors: Bazeille, S., Verrier, N., Cudel, C.  
Article number: 111721C  
ISBN (Electronic): 9781510630536

#### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering  
Volume: 11172  
ISSN (Print): 0277-786X  
ISSN (Electronic): 1996-756X  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering  
Keywords: Depth image-based rendering, Disparity estimation, Quality evaluation  
DOIs:  
10.1117/12.2521747

#### Bibliographical note

jufoid=71479  
Source: Scopus  
Source ID: 85070208910  
Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Bistable optical propagation in nematic liquid crystals

We demonstrate bistability when beams propagate and self-focus in nematic liquid crystals. Sample configurations subject to the Fréedericksz threshold support diffracting as well as self-confined beams for the same input power, leading to hysteresis.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Frontier Photonics, University "Roma Tre", Nonlinear Optics and OptoElectronics Lab, University of Southampton, United Kingdom  
Contributors: Piccardi, A., Alberucci, A., Kravets, N., Buchnev, O., Kaczmarek, M., Assanto, G.  
Publication date: 21 Jul 2014

#### Host publication information

Title of host publication: Nonlinear Photonics, NP 2014  
Publisher: Optical Society of America OSA  
ISBN (Print): 9781557528209  
ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Mechanics of Materials  
URLs:  
<http://www.scopus.com/inward/record.url?scp=84919754065&partnerID=8YFLogxK> (Link to publication in Scopus)  
Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Combining full-reference image visual quality metrics by neural network

A task of assessing full-reference visual quality of images is considered. Correlation between the obtained array of mean opinion scores (MOS) and the corresponding array of given metric values allows characterizing correspondence of a considered metric to HVS. For the largest openly available database TID2013 intended for metric verification, a Spearman correlation is about 0.85 for the best existing HVS-metrics. One simple way to improve an efficiency of assessing visual quality of images is to combine several metrics. Our work addresses a possibility of using neural networks for the aforementioned purpose. As learning data, we have used metric sets for images of the database TID2013 that are employed as the network inputs. Randomly selected half of 3000 images of the database TID2013 has been used at the learning stage whilst other half have been exploited for assessing quality of neural network based HVS-metric. Six metrics "cover" well all types of distortions: FSIMc, PSNR-HMA, PSNR-HVS, SFF, SR-SIM, and VIF, have been selected. As the result of NN learning, the Spearman correlation between the NN output and the MOS for the verification set of database TID2013 reaches 0.93 for the best configuration of NN. This is considerably better than for any particular metric employed as an input (FSIMc is the best among them). Analysis of the designed metric efficiency is carried out, its advantages and drawbacks are demonstrated.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Department of Signal Processing, Signal Processing Research Community (SPRC), National Aerospace University  
Contributors: Lukin, V. V., Ponomarenko, N. N., Ieremeiev, O., Egiazarian, K., Astola, J.

Publication date: 2015

### Host publication information

Title of host publication: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 9394

Publisher: SPIE

Article number: 93940K

ISBN (Print): 9781628414844

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Full-reference image visual quality assessment, Neural networks

DOIs:

10.1117/12.2085465

URLs:

<http://www.scopus.com/inward/record.url?scp=84928473490&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84928473490

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Complex-domain sparse imaging in terahertz pulse time-domain holography with balance detection

Terahertz pulse time-domain holography (THz PTDH) is an ultimate technique both for the measurement of object optical properties and broadband wavefront sensing. However, THz PTDH has valuable restriction connected with low signal-to-noise ratio which becomes a serious issue in coherent measurements. This noise problem could be solved by filtering with use of modern block-matching algorithms based on nonlocal similarity of small patches of images existing in investigated objects. Here we present the study on the use of denoising algorithms applied for hyperspectral THz data in the spatio-temporal and spatial-spectral domain. We provide a numerical simulation of denoising in case of broadband uniform topologically charged (BUTCH) beam of pulsed THz radiation.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Computing Sciences, ITMO University

Contributors: Kulya, M. S., Katkovnik, V., Egiazarian, K., Petrov, N. V.

Publication date: 2020

### Host publication information

Title of host publication: Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XIII

Publisher: SPIE

Editors: Sadwick, L. P., Yang, T.

Article number: 1127921

ISBN (Electronic): 9781510633216

### Publication series

Name: Proceedings of SPIE

Volume: 11279

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Hyperspectral data denoising, Pulse time-domain holography, Sparse imaging, THz radiation

DOIs:

10.1117/12.2549001

### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85083756750

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Compressive strain measurement using RFID patch antenna sensors

In this research, two radiofrequency identification (RFID) antenna sensor designs are tested for compressive strain measurement. The first design is a passive (battery-free) folded patch antenna sensor with a planar dimension of 61mm × 69mm. The second design is a slotted patch antenna sensor, whose dimension is reduced to 48mm × 44mm by introducing slots on antenna conducting layer to detour surface current path. A three-point bending setup is fabricated to apply compression on a tapered aluminum specimen mounted with an antenna sensor. Mechanics-electromagnetics

coupled simulation shows that the antenna resonance frequency shifts when each antenna sensor is under compressive strain. Extensive compression tests are conducted to verify the strain sensing performance of the two sensors. Experimental results confirm that the resonance frequency of each antenna sensor increases in an approximately linear relationship with respect to compressive strain. The compressive strain sensing performance of the two RFID antenna sensors, including strain sensitivity and determination coefficient, is evaluated based on the experimental data.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering, Virginia Tech

Contributors: Cho, C., Yi, X., Wang, Y., Tentzeris, M. M., Leon, R. T.

Publication date: 2014

#### Host publication information

Title of host publication: Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2014

Volume: 9061

Publisher: SPIE

Article number: 90610X

ISBN (Print): 9780819499875

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Folded patch antenna, Passive wireless sensor, RFID, Slotted patch antenna, Strain sensor

DOIs:

10.1117/12.2045122

URLs:

<http://www.scopus.com/inward/record.url?scp=84902151393&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84902151393

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Computational wavelength resolution for in-line lensless holography: Phase-coded diffraction patterns and wavefront group-sparsity

In-line lensless holography is considered with a random phase modulation at the object plane. The forward wavefront propagation is modelled using the Fourier transform with the angular spectrum transfer function. The multiple intensities (holograms) recorded by the sensor are random due to the random phase modulation and noisy with Poissonian noise distribution. It is shown by computational experiments that high-accuracy reconstructions can be achieved with resolution going up to the two thirds of the wavelength. With respect to the sensor pixel size it is a super-resolution with a factor of 32. The algorithm designed for optimal superresolution phase/amplitude reconstruction from Poissonian data is based on the general methodology developed for phase retrieval with a pixel-wise resolution in V. Katkovnik, "Phase retrieval from noisy data based on sparse approximation of object phase and amplitude", <http://www.cs.tut.fi/~lasip/DDT/index3.html>.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Signal Processing, Department of Photonics and Optical Information Technology, ITMO University

Contributors: Katkovnik, V., Shevkunov, I., Petrov, N. V., Egiazarian, K.

Publication date: 2017

#### Host publication information

Title of host publication: Digital Optical Technologies 2017

Publisher: SPIE

Article number: 1033509

ISBN (Electronic): 9781510611153

#### Publication series

Name: Proceedings of SPIE

Volume: 10335

ISSN (Print): 0277-786X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Discrete optical signal processing, Image processing, Noise in imaging systems, Phase retrieval, Superresolution

DOIs:

10.1117/12.2269327

### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85030715279

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Continuous-wave, cascaded raman laser at 1.3, 1.5, and 1.7 $\mu\text{m}$

#### General information

Publication status: Published

MoE publication type: Not Eligible

Organisations: Photonics, Research group: ORC, Research group: Semiconductor Technology and Applications, University of Strathclyde

Contributors: Casula, R., Penttinen, J. P., Guina, M., Kemp, A. J., Hastie, J. E.

Publication date: 1 Jan 2017

#### Host publication information

Title of host publication: The European Conference on Lasers and Electro-Optics, CLEO\_Europe 2017

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

#### Publication series

Name: Optics InfoBase Conference Papers

Volume: Part F82-CLEO\_Europe 2017

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

URLs:

<http://www.scopus.com/inward/record.url?scp=85039902858&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 85039902858

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Continuous-wave optical parametric oscillators for mid-infrared spectroscopy

The atmospheric window at 3 to 5  $\mu\text{m}$  is one of the most important spectral regions for molecular spectroscopy. This region accommodates strong fundamental vibrational spectra of several interesting molecules, including species relevant for air quality monitoring, medical diagnostics, and fundamental research. These applications require excellent spectroscopic sensitivity and selectivity. For example, atmospheric research often needs precise quantification of trace gas fractions of down to the parts-per-trillion level ( $10^{-12}$ ), with the capability of resolving individual spectral features of different molecular compounds. This sets stringent requirements for the light source of the spectrometer in terms of output power, noise, and linewidth. In addition, the wavelength tuning range of the light source needs to be large, preferably over the entire atmospheric window, in order to enable measurements of molecular fingerprints of several compounds. Continuous-wave optical parametric oscillators (CW-OPOs) are one of the few light sources that have the potential of combining all these favorable characteristics. This contribution summarizes our progress in the development of CW-OPOs, with an emphasis on precise frequency control methods for high-resolution molecular spectroscopy. Examples of new applications enabled by the advanced CW-OPO technologies will be presented. These examples include a demonstration of world-record detection sensitivity in trace gas analysis, as well as the first characterization of infrared spectrum of radioactive methane  $^{14}\text{CH}_4$ .

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Research group: Infrared Light Sources, University of Helsinki

Contributors: Vainio, M.

Publication date: 2020

#### Host publication information

Title of host publication: Nonlinear Frequency Generation and Conversion : Materials and Devices XIX

Publisher: SPIE

Editors: Schunemann, P. G., Schepler, K. L.

Article number: 1126419

ISBN (Print): 9781510632912

ISBN (Electronic): 9781510632929

#### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 11264

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Infrared spectroscopy, Molecular spectroscopy, Nonlinear optics, Optical frequency conversion

DOIs:

10.1117/12.2548711

### **Bibliographical note**

jufoid=71479

Source: Scopus

Source ID: 85084182629

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Cyclic quantum walks: Photonic realization and decoherence analysis**

Quantum walks serve as novel tools for performing efficient quantum computation and simulation. In a recent experimental demonstration [1] we have realized photonic quantum walks for simulating cyclic quantum systems, such as hexagonal lattices or aromatic molecules like benzene. In that experiment we explored the wave function dynamics and the probability distribution of a quantum particle located on a six-site system (with periodic boundary conditions), alongside with simpler demonstration of three- and four-site systems, under various initial conditions. Localization and revival of the wave function were demonstrated. After revisiting that experiment we will theoretically analyze the case of noisy quantum walks by implementing the bit-phase flip channel. This will allow us to draw conclusions regarding the performance of our photonic quantum simulation in noisy environments. Finally, we will briefly outline some future directions.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, University of Ottawa, Canada, National Research Council, Bar Ilan University, Massachusetts Institute of Technology

Contributors: Nejadsattari, F., Zhang, Y., Jayakody, M. N., Bouchard, F., Larocque, H., Sit, A., Fickler, R., Cohen, E., Karimi, E.

Publication date: 2020

### **Host publication information**

Title of host publication: Advanced Optical Techniques for Quantum Information, Sensing, and Metrology

Publisher: SPIE

Editors: Hemmer, P. R., Migdall, A. L., Hasan, Z. U.

Article number: 1129503

ISBN (Print): 9781510633537

ISBN (Electronic): 9781510633544

### **Publication series**

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 11295

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Decoherence, Photonic quantum walks, Quantum simulation

DOIs:

10.1117/12.2546566

### **Bibliographical note**

jufoid=71479

Source: Scopus

Source ID: 85084182226

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Depth map occlusion filling and scene reconstruction using modified exemplar-based inpainting**

RGB-D sensors are relatively inexpensive and are commercially available off-the-shelf. However, owing to their low complexity, there are several artifacts that one encounters in the depth map like holes, mis-alignment between the depth and color image and lack of sharp object boundaries in the depth map. Depth map generated by Kinect cameras also contain a significant amount of missing pixels and strong noise, limiting their usability in many computer vision applications. In this paper, we present an efficient hole filling and damaged region restoration method that improves the quality of the depth maps obtained with the Microsoft Kinect device. The proposed approach is based on a modified exemplar-based inpainting and LPA-ICI filtering by exploiting the correlation between color and depth values in local

image neighborhoods. As a result, edges of the objects are sharpened and aligned with the objects in the color image. Several examples considered in this paper show the effectiveness of the proposed approach for large holes removal as well as recovery of small regions on several test images of depth maps. We perform a comparative study and show that statistically, the proposed algorithm delivers superior quality results compared to existing algorithms.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), Dept. of Radio-Electronics Systems, Don State Technical University

Contributors: Voronin, V. V., Marchuk, V. I., Fisunov, A. V., Tokareva, S. V., Egiazarian, K. O.

Publication date: 2015

#### Host publication information

Title of host publication: Image Processing: Algorithms and Systems XIII

Publisher: SPIE

Article number: 93990S

ISBN (Print): 9781628414899

#### Publication series

Name: SPIE Conference Proceedings

Volume: 9399

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Depth map, Filtering, Image processing, Inpainting, Kinect, Occlusion

DOIs:

10.1117/12.2076506

Source: Scopus

Source ID: 84928473063

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Design and simulation of a slotted patch antenna sensor for wireless strain sensing

In this work, a slotted patch antenna is employed as a wireless sensor for monitoring structural strain and fatigue crack. Using antenna miniaturization techniques to increase the current path length, the footprint of the slotted patch antenna can be reduced to one quarter of a previously presented folded patch antenna. Electromagnetic simulations show that the antenna resonance frequency varies when the antenna is under strain. The resonance frequency variation can be wirelessly interrogated and recorded by a radiofrequency identification (RFID) reader, and can be used to derive strain/deformation. The slotted patch antenna sensor is entirely passive (battery-free), by exploiting an inexpensive off-the-shelf RFID chip that receives power from the wireless interrogation by the reader.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering, Virginia Tech

Contributors: Yi, X., Cho, C., Cook, B., Wang, Y., Tentzeris, M. M., Leon, R. T.

Publication date: 2013

#### Host publication information

Title of host publication: Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security 2013

Volume: 8694

Article number: 86941J

ISBN (Print): 9780819494771

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: RFID, Slotted patch antenna, Strain sensor, Wireless passive sensor

DOIs:

10.1117/12.2009233

URLs:

<http://www.scopus.com/inward/record.url?scp=84878419679&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84878419679

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Design, Fabrication, and Wireless Evaluation of a Passive 3D-printed Moisture Sensor on a Textile Substrate**

This paper introduces the first steps of fabrication and the initial wireless performance evaluation of a passive ultra-high frequency (UHF) radiofrequency identification (RFID)-based moisture sensor on a textile substrate. The sensor antenna was embroidered on a stretchable fabric firstly, and then embedded inside a 3D-printed platform. This 3D-printed sensor material changes its properties permanently, after exposure to a high moisture environment. Thus, the sensor can detect the increased moisture in the environment. Based on our initial results, this information can be clearly read from the changed backscattered signal of the embedded passive RFID tag. The fabricated sensor has an initial peak read range of 6 meters. After being dipped into water for 2 hours, the read range of the sensor has a significant decrease, but it is still readable from 5 meters. Thus, this moisture sensor can be read wirelessly from a convenient distance, when considering practical use of moisture sensors.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: BioMediTech

Contributors: Chen, X., He, H., Khan, Z., Sydänheimo, L., Ukkonen, L., Virkki, J.

Number of pages: 4

Pages: 1027-1030

Publication date: 1 Jun 2019

#### **Host publication information**

Title of host publication: 2019 Photonics and Electromagnetics Research Symposium - Spring, PIERS-Spring 2019 - Proceedings

Publisher: IEEE

Article number: 9017301

ISBN (Electronic): 9781728134031

#### **Publication series**

Name: Progress in Electromagnetics Research Symposium

Volume: 2019-June

ISSN (Print): 1559-9450

ISSN (Electronic): 1931-7360

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/PIERS-Spring46901.2019.9017301

Source: Scopus

Source ID: 85082012079

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Development of dust test method for motor drives**

Motor drives are used in various industrial processes. Some of the operational environments of the drives may contain contaminations like dust, salts and gases. Dust combined with humidity may cause electrical shorts, decreased insulation resistance, and corrosion on the electronics of the device. Therefore, it is essential to study the behavior of the devices under such conditions. In this study, a product level dust test method for low voltage motor drives was developed. Method was successfully used to study the accumulation of the dust inside devices and the behavior of the devices under dusty and humid conditions.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electrical Energy Engineering

Contributors: Pippola, J., Marttila, T., Frisk, L.

Number of pages: 4

Pages: 43-46

Publication date: 26 Jul 2017

#### **Host publication information**

Title of host publication: 2017 IMAPS Nordic Conference on Microelectronics Packaging, NordPac 2017

Publisher: IEEE

ISBN (Electronic): 9781538630556

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Polymers and Plastics

Keywords: dust test, motor drive, reliability

DOIs:

10.1109/NORDPAC.2017.7993161

Source: Scopus

Source ID: 85028615574

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Development of efficient electrically pumped nanolasers based on InAlGaAs tunnel junction**

We propose and experimentally demonstrate a metallo-dielectric nanolasers utilizing an InAlGaAs tunnel junction for efficient carrier injection, which reduce the complexity when optimizing the metal contact, and reduces the device resistance.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Research group: ORC, University of California San Diego

Contributors: Fang, C. Y., Vallini, F., Amili, A. E., Tukiainen, A., Lyytikäinen, J., Guina, M., Fainman, Y.

Publication date: 2018

#### **Host publication information**

Title of host publication: CLEO : Science and Innovations, CLEO\_SI 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/CLEO\_SI.2018.SW4Q.4

Source: Scopus

Source ID: 85048984466

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Dilute nitride SOAs for high-speed data processing in variable temperature conditions**

We present the first experimental study of a Dilute Nitride SOA with high-speed gain dynamics and attractive thermal characteristics as a data processing element at 10Gb/s and at different operating temperatures.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Aristotle University of Thessaloniki, School of Electrical and Computer Engineering, National Technical University of Athens

Contributors: Giannoulis, G., Korpijärvi, V. M., Iliadis, N., Mäkelä, J., Viheriälä, J., Apostolopoulos, D., Guina, M., Avramopoulos, H.

Publication date: 13 Mar 2015

#### **Host publication information**

Title of host publication: Optical Fiber Communication Conference, OFC 2015

Publisher: OSA - The Optical Society

ISBN (Print): 9781557529374

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Computer Networks and Communications, Instrumentation, Atomic and Molecular Physics, and Optics

URLs:

<http://www.scopus.com/inward/record.url?scp=84930886920&partnerID=8YFLogxK> (Link to publication in Scopus)

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Directional random laser by combining cavity-less lasing and spatial solitons in liquid crystals**

Combining a reorientational spatial optical soliton with optical gain and scattering in dye-doped liquid crystals, we demonstrate that a random laser can emit a smooth laser beam in a well-defined direction.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Research group: Nonlinear Optics, University "Roma Tre"

Contributors: Perumbilavil, S., Piccardi, A., Kauranen, M., Assanto, G.

Publication date: 2018

### Host publication information

Title of host publication: Nonlinear Photonics, NP 2018

Volume: Part F108-NP 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/NP.2018.NpW2C.4

Source: Scopus

Source ID: 85051269281

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Directional selectivity through the subwavelength slit in metallic gratings

An approach for obtaining strong directional selectivity through a single subwavelength slit in non-symmetric metallic gratings is shown theoretically and experimentally. Directionality effect originates from the different resonance frequencies of two interfaces.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Bilkent University, Nanotechnology Research Center

Contributors: Cakmakyapan, S., Caglayan, H., Serebryannikov, A., Ozbay, E.

Publication date: 2011

### Host publication information

Title of host publication: 2011 Conference on Lasers and Electro-Optics : Laser Science to Photonic Applications, CLEO 2011

Article number: 5951099

ISBN (Print): 9781557529107

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

URLs:

<http://www.scopus.com/inward/record.url?scp=80052115222&partnerID=8YFLogxK> (Link to publication in Scopus)

### Bibliographical note

EXT="Caglayan, Humeyra"

Source: Scopus

Source ID: 80052115222

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Dots-on-the-fly electron beam lithography

We demonstrate a novel approach for electron-beam lithography (EBL) of periodic nanostructures. This technique can rapidly produce arrays of various metallic and etched nanostructures with line and pitch dimensions approaching the beam spot size. Our approach is based on often neglected functionality which is inherent in most modern EBL systems. The raster/vector beam exposure system of the EBL software is exploited to produce arrays of pixel-like spots without the need to define coordinates for each spot in the array. Producing large arrays with traditional EBL techniques is cumbersome during pattern design, usually leads to large data files and easily results in system memory overload during patterning. In Dots-on-The-fly (DOTF) patterning, instead of specifying the locations of individual spots, a boundary for the array is given and the spacing between spots within the boundary is specified by the beam step size. A designed pattern element thus becomes a container object, with beam spacing acting as a parameterized location list for an array of spots confined by that container. With the DOTF method, a single pattern element, such as a square, rectangle or circle, can be used to produce a large array containing thousands of spots. In addition to simple arrays of nano-dots, we expand the technique to produce more complex, highly tunable arrays and structures on substrates of silicon, ITO/FTO coated glass, as well as uncoated fused silica, quartz and sapphire.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Optoelectronics Research Centre, Research group: Nanophotonics

Contributors: Isotalo, T. J., Niemi, T.

Number of pages: 7

Publication date: 2016

### Host publication information

Title of host publication: SPIE Proceedings : Alternative Lithographic Technologies VIII

Volume: 9777  
Publisher: SPIE  
Editor: Bencher, C.  
Article number: 97771E  
ISBN (Electronic): 9781510600126

#### Publication series

Name: Proceedings of SPIE

Publisher: SPIE

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Electrical and Electronic Engineering, Applied Mathematics

Keywords: electron beam lithography, nano-fabrication, nano-particle arrays, optoelectronics, periodic nano-structures, plasmonics

DOIs:

10.1117/12.2219136

Source: Scopus

Source ID: 84981516864

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Double-asymmetric-structure 1.5 $\mu$ m high power laser diodes

Design considerations for high pulsed power and brightness 1.5  $\mu$ m laser emitters for laser radar applications, based on comprehensive semi-analytical theory, are presented. A strongly asymmetric waveguide design with a bulk active layer positioned very near the p-emitter interface is chosen to minimize the current-induced losses at high power while maintaining a single, broad transverse mode. Moderate to high doping of the n-side of the Optical Confinement Layer and high p-doping of the p-cladding layer are used to reduce the residual current-induced losses and the electric resistance of the structure. For pulsed room-temperature operation, short laser resonators are found to be advantageous. First experimental results are presented. An as-cleaved sample with a stripe width of 90  $\mu$ m and a resonator 2 mm long exhibits an output power of about 18 W at a pumping current amplitude of 80 A, with 1 mm long resonators showing higher power output. Further improvements are predicted by structure optimization as well as increase in internal quantum efficiency and thermal performance.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, University of Oulu, Ioffe Physico-Technical Institute, University of York

Contributors: Hallman, L., Ryvkin, B. S., Avrutin, E. A., Aho, A. T., Viheriälä, J., Guina, M., Kostamovaara, J. T.

