High-temperature corrosion resistance of ferritic stainless steels (Fe–Cr based alloys) is built upon the formation of protective Cr-rich oxide scale. However, Cr vaporization limits the use of Fe–Cr alloys under extreme service conditions; in particular, it has been identified as the most significant failure mechanism in solid-oxide fuel cells (SOFCs). Our study focuses on the initial stages of oxide scale formation on ferritic stainless steels and shows that the Cr vaporization can be controlled via the alloy composition and heat treatments.

In this work, we investigate the influence of heat treatment on the initial stages of oxidation of two Ti–Nb stabilized ferritic stainless steels (EN 1.45091,2 and EN 1.45213,4) at 650 °C by synchrotron light mediated X-ray photoelectron spectroscopy (XPS) and photoemission electron microscopy (PEEM). The high degree of alloying makes these alloys suitable for high temperature applications, but also renders the alloys prone to microstructural changes that can affect the growth of protective oxide scale. As a demonstration of this, we show that the heat treatment induced precipitation of \((\text{FeCrSi})_2(\text{MoNb})\)-type Laves phase results in less pronounced surface segregation and oxidation of minor alloying elements (Mo, Mn, Nb, Ti, Si). Most significantly, the diffusion of Mn and the formation of low volatile \((\text{MnCr})_3\text{O}_4\) spinel oxide at the surface above Cr2O3 are strongly suppressed.

**General information**

State: Published  
Organisations: Photonics  
Authors: Ali-Löytty, H., Valden, M.  
Publication date: 4 Dec 2017  
Peer-reviewed: Unknown  
Event: Paper presented at Joint Annual Meeting of Finnish Synchrotron Radiation User Organisation (FSRUO) and Finnish Structural Biology Network (FinnBox), Turku, Finland.

**Electronic versions:**  
Ali-Löytty- FSRUO poster

Research output: Scientific ; Paper, poster or abstract

**High-Power 1180-nm GaInNAs DBR Laser Diodes**

We report high-power 1180-nm GaInNAs distributed Bragg reflector laser diodes with and without a tapered amplifying section. The untapered and tapered components reached room temperature output powers of 655 mW and 4.04 W, respectively. The diodes exhibited narrow linewidth emission with side-mode suppression ratios in the range of 50 dB for a broad range of operating current, extending up to 2 A for the untapered component and 10 A for the tapered component. The high output power is rendered possible by the use of a high quality GaInNAs-based quantum well gain region, which allows for lower strain and better carrier confinement compared with traditional GaInAs quantum wells. The development opens new opportunities for the power scaling of frequency-doubled lasers with emission at yellow–orange wavelengths.

**General information**

State: Published  
Ministry of Education publication type: A1 Journal article-refereed  
Organisations: Photonics, Research group: ORC, Research group: Surface Science, Okmetic Oyj, Norlase ApS, Denmark Technical University DTU  
Authors: Aho, A. T., Viheriälä, J., Korpijärvi, V., Koskinen, M., Virtanen, H., Christensen, M., Uusitalo, T., Lahtonen, K., Valden, M., Guina, M.  
Number of pages: 4  
Pages: 2023-2026  
Publication date: 1 Dec 2017  
Peer-reviewed: Yes

**Publication information**

Journal: IEEE Photonics Technology Letters  
Volume: 29  
Issue number: 23  
ISSN (Print): 1041-1135  
Ratings:

Scopus rating (2016): CiteScore 2.52 SJR 1.018 SNIP 1.279

Scopus rating (2015): SJR 1.263 SNIP 1.327 CiteScore 2.62

Scopus rating (2014): SJR 1.461 SNIP 1.614 CiteScore 2.78

Scopus rating (2013): SJR 1.487 SNIP 1.547 CiteScore 2.95

Scopus rating (2012): SJR 1.623 SNIP 1.706 CiteScore 2.46

Scopus rating (2011): SJR 1.51 SNIP 2.012 CiteScore 2.48

Scopus rating (2010): SJR 1.474 SNIP 1.623
We report numerically accurate path integral Monte Carlo results for harmonically confined two-dimensional quantum dots containing up to $N=60$ interacting electrons. The finite-temperature values are extrapolated to 0 K and zero time step in order to provide precise upper-bound energies. The ground-state energies are compared against coupled-cluster and diffusion Monte Carlo results available in the literature for $N \leq 20$. We also provide Padé fits for the energies as a function of $N$ for different strengths of the confining potential. The fits deviate less than 0.25% from the path integral Monte Carlo data. Overall, our upper-bound estimates for the ground-state energies have lower values than previous diffusion Monte Carlo benchmarks due to the accurate nodal surface in our simulations. Hence, our results set a new numerical benchmark for two-dimensional (spin-unpolarized) quantum dots up to a large number of electrons.
Decreasing Defect-State Density of Al2O3/GaIn1−xAs Device Interfaces with InOx Structures