Number of pages: 2

Pages: 19-20

Publication date: 1 Oct 2019

#### Host publication information

Title of host publication: Proceedings of the 2019 IEEE High Power Diode Lasers and Systems Conference, HPD 2019 - Co-located with Photonex 2019

Publisher: IEEE

ISBN (Electronic): 9781728130972

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Keywords: efficiency, high power lasers, laser diodes, modelling

DOIs:

10.1109/HPD48113.2019.8938671

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Double-side pumped membrane external-cavity surface-emitting laser (MECSEL) with increased efficiency emitting > 3 W in the 780 nm region

We demonstrate a double-side pumped MECSEL emitting more than 3 W of output power in the 780 nm wavelength region. The laser exhibits an efficiency as high as 34.4 %.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics

Contributors: Kahle, H., Phung, H., Penttinen, J., Rajala, P., Tukiainen, A., Ranta, S., Guina, M.

Publication date: 1 May 2019

### Host publication information

Title of host publication: 2019 Conference on Lasers and Electro-Optics, CLEO 2019 - Proceedings

Publisher: IEEE

ISBN (Electronic): 9781943580576

ASJC Scopus subject areas: Spectroscopy, Industrial and Manufacturing Engineering, Safety, Risk, Reliability and Quality, Management, Monitoring, Policy and Law, Electronic, Optical and Magnetic Materials, Radiology Nuclear Medicine and imaging, Instrumentation, Atomic and Molecular Physics, and Optics

DOIs:

10.23919/CLEO.2019.8749958

### Bibliographical note

INT=phys,"Rajala, Patrik"

Source: Scopus

Source ID: 85069191246

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Dynamic laser speckle metrology with binarization of speckle patterns

Dynamic laser speckle analysis is non-destructive detection of physical or biological activity through statistical processing of speckle patterns on the surface of diffusely reflecting objects. This method is sensitive to microscopic changes of the surface over time and needs simple optical means. Advances in computers and 2D optical sensors forced development of pointwise algorithms. They rely on acquisition of a temporal sequence of correlated speckle images and generate activity data as a 2D spatial contour map of the estimate of a given statistical parameter. The most widely used pointwise estimates are the intensity-based estimates which compose each map entry from a time sequence of intensity values taken at one and the same pixel in the acquired speckle images. Accuracy of the pointwise approach is strongly affected by the signal-dependent nature of the speckle data when the spread of intensity fluctuations depends on the intensity itself. The latter leads to erroneous activity determination at non-uniform distribution of intensity in the laser beam for the non-normalized estimates. Normalization of the estimates, introduces errors. We propose to apply binarization to the acquired speckle images by comparing the intensity values in the temporal sequence for a given spatial point to the mean intensity value estimated for this point and to evaluate a polar correlation function. Efficiency of this new processing algorithm is checked both by simulation and experiment.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Signal Processing, Research group: 3D MEDIA, Bulgarian Academy of Sciences

Contributors: Stoykova, E., Nazarova, D., Berberova, N., Gotchev, A., Ivanov, B., Mateev, G.

Publication date: 2017

### Host publication information

Title of host publication: 19th International Conference and School on Quantum Electronics: Laser Physics and Applications

Publisher: SPIE

Article number: 102260R

ISBN (Electronic): 9781510609532

### Publication series

Name: Proceedings of SPIE

Volume: 10226

ISSN (Print): 0277-786X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Binary patterns, Dynamic speckle, Intensity-based algorithms, Optical metrology, Pointwise processing

DOIs:

10.1117/12.2262330

### Bibliographical note

JUFOID=71479

Source: Scopus

Source ID: 85017345812

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Eco-friendly flexible wireless platforms by 3D printing pen

We present a new type of 3D printing pen fabrication of flexible passive UHF (ultra-high frequency) RFID (radio frequency identification) platforms. The used 3D printing material is cost-effective and fully biodegradable. The tag antenna is fabricated from conductive thread. This antenna and antenna-IC interconnections are fixed inside the 3D-printed platforms with 3D-printed fasteners. Thus, our solution requires no additional process steps or chemicals. For wireless evaluation,

the platforms are firstly bended around different size cylinders, with and without a 3D-printed top layer. Further, the reliability of the platforms in high moisture is also tested, by keeping the platforms in water for 1 minute. Based on these preliminary tests, our manufacturing method enables establishment of highly reliable eco-friendly platforms with excellent wireless performance. The developed solutions have versatile future applications, especially in the field of wearable electronics, where lightweight, cost-effective, flexible, and waterproof platforms are needed.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: BioMediTech  
Contributors: Mehmood, A., Chen, X., He, H., Ukkonen, L., Virkki, J.  
Number of pages: 4  
Pages: 2422-2425  
Publication date: 1 Dec 2019

#### Host publication information

Title of host publication: 2019 Photonics and Electromagnetics Research Symposium - Fall, PIERS - Fall 2019 - Proceedings  
Publisher: IEEE  
Article number: 9021887  
ISBN (Electronic): 9781728153049

#### Publication series

Name: 2019 Photonics and Electromagnetics Research Symposium - Fall, PIERS - Fall 2019 - Proceedings  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Mathematical Physics  
DOIs:  
10.1109/PIERS-Fall48861.2019.9021887  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### Effect of Epoxy Flux Underfill on Thermal Cycling Reliability of Sn-8Zn-3Bi Lead-Free Solder in a Sensor Application

The use of sensors has significantly increased in both domestic and industrial applications. In some applications, the sensor component is used along with a heat-sensitive component, therefore, the attachment process using common lead-free solders that have high melting temperature (e.g., Sn-Ag-Cu,  $T_m = 217$  °C) may be challenging. Among lead-free solders with low melting temperature, Sn-8%Zn-3%Bi (wt.%), lead-free solder has a rather similar melting temperature to that of typical Sn-Pb solders. In addition, it offers good mechanical properties. However, the presence of Zn makes it prone to oxidation especially at high temperatures. In this paper, the reliability of sensor attachments using Sn-8%Zn-3%Bi solder and epoxy flux underfill was studied under thermal cycling. Thermal cycling results showed that the lifetime of the lead-free solder joint was lower than that of the Sn-Pb-2Ag solder joints. Failure analysis revealed that the dominant failure mode in lead-free samples was delamination of the sensor pad. In contrast, the failure mode of Sn-36%Pb-2%Ag samples was fatigue crack inside the solder. Additionally, it was found that Sn-Zn-Bi lead-free solder was compatible with epoxy flux underfill.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Department of Electrical Engineering, Research area: Reliability  
Contributors: Mostofizadeh, M., Najari, M., Das, D., Pecht, M., Frisk, L.  
Number of pages: 7  
Pages: 2169-2175  
Publication date: 16 Aug 2016

#### Host publication information

Title of host publication: Proceedings - ECTC 2016: 66th Electronic Components and Technology Conference  
Publisher: IEEE  
ISBN (Electronic): 9781509012039  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering  
Keywords: Failure analysis, Sensor, Sn-Zn-Bi, Solder, Thermal cycling, Underfill  
DOIs:  
10.1109/ECTC.2016.209  
Source: Scopus  
Source ID: 84987788928  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Embroidered and e-textile conductors embedded inside 3D-printed structures**

This paper discusses the fabrication and wireless performance evaluation of textile-integrated passive ultra-high frequency (UHF) radiofrequency identification (RFID) tags, which are embedded inside flexible additively manufactured wireless platforms. Two different methods are utilized to fabricate the tag antenna, including embroidery with conductive thread and conductive e-textiles. After antenna fabrication, RFID ICs (integrated circuits) are attached to the antenna patterns, to achieve fully functional RFID tags. These two types of tags are embedded inside flexible 3D-printed platforms, which can protect the tags from mechanical stresses and moisture. Our preliminary results show that the peak read ranges of both types of platforms are higher than 6 meters, which are suitable for versatile wireless applications.

#### **General information**

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: BioMediTech  
Contributors: Khan, Z., He, H., Chen, X., Ukkonen, L., Virkki, J.  
Number of pages: 6  
Pages: 1675-1680  
Publication date: 1 Dec 2019

#### **Host publication information**

Title of host publication: 2019 Photonics and Electromagnetics Research Symposium - Fall, PIERS - Fall 2019 - Proceedings  
Publisher: IEEE  
Article number: 9021681  
ISBN (Electronic): 9781728153049  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Mathematical Physics  
DOIs:  
10.1109/PIERS-Fall48861.2019.9021681  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Enhanced-performance wireless conformal "smart skins" utilizing inkjet-printed carbon-nanostructures**

This paper introduces for the first time the integration of a UHF radio frequency identification (RFID) antenna with reduced graphene oxide (rGO), developed using direct-write techniques and utilizing an RFID chip for chemical gas detection. The module is realized by inkjet printing on a low-cost paper-based substrate, and the RFID tag is designed for the North America UHF RFID band. The electrical impedance of the rGO thin film changes in the presence of very small quantities of certain toxic gases, resulting in a variation of the backscattered power level which is easily detected by the RFID reader to realize reliable wireless toxic gas sensing. The inkjet printed RFID tag demonstrated a change in backscattered power of 9.18% upon exposure of 40 ppm NO<sub>2</sub> for 5 minutes.

#### **General information**

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology  
Contributors: Le, T., Lin, Z., Wong, C. P., Tentzeris, M. M.  
Number of pages: 6  
Pages: 769-774  
Publication date: 11 Sep 2014

#### **Host publication information**

Title of host publication: Proceedings - Electronic Components and Technology Conference  
Publisher: Institute of Electrical and Electronics Engineers Inc.  
Article number: 6897372  
ISBN (Electronic): 9781479924073  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering  
Keywords: Gas sensor, graphene, inkjet printing, T-match, UHF RFID, wireless  
DOIs:  
10.1109/ECTC.2014.6897372  
URLs:  
<http://www.scopus.com/inward/record.url?scp=84907903342&partnerID=8YFLogxK> (Link to publication in Scopus)  
Source: Scopus  
Source ID: 84907903342  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Evaluating transparent liquid screen overlay as a haptic conductor: Method of enhancing touchscreen based user interaction by a transparent deformable liquid screen overlay**

In line with our previous work, this research focuses on a method for attenuating acoustic components (noise) while providing enhanced vibrotactile feedback signals on mobile devices using, deformable touchscreen overlays. Traditional mechanism of providing tactile feedback to the fingertip via a flat rigid touchscreen is limited due to the dampening of the mechanoreceptors which are sensitive to static deformation and lie at the tips of the intermediate ridges in the epidermal-dermal junction. This tactile mechanism becomes useless when the fingertip acts against a ridged surface (chemically strengthened alkali-aluminosilicate glass). Furthermore, the actuation provided by most devices is indirect with little or no mediation mechanism, which results in filtering various signal frequencies, loss of signal intensity as well as creating acoustic noise. The resulting haptic signal is considerably inefficient and incongruent to the applied signal, which was designed to stimulate user skin contact. To resolve these issues we developed a unique transparent screen overlay conductor which contains an oil based composition (a low viscosity inert nonconductive liquid), that acts as a soft deformable interaction point, enhancing the ratio between tactile signals and the acoustic components, provided by haptic actuators. Using surface mounted and embedded actuators to the overlay, while being attached to an ExoPC Slate, we measured haptic signal to noise correlation, as well as signal efficiency and strength over multiple frequencies and concluded that the haptic conductor was able to limit auditory noise and mediate tactile signals more efficiently than traditional rigid glass based surfaces.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Augmented Human Activities (AHA), Fukoku-Rubber Co.

Contributors: Farooq, A., Evreinov, G., Raisamo, R., Takahata, D.

Publication date: 31 Dec 2015

#### **Host publication information**

Title of host publication: 2015 IEEE SENSORS - Proceedings

Publisher: Institute of Electrical and Electronics Engineers Inc.

Article number: 7370186

ISBN (Electronic): 9781479982028

ASJC Scopus subject areas: Instrumentation, Electronic, Optical and Magnetic Materials, Spectroscopy, Electrical and Electronic Engineering

Keywords: haptic signal mediation, haptics user interface, Liquid transparent screen overlay, piezoelectric and voice coil actuators, vibrotactile mechano-transduction

DOIs:

10.1109/ICSENS.2015.7370186

URLs:

<http://www.scopus.com/inward/record.url?scp=84963615224&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84963615224

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Fabrication and characterization of broadband superluminescent diodes for 2 $\mu\text{m}$ wavelength**

Single-mode superluminescent diodes operating at 2  $\mu\text{m}$  wavelength are reported. The structures are based on GaSb material systems and were fabricated by molecular beam epitaxy. Several waveguide designs have been implemented. A continuous-wave output power higher than 35 mW is demonstrated for a spectrum centered at around 1.92  $\mu\text{m}$ . We show that the maximum output power of the devices is strongly linked to spectrum width. Device having low output power exhibit a wide spectrum with a full-width half-maximum (FWHM) as large as 209 nm, while devices with highest output power exhibit a narrower spectrum with about 61 nm FWHM.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications

Contributors: Zia, N., Viheriälä, J., Koskinen, R., Koskinen, M., Suomalainen, S., Guina, M.

Publication date: 2016

#### **Host publication information**

Title of host publication: Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX

Publisher: SPIE

Article number: 97680Q

ISBN (Electronic): 9781510600034

#### **Publication series**

Name: Proceedings of SPIE

Volume: 9768

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Gallium antimonide, SLD design, Superluminescent diodes, Tilt waveguide

Electronic versions:

Proc\_SPIE\_9768\_97680Q\_N\_Zia\_et\_al\_author\_prepared\_version

DOIs:

10.1117/12.2209720

URLs:

<http://urn.fi/URN:NBN:fi:tty-201706201608>

### **Bibliographical note**

INT=orc,"Koskinen, Mervi"

Source: Scopus

Source ID: 84978727362

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Fabrication and performance evaluation of 3D-printed graphene passive UHF RFID tags on cardboard**

This paper discusses the fabrication and wireless performance of 3D-printed graphene-based passive UHF (ultra high frequency) RFID (radiofrequency identification) tags on two different cardboard packaging substrates. Our results confirm that the low-cost and eco-friendly graphene-based RFID tags achieve high performance with attainable read ranges of 3.2-3.8 meters. These results are superior to those of previously reported RFID tags with graphene antennas.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Biomaterials and Tissue Engineering Group, Research group: Wireless Identification and Sensing Systems Research Group, Southeast University

Contributors: He, H., Akbari, M., Chen, X., Nommeots-Nomm, A., Chen, L., Ukkonen, L., Virkki, J.

Number of pages: 4

Pages: 3322-3325

Publication date: 22 May 2017

### **Host publication information**

Title of host publication: 2017 Progress in Electromagnetics Research Symposium - Spring, PIERS 2017

Publisher: IEEE

ISBN (Electronic): 9781509062690

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/PIERS.2017.8262330

Source: Scopus

Source ID: 85044919743

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Fabrication and reliability evaluation of passive UHF RFID T-shirts**

In this paper, we present textile antennas fabricated for T-shirt RFID applications by cutting from commercially available electro-textile, by sewing with conductive thread, and by 3D printing with stretchable silver ink on a 100 % cotton fabric. The ready tags with attached ICs are coated with a protective stretchable encapsulant. The wireless performance of the T-shirt tags is evaluated initially as well as after seven washing cycles, followed by nine washing-drying cycles in a household washing and drying machines. The initial read ranges of all kinds of tags, when measured on-body, are around 3.5 meters. Based on the reliability testing results, the coating effectively protects the components from cyclic washing and drying.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Department of Electronic Engineering, City University of Hong Kong

Contributors: Chen, X., He, H., Ukkonen, L., Virkki, J., Lu, Y., Lam, H.

Number of pages: 4

Pages: 1-4

Publication date: 8 Jun 2018

### Host publication information

Title of host publication: 2018 IEEE International Workshop on Antenna Technology, iWAT2018 - Proceedings

Publisher: IEEE

ISBN (Electronic): 9781538618516

ASJC Scopus subject areas: Instrumentation, Computer Networks and Communications, Electronic, Optical and Magnetic Materials

Keywords: 3D Printing, electro-textiles, embroidery, passive UHF RFID, T-shirts, textiles, washing, wearable electronics

DOIs:

10.1109/IWAT.2018.8379146

### Bibliographical note

jufoid=79362

Source: Scopus

Source ID: 85050037887

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Fabrication Challenges in Embedding of Components and Embroidered Conductors into 3D-printed Textile Electronics Structures

The challenging unobtrusive implementation of electronics structures into clothing, with low cost and high reliability, can be achieved via utilising and adapting a novel structural additive manufacturing method. Our goal is to utilize 3D-printed flexible and washable wireless platforms, where electronics, embroidered antennas and interconnections are embedded mid-printing, created directly on textiles. During the fabrication process, several challenges were encountered. The most important challenges related to the embroidery process were repeated thread breakages, thread cluster formation at the opposite side of the embroidered pattern, and non-precise positioning of the thread at different embroidery rounds. Further, during 3D printing, positioning of the starting point of the printing, resulting as misaligned 3D-printed layers, was a major challenge. This paper describes in detail the challenges encountered during the fabrication process of clothing-integrated basic wireless components, passive UHF RFID tags. Despite the introduced challenges, the ready-made textile-integrated tags showed excellent wireless performance and read ranges of around 6 meters.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: BioMediTech

Contributors: Khan, Z., He, H., Chen, X., Ukkonen, L., Virkki, J.

Number of pages: 6

Pages: 1372-1377

Publication date: 1 Jun 2019

### Host publication information

Title of host publication: 2019 Photonics and Electromagnetics Research Symposium - Spring, PIERS-Spring 2019 - Proceedings

Publisher: IEEE

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Name: Progress in Electromagnetics Research Symposium

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ISSN (Print): 1559-9450

ISSN (Electronic): 1931-7360

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/PIERS-Spring46901.2019.9017223

Source: Scopus

Source ID: 85082014277

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Fluorescence bandwidth of 280nm from broadband Ce<sup>3+</sup>-doped silica fiber pumped with blue laser diode

Fluorescence properties of a Ce<sup>3+</sup>-doped silica fiber at different pump wavelengths between 405nm to 450 nm are investigated. With 405 nm pump wavelength and a fiber length of ~130-140 cm broadband fluorescence of ~280nm is achieved.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Research group: Nanophotonics, Aston University, Fiber Optics Research Center of the Russian Academy of Sciences, Russian Academy of Sciences  
Contributors: Yadav, A., Chichkov, N. B., Gumenyuk, R., Zherebtsov, E., Melkumov, M. A., Yashkov, M. V., Dianov, E. M., Rafailov, E. U.  
Number of pages: 1  
Pages: 133-133  
Publication date: 13 Aug 2018

#### Host publication information

Title of host publication: 2018 International Conference Laser Optics (ICLO)  
Publisher: IEEE  
Article number: 8435861  
ISBN (Electronic): 9781538636121  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics  
Keywords: Broadband source, Ce-doped fiber, Ce ions, Fluorescence  
DOIs:  
10.1109/LO.2018.8435861  
Source: Scopus  
Source ID: 85052525711  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### Frequency Comb Generation in a Continuous-Wave Pumped Second-Order Nonlinear Waveguide Resonator

Optical frequency comb generation has been experimentally studied using an integrated system based on a lithium niobate waveguide resonator featuring a strong quadratic nonlinearity. Our theoretical model shows good agreement with the experimental results.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Physics, Paderborn University, University of Helsinki, VTT Technical Research Centre of Finland  
Contributors: Abdallah, Z., Stefszky, M., Ulvila, V., Silberhorn, C., Vainio, M.  
Publication date: 1 May 2019

#### Host publication information

Title of host publication: 2019 Conference on Lasers and Electro-Optics, CLEO 2019 - Proceedings  
Publisher: IEEE  
ISBN (Electronic): 9781943580576  
ASJC Scopus subject areas: Spectroscopy, Industrial and Manufacturing Engineering, Safety, Risk, Reliability and Quality, Management, Monitoring, Policy and Law, Electronic, Optical and Magnetic Materials, Radiology Nuclear Medicine and imaging, Instrumentation, Atomic and Molecular Physics, and Optics  
DOIs:  
10.23919/CLEO.2019.8750403  
Source: Scopus  
Source ID: 85069196416  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### Frequency-doubled VECSEL employing a Volume Bragg Grating for linewidth narrowing

We report on a frequency-doubled VECSEL emitting at 512.6 nm. The laser spectrum was narrowed with a Volume Bragg Grating and the intracavity frequency-doubling was achieved with a periodically poled MgO-doped lithium niobate.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Photonics  
Contributors: Kantola, E., Penttinen, J., Leinonen, T., Ranta, S., Guina, M.  
Publication date: 2018

#### Host publication information

Title of host publication: CLEO : Applications and Technology, CLEO\_AT 2018  
Publisher: OSA - The Optical Society  
ISBN (Electronic): 9781557528209  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials  
DOIs:  
10.1364/CLEO\_AT.2018.JTu2A.17

Source: Scopus

Source ID: 85052561135

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Frequency-doubled wafer-fused 638 nm VECSEL with an output power of 5.6 W

We report on a frequency doubled vertical-external-cavity surface-emitting laser emitting 5.6 W at 635 nm. The cavity employed a wafer-fused AlInGaAs/InP-AlAs/GaAs gain mirror in a V-shaped configuration. The heatsink temperature was 20 °C.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, RTI-Research SA

Contributors: Kantola, E., Leinonen, T., Rantamäki, A., Guina, M., Sirbu, A., Iakovlev, V.

Publication date: 2018

#### Host publication information

Title of host publication: CLEO : Applications and Technology, CLEO\_AT 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/CLEO\_AT.2018.JTu2A.10

Source: Scopus

Source ID: 85049146963

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Germanium-on-glass solar cells

We report on the fabrication and characterization of Ge solar cells on glass realized by layer transfer and epitaxial regrowth. These devices exhibit typical conversion efficiency exceeding 2.4% under AM1.5 irradiation and maximum efficiency of 3.7% under concentrated excitation. This approach enables flexible and affordable multi-junction engineering for solar energy conversion.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, University "Roma Tre", Nonlinear Optics and OptoElectronics Lab, Barclays

Contributors: Colace, L., Soriano, V., Maragliano, C., Assanto, G., Fulgoni, D., Nash, L., Palmer, M.

Number of pages: 3

Pages: 255-257

Publication date: 2011

#### Host publication information

Title of host publication: 8th IEEE International Conference on Group IV Photonics, GFP 2011

Article number: 6053781

ISBN (Print): 9781424483389

ASJC Scopus subject areas: Electrical and Electronic Engineering, Ceramics and Composites, Electronic, Optical and Magnetic Materials

Keywords: germanium, solar cells, wafer bonding

DOIs:

10.1109/GROUP4.2011.6053781

URLs:

<http://www.scopus.com/inward/record.url?scp=81355136195&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 81355136195

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Green (In,Ga,Al)P-GaP light-emitting diodes grown on high-index GaAs surfaces

We report on green (550-560 nm) electroluminescence (EL) from (Al<sub>0.5</sub>Ga<sub>0.5</sub>)<sub>0.5</sub>In<sub>0.5</sub>P-(Al<sub>0.8</sub>Ga<sub>0.2</sub>)<sub>0.5</sub>In<sub>0.5</sub>P double p-i-n heterostructures with monolayer-scale tensile strained GaP insertions in the cladding layers and light-emitting diodes (LEDs) based thereupon. The structures are grown side-by-side on high-index and (100) GaAs substrates by molecular beam epitaxy. Cross-sectional transmission electron microscopy studies indicate that GaP insertions are flat, thus the GaP-barrier substrate orientation-dependent

heights should match the predictions of the flat model. At moderate current densities ( $\sim 500 \text{ A/cm}^2$ ) the EL intensity of the structures is comparable for all substrate orientations. Opposite to the (100)-grown structures, the EL spectra of (211) and (311)-grown devices are shifted towards shorter wavelengths ( $\sim 550 \text{ nm}$  at room temperature). At high current densities ( $> 1 \text{ kA/cm}^2$ ) a much higher EL intensity is achieved for the devices grown on high-index substrates. The integrated intensity of (311)-grown structures gradually saturates at current densities above  $4 \text{ kA/cm}^2$ , whereas no saturation is revealed for (211)-grown structures up to the current densities above  $14 \text{ kA/cm}^2$ . We attribute the effect to the surface orientation-dependent engineering of the GaP band structure which prevents the escape of the nonequilibrium electrons into the indirect conduction band minima of the p-doped ( $\text{Al}_{0.8}\text{Ga}_{0.2}\text{In}_{0.5}\text{P}$ ) cladding layers.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Frontier Photonics, Technische Universität Berlin, Fakultät VII-Wirtschaft und Management, 25.6.2012, VI Systems GmbH, CEMES-CNRS, A. F. Ioffe Physical Technical Institute, Institut Für Festkörperphysik

Contributors: Ledentsov, N. N., Shchukin, V. A., Lyytikäinen, J., Okhotnikov, O., Cherkashin, N. A., Shernyakov, Y. M., Payusov, A. S., Gordeev, N. Y., Maximov, M. V., Schlichting, S., Nippert, F., Hoffmann, A.

Publication date: 2015

#### Host publication information

Title of host publication: Proceedings of SPIE : Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XIX

Volume: 9383

Publisher: SPIE

Article number: 93830E

ISBN (Print): 9781628414738

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: high-index surface, light-emitting diode, tensile strained barrier

DOIs:

10.1117/12.2083953

Source: Scopus

Source ID: 84930074847

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### >8W GaInNAs VECSEL emitting at 615 nm

We report a high-power VECSEL emitting  $< 8 \text{ W}$  around  $615 \text{ nm}$ . The gain chip of the laser was grown by plasma-assisted molecular beam epitaxy and it comprised 10 GaInNAs quantum wells. The VECSEL cavity had a V-shaped geometry and a 10-mm-long non-critically phase-matched LBO crystal for second harmonic generation. The cavity incorporated also an etalon and a birefringent filter for controlling the output wavelength. With the aid of the second-harmonic output and the infrared light leaking out from the laser cavity, the single-pass conversion efficiency of the crystal was estimated to have a value of 0.75%.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics

Contributors: Leinonen, T., Penttinen, J. P., Korpijärvi, V. M., Kantola, E., Guina, M.

Publication date: 2015

#### Host publication information

Title of host publication: Proceedings of SPIE : Vertical External Cavity Surface Emitting Lasers (VECSELs) V

Volume: 9349

Publisher: SPIE

Article number: 934909

ISBN (Print): 9781628414394

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: frequency doubling, high power visible laser, OPSL, orange-red VECSEL, SDL, SHG

DOIs:

10.1117/12.2079162

Source: Scopus

Source ID: 84925597620

### Highly-efficient Ho:KY(WO<sub>4</sub>)<sub>2</sub> thin-disk lasers at 2.06 μm

The recent advances in the development of Holmium monoclinic double tungstate thin-disk lasers are reviewed. The thin-disk is based on a 250-μm-thick 3 at. % Ho:KY(WO<sub>4</sub>)<sub>2</sub> active layer grown on a (010)-oriented KY(WO<sub>4</sub>)<sub>2</sub> substrate. When pumped by a Tm-fiber laser at 1960 nm with a single-bounce pump geometry, the continuous-wave Ho:KY(WO<sub>4</sub>)<sub>2</sub> thin-disk laser generates an output power of 1.01 W at 2057 nm corresponding to a slope efficiency  $\eta$  of 60% and a laser threshold of only 0.15 W. The thin-disk laser is passively Q-switched with a GaSb-based quantum-well semiconductor saturable absorber mirror. In this regime, it generates an average output power of 0.551 W at ~2056 nm with  $\eta = 44\%$ . The best pulse characteristics are 4.1 μJ/201 ns at a repetition rate of 135 kHz. The laser performance, beam quality and thermo-optic aberrations of such lasers are strongly affected by the Ho<sup>3+</sup> doping concentration. For the 3 at. % Ho<sup>3+</sup>-doped thin-disk, the thermal lens is negative (the sensitivity factors for the two principal meridional planes are -1.7 and -0.6 m<sup>-1</sup>/W) and astigmatic. The Ho:KY(WO<sub>4</sub>)<sub>2</sub> epitaxial structures are promising as active elements in mode-locked thin-disk lasers at ~2060 nm.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Research group: ORC, Max Born Institute, Universitat Rovira i Virgili, LISA Laser Products OHG, ITMO University, Institute of Laser Physics of the Siberian Branch of the RAS

Contributors: Mateos, X., Loiko, P., Lamrini, S., Scholle, K., Fuhrberg, P., Suomalainen, S., Härkönen, A., Guina, M., Vatnik, S., Vedin, I., Aguiló, M., Díaz, F., Wang, Y., Griebner, U., Petrov, V.

Publication date: 2018

#### Host publication information

Title of host publication: Pacific-Rim Laser Damage 2018 : Optical Materials for High-Power Lasers

Publisher: SPIE, IEEE

Article number: 107130J

ISBN (Electronic): 9781510619920

#### Publication series

Name: Proceedings of SPIE

Volume: 10713

ISSN (Print): 0277-786X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: 2-micron lasers, Ho-lasers, monoclinic double tungstates, Q-switched lasers, thin-disk lasers

DOIs:

10.1117/12.2316822

#### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85051249536

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### High performance GaSb superluminescent diodes for tunable light source at 2 μm and 2.55 μm

We report on GaSb-based superluminescent diodes emitting an output power of 70 mW at 2 μm and the first demonstration of 2.55 μm SLD with mW-level output power at room temperature for compact gas sensors.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Research group: ORC

Contributors: Zia, N., Viheriälä, J., Koivusalo, E., Aho, A., Suomalainen, S., Guina, M.

Publication date: 2018

#### Host publication information

Title of host publication: CLEO : Applications and Technology, CLEO\_AT 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/CLEO\_AT.2018.JTu2A.28

Source: Scopus

Source ID: 85049139256

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### High-power 1550 nm tapered DBR lasers fabricated using soft UV-nanoimprint lithography

Paper reports the DBR-RWG surface grating design, the fabrication process, and the output characteristics of tapered DBR laser diodes for the applications, like for example LIDAR and range finding, that require eye-safe high-power single-mode coherent light sources. The fabricated regrowth-free DBR AlGaInAs/InP lasers exhibited a CW output power as high as 560 mW in single-mode operation at room temperature. At maximum output power the SMSR was 38 dB, proving the excellent behavior of the surface gratings. The tapered section enabled scaling the maximum CW power at room temperature from 125 mW to 560 mW, by increasing its length from 0.5 mm to 4.0 mm. The paper discusses the limitations and performance variation associated to the power scaling by using the tapered section length as a scaling parameter.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Nanophotonics, Research group: Semiconductor Technology and Applications, Materials Research Laboratory, Turun Yliopisto/Turun Biomateriaalikeskus

Contributors: Viheriälä, J., Aho, A. T., Mäkelä, J., Salmi, J., Virtanen, H., Leinonen, T., Dumitrescu, M., Guina, M.

Number of pages: 7

Publication date: 2016

#### Host publication information

Title of host publication: High-Power Diode Laser Technology and Applications XIV

Publisher: SPIE

Article number: 97330Q

ISBN (Electronic): 9781628419689

#### Publication series

Name: SPIE Conference Proceedings

Publisher: SPIE

Volume: 9733

ISSN (Print): 0277-786X

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: 1550 nm laser diode, DBR, Power scaling, Tapered laser diode

DOIs:

10.1117/12.2207423

#### Bibliographical note

INT=orc,"Aho, Antti T."

JUFID=71479

Source: Scopus

Source ID: 84978785955

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### High-Q resonance train in a plasmonic metasurface

We experimentally demonstrate a plasmonic surface that supports a series of high-quality-factor ( $Q \approx 100$ ) surface lattice resonances. These resonances are enabled by tuning the thickness of the top-cladding layer to confine higher order diffraction-orders.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, University of Ottawa, Canada, Iridian Spectral Technologies, University of Rochester Institute of Optics

Contributors: Saad-Bin-Alam, M., Reshef, O., Huttunen, M. J., Carlow, G., Sullivan, B., Menard, J. M., Dolgaleva, K., Boyd, R. W.

Publication date: 1 May 2019

#### Host publication information

Title of host publication: 2019 Conference on Lasers and Electro-Optics, CLEO 2019 - Proceedings

Publisher: IEEE

ISBN (Electronic): 9781943580576

ASJC Scopus subject areas: Spectroscopy, Industrial and Manufacturing Engineering, Safety, Risk, Reliability and Quality, Management, Monitoring, Policy and Law, Electronic, Optical and Magnetic Materials, Radiology Nuclear Medicine and imaging, Instrumentation, Atomic and Molecular Physics, and Optics

DOIs:

10.23919/CLEO.2019.8750206

Source: Scopus

Source ID: 85069156893

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Hot pen and laser writable photonic polymer films

An orange-reflecting photonic polymer film has been fabricated based on a hydrogen-bonded cholesteric liquid crystalline (CLC) polymer consisting of non-reactive (R)-(+)-3-methyladipic acid as the chiral dopant. This polymer film can be patterned easily by evaporating the chiral dopant at specific locations with a hot pen or a laser beam. Removal of chiral dopant leads to a decrease in the helical pitch at the heat treated areas leading to a change in color from orange to green revealing a high contrast pattern. The photonic patterns are irreversible and stable at ambient conditions. This makes such a CLC polymer film interesting as writable photonic paper.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Eindhoven University of Technology

Contributors: Moirangthem, M., Stumpel, J. E., Alp, B., Teunissen, P., Bastiaansen, C. W. M., Schenning, A. P. H. J.

Publication date: 2016

### Host publication information

Title of host publication: Emerging Liquid Crystal Technologies XI

Volume: 9769

Publisher: SPIE

Article number: 97690Y

ISBN (Electronic): 9781510600041

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Electrical and Electronic Engineering, Applied Mathematics

Keywords: Cholesteric liquid crystals, laser writing, patterned surface, photonic paper, thermal writing

DOIs:

10.1117/12.2209065

URLs:

<http://www.scopus.com/inward/record.url?scp=84982292427&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84982292427

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Inkjet-printed dual microfluidic-based sensor integrated system

Demonstrated is a novel method to the fabrication of microfluidic devices utilizing a dual-sensor approach. The fabrication incorporates the use of poly(methyl-methacrylate) (PMMA) and inkjet-printing techniques. PMMA, a low-cost, robust material with low dielectric loss, is ideal for sensor fabrication. In addition, inkjet-printing polymer (SU-8) as a bonding layer dramatically improves the bonding strength and pressure handling. Furthermore, this system integrates two independent sensors in the same circuit, enabling concurrent calibration of two fluids. Based on the reaction in one sensor, response in another sensor for the same fluid can be predicted. The two sensors both have a sensitivity over 21 %/log(r) and a good independence in calibrating fluids. The sensor system works at microwave frequency, enabling applications in wireless sensing including various chemical analysis.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, School of Electrical and Computer Engineering, University of Perugia

Contributors: Su, W., Cooper, J. R., Cook, B. S., Tentzeris, M. M., Mariotti, C., Roselli, L.

Publication date: 31 Dec 2015

### Host publication information

Title of host publication: 2015 IEEE SENSORS - Proceedings

Publisher: Institute of Electrical and Electronics Engineers Inc.

Article number: 7370300

ISBN (Electronic): 9781479982028

ASJC Scopus subject areas: Instrumentation, Electronic, Optical and Magnetic Materials, Spectroscopy, Electrical and Electronic Engineering

Keywords: additive manufacturing, inkjet printing, microfluidics

DOIs:

10.1109/ICSENS.2015.7370300

URLs:

<http://www.scopus.com/inward/record.url?scp=84963626729&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84963626729

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Inkjet-printed graphene-based wireless gas sensor modules**

In this paper we demonstrate the use of graphene as the basis for design and development of low-cost, self-powered, battery-less, wireless sensor solutions utilizing thin films produced from environmentally friendly, water-based, inkjet printed graphene oxide (GO) ink. The in-house developed novel sensor material demonstrates good response to ammonia gas (NH<sub>3</sub>), yielding a 6% normalized resistance change within 15 minutes of exposure to a concentration of 500 ppm. In addition, excellent recovery time is achieved using the RGO thin films, with over 30% of material recovery observed within 5 minutes without exposure to high temperature or any UV treatments. Finally, we present in this work important distinctive characteristics in the behavior of the RGO sensor when exposed to different types of gases, including the hard-to-detect CO gas, that can be exploited in order to further enhance the applicability of the material. The introduction of mass producible, stable, environmentally friendly, inkjet-printable GO on organic paper/kapton substrates lays the foundation for the development of a wide range of new low-cost, high performance graphene-based devices, such as inkjet-printed diodes, capacitors and transistors.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology

Contributors: Le, T., Lakafosis, V., Lin, Z., Wong, C. P., Tentzeris, M. M.

Number of pages: 6

Pages: 1003-1008

Publication date: 2012

#### **Host publication information**

Title of host publication: 2012 IEEE 62nd Electronic Components and Technology Conference, ECTC 2012

Article number: 6248958

ISBN (Print): 9781467319669

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Gas sensor, graphene, inkjet printing, RFID, RGO, thin films

DOIs:

10.1109/ECTC.2012.6248958

URLs:

<http://www.scopus.com/inward/record.url?scp=84866863845&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84866863845

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Inkjet printed single layer high-density circuitry for a MEMS device**

For example high-density redistribution layers (RDL) require narrow conductor width and low enough resistance. We have studied the applicability of an additive electrodynamic inkjet printer, Super Inkjet (SIJ), as a potential replacement for the current non-additive manufacturing method used in circuitry fabrication for MEMS devices. This was done by examining the topography of the printed lines and relating this to the resistance. For example five and two micron wide conductors were demonstrated with aspect ratio as high as 0,8 and 0,9. The average resistivity value for the five micron wide conductors was 17  $\mu\text{Ohm}\cdot\text{cm}$  and 15  $\mu\text{Ohm}\cdot\text{cm}$  for the two micron case. Also the repeatability of the line width calibration process was evaluated. The accuracy was found to be approximately one micron.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Augmented Human Activities (AHA), Department of Electronics and Communications Engineering,

Research group: Laboratory for Future Electronics

Contributors: Laurila, M., Soltani, A., Mäntysalo, M.

Number of pages: 5

Pages: 968-972

Publication date: 15 Jul 2015

#### Host publication information

Title of host publication: 2015 IEEE 65th Electronic Components and Technology Conference (ECTC)

Publisher: IEEE

ISBN (Print): 9781479986095

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/ECTC.2015.7159712

#### Bibliographical note

AUX=elt,"Laurila, Mika-Matti"

Source: Scopus

Source ID: 84942107842

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Integrated multi-wavelength mid-IR light source for gas sensing

Cost effective multi-wavelength light sources are key enablers for spectroscopic applications at Mid-IR wavelength range. Utilizing a novel Mid-IR Si-based photonic integrated circuit filter and wide-band Mid-IR SLEDs, we show the concept of a light source that covers 2.7-3.5  $\mu\text{m}$  wavelength range with a resolution  $<1\text{nm}$ . The spectral bands are switchable and tunable and they can be modulated. The source allows for the fabrication of an affordable multi-band gas sensor with good selectivity and sensitivity. The unit price can be lowered in high volumes by utilizing tailored molded IR lens technology and automated packaging and assembling technologies. The status of the development of the key components of the light source are reported. The Mid-IR PIC is based on the use of thick-SOI technology, SLED is based on AlGaInAsSb materials and the lenses are tailored single crystal, nonoxide glass and heavy metal oxide glasses fabricated by the use of hot-embossing. The packaging concept utilizing automated assembly tools are depicted. In safety and security applications, the Mid-IR wavelength range covered by the source allows for the detection of several harmful gas components with a single sensor. At the moment, affordable sources are not available. The market impact is expected to be disruptive, since the devices currently in the market are either complicated, expensive and heavy instruments, or the applied measurement principles are inadequate in terms of stability and selectivity.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Research group: ORC, VTT Technical Research Centre of Finland, Institute of Electronic Materials Technology, Vaisala Oyj, Airoptic Sp. z o.o., GasSecure, VIGO System S.A.

Contributors: Karioja, P., Alajoki, T., Cherchi, M., Ollila, J., Harjanne, M., Heinilehto, N., Suomalainen, S., Zia, N., Tuorila, H., Viheriälä, J., Guina, M., Buczynski, R., Kasztelaniec, R., Salo, T., Virtanen, S., Kluczynski, P., Borgen, L., Ratajczyk, M., Kalinowski, P.

Publication date: 2018

#### Host publication information

Title of host publication: Next-Generation Spectroscopic Technologies XI

Publisher: SPIE, IEEE

Article number: 106570A

ISBN (Electronic): 9781510618251

#### Publication series

Name: SPIE Conference Proceedings

Volume: 10657

ISSN (Print): 0277-786X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: gas sensing, Mid-IR integrated optics, Mid-IR lens, photonics packaging, PIC, Si photonics, SLED

DOIs:

10.1117/12.2305712

#### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85050701514

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Integrating III-V, Si, and polymer waveguides for optical interconnects: RAPIDO

We present a vision for the hybrid integration of advanced transceivers at 1.3  $\mu\text{m}$  wavelength, and the progress done towards this vision in the EU-funded RAPIDO project. The final goal of the project is to make five demonstrators that show

the feasibility of the proposed concepts to make optical interconnects and packet-switched optical networks that are scalable to Pb/s systems in data centers and high performance computing. Simplest transceivers are to be made by combining directly modulated InP VCSELs with 12  $\mu\text{m}$  SOI multiplexers to launch, for example, 200 Gbps data into a single polymer waveguide with 4 channels to connect processors on a single line card. For more advanced transceivers we develop novel dilute nitride amplifiers and modulators that are expected to be more power-efficient and temperature-insensitive than InP devices. These edge-emitting III-V chips are flip-chip bonded on 3  $\mu\text{m}$  SOI chips that also have polarization and temperature independent multiplexers and low-loss coupling to the 12  $\mu\text{m}$  SOI interposers, enabling to launch up to 640 Gbps data into a standard single mode (SM) fiber. In this paper we present a number of experimental results, including low-loss multiplexers on SOI, zero-birefringence Si waveguides, micron-scale mirrors and bends with 0.1 dB loss, direct modulation of VCSELs up to 40 Gbps,  $\pm 0.25\mu\text{m}$  length control for dilute nitride SOA, strong band edge shifts in dilute nitride EAMs and SM polymer waveguides with 0.4 dB/cm loss.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, VTT Technical Research Centre of Finland, IBM Research, Vertilas GmbH, Scuola Superiore sant'Anna, Tyndall National Institute at National University of Ireland, Cork, Modulight Inc.

Contributors: Aalto, T., Harjanne, M., Offrein, B. J., Caër, C., Neumeyr, C., Malacarne, A., Guina, M., Sheehan, R. N., Peters, F. H., Melanen, P.

Publication date: 2016

#### Host publication information

Title of host publication: Optical Interconnects XVI

Publisher: SPIE

Article number: 97530D

ISBN (Print): 9781628419887

#### Publication series

Name: Proceedings of SPIE

Volume: 9753

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: electro absorption modulator, hybrid integration, optical interconnect, optical interposer, optoelectronics, polymer photonics, semiconductor optical amplifier, Silicon photonics, VCSEL, wavelength multiplexers

DOIs:

10.1117/12.2214786

#### Bibliographical note

EXT="Melanen, Petri"

Source: Scopus

Source ID: 84975114015

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Intelligent data service for farmers

The agricultural sector in Finland has been lagging behind in digital development. Development has long been based on increasing production by investing in larger machines. Over the past decade, change has begun to take place in the direction of digitalization. One of the challenges is that different manufacturers are trying to get farmers' data on their own closed cloud services. In the worst case, farmers may lose an overall view of their farms and opportunities for deeper data analysis because their data is located in different services. The goals and previously studied challenges of the 'MIKÄ DATA' project are described in this research. This project will build an intelligent data service for farmers, which is based on the Oskari platform. In the 'Peltodata' service, farmers can see their own field data and many other data sources layer by layer. The project is focused on the study of machine learning techniques to develop harvest yield prediction and find out the correlation between many data sources. The 'Peltodata' service will be ready at the end of 2019.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Computing Sciences

Contributors: Linna, P., Narra, N., Grönman, J.

Number of pages: 4

Pages: 1072-1075

Publication date: 1 May 2019

### Host publication information

Title of host publication: 2019 42nd International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2019 - Proceedings

Publisher: IEEE

Editors: Skala, K., Car, Z., Pale, P., Huljenic, D., Janjic, M., Koracic, M., Sruc, V., Ribaric, S., Grbac, T. G., Butkovic, Z., Cicin-Sain, M., Skvorc, D., Mauher, M., Babic, S., Gros, S., Vrdoljak, B., Tijan, E.

ISBN (Electronic): 9789532330984

ASJC Scopus subject areas: Computer Networks and Communications, Hardware and Architecture, Information Systems, Energy Engineering and Power Technology, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Agriculture, Artificial intelligence, Platform

DOIs:

10.23919/MIPRO.2019.8756688

URLs:

[http://docs.mipro-proceedings.com/proceedings/mipro\\_2019\\_proceedings.pdf](http://docs.mipro-proceedings.com/proceedings/mipro_2019_proceedings.pdf)

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Interstitial photodynamic therapy and glioblastoma: Light fractionation study on a preclinical model: Preliminary results

**Background:** Glioblastoma is a high-grade cerebral tumor with local recurrence and poor outcome. Photodynamic therapy (PDT) is a local treatment based on the light activation of a photosensitizer (PS) in the presence of oxygen to form cytotoxic species. Fractionation of light delivery may enhance treatment efficiency by restoring tissue oxygenation. **Objectives:** To evaluate the efficiency of light fractionation using MRI imaging, including diffusion and perfusion, compared to histological data. **Materials and Methods:** Thirty-nine "Nude" rats were grafted with human U87 cells into the right putamen. After PS precursor intake (5-ALA), an optic fiber was introduced into the tumor. The rats were randomized in three groups: without illumination, with monofractionated illumination and the third one with multifractionated light. Treatment effects were assessed with early MRI including diffusion and perfusion sequences. The animals were eventually sacrificed to perform brain histology. **Results:** On MRI, we observed elevated diffusion values in the center of the tumor among treated animals, especially in multifractionated group. Perfusion decreased around the treatment site, all the more in the multifractionated group. Histology confirmed our MRI findings, with a more extensive necrosis and associated with a rarified angiogenic network in the treatment area, after multifractionated PDT. However, we observed more surrounding edema and neovascularization in the peripheral ring after multifractionated PDT. **Conclusion:** Fractionated interstitial PDT induced specific tumoral lesions. The multifractionated scheme was more efficient, inducing increased tumoral necrosis, but it also caused significant peripheral edema and neovascularization. Diffusion and perfusion MRI imaging were able to predict the histological lesions.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, Lille University Hospital, Univ Paris 06, Centre National de la Recherche Scientifique (CNRS), Pierre & Marie Curie University - Paris 6, Institut de Recherche pour le Developpement (IRD), Inria, Institut National de la Sante et de la Recherche Medicale (Inserm), Univ Sorbonne, CNRS, ICM, UMR S 1127, UMR 7225, U1127, INSERM, Inria Paris Rocquencourt, Inst Cerveau & Mo

Contributors: Leroy, H. A., Vermandel, M., Tétard, M. C., Lejeune, J. P., Mordon, S., Reyns, N.