Control of defect densities at insulator/GaIn1−xAs interfaces is essential for optimal operation of various devices like transistors and infrared detectors to suppress, for example, nonradiative recombination, Fermi-level pinning, and leakage currents. It is reported that a thin InOx interface layer is useful to limit the formation of these defects by showing effect of InOx on quantum efficiency of Ga0.45In0.55As detector and on photoluminescence of GaAs. A study of the Al2O3/GaAs interface via hard X-ray synchrotron photoelectron spectroscopy reveals chemical structure changes at the interface induced by this beneficial InOx incorporation: the InOx sheet acts as an O diffusion barrier that prevents oxidation of GaAs and concomitant As bond rupture.

Tuning Localized Surface Plasmon Resonances by Self-Assembly in Multi-Metal Nanostructures

Block copolymers together with conventional nanolithography offer an intriguing possibility to realize complex photonic nanostructures that would otherwise be impossible or extremely difficult to manufacture. Sub-wavelength nanostructures made of noble metals exhibit localized surface plasmon resonances that can be tailored by tuning the geometry of the structures. We demonstrate that combining plasmonic nanoarrays with block copolymer self-assembly allows realization of multi-metal structures that display altered optical behavior.
Solvothermal annealing resulted in the PS-P2VP assembling in the gap regions of the plasmonic structures. The P2VP domains could then be converted into a variety of metals such as Au, Ag or Pt to populate the gap with plasmonic nanoparticles. 3D and 2D computational modeling was used to estimate the effects of geometry and material combinations on the far field spectrum and the local field-enhancement in the gap. Self-assembled multimaterial plasmonic devices have various applications in near field sensing, nonlinear optical interactions and photocatalysis.

General information
State: Published
Organisations: Photonics, Research group: Nanophotonics
Authors: Hulkkonen, H., Salminen, T., Rasappa, S., Niemi, T.
Publication date: 17 Sep 2017
Peer-reviewed: Unknown
Research output: Scientific → Paper, poster or abstract

FinEstBeaMS: A wide-range Finnish-Estonian Beamline for Materials Science at the 1.5 GeV storage ring at the MAX IV Laboratory
The FinEstBeaMS beamline is under construction at the 1.5 GeV storage ring of the MAX IV Laboratory at Lund, Sweden. It has been designed to cover an unusually wide energy range from ultraviolet (4.3 eV) to soft X-rays (1000 eV) but experiment will also be possible at the Mg and Al Kα energies. Instead of having two insertion devices and a different optical scheme for low and high photon energy regions, we have based our design on a single long-period, elliptically polarizing undulator and a plane grating monochromator. This solution will provide very good conditions for planned experiments in the whole photon energy region. The beamline will have two branches: one will be used to investigate free atoms, molecules and clusters with photoelectron/photoion coincidence spectroscopy as well as solids with photoluminescence spectroscopy whereas the other one will be dedicated to ultra-high vacuum studies of surfaces and interphases, utilizing X-ray photoelectron spectroscopy and X-ray absorption spectroscopy. This paper focuses on the optical design of the beamline and general design concepts of the gasphase and solid-state end stations.

General information
State: Published
Ministry of Education 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, MAX IV Laboratory, Lund University, University of Turku, University of Turku, Department of Chemistry, FI-20014 Turku, Finland, Department of Physics and Astronomy, University of Turku, University of Oulu, Nano and Molecular Systems Research Unit, Univ Tartu, University of Turku, Dept Phys & Astron
Number of pages: 7
Pages: 83-89
Publication date: 1 Jul 2017
Peer-reviewed: Yes

Publication information
Journal: Nuclear instruments and Methods in Physics Research Section A: Accelerators Spectrometers Detectors and Associated Equipment
Volume: 859
ISSN (Print): 0168-9002
Ratings:
Scopus rating (2016): SJR 0.916 SNIP 1.352 CiteScore 1.44
Scopus rating (2015): SJR 0.915 SNIP 1.334 CiteScore 1.21
Scopus rating (2014): SJR 0.852 SNIP 1.303 CiteScore 1.24
Scopus rating (2013): SJR 0.944 SNIP 1.398 CiteScore 1.48
Scopus rating (2012): SJR 0.806 SNIP 1.071 CiteScore 1.19
Scopus rating (2011): SJR 0.918 SNIP 1.424 CiteScore 1.29
Scopus rating (2010): SJR 0.893 SNIP 1.113
Scopus rating (2009): SJR 0.75 SNIP 1.386
We report a triple junction InGaP/GaAs/InGaNAs solar cell with efficiency of ~31% at AM0, 25 °C fabricated using a combined molecular beam epitaxy (MBE) and metal-organic chemical vapour deposition (MOCVD) processes. The prototype cells comprise of InGaNAs (Indium Gallium Nitride Arsenide) bottom junction grown on a GaAs (Gallium Arsenide) substrate by MBE and middle and top junctions deposited by MOCVD. Repeatable cell characteristics and uniform efficiency pattern over 4-inch wafers were obtained. Combining the advantages offered by MBE and MOCVD opens a new perspective for fabrication of high-efficiency space tandem solar cells with three or more junctions. Results of radiation resistance of the sub-cells are also presented and critically evaluated to achieve high efficiency in EOL conditions.
Advances of GaAs laser diode technology for photonic integration