Publication date: 2015

### Host publication information

Title of host publication: Optical Techniques in Neurosurgery, Neurophotonics, and Optogenetics II

Volume: 9305

Publisher: SPIE

Article number: 93050D

ISBN (Electronic): 9781628413953

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Biomaterials, Radiology Nuclear Medicine and imaging

DOIs:

10.1117/12.2079347

URLs:

<http://www.scopus.com/inward/record.url?scp=84928128691&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84928128691

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Investigating human skin using deep learning enhanced multiphoton microscopy

Histopathological image analysis of stained tissue slides is routinely performed by a pathologist to diagnose diseases, such as cancers. Although the approach is effective, it is labor-intensive, time-consuming and risks being biased. Therefore, it would be beneficial to develop faster and more cost-effective approaches. Multiphoton microscopy can

alleviate these problems by allowing label-free imaging with high contrast. When label-free multiphoton microscopy is combined with deep learning based image analysis, a wide variety of possibilities arise for the real-time characterization and diagnosis of tissues. Here, we overview our recent work on this topic focusing on automated classification of tissue images taken from human skin near the dermoepidermal junction.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Research group: Nonlinear Optics, University Politehnica of Bucharest, Carol Davila University of Medicine and Pharmacy

Contributors: Huttunen, M. J., Hristu, R., Dumitru, A., Costache, M., Stanciu, S. G.

Publication date: 1 Jul 2019

#### Host publication information

Title of host publication: 21st International Conference on Transparent Optical Networks, ICTON 2019

Publisher: IEEE

ISBN (Electronic): 9781728127798

#### Publication series

Name: International Conference on Transparent Optical Networks

ISSN (Electronic): 2161-2064

ASJC Scopus subject areas: Computer Networks and Communications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Deep learning, Label-free, Machine learning, Nonlinear microscopy, Tissue characterization

DOIs:

10.1109/ICTON.2019.8840265

#### Bibliographical note

jufoid=72297

Source: Scopus

Source ID: 85073067873

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Labyrinth based left-handed metamaterials and sub-wavelength focusing of electromagnetic waves

We propose and demonstrate a resonant structure that solves two major problems related to the split-ring resonator structure. These major problems may be stated as the bianisotropy and electric coupling to the magnetic resonance. These two problems introduce difficulties in obtaining isotropic left-handed metamaterial mediums. The resonant structure that we propose here solves both of these problems. We further show that in addition to the magnetic resonance, when combined with a suitable wire medium, the structure that we propose exhibits left-handed transmission band. We further demonstrate the sub-wavelength focusing of electromagnetic waves by use of a two dimensional labyrinth based metamaterial. Our experimental results showed that it is possible to focus the source field with half widths as small as  $\lambda/4$  by using the labyrinth based metamaterial.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Bilkent University

Contributors: Ozbay, E., Bulu, I., Caglayan, H.

Publication date: 2006

#### Host publication information

Title of host publication: Photonic Crystal Materials and Devices IV

Volume: 6128

Article number: 612813

ISBN (Print): 0819461709, 9780819461704

#### Publication series

Name: Proceedings of SPIE

Publisher: SPIE

Volume: 6128

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Left-handed medium, Magnetic Resonance, Metamaterial, Split-ring Resonator, Sub-wavelength Focusing

DOIs:

10.1117/12.649548

URLs:

<http://www.scopus.com/inward/record.url?scp=33745626124&partnerID=8YFLogxK> (Link to publication in Scopus)

#### **Bibliographical note**

EXT="Caglayan, Humeyra"

Source: Scopus

Source ID: 33745626124

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### **Light propagation analysis in nervous tissue for wireless optogenetic nanonetworks**

In recent years, numerous methods have been sought for developing novel solutions to counter neurodegenerative diseases. An objective that is being investigated by researchers is to develop cortical implants that are able to wirelessly stimulate neurons at the single cell level. This is a major development compared to current solutions that use electrodes, which are only able to target a population of neurons, or optogenetics, which requires optical fiber-leads to be embedded deep into the brain. In this direction, the concept of wireless optogenetic nanonetworks has been recently introduced. In such architecture, miniature devices are implanted in the cortex for neuronal stimulation through optogenetics. One of the aspects that will determine the topology and performance of wireless optogenetic nanonetworks is related to light propagation in genetically-engineered neurons. In this paper, a channel model that captures the peculiarities of light propagation in neurons is developed. First, the light propagation behavior using the modified Beer-Lambert law is analyzed based on the photon transport through the nervous tissue. This includes analyzing the scattering light diffraction and diffusive reflection that results from the absorption of neural cell chromophores, as well as validating the results by means of extensive multiphysics simulations. Then, analysis is conducted on the path loss through cells at different layers of the cortex by taking into account the multi-path phenomenon. Results show that there is a light focusing effect in the soma of neurons that can potentially help the to stimulate the target cells.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electronics and Communications Engineering, State University of New York

Contributors: Wirdatmadja, S., Johari, P., Balasubramaniam, S., Bae, Y., Stachowiak, M. K., Jornet, J. M.

Publication date: 2018

#### **Host publication information**

Title of host publication: Optogenetics and Optical Manipulation 2018

Publisher: SPIE

Article number: 104820R

ISBN (Electronic): 9781510614499

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Atomic and Molecular Physics, and Optics, Radiology Nuclear Medicine and imaging

Keywords: Light propagation, Optogenetics, Single-neuron stimulation, Wireless nanonetworks

DOIs:

10.1117/12.2288786

#### **Bibliographical note**

jufoid=65546

Source: Scopus

Source ID: 85047010302

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### **Localization of light at vanishingly small disorder-levels with heavy photons**

We show that the key parameter driving the spatial extent of localized modes formed in randomly-perturbed periodic media near the band edge is the effective photon mass rather than the group index.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, CNRS, Université de Bordeaux, ICMCB, Laboratoire Photonique, CNRS-Univ.

Bourgogne, University of Ottawa, Canada, University of York

Contributors: Baron, A., Faggiani, R., Zang, X., Lalouat, L., Schulz, S. A., Vynck, K., O'Regan, B., Cluzel, B., De Fornel, F., Krauss, T. F., Lalanne, P.

Publication date: 10 Aug 2015

#### **Host publication information**

Title of host publication: 2015 Conference on Lasers and Electro-Optics, CLEO 2015

Volume: 2015-August

Publisher: Optical Society of America OSA

Article number: 7183319

ISBN (Electronic): 9781557529688

ASJC Scopus subject areas: Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials

Keywords: Geometry, Indexes, Microscopy, Nonhomogeneous media, Optical waveguides, Photonics

DOIs:

10.1364/CLEO\_QELS.2015.FW1C.4

URLs:

<http://www.scopus.com/inward/record.url?scp=84954056218&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84954056218

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Local Mechanical Properties at the Dendrite Scale of Ni-Based Superalloys Studied by Advanced High Temperature Indentation Creep and Micropillar Compression Tests**

Chemical inhomogenities due to dendritic solidification of Ni-based superalloys result in different local microstructures with varying mechanical properties. New indentation creep test methods allow probing of the local creep properties at the dendrite scale at high temperatures. The as-cast single crystalline Ni-based superalloy ERBO1A (a derivative alloy of CMSX-4) was investigated and electron-probe microanalysis (EPMA) measurements revealed strong segregation of, e.g., Re and W in the dendritic region and, e.g., Ta in the interdendritic region. Indentation creep experiments at 750 °C and micropillar compression tests at 785 °C were conducted in both regions, and a higher creep strength was found in the dendritic region compared to the interdendritic region. Theoretical models for solid solution hardening as well as  $\gamma'$  precipitation hardening confirm these results, since they predict a higher strength in the dendritic region than in the interdendritic region. Compared with the fully heat treated state, a smaller difference in the local mechanical properties or even a reverse strength ratio of the dendritic and interdendritic region can be expected.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Materials Science and Environmental Engineering, Research group: Materials Characterization, Friedrich-Alexander-Universität Erlangen-Nürnberg, Swiss Federal Laboratories for Materials Science and Technology, Fraunhofer Institut für Keramische Technologien und Systeme

Contributors: Haußmann, L., Neumeier, S., Kolb, M., Ast, J., Mohanty, G., Michler, J., Göken, M.

Number of pages: 9

Pages: 273-281

Publication date: 2020

#### **Host publication information**

Title of host publication: Superalloys 2020 : Proceedings of the 14th International Symposium on Superalloys

Publisher: Springer

Editors: Tin, S., Hardy, M., Clews, J., Cormier, J., Feng, Q., Marcin, J., O'Brien, C., Suzuki, A.

ISBN (Print): 9783030518332

ISBN (Electronic): 978-3-030-51834-9

#### **Publication series**

Name: The Minerals, Metals and Materials Series

ISSN (Print): 2367-1181

ISSN (Electronic): 2367-1696

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Energy Engineering and Power Technology, Mechanics of Materials, Metals and Alloys, Materials Chemistry

Keywords: Dendritic segregations, Indentation creep, Micropillar compression, Ni-based superalloy

DOIs:

10.1007/978-3-030-51834-9\_26

#### **Bibliographical note**

JUFOID=86210

Source: Scopus

Source ID: 85091283715

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Machine learning for adaptive bilateral filtering**

We describe a supervised learning procedure for estimating the relation between a set of local image features and the local optimal parameters of an adaptive bilateral filter. A set of two entropy-based features is used to represent the properties of the image at a local scale. Experimental results show that our entropy-based adaptive bilateral filter outperforms other extensions of the bilateral filter where parameter tuning is based on empirical rules. Beyond bilateral filter, our learning procedure represents a general framework that can be used to develop a wide class of adaptive filters.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), NVIDIA

Contributors: Frosio, I., Egiazarian, K., Pulli, K.

Publication date: 2015

#### **Host publication information**

Title of host publication: Image Processing: Algorithms and Systems XIII

Volume: 9399

Publisher: SPIE

Article number: 939908

ISBN (Print): 9781628414899

#### **Publication series**

Name: Proceedings of SPIE - The International Society for Optical Engineering

Publisher: The International Society for Optical Engineering

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Adaptive bilateral filter, Denoising, Machine learning, Optimization, Training

DOIs:

10.1117/12.2077733

Source: Scopus

Source ID: 84928485491

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Maintenance-free moisture sensor on dishcloth substrate**

In this study, a passive UHF RFID-based moisture sensor is fabricated and evaluated. The sensor tag can sense the high humidity of the environment and indicate it with a permanent change in its backscattered signal. The sensor tag antenna and antenna-IC interconnections are fabricated on a biodegradable dishcloth material using conductive thread. The sensors are tested in an anechoic chamber and in normal office conditions, when initially dry, after dipped into water for 1 minute, and again after 24 hours of drying in air. These sensor tags initially show read ranges of 6-9 meters throughout the global UHF RFID frequency band. When wet, the read range decreases to 5 meters, while after 24 hours of drying, the read ranges of the tags permanently decrease to around 2-4 meters. The dishcloth material comes thicker when wet, also causing a change to the embroidered antenna structure, finally causing the permanent change in the backscattered signal. In normal office conditions, moisture causes the average backscattered signal an obvious change from around -66 dBm to -69 dBm.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: BioMediTech, City University of Hong Kong

Contributors: Chen, X., He, H., Yang, Y., Gou, M., Sydanheimo, L., Ukkonen, L., Virkki, J.

Number of pages: 4

Pages: 2418-2421

Publication date: 1 Dec 2019

#### **Host publication information**

Title of host publication: 2019 Photonics and Electromagnetics Research Symposium - Fall, PIERS - Fall 2019 - Proceedings

Publisher: IEEE

Article number: 9021487

ISBN (Electronic): 9781728153049

ASJC Scopus subject areas: Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Mathematical Physics

DOIs:

10.1109/PIERS-Fall48861.2019.9021487

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Measuring bend losses in large-mode-area fibers

We investigate the measurement of bend losses in few-mode large-mode-area (LMA) fibers. The influence of the light source spectral characteristics, modal power content and cladding light on the measurement accuracy and precision is studied experimentally. Monte-Carlo simulations are performed to understand the distribution of the variations. This study provides practical guidelines for bend loss measurements.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, nLIGHT Corporation

Contributors: Ye, C., Koponen, J., Aallos, V., Kokki, T., Petit, L., Kimmelma, O.

Publication date: 2015

#### Host publication information

Title of host publication: Fiber Lasers XII: Technology, Systems, and Applications

Volume: 9344

Publisher: SPIE

Article number: 934425

ISBN (Electronic): 9781628414349

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Bend loss, Few-mode, Fiber amplifiers, Fiber lasers, Large-mode-area fiber, Silica optical fiber

DOIs:

10.1117/12.2076813

URLs:

<http://www.scopus.com/inward/record.url?scp=84931311791&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84931311791

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### MECSELs with direct emission in the 760 nm to 810 nm spectral range: A single- and double-side pumping comparison and high-power continuous-wave operation

We compared single-side pumping (SSP) and double-side pumping (DSP) of a semiconductor membrane external-cavity surface-emitting laser (MECSEL). The MECSEL's active region was based on a 4×3 AlGaAs quantum well (QW) structure. This structure was embedded between two silicon carbide (SiC) wafer pieces that were used as transparent intra-cavity (IC) heat spreaders creating a symmetrical cooling environment. The MECSEL structure targeted emission at 780nm and was operated at 20°C heat sink temperature. Via DSP the differential efficiency was improved from 31.9% to 34.4 %. The laser threshold was reduced from 0.79 W to 0.69 W of absorbed pump power while the maximum output power was increased from 3.13 W to 3.22 W. The DSP configuration enabled these improvements by a reduced thermal resistance of the gain element by 9 %. The MECSEL operated at a fundamental Gaussian TEM<sub>00</sub> mode profile and the beam quality was measured to be  $M^2 < 1.09$ . We further demonstrate a maximum tuning range from 767 nm to 811 nm. A similar active region with about half the thickness (2×3 AlGaAs QWs) was investigated using the DSP configuration and first results are presented here. 500-µm-thick sapphire IC heat spreaders were used instead of SiC. The output power exceeded 0.5W and the emission was spectrally located around 770 nm.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics

Contributors: Kahle, H., Penttinen, J. P., Phung, H. M., Rajala, P., Tukiainen, A., Ranta, S., Guina, M.

Publication date: 2019

#### Host publication information

Title of host publication: Vertical External Cavity Surface Emitting Lasers (VECSELs) IX

Publisher: SPIE, IEEE

Editor: Keller, U.

Article number: 109010D

ISBN (Electronic): 9781510624443

#### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 10901

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: AlGaAs, DBR-free, MECSEL, Near infra-red, Thermal management, Thermal resistance, VECSEL

DOIs:

10.1117/12.2512111

### **Bibliographical note**

INT=phys,"Rajala, Patrik"

jufoid=71479

Source: Scopus

Source ID: 85066635597

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Mode coupling in few-mode large-mode-area fibers**

We present an experimental study on mode coupling characteristics of few-mode large-mode-area (LMA) fibers, which are widely used in high power fiber lasers. The modal power allocation is measured by modal decomposition of the nearfield intensity profile of the output beam. Cut-back measurements are carried out with commonly-used fibers with different fiber geometries. The evolution of the modal power content due to mode coupling is presented. The influence of the fiber geometry on mode coupling is discussed.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, nLIGHT Corporation

Contributors: Ye, C., Koponen, J., Aallos, V., Petit, L., Kimmelma, O., Kokki, T.

Publication date: 2014

### **Host publication information**

Title of host publication: Fiber Lasers XI: Technology, Systems, and Applications

Volume: 8961

Publisher: SPIE

Article number: 89612W

ISBN (Print): 9780819498748

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Beam quality, Few-mode, Large-mode-area fiber, Mode coupling, Mode decomposition, Silica optical fiber

DOIs:

10.1117/12.2038575

URLs:

<http://www.scopus.com/inward/record.url?scp=84900835091&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84900835091

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Molecular dynamics simulations for Xe absorbed in zeolites**

We have carried out molecular dynamics simulations for Xe atoms absorbed in two different zeolites, NaA and AIPO-11. The main emphasis is in the distribution of Xe in the zeolites, Xe-Xe<sub>n</sub> interactions in NaA, and structural data on Xe-zeolite cage interactions. We report single-particle and pair correlation data, along with diffusion constants of Xe at 300 K. NMR chemical shifts of Xe were estimated using ab initio parametrization.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: University of Oulu

Contributors: Kantola, J. H., Vaara, J., Rantala, T. T., Jokisaari, J.

Number of pages: 6

Pages: 599-604

Publication date: 1996

### **Host publication information**

Title of host publication: Materials Research Society Symposium - Proceedings

Volume: 408

Publisher: MATERIALS RESEARCH SOCIETY

Editors: Kaxiras, E., Joannopoulos, J., Vashishta, P., Kalia, R. K.

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.1557/PROC-408-599

Source: Scopus

Source ID: 0030315761

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Monolithic GaInNAsSb/GaAs VECSEL emitting at 1550 nm

We report the first monolithic GaAs-based vertical external-cavity surface-emitting laser (VECSEL) operating at 1550 nm. The VECSEL is based on a gain mirror which was grown by plasma-assisted molecular beam epitaxy and comprises 8 GaInNAsSb/GaAs quantum wells and an AlAs/GaAs distributed Bragg reflector. When pumped by an 808 nm diode laser, the laser exhibited an output power of 80 mW for a mount temperature of 16 °C.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics

Contributors: Korpijärvi, V., Kantola, E. L., Leinonen, T., Guina, M.

Publication date: 2015

### Host publication information

Title of host publication: SPIE conference proceedings

Volume: 9349

Publisher: SPIE

Article number: 93490D

ISBN (Print): 9781628414394

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: dilute nitride, diode-pumped lasers, GaInNAsSb, semiconductor disk lasers, Semiconductor lasers, vertical external cavity surface emitting lasers

DOIs:

10.1117/12.2077517

Source: Scopus

Source ID: 84925652903

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Multicolor nonlinear pulse compression by consecutive optical parametric amplification in quasi-phase matched structures

Simultaneous generation of the 2<sup>nd</sup> and 3<sup>rd</sup> harmonic, excited by linearly frequency-chirped fundamental pulse in quasiphase matched grating with linearly varying inverse domain sizes has been studied numerically with taking into account effects of the group velocity mismatches and dispersions. Mechanisms of efficient nonlinear pulse compressions and conversion efficiencies of the generated harmonics have been analyzed.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, Academy of Sciences of the Republic of Uzbekistan, Tashkent State Technical University, Nonlinear Optics and OptoElectronics Lab, University "Roma Tre"

Contributors: Sapaev, U. K., Yusupov, D. B., Assanto, G.

Publication date: 2011

### Host publication information

Title of host publication: ICONO 2010: International Conference on Coherent and Nonlinear Optics

Volume: 7993

Article number: 79930Q

ISBN (Print): 9780819485663

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Cascading, Lithium niobate, Nonlinear pulse compression, Parametric effects, Quasi-phase matching, Simultaneous frequency doubling and tripling

DOIs:

10.1117/12.882887

URLs:

<http://www.scopus.com/inward/record.url?scp=79951653950&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79951653950

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Multiwavelength surface contouring from phase-coded diffraction patterns**

We propose a new algorithm for absolute phase retrieval from multiwavelength noisy phase coded diffraction patterns in the task of surface contouring. A lensless optical setup is considered with a set of successive single wavelength experiments. The phase masks are applied for modulation of the multiwavelength object wavefronts. The algorithm uses the forward and backward propagation for coherent light beams and sparsely encoding wavefronts which leads to the complex-domain block-matching 3D filtering. The key-element of the algorithm is an original aggregation of the multiwavelength object wavefronts for high-dynamic-range profile measurement. Numerical experiments demonstrate that the developed approach leads to the effective solutions explicitly using the sparsity for noise suppression and high-accuracy object profile reconstruction.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Signal Processing, Research group: Computational Imaging-CI, ITMO University

Contributors: Katkovnik, V., Shevkunov, I., Petrov, N. V., Eguiazarian, K.

Publication date: 1 Jan 2018

### **Host publication information**

Title of host publication: Unconventional Optical Imaging 2018. Strasbourg, France

Publisher: SPIE

Article number: 106771B

ISBN (Print): 978-1-5106-1880-0

### **Publication series**

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 10677

ISSN (Electronic): 0277-786X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: absolute phase retrieval, discrete optical signal processing, Multiwavelength phase retrieval, phase imaging, surface contouring

Electronic versions:

multiwavelength-surface-contouring\_last

DOIs:

10.1117/12.2306127

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202001231493>

Source: Scopus

Source ID: 85052446644

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Nanoparticles in optical waveguides: A toolbox to promote lasers, amplifiers and sensors**

The success of glass photonics are many, with a large spectrum of applications covering Information and Communication Technology, Health and Biology, Structural Engineering, and Environment Monitoring Systems, etc. A paradigmatic example is the development of the Erbium-Doped Fiber Amplifier (EDFA) allowing the raise of optical telecommunications and high speed internet. Silica glass is the most common glass used for photonics applications. However, certain of its characteristics may be detrimental for luminescence properties (low rare-earth solubility, high phonon energy, etc). To overcome these limitations, the use of nanoparticles in optical waveguides has gained large interest in modern photonic technology nowadays. Such waveguides would combine the advantages of silica (transparency, cost, chemical and mechanical durability, etc.) and the specific properties provided by the nanoparticles which encapsulate the rare-earth ions. In this paper, we discuss on the opportunities offered by the nanoparticles addition in glasses for lasers and amplifiers thanks to the engineering of the spectroscopic properties. We present also an emerging application: sensors based on high scattered fibers.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Research group: Photonics Glasses, Université Côte d'Azur, Ecole Centrale de Nantes, Academy of Sciences, UPRES EA 4464, University of Montpellier, CSMFO Lab., Enrico Fermi Centre  
Contributors: Blanc, W., Vermillac, M., Petit, L., Lukowiak, A., Lu, Z., Mady, F., Benabdesselam, M., Chaussedent, S., Mehdi, A., Ferrari, M.  
Publication date: 1 Jul 2019

#### Host publication information

Title of host publication: 21st International Conference on Transparent Optical Networks, ICTON 2019  
Publisher: IEEE  
ISBN (Electronic): 9781728127798

#### Publication series

Name: International Conference on Transparent Optical Networks  
ISSN (Electronic): 2161-2064  
ASJC Scopus subject areas: Computer Networks and Communications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials  
Keywords: Amplifiers, Glass, Lasers, Nanoparticles, Sensors, Waveguides  
DOIs:  
10.1109/ICTON.2019.8840208

#### Bibliographical note

jufoid=72297  
Source: Scopus  
Source ID: 85073052623  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### Narrow Bandgap Dilute Nitride Materials for 6-junction Space Solar Cells

Narrow bandgap p-i-n dilute nitride GaInNAsSb junctions, for use as bottom cell in 6-junction solar cells, are reported. In particular, we demonstrate a high optical quality for GaInNAsSb junction with a bandgap  $\sim 0.78$  eV, corresponding to a N content of 6.2%. Under AM0 illumination, such cell exhibits a photocurrent of 36.6 mA/cm<sup>2</sup>. By extracting the parameters of the experimental cell, we estimate the the AM0 efficiency of a 6-junction multijunction solar cell employing the GaInNAsSb junction, to attain a value of 33%. Further improvements are discussed towards achieving the full potential of the 6-junction design.

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Physics, Research group: ORC, Research group: Nanophotonics  
Contributors: Isoaho, R., Aho, A., Tukiainen, A., Aho, T., Raappana, M., Salminen, T., Reuna, J., Guina, M.  
Number of pages: 3  
Publication date: 2019

#### Host publication information

Title of host publication: 2019 European Space Power Conference (ESPC)  
Publisher: IEEE  
ISBN (Print): 978-1-7281-2127-7  
ISBN (Electronic): 978-1-7281-2126-0  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Renewable Energy, Sustainability and the Environment  
Keywords: Solar cell, dilute nitride semiconductors, III-V semiconductor  
Electronic versions:  
Narrow Bandgap Dilute Nitride Materials 2019  
DOIs:  
10.1109/ESPC47532.2019.9049263  
URLs:  
<http://urn.fi/URN:NBN:fi:tuni-202009106949>  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### New multisoliton complex in Bi-doped fiber laser operated at 1450 nm

#### General information

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Photonics, Research group: Nanophotonics, Ulyanovsk State University, Fiber Optics Research Center of the Russian Academy of Sciences, Russian Academy of Sciences

Contributors: Gumenyuk, R., Rissanen, J., Korobko, D. A., Zolotovskiy, I. O., Melkumov, M., Khopin, V. F.  
Publication date: 2017

#### Host publication information

Title of host publication: European Quantum Electronics Conference 2017

Volume: Part F81-EQEC 2017

Publisher: The Optical Society; OSA

Article number: EF\_5\_4

ISBN (Electronic): 978-1-5090-6736-7

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

URLs:

[https://www.osapublishing.org/abstract.cfm?uri=eqec-2017-EF\\_5\\_4](https://www.osapublishing.org/abstract.cfm?uri=eqec-2017-EF_5_4)

URLs:

<http://www.scopus.com/inward/record.url?scp=85039792281&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 85039792281

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Noise characterization of Ge/Si photodetectors

We investigate the noise in Ge/Si photodiodes. The noise performance is characterized by current voltage characteristics and spectral analysis and the results compared with reference Ge/Ge photodetectors. Both thermal and shot noise are of the same order, while Ge/Si devices exhibit a significantly larger  $1/f$  noise.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, University "Roma Tre", Nonlinear Optics and OptoElectronics Lab

Contributors: Colace, L., Scacchi, A., Assanto, G.

Number of pages: 3

Pages: 290-292

Publication date: 2011

#### Host publication information

Title of host publication: 8th IEEE International Conference on Group IV Photonics, GFP 2011

Article number: 6053793

ISBN (Print): 9781424483389

ASJC Scopus subject areas: Electrical and Electronic Engineering, Ceramics and Composites, Electronic, Optical and Magnetic Materials

Keywords: Ge/Si photodetectors, near infrared, noise

DOIs:

10.1109/GROUP4.2011.6053793

URLs:

<http://www.scopus.com/inward/record.url?scp=81355136186&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 81355136186

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Noise measurements from reconstructed digital breast tomosynthesis

In this work, we investigated and measured the noise in Digital Breast Tomosynthesis (DBT) slices considering the back-projection (BP) algorithm for image reconstruction. First, we presented our open-source DBT reconstruction toolbox and validated with a freely available virtual clinical trials (VCT) software, comparing our results with the reconstruction toolbox available at the Food and Drug Administration's (FDA) repository. A virtual anthropomorphic breast phantom was generated in the VCT environment and noise-free DBT projections were simulated. Slices were reconstructed by both toolboxes and objective metrics were measured to evaluate the performance of our in-house reconstruction software. For the noise analysis, commercial DBT systems from two vendors were used to obtain x-ray projections of a uniform polymethyl methacrylate (PMMA) physical phantom. One system featured an indirect thallium activated cesium iodide (CsI(Tl)) scintillator detector and the other a direct amorphous selenium (a-Se) detector. Our in-house software was used to reconstruct raw projections into tomographic slices, and the mean pixel value, noise variance, signal-to-noise ratio (SNR) and the normalized noise power spectrum (NNPS) were measured. In addition, we investigated the adequacy of a heteroskedastic Gaussian model, with an affine variance function, to describe the noise in the reconstruction domain. The measurements show that the variance and SNR from reconstructed slices report similar spatial and signal dependency from previously reported in the projection domain. NNPS showed that the reconstruction process correlates the noise of the DBT slices in the case of projections degraded with almost uncorrelated noise.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Computing Sciences, University of São Paulo, Pio XII Foundation, University of Pennsylvania

Contributors: Vimieiro, R. B., Borges, L. R., Caron, R. F., Barufaldi, B., Bakic, P. R., Maidment, A. D., Vieira, M. A.

Publication date: 1 Mar 2019

### Host publication information

Title of host publication: Medical Imaging 2019 : Physics of Medical Imaging

Publisher: SPIE, IEEE

Editors: Schmidt, T. G., Chen, G., Bosmans, H.

Article number: 109480C

ISBN (Electronic): 9781510625433

### Publication series

Name: Progress in Biomedical Optics and Imaging - Proceedings of SPIE

Volume: 10948

ISSN (Print): 1605-7422

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Biomaterials, Atomic and Molecular Physics, and Optics, Radiology Nuclear Medicine and imaging

Keywords: Back-projection, Digital breast tomosynthesis, Image reconstruction, Noise measurements, Virtual clinical trials  
DOIs:

10.1117/12.2512977

Source: Scopus

Source ID: 85068400087

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### No-reference visual quality assessment for image inpainting

Inpainting has received a lot of attention in recent years and quality assessment is an important task to evaluate different image reconstruction approaches. In many cases inpainting methods introduce a blur in sharp transitions in image and image contours in the recovery of large areas with missing pixels and often fail to recover curvy boundary edges. Quantitative metrics of inpainting results currently do not exist and researchers use human comparisons to evaluate their methodologies and techniques. Most objective quality assessment methods rely on a reference image, which is often not available in inpainting applications. Usually researchers use subjective quality assessment by human observers. It is difficult and time consuming procedure. This paper focuses on a machine learning approach for no-reference visual quality assessment for image inpainting based on the human visual property. Our method is based on observation that Local Binary Patterns well describe local structural information of the image. We use a support vector regression learned on assessed by human images to predict perceived quality of inpainted images. We demonstrate how our predicted quality value correlates with qualitative opinion in a human observer study. Results are shown on a human-scored dataset for different inpainting methods.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), Dept. of Radio-Electronics Systems, Don State Technical University

Contributors: Voronin, V. V., Frantc, V. A., Marchuk, V. I., Sherstobitov, A. I., Egiazarian, K.

Publication date: 2015

### Host publication information

Title of host publication: Image Processing: Algorithms and Systems XIII

Publisher: SPIE

Article number: 93990U

ISBN (Print): 9781628414899

### Publication series

Name: SPIE Conference Proceedings

Volume: 9399

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Inpainting, Machine learning, Metric, Quality assessment, SVR, Visual salience

DOIs:

10.1117/12.2076507

Source: Scopus

Source ID: 84928473922

### **Novel enhancement techniques for ultra-high-performance conformal wireless sensors and 'smart skins' utilizing inkjet-printed graphene**

We introduce various novel techniques for the performance enhancement of nanotechnology-enabled wireless platforms utilizing inkjet-printed graphene thin films, especially for gas sensing applications in this paper. Compared to previously reported results (6% sensitivity after exposure to 500 ppm  $\text{NH}_3$ ), we have improved the performance by nearly a factor of 10, increasing the sensitivity to 4.8% at 60 ppm. Key advancements to the reduced graphene oxide (rGO) thin film include: (i) drastically reduced (micron to nm) film thickness via surface modification techniques, specifically enhancing charge transport properties, and (ii) increased porosity obtained via a unique in-house developed nano-patterning process. The proposed graphene-based thin film approach could set the foundation for a plethora of novel wireless sensing and gas-reconfigurable communication platforms.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology

Contributors: Le, T., Lin, Z., Wong, C. P., Tentzeris, M. M.

Number of pages: 4

Pages: 1640-1643

Publication date: 2013

#### **Host publication information**

Title of host publication: 2013 IEEE 63rd Electronic Components and Technology Conference, ECTC 2013

Article number: 6575792

ISBN (Print): 9781479902330

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/ECTC.2013.6575792

URLs:

<http://www.scopus.com/inward/record.url?scp=84883371367&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84883371367

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Novel $\text{Er}^{3+}$ doped phosphate glass-ceramics for photonics**

In this invited proceeding, we report our latest results on the development of  $\text{Er}^{3+}$  doped phosphate glass-ceramics. Those new glass-ceramics were processed using different techniques, such as direct doping of particles into the glass melt and glass-ceramics methods. First, we explain the challenges to balance the survival and dispersion of  $\text{Er}^{3+}$  doped particles when preparing phosphate glass-ceramics using the direct doping of particles. Then, we discuss the impact of the glass crystallization on the luminescence properties of  $\text{Er}^{3+}$  ions.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Politecnico di Torino, Istituto Superiore Mario Boella, CSMFO Lab.

Contributors: Petit, L., Nguyen, H., Hongisto, M., Salminen, T., Hakkarainen, T., Lopez-Iscoa, P., Pugliese, D., Boetti, N. G., Milanese, D.

Publication date: 1 Sep 2017

#### **Host publication information**

Title of host publication: ICTON 2017 - 19th International Conference on Transparent Optical Networks

Publisher: IEEE COMPUTER SOCIETY PRESS

ISBN (Electronic): 9781538608586

ASJC Scopus subject areas: Computer Networks and Communications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: glass-ceramics, luminescence, nucleation and growth, particles-containing phosphate glasses

DOIs:

10.1109/ICTON.2017.8024877

#### **Bibliographical note**

INT=fot,"Nguyen, H."

INT=fot,"Hongisto, M."

jufoid=72297

Source: Scopus

Source ID: 85030976055

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Novel highly-efficient and misalignment insensitive wireless power transfer systems utilizing Strongly Coupled Magnetic Resonance principles**

The wireless powering efficiency of traditional Strongly Coupled Magnetic Resonance (SCMR) systems is highly sensitive to the alignment between the transmitter and receiver elements; an issue that has limited their applicability in practical wireless power transfer systems. This paper proposes a novel set of SCMR-based topologies that are insensitive to misalignment and isotropic while providing large wireless powering efficiencies. The systems, which are presented here, achieve power transfer efficiencies above 50% over the complete misalignment range of 0-90° with performance that is significantly better than typical SCMR elements.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Florida International University, Georgia Institute of Technology

Contributors: Daerhan, D., Jonah, O., Hu, H., Georgakopoulos, S. V., Tentzeris, M. M.

Number of pages: 4

Pages: 759-762

Publication date: 11 Sep 2014

#### **Host publication information**

Title of host publication: Proceedings - Electronic Components and Technology Conference

Publisher: Institute of Electrical and Electronics Engineers Inc.

Article number: 6897370

ISBN (Electronic): 9781479924073

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

DOIs:

10.1109/ECTC.2014.6897370

URLs:

<http://www.scopus.com/inward/record.url?scp=84907906443&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84907906443

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Observation of local electroluminescent cooling and identifying the remaining challenges**

The cooling of a light emitting diode (LED) by photons carrying out more energy than was used to electrically bias the device, has been predicted decades ago.<sup>1, 2</sup> While this effect, known as electroluminescent cooling (ELC), may allow e.g. fabricating thermophotonic heat pumps (THP) providing higher efficiencies than the existing solid state coolers,<sup>3</sup> ELC at powers sufficient for practical applications is still not demonstrated. To study high-power ELC we use double diode structures (DDSs), which consist of a double heterojunction (DHJ) LED and a photodiode (PD) grown within a single technological process and, thus, enclosed in a cavity with a homogeneous refractive index.<sup>4, 5</sup> The presence of the PD in the structure allows to more directly probe the efficiency of the LED, without the need for light extraction from the system, reducing undesirable losses. Our analysis of experimentally measured I - V curves for both the LED and the PD suggests that the local efficiency of the high-performance LEDs we have fabricated is approximately 110%, exceeding unity over a wide range of injection current densities of up to about 100A/cm<sup>2</sup>. At present the efficiency of the full DDS, however, still falls short of unity, not allowing direct evidence of the extraction of thermal energy from the LED. Here we review our previous studies of DDS for high-power EL cooling and discuss in more detail the remaining bottlenecks for demonstrating high-power ELC in the DDS context: the LED surface states, resistive and photodetection losses. In particular we report our first surface passivation measurements. Further optimization therefore mainly involves reducing the influence of the surface states, e.g. using more efficient surface passivation techniques and optimizing the PD. This combined with the optimization of the DDS layer thicknesses and contact metallization schemes is expected to finally allow purely experimental observation of high-power ELC.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Aalto University

Contributors: Radevici, I., Sadi, T., Tripurari, T., Tiira, J., Ranta, S., Tukiainen, A., Guina, M., Oksanen, J.

Publication date: 2019

#### **Host publication information**

Title of host publication: Photonic Heat Engines : Science and Applications  
Publisher: SPIE, IEEE  
Editors: Seletskiy, D. V., Epstein, R. I., Sheik-Bahae, M.  
Article number: 109360A  
ISBN (Electronic): 9781510625143

#### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 10936

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Double diode structures, Electroluminescent cooling, III-V semiconductors, Quantum efficiency, Surface states  
DOIs:

10.1117/12.2505814

#### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85065604697

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Optical and topographic changes in water-responsive patterned cholesteric liquid crystalline polymer coatings

In this work, we present patterned water-responsive coatings, which alter both their topological and optical properties. The polymer coatings are based on a hydrogen-bonded cholesteric liquid crystalline polymer network. A two-step photopolymerization procedure leads to a patterned coating with repeating liquid crystalline and isotropic areas. The cholesteric liquid crystalline areas reflect green light, whilst the isotropic areas are transparent for visible light. Treatment with alkaline solution results in a hygroscopic polymer salt coating. When placed in demineralized water, the polymer films swells, leading to an enhancement of the surface topography structure in which the liquid crystalline areas swell more. Moreover, the pitch of the helical organization in the cholesteric areas increases due to this swelling leading to a color change from green to red.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Eindhoven University of Technology, School of Mathematical Sciences

Contributors: Stumpel, J. E., Broer, D. J., Bastiaansen, C. W. M., Schenning, A. P. H. J.

Publication date: 2014

#### Host publication information

Title of host publication: Proceedings of SPIE : Organic Photonics VI

Volume: 9137

Publisher: SPIE

Article number: 91370U

ISBN (Print): 9781628410853

#### Publication series

Name: Proceedings of SPIE: the International Society for Optical Engineering

Publisher: SPIE

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: cholesteric liquid crystals, patterned surfaces, responsive optical coatings, responsive surface topographies, water-responsive

DOIs:

10.1117/12.2052678

URLs:

<http://www.scopus.com/inward/record.url?scp=84902324488&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Stumpel, Jelle"

Source: Scopus

Source ID: 84902324488

### **Optical fiber amplifier with spectral compression elements for high-power laser pulse generation**

We report main features of spectral compression of parabolic pulses in nonlinear optical fibers. It is shown that the variational analysis correctly describes evolution of pulse parameters during spectral compression. The model of cascade amplifier system employing spectral compression is developed to achieve superior spectral densities. The proposed configuration is promising as optical pulse preamplifier for operation in the high-energy pulse laser systems.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, University de Mons, Ulyanovsk State University, Optoelectronic Research Center

Contributors: Fotiadi, A. A., Korobko, D. A., Okhotnikov, O. G., Zolotovskii, I. O.

Publication date: 2016

#### **Host publication information**

Title of host publication: Nonlinear Optics and its Applications IV

Volume: 9894

Publisher: SPIE

Article number: 989411

ISBN (Electronic): 9781510601390

#### **Publication series**

Name: Proceedings of SPIE

Volume: 9894

ISSN (Print): 0277-786X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Electrical and Electronic Engineering, Applied Mathematics

Keywords: Fiber optics amplifiers, high-power laser pulses, nonlinear spectral compression, phase self-modulation

DOIs:

10.1117/12.2223637

Source: Scopus

Source ID: 84985911601

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Optical Frequency Comb Photoacoustic Spectroscopy**

We combine for the first time a mid-infrared optical frequency comb Fourier transform spectrometer with cantilever-enhanced photoacoustic detection and measure high-resolution broadband spectra of the fundamental band of methane in a few milliliter sample volume.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Energy Technology and Thermal Process Chemistry, University of Helsinki

Contributors: Sadiq, I., Mikkonen, T., Vainio, M., Toivonen, J., Foltynowicz, A.

Publication date: 1 May 2019

#### **Host publication information**

Title of host publication: 2019 Conference on Lasers and Electro-Optics, CLEO 2019 - Proceedings

Publisher: IEEE

ISBN (Electronic): 9781943580576

ASJC Scopus subject areas: Spectroscopy, Industrial and Manufacturing Engineering, Safety, Risk, Reliability and Quality, Management, Monitoring, Policy and Law, Electronic, Optical and Magnetic Materials, Radiology Nuclear Medicine and imaging, Instrumentation, Atomic and Molecular Physics, and Optics

DOIs:

10.23919/CLEO.2019.8749688

Source: Scopus

Source ID: 85069190764

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Passive UHF RFID-based user interface on a wooden surface**

We present a passive ultra-high frequency (UHF) radio frequency identification (RFID)-based human-technology interface platform. The platform comprises of two dipole antennas and three integrated circuits (IC), each with a unique ID. The platform, which is fixed on a wooden table by cutting the antennas and antenna-IC interconnections from copper tape, can

be used for push button and swipe controlling. Each IC can be activated, i.e., connected to the antennas, by touching with finger. As the RFID reader can be connected to any application through WIFI, these ICs can act as wireless input points integrated into furniture, items, and textiles, where they can be used as inputs to desired digital actions. The platform allows all connected devices to be controlled accurately and effortlessly, which will take the convenience of implementation and utilization of these systems to a new level. As a preliminary trial, the platform was tested by two people giving 200 random inputs and 98% and 99% success rates were achieved. Based on these results, this type of passive RFID-based solutions could be used for administrating interfaces that would administer wide variety of interaction modalities, such as touch or tangible interaction on flat surfaces (e.g., tabletop surfaces, walls, doors).

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: BioMediTech, Computing Sciences, Tampere University

Contributors: Mehmood, A., Vianto, V., He, H., Chen, X., Buruk, O. O., Ukkonen, L., Virkki, J.

Number of pages: 4

Pages: 1760-1763

Publication date: 1 Dec 2019

#### Host publication information

Title of host publication: 2019 Photonics and Electromagnetics Research Symposium - Fall, PIERS - Fall 2019 - Proceedings

Publisher: IEEE

Article number: 9021441

ISBN (Electronic): 9781728153049

ASJC Scopus subject areas: Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Mathematical Physics

DOIs:

10.1109/PIERS-Fall48861.2019.9021441

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Performance of Solar Cell Grids based on Ag, Au, and Al for Cost-Effective Manufacturing

We report on the performance of contact grids based on Ag, Al, and Au applied to III-V multijunction solar cells. We compare their suitability as grid metals from different perspectives, including price, mass-to-conductivity ratio, and abundance. The grid functionality was evaluated by performing charge transport experiments under simulated sunlight. The best solar cell performance was obtained for Ag contacts. On the other hand, Al and Ag provide the most cost-effective approach: when compared to Au for equal conductivities, the cost for the grid material being only about 1.1% in the case of Ag, and 0.7% for Al.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Research group: ORC

Contributors: Raappana, M., Aho, A., Aho, T., Isoaho, R., Anttola, E., Kajas, N., Polojärvi, V., Tukiainen, A., Guina, M.

Publication date: Oct 2019

#### Host publication information

Title of host publication: 2019 European Space Power Conference (ESPC)

Publisher: IEEE

ISBN (Print): 978-1-7281-2127-7

ISBN (Electronic): 978-1-7281-2126-0

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Renewable Energy, Sustainability and the Environment

Keywords: Solar Cell, Semiconducting III-V Materials

DOIs:

10.1109/ESPC.2019.8932002

#### Bibliographical note

INT=PHYS, "Anttola, Elina"

INT=PHYS, "Kajas, Ninja"

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Persistent luminescent glasses prepared using the direct doping method

We review our work on the development of persistent luminescent (PeL) glasses with different compositions. The direct doping method used for preparation of such glasses is explained. Special attention is paid to the stability of the PeL microparticles (MPs) in the glasses during the glass preparation. We demonstrate that the MPs stability is not only sensitive to the melting conditions but also to the glass composition.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Tampere University, Leibniz Institute of Photonic Technology e.V., Turun yliopisto, Kyoto University

Contributors: Aryal, U., Ojha, N., Trautvetter, T., Lastusaari, M., Ueda, J., Mueller, R., Veber, A., Petit, L.

Publication date: 1 Jul 2019

### Host publication information

Title of host publication: 21st International Conference on Transparent Optical Networks, ICTON 2019

Publisher: IEEE

ISBN (Electronic): 9781728127798

### Publication series

Name: International Conference on Transparent Optical Networks

ISSN (Electronic): 2161-2064

ASJC Scopus subject areas: Computer Networks and Communications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Direct doping method, Particles, Persistent luminescence, Phosphate glasses

DOIs:

10.1109/ICTON.2019.8840287

Source: Scopus

Source ID: 85073059546

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Phase-coded computational imaging for depth of field extension

We present a computational imaging approach, combining a phase-coded computational camera with a corresponding CNN-based deblurring network, that enables extended depth of field images. The simulations demonstrate promising results achieving significant depth of field extension.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Computing Sciences

Contributors: Sahin, E., Akpınar, U., Gotchev, A.

Publication date: 13 May 2019

### Host publication information

Title of host publication: Proceedings - Digital Holography and Three-Dimensional Imaging 2019

Publisher: Optical Society of America

ISBN (Electronic): 9781943580590

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

Source: Scopus

Source ID: 85086015554

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Picosecond MOPA with ytterbium doped tapered double clad fiber

The powerful picosecond master oscillator - power amplifier (MOPA) with double clad ytterbium doped tapered fiber as a buster amplifier has been demonstrated in the presented paper. The developed MOPA has 60ps pulses with 0.3mJ pulse energy and 5MW peak power.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: Ultrafast and intense lasers, Photonics, Research group: Nanophotonics, Ampliconix Ltd, Institute of Radio Engineering and Electronics of the Russian Academy of Sciences

Contributors: Filippov, V., Vorotynskii, A., Noronen, T., Gumenyuk, R., Chamorovskii, Y., Golant, K.

Number of pages: 6

Publication date: 2017

### Host publication information

Title of host publication: Fiber Lasers XIV : Technology and Systems

Volume: 10083

Publisher: SPIE

Article number: 100831H

ISBN (Electronic): 9781510606074

### Publication series

Name: Proceedings of SPIE

Publisher: SPIE

No.: 10083

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Fiber laser, Picosecond laser, Ultrafast laser

DOIs:

10.1117/12.2252006

Source: Scopus

Source ID: 85019465842

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Pipeline for effective denoising of digital mammography and digital breast tomosynthesis

Denoising can be used as a tool to enhance image quality and enforce low radiation doses in X-ray medical imaging. The effectiveness of denoising techniques relies on the validity of the underlying noise model. In full-field digital mammography (FFDM) and digital breast tomosynthesis (DBT), calibration steps like the detector offset and flat-fielding can affect some assumptions made by most denoising techniques. Furthermore, quantum noise found in X-ray images is signal-dependent and can only be treated by specific filters. In this work we propose a pipeline for FFDM and DBT image denoising that considers the calibration steps and simplifies the modeling of the noise statistics through variance-stabilizing transformations (VST). The performance of a state-of-the-art denoising method was tested with and without the proposed pipeline. To evaluate the method, objective metrics such as the normalized root mean square error (N-RMSE), noise power spectrum, modulation transfer function (MTF) and the frequency signal-to-noise ratio (SNR) were analyzed. Preliminary tests show that the pipeline improves denoising. When the pipeline is not used, bright pixels of the denoised image are under-filtered and dark pixels are over-smoothed due to the assumption of a signal-independent Gaussian model. The pipeline improved denoising up to 20% in terms of spatial N-RMSE and up to 15% in terms of frequency SNR. Besides improving the denoising, the pipeline does not increase signal smoothing significantly, as shown by the MTF. Thus, the proposed pipeline can be used with state-of-the-art denoising techniques to improve the quality of DBT and FFDM images.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Signal Processing, University of São Paulo, University of Pennsylvania

Contributors: Borges, L. R., Bakic, P. R., Foi, A., Maidment, A. D., Vieira, M. A.