General information
State: Published
Organisations: Photonics
Authors: Guina, M., Isoaho, R., Aho, A., Tukiainen, A., Tuorila, H., Viheriäliä, J.
Publication date: 2017
Peer-reviewed: Unknown

Composition and Bandgap determination of MBE-grown GaInNAsSb

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Department of Materials Science
Authors: Aho, A., Korpijärvi, V., Isoaho, R., Malinen, P., Tukiainen, A., Honkanen, M. H., Guina, M.
Publication date: 2017

Host publication information
Title of host publication: 19th International Conference on Molecular-Beam Epitaxy

Bibliographical note

Design considerations on GaInNAs solar cells with back surface reflectors
We report on modeling of electrical characteristics of dilute nitride GaInNAs solar cells with specular and diffuse back surface reflectors. The paper concentrates on optimization of the GaInNAs junction thickness and doping level for various reflectors. Usually, it is considered that the doping level of GaInNAs should be clearly below 1×1016 cm-3 to be usable for active sub-junction material of high-efficiency triple junction solar cells. Here we show that this requirement can be alleviated by using high quality diffuse back surface reflectors and thus GaInNAs with background doping levels even exceeding 1×1016 cm-3 can be used for junction formation for high-efficiency multijunction solar cells. The reflectance of the back surface reflector is shown to affect the optimal GaInNAs thickness. The higher the reflectance the thinner layers can be used. We also show that the optimal GaInNAs layer thickness is different depending on whether the optimization is done for the short circuit current density or open circuit voltage.

General information
State: Published
Organisations: Photonics
Authors: Tukiainen, A., Aho, A., Aho, T., Polojärvi, V., Guina, M.
Publication date: 2017
Peer-reviewed: Unknown

Development process of novel high-power 750 nm direct emitting VECSELs

General information
State: Published
Organisations: Photonics, Research group: ORC
Authors: Nechay, K., Saarinen, E., Ranta, S., Penttinen, J., Tukiainen, A., Guina, M.
Publication date: 2017
Peer-reviewed: Unknown
Event: Paper presented at Optics and Photonics days 2017, Oulu, Finland.
Improved corrosion properties of Hot Dip Galvanized Steel by nanomolecular silane layers as hybrid interface between zinc and top coatings

Thin organic coatings (TOC) or paints on hot dip galvanized steel (HDGS) improve the corrosion properties and create visually pleasing surfaces. Delamination of these coatings lead to corrosion and peeling of the paints. Hence, a novel method for improved adhesion and corrosion properties for HDGS surfaces is introduced. It is shown how the fabrication of a nanomolecular silane film as an interfacial layer between the HDGS and TOC or paint improves the corrosion properties of HDGS in different pH regimes. Understanding the corrosion behavior of ultra-thin silane layers under differing pH is crucial as subsequent coatings have different pHs. By varying the silanization parameters two different nanomolecular surface structures of aminopropyl trimethoxysilane (APS) on HDGS were fabricated: well-ordered monolayers with approximately 1 nm thickness and highly clustered APS films with a thickness in the range of 5–8 nm. To verify the nanomolecular APS structures, photoelectron spectroscopy (PES) and contact angle (CA) measurements were employed. The corrosion properties of HDGS and silanized HDGS were studied with linear sweep voltammetry (LSV) and electrochemical impedance spectroscopy (EIS). It is shown that at pH 5 and 7 passivation behavior is observed on silanized samples but the most significant improvement in corrosion resistance is found at pH 10 where the corrosion currents of silanized samples are up to two orders of magnitude lower than on uncoated metallic samples. Also, it is demonstrated that the corrosion inhibition of APS is not only dependent on the thickness of the silane film, but also the molecular ordering at the surface. The thin, well-ordered APS monolayer is more resistant towards corrosion in NaCl solution (pH 7) than thicker clustered APS layer. This indicates that the highly ordered nanomolecular surface structure protects the HDGS-silane interface from the Cl- adsorption better than the thicker, but more randomly ordered APS layers. Nanomolecular interfacial silane films for enhanced corrosion and adhesion properties on HDGS are transferrable to industrial production lines providing a low cost and environmentally friendly method for improved HDGS products.
Novel III-V Heterostructures for High Efficiency Solar Cells