Publication date: 2017

### Host publication information

Title of host publication: Medical Imaging 2017 : Physics of Medical Imaging

Publisher: SPIE

Article number: 1013206

ISBN (Electronic): 9781510607095

### Publication series

Name: Progress in biomedical optics and imaging

ISSN (Electronic): 1605-7422

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics, Biomaterials, Radiology Nuclear Medicine and imaging

Keywords: Denoising, Digital breast tomosynthesis, Full field digital mammography, Variance stabilization

Electronic versions:

Borges-Pipeline-SPIE2017

DOIs:

10.1117/12.2255058

URLs:

<http://urn.fi/URN:NBN:fi:tty-201907151960>

### Bibliographical note

jufoid=65546

Source: Scopus

Source ID: 85020415748

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Power and wavelength scaling using semiconductor disk laser - bismuth fiber MOPA systems**

We present a master oscillator power amplifier (MOPA) system that comprises a mode-locked semiconductor disk laser (SDL) emitting at 1.33  $\mu\text{m}$  and a bismuth-doped fiber amplifier. The mode-locked SDL was fabricated by wafer bonding an InP-based gain section with a GaAs-based distributed Bragg reflector (DBR) using (3-Mercaptopropyl)trimethoxysilane. The bismuth-doped fiber amplifier was pumped with a continuous wave SDL emitting at 1.18  $\mu\text{m}$ . The MOPA system produced pulses at a repetition rate of 827 MHz with a pulse energy of 0.62 nJ, which corresponds to an average output power of more than 0.5 W.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Research group: Semiconductor Technology and Applications, Ulyanovsk State University, Fiber Optics Research Center, Russian Academy of Sciences

Contributors: Heikkinen, J., Gumenyuk, R., Rantamäki, A., Lyytikäinen, J., Leinonen, T., Zolotovskii, I., Melkumov, M., Dianov, E. M., Okhotnikov, O. G.

Number of pages: 7

Publication date: 2015

#### **Host publication information**

Title of host publication: Vertical External Cavity Surface Emitting Lasers (VECSELS) V

Place of publication: BELLINGHAM

Publisher: SPIE

Editor: Guina, M.

Article number: 93490E

ISBN (Print): 9781628414394

#### **Publication series**

Name: Proceedings of SPIE

Publisher: SPIE-INT SOC OPTICAL ENGINEERING

Volume: 9349

ISSN (Print): 0277-786X

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Semiconductor disk laser (SDL), vertical-external-cavity surface-emitting laser (VECSEL), modelocking, wafer bonding, bismuth-doped fiber, master oscillator power amplifier (MOPA), SUPERCONTINUUM GENERATION, OUTPUT POWER, PICOSECOND, VECSEL, PULSES, GHZ

DOIs:

10.1117/12.2076805

Source: WOS

Source ID: 000353134900011

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Preserving natural scene lighting by strobe-lit video**

Capturing images in low light intensity, and preserving ambient light in such conditions pose significant problems in terms of achievable image quality. Either the sensitivity of the sensor must be increased, filling the resulting image with noise, or the scene must be lit with artificial light, destroying the aesthetic quality of the image. While the issue has been previously tackled for still imagery using cross-bilateral filtering, the same problem exists in capturing video. We propose a method of illuminating the scene with a strobe light synchronized to every other frame captured by the camera, and merging the information from consecutive frames alternating between high gain and high intensity lighting. The motion between the frames is compensated using motion estimation based on block matching between strobe-illuminated frames. The uniform lighting conditions between every other frame make it possible to utilize conventional motion estimation methods, circumventing the image registration challenges faced in fusing flash/non-flash pairs from non-stationary images. The results of the proposed method are shown to closely resemble those computed using the same filter based on reference images captured at perfect camera alignment. The method can be applied starting from a simple set of three frames to video streams of arbitrary lengths with the only requirements being sufficiently accurate syncing between the imaging device and the lighting unit, and the capability to switch states (sensor gain high/low, illumination on/off) fast enough.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Signal Processing, Research group: 3D MEDIA, Signal Processing Research Community (SPRC)

Contributors: Suominen, O., Gotchev, A.

Publication date: 2015

#### Host publication information

Title of host publication: Image Processing: Algorithms and Systems XIII

Publisher: SPIE

Article number: 939919

ISBN (Print): 9781628414899

#### Publication series

Name: SPIE Conference Proceedings

Volume: 9399

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Ambient light, Bilateral filter, Computational photography, Image denoising, Low-light, Motion compensation

Electronic versions:

EI2015\_suominen

DOIs:

10.1117/12.2185013

URLs:

<http://urn.fi/URN:NBN:fi:tyy-201606064228>

Source: Scopus

Source ID: 84928473920

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### Processing and Characterization of Bioactive Borosilicate Glasses and Scaffolds with Persistent Luminescence

In this proceeding, we report our latest results on the development of borosilicate glasses with persistent luminescence (PeL). Those PeL glasses were processed by adding PeL microparticles (MPs) in the glass using the direct doping method. First, we explain the challenges to balance the survival and dispersion of MPs when preparing borosilicate glasses using this method. Then, we show that scaffold can be obtained using the sintering process from these glasses but also by adding PeL microparticles (MPs) in the glass powder prior to sintering. Finally, we discuss the impact of the scaffold fabrication process on the PeL properties of the MPs.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Biomaterials and Tissue Engineering Group, Photonics, Research group: Photonics Glasses, Turku University of Applied Science

Contributors: Del Cerro, P. R., Saarinen, M., Massera, J., Norrbo, I., Lastusaari, M., Petit, L.

Number of pages: 5

Publication date: 26 Sep 2018

#### Host publication information

Title of host publication: 2018 20th International Conference on Transparent Optical Networks, ICTON 2018

Volume: 2018-July

Publisher: IEEE COMPUTER SOCIETY PRESS

Article number: 8473916

ISBN (Electronic): 9781538666043

#### Publication series

Name: Conference proceedings : International Conference on Transparent Optical Networks

ISSN (Print): 2161-2056

ASJC Scopus subject areas: Computer Networks and Communications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: borosilicate glasses, direct particles doping method, Dy microparticles, persistent luminescence, sintering, SrAlO:Eu

DOIs:

10.1109/ICTON.2018.8473916

#### Bibliographical note

INT=fot,"Del Cerro, P. Roldan"

Source: Scopus

Source ID: 85055532457

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Processing of printed silver patterns on an ETFE substrate

Printed electronics makes it possible to fabricate devices on thin and flexible substrates at a low cost and with simple processing. However, substrate characteristics can make patterning challenging. Here, we report our approach for processing printed silver patterns on an extremely hydrophobic ethylene-Tetrafluoroethylene (ETFE) foil substrate. The effects of selected surface modification methods on substrate characteristics and final print quality were studied, and the thermal characteristics of ETFE were determined. Conductive silver patterns were fabricated using both screen printing and inkjet printing techniques. Additionally, intense pulse light method was compared to thermal annealing as an alternative annealing method. The surface modification of ETFE was observed to affect ink wetting and print quality. It was concluded that the impact of the chosen annealing method on the final characteristics of the printed structures was significant.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electronics and Communications Engineering, Trelic Ltd.

Contributors: Mikkonen, R., Lahokallio, S., Frisk, L., Mäntysalo, M.

Number of pages: 7

Pages: 1-7

Publication date: 31 Jul 2018

#### Host publication information

Title of host publication: Proceedings - 2018 IMAPS Nordic Conference on Microelectronics Packaging, NORDPAC 2018

Publisher: IEEE

Article number: 8423860

ISBN (Print): 9789526815053

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: DSC, ETFE, IPL, Printed electronics, TMA

Electronic versions:

Accepted author manuscript

DOIs:

10.23919/NORDPAC.2018.8423860

URLs:

<http://urn.fi/URN:NBN:fi:tuni-201909273542>

#### Bibliographical note

EXT="Lahokallio, Sanna"

EXT="Frisk, Laura"

Source: Scopus

Source ID: 85051476038

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Processor core for 32 kbit/s G.726 ADPCM codecs

This paper describes an application specific DSP core designed to be used in a CCITT 32 kbit/s G.726 Adaptive Differential Pulse Code Modulation codec. The instruction set architecture and the programming model of the DSP core were derived from an algorithm profile and complexity analysis and the core was implemented using VHDL and logic synthesis. Architecture design efforts were concentrated on finding the minimum amount of hardware resources which could implement the required functionality within the clock cycle count limit. The result is a Harvard architecture processor core which can be used to implement the 32 kbit/s G.726 ADPCM encoding/decoding functions with very modest external instruction and data memory requirements. In a typical configuration the processor can perform a full encode decode operation for one sample in less than 1100 clock cycles. A gate-level implementation of less than 4000 gates of silicon area was created using logic synthesis for a standard cell technology.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Signaalinkäsittely

Contributors: Vehviläinen, J., Nurmi, J.

Number of pages: 4

Pages: 1932-1935

Publication date: 1995

#### Host publication information

Title of host publication: 1995 IEEE International Symposium on Circuits and Systems. ISCAS '95

Volume: 3

Publisher: IEEE

ISBN (Print): 0-7803-2570-2

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/ISCAS.1995.523797

Source: Scopus

Source ID: 0029200296

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Propagation dynamics of ultrabroadband terahertz beams with orbital angular momentum for wireless data transfer**

We investigate an approach to short and medium-range wireless communications based on the use of terahertz beams possessing an orbital angular momentum (OAM) that allows for noise-resistant broadband carrier. A theoretical model of the proposed beams generation is developed and numerical predictions are given for propagation and visualization of complex-structured THz beams, including ones carrying a unit topological charge on a large number of spectral components of broadband terahertz radiation. The assessment method which in our case is terahertz pulse time-domain holography allows for analyzing spatio-or and spatio-spectral evolution of arbitrary shaped THz wave trains during their propagation in free space and interaction with obstacles.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electrical Engineering, ITMO University, University of Birmingham

Contributors: Kulya, M. S., Sokolenko, B., Gorodetsky, A., Petrov, N. V.

Publication date: 2020

### **Host publication information**

Title of host publication: Broadband Access Communication Technologies XIV

Publisher: SPIE

Editors: Dingel, B. B., Tsukamoto, K., Mikroulis, S.

Article number: 113070J

ISBN (Print): 9781510633773

ISBN (Electronic): 9781510633780

### **Publication series**

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 11307

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: THz radiation, Vortex beams, wireless data transfer

DOIs:

10.1117/12.2547695

### **Bibliographical note**

jufoid=71479

Source: Scopus

Source ID: 85081176736

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Pulsed high-power yellow-orange VECSEL**

We report on the development of a pulsed high-power frequency doubled vertical-external-cavity surface-emitting laser (VECSEL) with a peak output power of 14 W and emission spectrum near 588 nm. The semiconductor gain chip was grown by molecular beam epitaxy and comprised 10 GaInAs quantum wells. The gain structure was designed to be antiresonant at 1180 nm. The fundamental wavelength was frequency doubled to the yellow-orange spectral range using a 10-mm long critically phase matched lithium triborate nonlinear crystal, situated at the mode waist of the V-shaped laser cavity. The emission spectrum was narrowed down to FWHM of < 0.2 nm by employing a 1.5 mm birefringent filter and a 100- $\mu$ m-thick etalon inside the cavity. By directly modulating the pump laser of the VECSEL, we were able to produce pulse widths down to 570 ns with average and peak output power of 81 mW and 14 W, respectively. The repetition rate was kept constant at 10 kHz throughout the measurements. The maximum peak power obtained was pump power limited. In comparison, at the same coolant temperature, a maximum of 8.5 W was achieved in continuous wave. The maximum optical-to-optical conversion efficiency (absorbed peak pump power to peak output power) was calculated to be 20-21 %. © 2014 SPIE.

### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics, Optoelectronics Research Centre, Tampere University of Technology

Contributors: Kantola, E., Leinonen, T., Ranta, S., Tavast, M., Guina, M.

Publication date: 2014

#### Host publication information

Title of host publication: Photonics Europe 2014, Semiconductor Lasers and Laser Dynamics VI, April 14-17, 2014, Brussels, Belgium. Proceedings of SPIE

Volume: 9134

Publisher: SPIE

Article number: 91340Z

ISBN (Print): 978-1-6284-1090-7

#### Publication series

Name: SPIE Conference Proceedings

Volume: 9134

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Frequency doubling, Gain modulation, High-efficiency, High-power, Pulsed, SHG, Yellow-orange VECSEL

DOIs:

10.1117/12.2054716

URLs:

<http://www.scopus.com/inward/record.url?scp=84902438552&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-08-31<br/>Publisher name: SPIE - International Society for Optical Engineering

Source: researchoutputwizard

Source ID: 654

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Quantum-well Laser Emitting at 1.2 $\mu\text{m}$ -1.3 $\mu\text{m}$ Window Monolithically Integrated on Ge Substrate

We report a quantum-well laser diode monolithically integrated on Ge substrate. The gain is provided by two GaInNAsSb/GaAs quantum-wells with emission at 1.2  $\mu\text{m}$ -1.3  $\mu\text{m}$ . The diode exhibits continuous-wave operation with mW-level output power at room temperature.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Research group: ORC

Contributors: Guina, M., Isoaho, R., Viheriälä, J., Aho, A., Aho, A., Tukiainen, A.

Number of pages: 3

Pages: 1-3

Publication date: 24 Apr 2018

#### Host publication information

Title of host publication: 43rd European Conference on Optical Communication, ECOC 2017

Publisher: IEEE

ISBN (Electronic): 9781538656242

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/ECOC.2017.8345837

Source: Scopus

Source ID: 85046978554

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Real-time depth image-based rendering with layered dis-occlusion compensation and aliasing-free composition

Depth Image-based Rendering (DIBR) is a popular view synthesis technique which utilizes the RGB+D image format, also referred to as view-plus-depth scene representation. Classical DIBR is prone to dis-occlusion artefacts, caused by the lack of information in areas behind foreground objects, which appear visible in the synthesized images. A number of recently proposed compensation techniques have addressed the problem of hole filling. However, their computational complexity

does not allow for real-time view synthesis and may require additional user input. In this work, we propose a hole-compensation technique, which works fully automatically and in a perceptually-correct manner. The proposed technique applies a two-layer model of the given RGB+D imagery, which is specifically tailored for rendering with free viewpoint selection. The main two components of the proposed technique are an adaptive layering of depth into relative 'foreground' and 'background' layers to be rendered separately and an additional blending filtering aimed at creating a blending function for aliasing cancellation during the process of view composition. The proposed real-time implementation turns ordinary view-plus-depth images to true 3D scene representations, which allow visualization in the fly-around manner.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Signal Processing, Research group: 3D MEDIA, Signal Processing Research Community (SPRC)

Contributors: Smirnov, S., Gotchev, A.

Publication date: 2015

#### Host publication information

Title of host publication: Proceedings of SPIE - The International Society for Optical Engineering

Publisher: SPIE

Article number: 93990T

ISBN (Print): 9781628414899

#### Publication series

Name: SPIE Conference Proceedings

Volume: 9399

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Electronic versions:

Smirnov 2015

DOIs:

10.1117/12.2086895

URLs:

<http://urn.fi/URN:NBN:fi:ty-201606154257>

Source: Scopus

Source ID: 84928501129

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Real-time measurements of nonlinear instabilities in optical fibers

We review recent advances in the real-time characterization of instabilities in nonlinear fiber optics systems. In particular, we show how these techniques can provide novel insight into the dynamics of ultrafast complex optical systems.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, UMR 6174

Contributors: Ryczkowski, P., Närhi, M., Billet, C., Merolla, J. M., Dudley, J. M., Genty, G.

Publication date: 2018

#### Host publication information

Title of host publication: CLEO : Applications and Technology, CLEO\_AT 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/CLEO\_AT.2018.AF2Q.1

Source: Scopus

Source ID: 85049124778

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Real-time measurements of ultrafast instabilities in nonlinear fiber optics: Recent advances

Recent years have seen renewed interest in the study of nonlinear fibre laser and propagation dynamics through the use of real-time measurement techniques for non-repetitive ultrafast optical signals. In this paper we review our recent work in this field using dispersive Fourier Transform and Time Lens techniques.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, UMR 6174

Contributors: Dudley, J. M., Ryczkowski, P., Närhi, M., Billet, C., Merolla, J. M., Lapre, C., Meng, F., Lacourt, P. A., Genty, G.

Publication date: 1 Jul 2019

### Host publication information

Title of host publication: 21st International Conference on Transparent Optical Networks, ICTON 2019

Publisher: IEEE

ISBN (Electronic): 9781728127798

### Publication series

Name: International Conference on Transparent Optical Networks

ISSN (Electronic): 2161-2064

ASJC Scopus subject areas: Computer Networks and Communications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/ICTON.2019.8840476

### Bibliographical note

jufoid=72297

Source: Scopus

Source ID: 85073069033

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Reliability of ACA interconnections on microvia HDI PCBs in thermal cycling conditions

New packaging technologies require new high density substrates. In built up high density interconnect (HDI) printed circuit boards (PCB) high density is achieved by using built up microvia layers. Such HDI PCBs may be used in many applications. In flip chip technology a bare chip is attached directly to a substrate which enables very high density and requires often also HDI PCBs. Anisotropic conductive adhesives (ACA) are especially well suited interconnection materials for high density flip chip applications. In this study the reliability of flip chip ACA attachments on several different HDI PCBs was studied. The PCBs had similar core layers, but the microvia layers of the PCBs were different. Test chips were attached on these PCBs using an ACA film (ACF). The reliability of the interconnections was tested using fast thermal cycling between the temperatures of -40°C and 125°C. Several failures were seen with all PCB materials during the 2,000 cycles of testing. The differences in the reliability of the different microvia layers were found to be relatively small and the microvia layer composition did not seem to be critical for the thermal cycling reliability of the ACF interconnections.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Electrical Engineering, Research area: Reliability

Contributors: Frisk, L., Lahokallio, S., Kiilunen, J.

Publication date: 5 Jun 2016

### Host publication information

Title of host publication: IMAPS Nordic Annual Conference 2016 Proceedings

Publisher: IMAPS-International Microelectronics and Packaging Society

Editor: Kutilainen, J.

ISBN (Electronic): 9781510827226

ASJC Scopus subject areas: Electrical and Electronic Engineering, Engineering (miscellaneous), Electronic, Optical and Magnetic Materials

Keywords: Anisotropic conductive adhesive, Flip chip, High density interconnect, Printed circuit board, Reliability, Thermal cycling

Source: Scopus

Source ID: 84988001295

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### RFDNA: A wireless authentication system on flexible substrates

The design and development of RFDNA, an RF authentication system consisting of wirelessly transmitting and receiving electromagnetic signals in the presence of a constellation of dense metals called certificates of authenticity that act as reflecting obstacles, has been performed [1]. The unique feature of this system is that the authentication is physical (hardware-based). Therefore, an integration process necessitates the manufacturing of certificates of authenticity to be durable and able to withstand normal wear and tear. In this system, one of the drawbacks has been the materials that have been used in the design. The materials for the readers have been designed on bulkier, non-conformable substrates,

such as FR4. Additionally, the certificates of authenticity consisted of metal wires that have been densely placed into heated plastic that is hardened to maintain the wires' position. In order to realize a more practical implementation, a new class of certificates of authenticity and readers need to be manufactured on flexible substrates. This paper will focus on the design of a new antenna for an RFDNA reader on flexible substrates.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Microsoft Research, Georgia Institute of Technology, School of Electrical and Computer Engineering

Contributors: Dejean, G., Lakafosis, V., Traille, A., Lee, H., Gebara, E., Tentzeris, M., Kirovski, D.

Number of pages: 6

Pages: 1332-1337

Publication date: 2011

#### Host publication information

Title of host publication: 2011 IEEE 61st Electronic Components and Technology Conference, ECTC 2011

Article number: 5898684

ISBN (Print): 9781612844978

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

DOIs:

10.1109/ECTC.2011.5898684

URLs:

<http://www.scopus.com/inward/record.url?scp=79960402541&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79960402541

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Screen-Printed Stretchable Interconnects

This article focuses on characterization of screen printed electrical interconnects for wearable applications. The interconnects are screen printed with stretchable silver-based ink on a thermoplastic polyurethane film. By optimizing the process parameters, we were able to fabricate 200  $\mu\text{m}$  line widths with spacing of 200  $\mu\text{m}$ . The average sheet resistance is 36.2 m $\Omega$ , however a significant lot-To-lot deviation was noted. In the strain tests, half of the samples have lost conductivity when 74.1% strain is reached. The normalized resistances of the samples rise linearly to approximately 30 % strain, after which the growth rate and deviation between samples increases significantly. It was also discovered that no cracking can be found from the traces while subjected to strains under 30%.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Department of Electronics and Communications Engineering

Contributors: Suikkola, J., Kankkunen, T., Iso-Ketola, P., Vanhala, J., Mäntysalo, M.

Number of pages: 6

Pages: 1650-1655

Publication date: 16 Aug 2016

#### Host publication information

Title of host publication: Proceedings - ECTC 2016: 66th Electronic Components and Technology Conference

Publisher: IEEE

ISBN (Electronic): 9781509012039

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: Printed electronics, Screen printed, Stretchable, Wearable

DOIs:

10.1109/ECTC.2016.132

#### Bibliographical note

INT=elt,"Kankkunen, Timo"

INT=elt,"Suikkola, Jari"

Source: Scopus

Source ID: 84987850149

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Screen printed temporary tattoos for skin-mounted electronics

This paper focus on fabrication and analyzation of screen-printed temporary transfer electrical tattoos. Stretchable conductors and insulators are printed on temporary transfer tattoo paper. The printed lines are electrically and electromechanically characterized. Four different test structures were used to evaluate the sheet resistance and the quality of the printing process. The acquired sheet resistance of the tattoos was  $42 \text{ m}\Omega/\square$  with a standard deviation of  $6 \text{ m}\Omega/\square$ . The maximum tensile strain before breaking was 19.4 %. Finally, on-skin performance was evaluated by attaching a printed tattoo on a knee and backhand of a test person. The skin-mounted tattoo showed good electrical performance and conformability.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electrical Engineering, Research group: Wireless Communications and Positioning

Contributors: Tuominen, S., Mäntysalo, M.

Number of pages: 6

Pages: 1252-1257

Publication date: 1 May 2019

#### Host publication information

Title of host publication: IEEE 69th Electronic Components and Technology Conference, ECTC 2019

Publisher: IEEE

ISBN (Electronic): 9781728114989

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

Keywords: Printed electronics, Stretchable electronics, Temporary electrical tattoo

Electronic versions:

p568

DOIs:

10.1109/ECTC.2019.00194

URLs:

<http://urn.fi/URN:NBN:fi:tuni-202001151299>

#### Bibliographical note

INT=elen,"Tuominen, Samuli"

Source: Scopus

Source ID: 85072291977

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### SESAM mode-locked Tm: CALGO laser at 2 $\mu\text{m}$

GaSb-based SESAM is successfully employed for passive mode locking of a  $\text{Tm}^{3+}$ :  $\text{CaGdAlO}_4$  laser operating near 2  $\mu\text{m}$ . The pulse duration is around 650 fs at a repetition rate  $\sim 100$  MHz.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: Semiconductor Technology and Applications, Optoelectronics Research Centre, Frontier Photonics, Max Born Institute, Shanghai Jiaotong University, Jiangsu Normal University, Vital Materials Co., Limited, Dipartimento di Ingegneria Industriale e Dell'Informazione, Universitat Rovira i Virgili, Belarusian National Technical University

Contributors: Wang, Y., Xie, G., Xu, X., Di, J., Qin, Z., Suomalainen, S., Guina, M., Härkönen, A., Agnesi, A., Griebner, U., Mateos, X., Loiko, P., Petrov, V.

Publication date: 2015

#### Host publication information

Title of host publication: Advanced Solid State Lasers, ASSL 2015

Publisher: Optical Society of America OSA

Article number: AW1A.2

ISBN (Print): 9781943580026

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1364/ASSL.2015.AW1A.2

Source: Scopus

Source ID: 84947590871

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Short-range supercontinuum based lidar for combustion diagnostics**

We developed a short range Lidar system using a supercontinuum source spectrally tailored to cover the ro-vibrational transition energies of desired components of a flue gas. The system enables simultaneous remote measurements of the gas parameters, like temperature and concentration which play a key role in the performance of combustion power plants. The technique requires only one inspection window and can thus be used in combustion units with limited access. It exploits differential absorption between specific wavelength bands of the gas absorption spectrum. The transmittance of individual wavelength band is derived from the detected backscattered temporal intensity of the supercontinuum pulses. We demonstrate preliminary industrial measurement of water vapor temperature and concentration in a full scale boiler. The technique also enables 3D mapping of temperature and concentration.

#### **General information**

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Physics, Valmet Technologies Oy  
Contributors: Saleh, A., Ryczkowski, P., Genty, G., Toivonen, J.  
Publication date: 2019

#### **Host publication information**

Title of host publication: SPIE Future Sensing Technologies  
Publisher: SPIE, IEEE  
Editors: Kimata, M., Valenta, C. R.  
Article number: 111970Y  
ISBN (Electronic): 9781510631113

#### **Publication series**

Name: Proceedings of SPIE  
Volume: 11197  
ISSN (Print): 0277-786X  
ISSN (Electronic): 1996-756X  
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering  
Keywords: Combustion, Diagnostics, Lidar, Remote sensing, Supercontinuum  
DOIs:  
10.1117/12.2542720

#### **Bibliographical note**

jufoid=71479  
Source: Scopus  
Source ID: 85078209433  
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Simulation of photon-photon resonance enhanced direct modulation bandwidth of DFB lasers**

Simulations and experimental results of high-frequency photon-photon resonance are used to examine the possibilities to extend the direct modulation bandwidth in dual-mode distributed feedback lasers beyond the conventional limit set by the carrier-photon resonance.

#### **General information**

Publication status: Published  
MoE publication type: A4 Article in a conference publication  
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Brighterwave Inc, Politecnico di Torino  
Contributors: Dumitrescu, M., Uusitalo, T., Virtanen, H., Laakso, A., Bardella, P., Montrosset, I.  
Number of pages: 2  
Pages: 147-148  
Publication date: 17 Aug 2016

#### **Host publication information**

Title of host publication: 16th International Conference on Numerical Simulation of Optoelectronic Devices, NUSOD 2016  
Publisher: IEEE  
ISBN (Electronic): 978-1-4673-8603-6  
ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Modelling and Simulation, Numerical Analysis  
DOIs:  
10.1109/NUSOD.2016.7547075

#### **Bibliographical note**

EXT="Laakso, A."

Source: Scopus

Source ID: 84987641496

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Simulation studies of DFB laser longitudinal structures for narrow linewidth emission**

Simulation studies targeting high-power narrow-linewidth emission from DFB lasers are presented. The linewidth and output power calculations take into account the mirror losses, including the grating and the facets, as well as spontaneous emission noise, effective refractive index, power and carrier density variations inside the cavity. The longitudinal power and carrier density distributions have been evaluated and their effects on longitudinal spatial hole burning and possible side mode lasing are discussed.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications

Contributors: Virtanen, H., Uusitalo, T., Dumitrescu, M.

Number of pages: 2

Pages: 153-154

Publication date: 17 Aug 2016

#### **Host publication information**

Title of host publication: 16th International Conference on Numerical Simulation of Optoelectronic Devices, NUSOD 2016

Publisher: IEEE

ISBN (Electronic): 9781467386036

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Modelling and Simulation, Numerical Analysis

DOIs:

10.1109/NUSOD.2016.7547078

Source: Scopus

Source ID: 84987641768

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Simultaneous binary hash and features learning for image retrieval**

Content-based image retrieval systems have plenty of applications in modern world. The most important one is the image search by query image or by semantic description. Approaches to this problem are employed in personal photo-collection management systems, web-scale image search engines, medical systems, etc. Automatic analysis of large unlabeled image datasets is virtually impossible without satisfactory image-retrieval technique. It's the main reason why this kind of automatic image processing has attracted so much attention during recent years. Despite rather huge progress in the field, semantically meaningful image retrieval still remains a challenging task. The main issue here is the demand to provide reliable results in short amount of time. This paper addresses the problem by novel technique for simultaneous learning of global image features and binary hash codes. Our approach provide mapping of pixel-based image representation to hash-value space simultaneously trying to save as much of semantic image content as possible. We use deep learning methodology to generate image description with properties of similarity preservation and statistical independence. The main advantage of our approach in contrast to existing is ability to fine-tune retrieval procedure for very specific application which allow us to provide better results in comparison to general techniques. Presented in the paper framework for data-dependent image hashing is based on use two different kinds of neural networks: convolutional neural networks for image description and autoencoder for feature to hash space mapping. Experimental results confirmed that our approach has shown promising results in compare to other state-of-the-art methods.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Don State Technical University, Univ of Texas at San Antonio

Contributors: Frantc, V. A., Makov, S. V., Voronin, V. V., Marchuk, V. I., Semenishchev, E. A., Egiazarian, K. O., Agaian, S.

Publication date: 2016

#### **Host publication information**

Title of host publication: Mobile Multimedia/Image Processing, Security, and Applications 2016

Publisher: SPIE

Article number: 986902

ISBN (Electronic): 9781510601109

### Publication series

Name: SPIE Conference Proceedings

Volume: 9869

ISSN (Print): 0277-786X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: autoencoder, content-based image retrieval, deep convolutional neural network, semantic hashing

DOIs:

10.1117/12.2223605

Source: Scopus

Source ID: 84991480411

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Single exposure lensless subpixel phase imaging

Lensless phase-retrieval system with phase modulation of free propagation wavefront is proposed. Contrary to the traditional super-resolution phase-retrieval, the method in this paper requires a single observation only and uses advanced SR-SPAR iterative technique. Successful object imaging relies on modulation of the object wavefront with a random phase-mask, which generates enlarged intensity patterns, allowing us to extract more information than it is possible without such a mask. The achieved high-quality super-resolution phase-imaging is demonstrated by simulation-tests produced with the parameters corresponding to the physical prototype of the considered optical system.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Computing Sciences, Research group: Computational Imaging-CI

Contributors: Kocsis, P., Shevkunov, I., Katkovnik, V., Egjazarian, K.

Number of pages: 9

Publication date: 2019

### Host publication information

Title of host publication: Digital Optical Technologies 2019

Publisher: SPIE, IEEE

Editors: Kress, B. C., Schelkens, P.

ISBN (Electronic): 9781510628038

### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 11062

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Diffractive optical element, Lensless imaging, Lensless system design, Phase imaging, Phase measurement, Phase retrieval, Sparse representation, Sub-pixel resolution

DOIs:

10.1117/12.2525679

Source: Scopus

Source ID: 85074197001

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Single KTiOPO4 nanocrystals for nonlinear probing of local optical fields and interaction with a metallic nanostructure

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: CNRS Centre National de la Recherche Scientifique, Laboratoire de Photonique Quantique et Moléculaire-ENS Cachan, UMR 8537, Laboratoire de Physique de la Matière Condensée-Ecole Polytechnique-CNRS, ESPCI, Laboratoire Photons Et Matière, UPR A0005, Ecole Polytechnique, Cristal Laser S.A.

Contributors: Slablab, A., Le Xuan, L., Zhou, C., Chauvat, D., De Wilde, Y., Perruchas, S., Tard, C., Gacoin, T., Villeval, P., Roch, J. F.

Publication date: 2009

### Host publication information

Title of host publication: CLEO/Europe - EQEC 2009 - European Conference on Lasers and Electro-Optics and the European Quantum Electronics Conference

Article number: 5192089

ISBN (Print): 9781424440801

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/CLEOE-EQEC.2009.5192089

Source: Scopus

Source ID: 70449578610

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Site-controlled InAs Quantum Dots for Plasmonics

We present site-controlled epitaxy of InAs quantum dots (QD) for plasmonics and report QD-plasmon coupling in a hybrid structure consisting of site-controlled InAs/GaAs QD chains in the proximity of an Ag film.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications,

Research group: Laboratory for Future Electronics, Department of Physics, Research group: Nanophotonics

Contributors: Hakkarainen, T., Tommila, J., Schramm, A., Simonen, J., Niemi, T., Strelow, C., Kipp, T., Kontio, J., Guina, M.

Publication date: 2016

#### Host publication information

Title of host publication: Conference on Lasers and Electro-Optics 2016 : QELS\_Fundamental Science

Publisher: OSA - The Optical Society

Article number: FM1B.3

ISBN (Electronic): 978-1-943580-11-8

ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials

Keywords: (250.5403) Plasmonics, (160.4236) Nanomaterials, (160.6000) Semiconductor materials

DOIs:

10.1364/CLEO\_QELS.2016.FM1B.3

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Strong localization in unintentional disordered photonics crystal waveguides

Photonics crystal waveguide (PhCW), as a promising tool for realizing photonic integrated chip, can provide remarkable confinements of light field. In this report, we show that real PhCWs (i.e. PhCWs with fabrication imperfections left by state of the art fabrication facilities) without any intentional disorder support highly-confined localization states with a spatial extent comparable to that achieved with engineered micro-cavities [1]-[2].

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Frontier Photonics, Laboratoire Photonique Numérique et Nanosciences, CNRS

Contributors: Zang, X., Lalanne, P.

Number of pages: 3

Pages: 322-324

Publication date: 2013

#### Host publication information

Title of host publication: 2013 7th International Congress on Advanced Electromagnetic Materials in Microwaves and Optics, METAMATERIALS 2013

Publisher: IEEE COMPUTER SOCIETY PRESS

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

DOIs:

10.1109/MetaMaterials.2013.6809040

Source: Scopus

Source ID: 84901218135

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### Study of second-harmonic generation from CdS nanostructured thin film

We investigate the second-order nonlinear optical properties of a nanostructured cadmium sulfide thin film by optical second-harmonic generation. The relative values of the components of the second-order susceptibility tensor are found to be 1,  $\chi_{xxz}$  = 0.14,  $\chi_{zxx}$  = and 0.07.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Department of Physics, Research area: Optics, Research group: Nonlinear Optics, Frontier Photonics, International School of Photonics, Cochin University of Science and Technology

Contributors: Mathew, S., Koskinen, K., Czaplicki, R., Pradeep, C., Kailasnath, M., GVallabhan, C. P., Kauranen, M., Radhakrishnan, P.

Number of pages: 4

Publication date: 19 Dec 2014

### Host publication information

Title of host publication: 12th International Conference on Fiber Optics and Photonics

Publisher: Optical Society of America (OSA)

Article number: M4A.46

ISBN (Print): 9781557528827

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1364/PHOTONICS.2014.M4A.46

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Sub-100 fs pulse generation from a Tm,Ho: CALYO laser mode-locked by a GaSb-based SESAM at ~2043 nm

We report on the first sub-100-fs mode-locked Ho<sup>3+</sup>-laser in the 2- $\mu$ m spectral range. The disordered co-doped Tm,Ho:CaYAIO<sub>4</sub> (Tm,Ho:CALYO) crystal produced pulses as short as 87 fs with 27-mW average output power at 80.45-MHz repetition rate.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Max Born Institute, Jiangsu Normal University, Universitat Rovira i Virgili, China Academy of Engineering Physics, ITMO University, Tongji University

Contributors: Zhao, Y., Wang, Y., Zhang, X., Mateos, X., Pan, Z., Loiko, P., Zhou, W., Xu, X., Xu, J., Shen, D., Suomalainen, S., Härkönen, A., Guina, M., Griebner, U., Petrov, V.

Publication date: 1 Jan 2018

### Host publication information

Title of host publication: CLEO : Science and Innovations, CLEO\_SI 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/CLEO\_SI.2018.SF2N.1

Source: Scopus

Source ID: 85048984709

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Sub-10 optical-cycle mode-locked Tm:(Lu<sub>2/3</sub>Sc<sub>1/3</sub>)<sub>2</sub>O<sub>3</sub> mixed ceramic laser at 2057 nm

We present the first sub-10 optical-cycle bulk solid-state laser emitting in the 2- $\mu$ m spectral range: A Tm<sup>3+</sup>:(Lu<sub>2/3</sub>Sc<sub>1/3</sub>)<sub>2</sub>O<sub>3</sub> mixed ceramic laser mode-locked by a near-surface design GaSb-based SESAM produced nearly Fourier-limited pulses as short as 63 fs.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Research group: ORC, Max Born Institute, China Academy of Engineering Physics, ITMO University, Jiangsu Normal University, Universitat Rovira i Virgili

Contributors: Wang, Y., Jing, W., Loiko, P., Zhao, Y., Huang, H., Suomalainen, S., Härkönen, A., Guina, M., Mateos, X., Griebner, U., Petrov, V.

Number of pages: 3

Publication date: 2017

### Host publication information

Title of host publication: Advanced Solid State Lasers 2017 : Nagoya, Aichi Japan 1–5 October 2017

Publisher: The Optical Society; OSA

Article number: ATu6A.4

ISBN (Electronic): 978-0-9600380-7-7

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/ASSL.2017.ATu6A.4

Source: Scopus

Source ID: 85039167684

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Sub-parts-per-trillion sensitivity in trace gas detection by cantilever-enhanced photo-acoustic spectroscopy**

We report a simple cantilever-enhanced photoacoustic detector, which reaches exceptionally good sensitivity in trace gas detection of hydrogen fluoride by using a highly stable narrow-linewidth optical parametric oscillator at 2.476  $\mu\text{m}$ .

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, University of Helsinki, Gasera Ltd.

Contributors: Tomberg, T., Vainio, M., Hieta, T., Halonen, L.

Publication date: 2018

#### **Host publication information**

Title of host publication: CLEO : Applications and Technology, CLEO\_AT 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/CLEO\_AT.2018.ATh1O.8

Source: Scopus

Source ID: 85049146097

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Switchable unidirectional second-harmonic emission through GaAs nanoantennas**

Switching the scattering direction of high-index dielectric nanoantennas between forward and backward, via Mie resonances in the linear regime, has been widely studied, recently. However, switching the harmonic emission of nanoantennas without applying any physical change to the antennas, such as geometry, or environment, is a challenging task that has not been demonstrated yet. Here, we investigate multipolar second-harmonic switch from GaAs nanoantennas. Based on the peculiar nonlinearities of zinc-blende semiconductors, we demonstrate both theoretically and experimentally unidirectional nonlinear emission routing and switching via pump polarization control. Our results offer exciting opportunities for nonlinear nanophotonics technologies, such as nanoscale light routing elements, nonlinear light sources, nonlinear imaging, multifunctional flat optical elements.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: Nonlinear Optics, Physics, School of Engineering and Information Technology, University of New South Wales (UNSW) Australia, HCI e 486.1, Australian National University, Institute of Applied Physics of the Russian Academy of Sciences

Contributors: Xu, L., Saerens, G., Timofeeva, M., Miroshnichenko, A. E., Camacho-Morales, R., Volkovskaya, I., Smirnova, D. A., Lysevych, M., Huang, L., Cai, M., Karouta, F., Hoe Tan, H., Kauranen, M., Jagadish, C., Grange, R., Neshev, D. N., Rahmani, M.

Publication date: 2019

#### **Host publication information**

Title of host publication: AOS Australian Conference on Optical Fibre Technology, ACOFT 2019 and Australian Conference on Optics, Lasers, and Spectroscopy, ACOLS 2019

Publisher: SPIE

Editors: Mitchell, A., Rubinsztein-Dunlop, H.

Article number: 112000J

ISBN (Electronic): 9781510631403

#### **Publication series**

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 11200

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Dielectric nanoresonators, Mie resonance, Second harmonic generation, Unidirectional emission

DOIs:

10.1117/12.2539887

### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85079683447

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### System-level design for partially reconfigurable hardware

In this paper, we present a SystemC-based approach for system-level design of partially reconfigurable hardware. The main focuses are resource estimation to support system analysis, reconfiguration modeling for fast performance simulation, automatic generation of reconfigurable components and a static prefetch scheduler. The approach was applied in a real design case of a part of a WCDMA decoding algorithm on a commercial reconfigurable platform.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Digitaali- ja tietokonetekniikka, VTT Technical Research Centre of Finland

Contributors: Qu, Y., Tiensyrjä, K., Soininen, J. P., Nurmi, J.

Number of pages: 4

Pages: 2738-2741

Publication date: 2007

### Host publication information

Title of host publication: 2007 IEEE International Symposium on Circuits and Systems

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

DOIs:

10.1109/ISCAS.2007.378619

Source: Scopus

Source ID: 34548825693

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Tailoring directional scattering of second-harmonic generation from (111)-GaAs nanoantennas

The group of zincblende III-V compound semiconductors, especially (100)-grown AlGaAs and GaAs, have recently been presented as promising materials for second harmonic generation (SHG) at the nanoscale. However, major obstacles to push the technology towards practical applications are the limited control over directionality of the SH emission and especially zero forward/backward radiation. In this work we provide both theoretically and experimentally a solution to these problems by presenting the first SHG nanoantennas made from (111)-GaAs embedded in a low index material. These nanoantennas show superior forward directionality compared to their (100)-counterparts. Most importantly, it is possible to manipulate the SHG radiation pattern of the nanoantennas by changing the pump polarization without affecting the linear properties and the total nonlinear conversion efficiency.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Research group: Nonlinear Optics, Physics, Australian National University, Friedrich-Schiller-University Jena, School of Engineering and Information Technology, University of New South Wales (UNSW) Australia, Institute of Applied Physics of the Russian Academy of Sciences

Contributors: Sautter, J., Xu, L., Miroshnichenko, A., Lysevych, M., Volkovskaya, I., Smirnova, D., Camacho Morales, M., Zangeneh Kamali, K., Karouta, F., Vora, K., Tan, H. H., Kauranen, M., Staude, I., Jagadish, C., Neshev, D. N., Rahmani, M.

Publication date: 2019

### Host publication information

Title of host publication: AOS Australian Conference on Optical Fibre Technology, ACOFT 2019 and Australian Conference on Optics, Lasers, and Spectroscopy, ACOLS 2019

Publisher: SPIE

Editors: Mitchell, A., Rubinsztein-Dunlop, H.

Article number: 112000H

ISBN (Electronic): 9781510631403

### Publication series

Name: Proceedings of SPIE - The International Society for Optical Engineering

Volume: 11200

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Dielectric nanoantennas, Directional emission, Multipolar interference, Second harmonic generation

DOIs:

10.1117/12.2539086

### Bibliographical note

jufoid=71479

Source: Scopus

Source ID: 85079653740

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Teaching for virtual work

Universities are still mainly preparing students for the world, where 'do something useful', i.e. 'do something with your hands' was the main principle and work was done during strictly regulated time. But world has changed and traditional areas of human activity (what also are the main target in University courses) are rapidly diminishing. More important have become virtual products - computer programs, mobile apps, social networks, new types of digital currencies, IOT (voice in your bathroom suggesting to buy the next model of Alexa), video games, interactive TV, virtual reality etc. Most of these new areas are not present in current curricula and there are problems with involving them in curricula - (working) students know (some aspects of) these areas better than many of university teachers, since corresponding knowledge is not yet present in textbooks - it is present only on Internet. The Internet strongly influences both what we teach and how we teach.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Computing Sciences, Tallinn University of Technology, University of Lapland

Contributors: Henno, J., Jaakkola, H., Mäkelä, J.

Number of pages: 9

Pages: 818-826

Publication date: 1 May 2019

### Host publication information

Title of host publication: 2019 42nd International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2019 - Proceedings

Publisher: IEEE

Editors: Skala, K., Car, Z., Pale, P., Huljenic, D., Janjic, M., Korcic, M., Sruk, V., Ribaric, S., Grbac, T. G., Butkovic, Z., Cicin-Sain, M., Skvorc, D., Mauher, M., Babic, S., Gros, S., Vrdoljak, B., Tijan, E.

ISBN (Electronic): 9789532330984

ASJC Scopus subject areas: Computer Networks and Communications, Hardware and Architecture, Information Systems, Energy Engineering and Power Technology, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.23919/MIPRO.2019.8756778

URLs:

[http://docs.mipro-proceedings.com/proceedings/mipro\\_2019\\_proceedings.pdf](http://docs.mipro-proceedings.com/proceedings/mipro_2019_proceedings.pdf)

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### The effects of I/Q imbalance on wireless communications: A survey

Radio frequency front-ends constitute a core part of both conventional and emerging communication systems. Yet, although hardware realizations practically suffer from several types of impairments that degrade the overall system performance, the corresponding effects are often neglected and transceivers are assumed ideal. This typically refers to effects that are typically related to amplifier nonlinearities, phase noise and in phase and quadrature imbalance (IQI), with the latter being among the most critical ones. In this context, this work provides a thorough survey on the effects of IQI, aiming to highlight their important manifestations which depending on the considered scenario can result to destructive and occasionally constructive effects.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Khalifa University, Department of Electrical and Computer Engineering, University of Surrey, Aristotle University of

Thessaloniki

Contributors: Selim, B., Sofotasios, P. C., Muhaidat, S., Karagiannidis, G. K.

Publication date: 2 Mar 2017

#### Host publication information

Title of host publication: 2016 IEEE 59th International Midwest Symposium on Circuits and Systems (MWSCAS)

Publisher: IEEE

ISBN (Electronic): 9781509009169

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

DOIs:

10.1109/MWSCAS.2016.7870102

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### The magical world of metamaterials

We review experimental and theoretical studies performed on left-handed metamaterials (LHM). The metamaterials exhibit quiet unusual electromagnetic properties such as negative refraction, negative phase velocity, subwavelength focusing, subwavelength cavities and enhanced transmission.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Nanotechnology Research Center, Bilkent University

Contributors: Caglayan, H., Ozbay, E.

Publication date: 2009

#### Host publication information

Title of host publication: Photonic Materials, Devices, and Applications III

Volume: 7366

Article number: 73660X

ISBN (Print): 9780819476401

#### Publication series

Name: Proceedings of SPIE

Publisher: SPIE

Volume: 7366

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: Left-handed metamaterial, Metamaterials, Negative refractive index, Superlens

DOIs:

10.1117/12.821407

URLs:

<http://www.scopus.com/inward/record.url?scp=70349983117&partnerID=8YFLogxK> (Link to publication in Scopus)

#### Bibliographical note

EXT="Caglayan, Humeyra"

Source: Scopus

Source ID: 70349983117

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

#### Thermal effects on a passive wireless antenna sensor for strain and crack sensing

For application in structural health monitoring, a folded patch antenna has been previously designed as a wireless sensor that monitors strain and crack in metallic structures. Resonance frequency of the RFID patch antenna is closely related with its dimension. To measure stress concentration in a base structure, the sensor is bonded to the structure like a traditional strain gage. When the antenna sensor is under strain/deformation together with the base structure, the antenna resonance frequency varies accordingly. The strain-related resonance frequency variation is wirelessly interrogated and recorded by a reader, and can be used to derive strain/deformation. Material properties of the antenna components can have significant effects on sensor performance. This paper investigates thermal effects through both numerical simulation and temperature chamber testing. When temperature fluctuates, previous sensor design (with a glass microfiber-reinforced PTFE substrate) shows relatively large variation in resonance frequency. To improve sensor performance, a new ceramic-filled PTFE substrate material is chosen for re-designing the antenna sensor. Temperature chamber experiments are also conducted to the sensor with new substrate material, and compared with previous design.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering, Virginia Tech

Contributors: Yi, X., Vyas, R., Cho, C., Fang, C. H., Cooper, J., Wang, Y., Leon, R. T., Tentzeris, M. M.

Publication date: 2012

### Host publication information

Title of host publication: Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2012

Volume: 8345

Article number: 83450F

ISBN (Print): 9780819490025

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Crack sensor, Folded patch antenna, Passive wireless sensor, RFID, Strain sensor, Thermal effect

DOIs:

10.1117/12.914833

URLs:

<http://www.scopus.com/inward/record.url?scp=84861112128&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84861112128

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Thickness variation study of RFID-based folded patch antennas for strain sensing

This paper explores folded patch antennas for the development of low-cost and wireless smart-skin sensors that monitor the strain in metallic structures. When the patch antenna is under strain/deformation, its resonance frequency varies accordingly. The variation can be easily interrogated and recorded by a wireless reader that also provides power for the antenna operation. The patch antenna adopts a specially selected substrate material with low dielectric constant, as well as an inexpensive off-the-shelf radiofrequency identification (RFID) chip for signal modulation. A thicker substrate increases RFID signal-to-noise ratio, but reduces the strain transfer efficiency. To experimentally study the effect of substrate thickness, two prototype folded patch antennas with different substrate thicknesses have been designed and manufactured. For both prototypes, tensile testing results show strong linearity between the interrogated resonance frequency and the strain experienced by the antenna. Longer interrogation range is achieved with the larger substrate thickness.

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering

Contributors: Yi, X., Wu, T., Lantz, G., Wang, Y., Leon, R. T., Tentzeris, M. M.

Publication date: 2011

### Host publication information

Title of host publication: Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2011

Volume: 7981

Article number: 79811H

ISBN (Print): 9780819485434

ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: folded patch antenna, passive wireless sensor, RFID, strain sensor, substrate thickness

DOIs:

10.1117/12.879868

URLs:

<http://www.scopus.com/inward/record.url?scp=79956325124&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 79956325124

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### Towards efficient nonlinear plasmonic metasurfaces

Nonlinear processes are important in many fields of photonics ranging from biomedical imaging to ultrashort pulse generation. Progress in nanophotonics and metamaterials has created a growing demand for nanoscale nonlinear optical components. However, it is difficult to answer this demand by using traditional materials motivating the search for alternatives approaches. Nonlinear plasmonics has emerged as a viable solution for enabling efficient and nanoscale

nonlinear optics. Despite steady progress, so far achieved conversion efficiencies of metamaterials have not yet rivalled conventional nonlinear materials. Here, we discuss our recent progress in development of efficient nonlinear plasmonic metamaterials. Focus is on metasurfaces utilizing collective responses known as surface lattice resonances, which can be used to dramatically boost nonlinear responses of metasurfaces.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Physics, Research group: Nonlinear Optics, Tampere University, University of Ottawa, Canada, Institute of Physics, Nicolaus Copernicus University, University of Eastern Finland, CRPP, University of Rochester

Contributors: Huttunen, M. J., Stolt, T., Reshef, O., Kiviniemi, A., Czaplicki, R., Zang, X., Vartiainen, I., Butet, J., Kuittinen, M., Martin, O. J., Dolgaleva, K., Boyd, R. W., Kauranen, M.

Publication date: 1 Jul 2019

#### Host publication information

Title of host publication: 21st International Conference on Transparent Optical Networks, ICTON 2019

Publisher: IEEE

ISBN (Electronic): 9781728127798

#### Publication series

Name: International Conference on Transparent Optical Networks

ISSN (Electronic): 2161-2064

ASJC Scopus subject areas: Computer Networks and Communications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

Keywords: Frequency conversion, Metasurfaces, Nonlinear metamaterials, Surface lattice resonances

DOIs:

10.1109/ICTON.2019.8840277

#### Bibliographical note

jufoid=72297

EXT="Czaplicki, Robert"

INT=phys,"Stolt, Timo"

Source: Scopus

Source ID: 85073076777

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

#### Transverse structure optimization of laterally-coupled ridge waveguide DFB lasers

A new figure of merit for single transverse mode operation and an accurate procedure for calculating the coupling coefficient in distributed feedback lasers with laterally-coupled ridge waveguide surface grating structures are introduced. Based on the difference in optical confinement between the pumped and un-pumped regions in the transverse plane, the single transverse mode figure of merit is effective and easy to calculate, while the improved coupling coefficient calculation procedure gives experimentally confirmed better results than the standard calculation approaches.

#### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications

Contributors: Uusitalo, T., Virtanen, H., Dumitrescu, M.

Number of pages: 2

Pages: 79-80

Publication date: 17 Aug 2016

#### Host publication information

Title of host publication: 16th International Conference on Numerical Simulation of Optoelectronic Devices, NUSOD 2016

Publisher: IEEE

Article number: 7547038

ISBN (Electronic): 9781467386036

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Modelling and Simulation, Numerical Analysis

DOIs:

10.1109/NUSOD.2016.7547038

Source: Scopus

Source ID: 84987653468

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

### **Tunable Reflection Type Plasmon Induced Transparency with Graphene**

Plasmon induced transparency (PIT) has always been investigated in transmission mode, which makes the design dependent upon the type of substrate. In this work, we propose a first tunable reflection type PIT (RPIT) device based on simple design of two parallel gold strips on graphene. We have numerically investigated the design by using Finite Difference Time-Domain (FDTD) method. This response is tunable by changing the Fermi level ( $E_f$ ) of graphene. High tunability of 215 nm shift was observed by changing the  $E_f$  of graphene from 0 to 0.8 eV. The spectral contrast ratio of our device is 99.2%.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Department of Electrical and Electronics Engineering, Bilkent University, Nanotechnology Research Center

Contributors: Habib, M., Ozbay, E., Caglayan, H.

Number of pages: 3

Pages: 170-172

Publication date: 13 Nov 2018

#### **Host publication information**

Title of host publication: 2018 12th International Congress on Artificial Materials for Novel Wave Phenomena, METAMATERIALS 2018

Publisher: IEEE

ISBN (Electronic): 9781538647028

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Acoustics and Ultrasonics, Atomic and Molecular Physics, and Optics, Radiation

DOIs:

10.1109/MetaMaterials.2018.8534142

#### **Bibliographical note**

EXT="Habib, M."

Source: Scopus

Source ID: 85058538366

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

### **Two-part stretchable passive UHF RFID textile tags**

We present two-part stretchable passive UHF RFID textile tags using electro-textile and embroidered antennas, and test their reliability under cyclic stretching. The tags' wireless performance is evaluated initially and after up to a 100 stretching cycles. The measurement results show that the initial read ranges of the electro-textile and embroidered tags are 5.5 meters and 6.3 meters, respectively. The cyclic strain does not affect the read ranges of the embroidered tags, and the read ranges of the electro-textile tags are only slightly affected, i.e., decreased about 50 cm after the first stretching cycle, and then settled. Based on these results, the use of two-part structures can improve the strain reliability of textile RFID tags.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Faculty of Biomedical Sciences and Engineering, Mathematics, Research group: Wireless Identification and Sensing Systems Research Group, Southeast University

Contributors: Chen, X., He, H., Chen, L., Raunonen, P., Ukkonen, L., Virkki, J.

Number of pages: 4

Pages: 3318-3321

Publication date: 22 May 2017

#### **Host publication information**

Title of host publication: 2017 Progress in Electromagnetics Research Symposium - Spring, PIERS 2017

Publisher: Electromagnetics Academy

ISBN (Electronic): 9781509062690

ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials

DOIs:

10.1109/PIERS.2017.8262329

Source: Scopus

Source ID: 85044939028

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

## Ultrafast picosecond MOPA with Yb-doped tapered double clad fiber

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Photonics, Ampliconyx Ltd, Institute of Radio Engineering and Electronics of the Russian Academy of Sciences, St. Petersburg State Polytechnical University

Contributors: Noronen, T., Gumenyuk, R., Chamorovskii, Y., Golant, K., Odnoblyudov, M., Filippov, V.

Publication date: 2017

### Host publication information

Title of host publication: The European Conference on Lasers and Electro-Optics 2017 : Munich Germany 25–29 June 2017

Volume: Part F82-CLEO\_Europe 2017

Publisher: The Optical Society; OSA

Article number: CJ\_9\_4

ISBN (Electronic): 978-1-5090-6736-7

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

URLs:

[https://www.osapublishing.org/abstract.cfm?uri=CLEO\\_Europe-2017-CJ\\_9\\_4](https://www.osapublishing.org/abstract.cfm?uri=CLEO_Europe-2017-CJ_9_4)

Source: Scopus

Source ID: 85039921118

Research output: Chapter in Book/Report/Conference proceeding > Conference contribution > Scientific > peer-review

## Ultra-large mode area single frequency anisotropic MOPA with double clad Yb-doped tapered fiber

We demonstrate all-fiber master oscillator - power amplifier delivered 70W output power at 1033.33nm with 8 kHz FWHM linewidth without any problems with SBS. The anisotropic ytterbium doped tapered double clad amplifier with 50  $\mu$ m MFD and polarization extinction ratio about 30 dB is developed as a burst stage. The output radiation demonstrated perfect beam quality ( $M^2=1.03/1.08$ ).

### General information

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: Ampliconyx Ltd, Institute of Radio Engineering and Electronics of the Russian Academy of Sciences, St. Petersburg State Polytechnical University

Contributors: Noronen, T., Fedotov, A., Rissanen, J., Gumenyuk, R., Butov, O., Chamorovskii, Y., Golant, K., Odnoblyudov, M., Filippov, V.

Number of pages: 6

Publication date: 1 Jan 2018

### Host publication information

Title of host publication: Fiber Lasers XV : Technology and Systems

Publisher: SPIE, IEEE

Article number: 105121T

ISBN (Electronic): 9781510615090

### Publication series

Name: Proceedings of SPIE

Publisher: SPIE

Volume: 10512

ISSN (Print): 0277-786X

ISSN (Electronic): 1996-756X

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering

Keywords: active fiber, fiber amplifier, Fiber laser

Electronic versions:

Noronen T. Ultra-large mode area single frequency anisotropic MOPA with double clad Yb-doped tapered fiber

DOIs:

10.1117/12.2288942

URLs:

<http://urn.fi/URN:NBN:fi:tty-201908211995>

### Bibliographical note

EXT="Noronen, Teppo"  
EXT="Fedotov, Andrei"  
INT=fot, "Rissanen, Joona"  
EXT="Gumenyuk, Regina"  
EXT="Filippov, Valery"

Source: Scopus

Source ID: 85045656071

Research output: [Chapter in Book/Report/Conference proceeding](#) › [Conference contribution](#) › [Scientific](#) › [peer-review](#)

### **Walking anisotropic spatial solitons and their steering in nematic liquid crystals**

A novel nematic liquid crystal cell allows the excitation of anisotropic spatial solitons and their angular steering, acting on walk-off thru the applied bias. The input interface enables polarization-healing soliton generation and spatial routing.

#### **General information**

Publication status: Published

MoE publication type: A4 Article in a conference publication

Organisations: University "Roma Tre", Nonlinear Optics and OptoElectronics Lab, University of Calabria

Contributors: Peccianti, M., Alberucci, A., Assanto, G., De Luca, A., Coschignano, G., Umetsu, C.

Publication date: 1 Jan 2005

#### **Host publication information**

Title of host publication: Nonlinear Guided Waves and Their Applications, NLGW 2005

Publisher: Optical Society of America OSA

ISBN (Print): 1557527911

ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Electronic, Optical and Magnetic Materials, Electrical and Electronic Engineering

DOIs:

10.1364/NLGW.2005.FA1

Research output: [Chapter in Book/Report/Conference proceeding](#) › [Conference contribution](#) › [Scientific](#) › [peer-review](#)

### **Surface topography studied by off-axis digital holography**

The topography of surface relief gratings patterned on  $\text{As}_2\text{S}_3$ -Se nanomultilayers was investigated by digital holographic microscopy. For the high-accuracy phase reconstruction of the topography we used the sparse wavefront modeling. Experimental results are presented.

#### **General information**

Publication status: Published

MoE publication type: D3 Professional conference proceedings

Organisations: Signal Processing, Research group: Computational Imaging-CI, Institute of Applied Physics Academy of Sciences of Moldova, University of Stuttgart

Contributors: Achimova, E., Abaskin, V., Cazac, V., Meshalkin, A., Pedrini, G., Claus, D., Shevkunov, I., Katkovnik, V.

Publication date: 2018

#### **Host publication information**

Title of host publication: Novel Optical Materials and Applications, NOMA 2018

Volume: Part F107-NOMA 2018

Publisher: OSA - The Optical Society

ISBN (Electronic): 9781557528209

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/NOMA.2018.NoW1J.7

Source: Scopus

Source ID: 85051277835

Research output: [Chapter in Book/Report/Conference proceeding](#) › [Conference contribution](#) › [Professional](#)

### **1180 nm GaInNAs quantum well based high power DBR laser diodes**

Abstract: state-of-the-art 560 mW output power in continuous-wave operation at room temperature. The maximum CW power varies between 210mW and 660mW when the ambient temperature is changed between 5 and 80 °C. The emission spectrum variation with the bias current is shown in Fig. 2. Preliminary results from tapered RWG-LDs on the other hand show output power up to 2750mW at 10A current with narrow spectrum locked to the grating (not shown).

#### **General information**

Publication status: Published

Organisations: Photonics

Contributors: Viheriälä, J., Aho, A., Virtanen, H., Dumitrescu, M., Guina, M.

Publication date: 2017

Peer-reviewed: Unknown

Event: Paper presented at SPIE Photonics West 2017, San Francisco, United States.

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Engineering(all)

Keywords: GaInNAs, DBR laser, DBR, SHG, 1180nm, 1178nm, 1154nm

Research output: Other conference contribution > Paper, poster or abstract > Scientific

### 1.3 $\mu\text{m}$ InAs quantum dot semiconductor disk laser

Vertical-external-cavity surface-emitting lasers (VECSEL), or semiconductor disk lasers (SDL), are attractive laser source for a wide range of applications owing to unique possibility to combine high output power with an excellent beam quality [1]. The intrinsic features of InAs quantum dots (QD) can offer low threshold, broad wavelength tunability, fast carrier dynamics and low temperature sensitivity. Recently, continuous wave (CW) operation of QD-based VECSEL emitting at 1.25  $\mu\text{m}$  with output powers reaching multi-watt levels were achieved at room temperature [2]. However, extending the emission wavelength to 1.3  $\mu\text{m}$  and beyond becomes more challenging. To date, QD-based VECSEL with optical power greater than 0.5 mW at 1305 nm has been demonstrated [3]. Here, we present a record-high power InAs/InGaAs QD-based VECSEL operating at the wavelength of 1.3  $\mu\text{m}$ .

#### General information

Publication status: Published

Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Ioffe Physico-Technical Institute, Peter the Great St. Petersburg Polytechnic University

Contributors: Blokhin, S. A., Bobrov, M. A., Blokhin, A. A., Kuzmenkov, A. G., Vasil'Ev, A. P., Maleev, N. A., Dudelev, V. V., Soboleva, K. K., Sokolovskii, G. S., Rantamäki, A., Okhotnikov, O., Ustinov, V. M.

Pages: R317

Publication date: 23 Aug 2016

Peer-reviewed: Unknown

Event: Paper presented at 2016 International Conference Laser Optics, LO 2016, St. Petersburg, Russian Federation.

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Electronic versions:

Blokhin-LO2016-1.3  $\mu\text{m}$  InAs Quantum Dot Semiconductor Disk Laser

DOIs:

[10.1109/LO.2016.7549727](https://doi.org/10.1109/LO.2016.7549727)

URLs:

<http://urn.fi/URN:NBN:fi:tty-201612024842>

URLs:

<http://www.laseroptics.ru/publications.html> (Conference website)

Source: Scopus

Source ID: 84987923895

Research output: Other conference contribution > Paper, poster or abstract > Scientific

### Advanced scheme of amplifier similariton laser

We propose an advanced scheme of amplifier similariton laser providing an output pulse spectrum much wider than the gain bandwidth. The proposed scheme demonstrates a drastic increase of the output pulse spectrum width, reduction of the pulse duration, and increase of the output pulse peak power after compression.

#### General information

Publication status: Published

Organisations: Optoelectronics Research Centre, Ulyanovsk State University, A. M. Prokhorov General Physics Institute, Russian Academy of Sciences

Contributors: Korobko, D. A., Okhotnikov, O. G., Sysoliatin, A. A., Zolotovskii, I. O.

Pages: R858

Publication date: 23 Aug 2016

Peer-reviewed: Unknown

Event: Paper presented at 2016 International Conference Laser Optics, LO 2016, St. Petersburg, Russian Federation.

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Keywords: amplifier similariton laser, generation of extra broad spectrum, parabolic pulses

DOIs:

[10.1109/LO.2016.7549889](https://doi.org/10.1109/LO.2016.7549889)

URLs:

<http://www.laseroptics.ru/publications.html> (Conference website)

Source: Scopus

Source ID: 84987901019

Research output: Other conference contribution › Paper, poster or abstract › Scientific

### **Finite element method incorporating coupled magneto-elastic model for magneto-mechanical energy harvester**

This paper presents a numerical method for modeling magneto-mechanical energy harvesting devices. Our existing energy-based single-valued (SV) magneto-mechanical material model is utilized for the first time in a 2-D finite element formulation for an energy-harvesting application. The SV material model yields the magnetic field strength as a function of strain and magnetic flux density. The proposed method can predict the voltage induced in a pickup coil due to inverse magnetostriction, when the test sample is subjected to dynamic loading. The results from the numerical method are experimentally verified using a prototype energy harvester.

#### **General information**

Publication status: Published

Organisations: Electrical Energy Engineering, Civil Engineering, Research group: Electromechanics, Research area: Power engineering

Contributors: Ahmed, U., Harju, J., Poutala, J., Ruuskanen, P., Rasilo, P., Kouhia, R.

Number of pages: 2

Publication date: 19 Jun 2017

Peer-reviewed: Unknown

Event: Paper presented at Compumag 2017, Daejeon, Korea, Democratic People's Republic of.

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials

Keywords: Magnetostriction, Energy harvesting, Coupled problems, Finite element analysis, Magneto elastic, stress

Electronic versions:

Short\_Paper\_Final

URLs:

<http://www.compumag2017.com/program.php> (The program binder of the poster publication)

#### **Bibliographical note**

The 2 pages digest was presented as poster presentation during conference.

INT="Harju, Jarmo"

INT="Ruuskanen, Pekka"

Research output: Other conference contribution › Paper, poster or abstract › Scientific

### **Narrow-linewidth operation of folded VECSEL cavity with twist-mode configuration**

VECSELs exhibit much different longitudinal mode behavior when the device is placed at a fold of a standing wave cavity. Lasing spectrum can be narrowed by employing mode-twisting, stabilizing the standing-wave pattern at the VECSEL.

#### **General information**

Publication status: Published

MoE publication type: Not Eligible

Organisations: University of Arizona, Hart SCI, Vexlum Ltd.

Contributors: Kaneda, Y., Hart, M. L., Warner, S. H., Penttinen, J. P., Guina, M.

Number of pages: 2

Publication date: 2018

Peer-reviewed: Unknown

Event: Paper presented at Advanced Solid State Lasers, ASSL 2018, Boston, United States.

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials

DOIs:

10.1364/ASSL.2018.ATh2A.7

URLs:

<http://www.scopus.com/inward/record.url?scp=85059479588&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 85059479588

Research output: Other conference contribution › Paper, poster or abstract › Scientific

### **State of polarization in anisotropic tapered fiber with extremely large core diameter**

We produced numerical and experimental research of polarization maintaining properties of adiabatic anisotropic tapered optical fiber with extremely large output core diameter. Results show that polarization state of light coupling in the narrow end did not degrade dramatically through whole fiber length (while core diameter increasing adiabatically upto tens of wavelengths).

### General information

Publication status: Published

Organisations: Optoelectronics Research Centre, Russian Quantum Center, Institute of Radio Engineering and Electronics of the Russian Academy of Sciences

Contributors: Ustimchik, V. E., Vyatkin, M. Y., Popov, S. M., Chamorovskii, Y. K., Filippov, V. N., Nikitov, S. A.

Pages: S123

Publication date: 23 Aug 2016

Peer-reviewed: Unknown

Event: Paper presented at 2016 International Conference Laser Optics, LO 2016, St. Petersburg, Russian Federation.

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

Keywords: birefringence, large mode area fibers, polarization, taper fiber

DOIs:

10.1109/LO.2016.7549956

URLs:

<http://www.laseroptics.ru/publications.html> (Conference website)

Source: Scopus

Source ID: 84987880925

Research output: Other conference contribution › Paper, poster or abstract › Scientific

### Parametric conversion in micrometer and submicrometer structured ferroelectric crystals by surface poling

We report on recent technological improvements concerning nonlinear patterning of lithium niobate and lithium tantalate in the micrometer and submicrometer scales using surface periodic poling for ferroelectric domain inversion. The fabricated samples were employed for frequency doubling via quasiphase-matching both in bulk and guided wave geometries, including forward and backward configurations and wavelength conversion in bands C and L. We also investigated short-period quasiperiodic samples with randomly distributed mark-to-space ratios.

### General information

Publication status: Published

MoE publication type: A2 Review article in a scientific journal

Organisations: Frontier Photonics, Building No. 9, Nonlinear Optics and OptoElectronics Lab, University "Roma Tre"

Contributors: Busacca, A. C., Stivala, S., Curcio, L., Assanto, G.

Publication date: 2012

Peer-reviewed: Yes

### Publication information

Journal: International Journal of Optics

Volume: 2012

Article number: 606892

ISSN (Print): 1687-9384

Ratings:

Scopus rating (2012): CiteScore 0.4 SJR 0.184 SNIP 0.437

Original language: English

ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Atomic and Molecular Physics, and Optics

DOIs:

10.1155/2012/606892

URLs:

<http://www.scopus.com/inward/record.url?scp=84858185701&partnerID=8YFLogxK> (Link to publication in Scopus)

Source: Scopus

Source ID: 84858185701

Research output: Contribution to journal › Review Article › Scientific › peer-review

### Stimuli-responsive photonic polymer coatings

This feature article focuses on the highlights in the development of photonic polymer coatings that can change their volume or surface topology in a reversible, dynamic fashion when exposed to an external stimulus. Topographic response is established using hydrogels or liquid crystal polymer networks. By changing the surface corrugation in response to light various functional coating properties can be modulated, for instance wettability and/or mechanical friction. The same volume changes in photonic coatings caused by different stimuli lead to changes in light reflection.

### General information

Publication status: Published

MoE publication type: A2 Review article in a scientific journal

Organisations: Eindhoven University of Technology

Contributors: Stumpel, J. E., Broer, D. J., Schenning, A. P. H. J.

Number of pages: 10

Pages: 15839-15848  
Publication date: 28 Dec 2014  
Peer-reviewed: Yes

**Publication information**

Journal: Chemical Communications

Volume: 50

Issue number: 100

ISSN (Print): 1359-7345

Ratings:

Scopus rating (2014): CiteScore 11.6 SJR 2.692 SNIP 1.427

Original language: English

ASJC Scopus subject areas: Chemistry(all), Catalysis, Ceramics and Composites, Electronic, Optical and Magnetic Materials, Surfaces, Coatings and Films, Materials Chemistry, Metals and Alloys

DOIs:

10.1039/c4cc05072j

URLs:

<http://www.scopus.com/inward/record.url?scp=84911908006&partnerID=8YFLogxK> (Link to publication in Scopus)

**Bibliographical note**

EXT="Stumpel, Jelle"

Source: Scopus

Source ID: 84911908006

Research output: Contribution to journal › Review Article › Scientific › peer-review