General information
State: Published
Organisations: Photonics
Authors: Polojärvi, V., Aho, A., Tukiainen, A., Raappana, M., Aho, T., Isoaho, R., Guina, M.
Publication date: 2017
Peer-reviewed: Unknown
Event: Paper presented at Optics and Photonics days 2017, Oulu, Finland.
Research output: Scientific › Paper, poster or abstract

Performace of Dilute Nitride Triple Junction Space Solar Cell Grown by MBE
Dilute nitride arsenide antimonide compounds offer widely tailorable band-gaps, ranging from 0.8 eV to 1.4 eV, for the development of lattice-matched multijunction solar cells with three or more junctions. Here we report on the performance of GaInP/GaAs/GaInNAsSb solar cell grown by molecular beam epitaxy. An efficiency of 27% under AM0 conditions is demonstrated. In addition, the cell was measured at different temperatures. The short circuit current density exhibited a temperature coefficient of 0.006 mA/cm²/°C while the corresponding slope for the open circuit voltage was −6.8 mV/°C. Further efficiency improvement, up to 32%, is projected by better current balancing and structural optimization.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Photonics, Research group: ORC
Authors: Aho, A., Isoaho, R., Tukiainen, A., Polojärvi, V., Raappana, M., Aho, T., Guina, M.
Publication date: 2017

Host publication information
Title of host publication: 11th European Space Power Conference, 3-7 October 2016 Thessaloniki, Greece
Publisher: EDP Sciences
Article number: 03008

Publication series
Name: E3S Web of Conferences
Volume: 16
ISSN (Electronic): 2267-1242
Electronic versions:
e3sconf_espc2017_03008
DOIs:
10.1051/e3sconf/20171603008
Links:
http://urn.fi/URN:NBN:fitty-201706201606
Research output: Scientific › peer-review › Conference contribution

Quantum-Well Laser Emitting at 1.2 µm-1.3 µm 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 1200 nm-1300 nm. The diode exhibits continuous-wave operation with mW-level output power at room temperature.
Temperature Dependent Characteristics of GaInP/GaAs/GaInNAsSb Solar Cell Under Simulated AM0 Spectra

We report on the temperature characteristics of GaInP/GaAs/GaInNAsSb triple junction solar cell monolithically grown by molecular beam epitaxy. We have measured the temperature dependent light-biased current-voltage characteristics for simulated AM0 spectral conditions using two simulators: a customized three band source and a Xenon lamp with AM0 filter. The current-voltage characteristics of the cell were measured in temperature range of 25-90°C with both solar simulators. At 25°C the cell demonstrated active area efficiencies of 26.7% and 21.1% when illuminated with the three band simulator and Xenon source, respectively. Significant deviations between the measurements were observed as the cell demonstrated approximately 30% lower short-circuit current density when illuminated with the Xenon source compared to the measurement made with the three band simulator. The temperature coefficients for the cell characteristics were determined from the temperature dependent current-voltage data. For the three band simulator, the temperature coefficients for short-circuit current density and open-circuit voltage of the cell were found to be 5.3 \( \mu A/cm^2/°C \) and -6.8 mV/°C, respectively, and are in agreement with results reported for GaInP/GaAs/Ge solar cells. Illumination with filtered Xenon lamp leads to significantly higher temperature coefficient for short-circuit current density. The conversion efficiency of the cell decreased with a slope of -0.068 abs.-%/°C when illuminated with the three band simulator.
Improved antifouling properties and selective biofunctionalization of stainless steel by employing heterobifunctional silane-polyethylene glycol overlayers and avidin-biotin technology

A straightforward solution-based method to modify the biofunctionality of stainless steel (SS) using heterobifunctional silane-polyethylene glycol (silane-PEG) overlayers is reported. Reduced nonspecific biofouling of both proteins and bacteria onto SS and further selective biofunctionalization of the modified surface were achieved. According to photoelectron spectroscopy analyses, the silane-PEGs formed less than 10 Å thick overlayers with close to 90% surface coverage and reproducible chemical compositions. Consequently, the surfaces also became more hydrophilic, and the observed non-specific biofouling of proteins was reduced by approximately 70%. In addition, the attachment of E. coli was reduced by more than 65%. Moreover, the potential of the overlayer to be further modified was demonstrated by successfully coupling biotinylated alkaline phosphatase (bAP) to a silane-PEG-avidin biotin overlay via avidin-biotin bridges. The activity of the immobilized enzyme was shown to be well preserved without compromising the achieved antifouling properties. Overall, the simple solution-based approach enables the tailoring of SS to enhance its activity for biomedical and biotechnological applications.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Surface Science, BioMediTech, University of Jyväskylä, Department of Physics, NanoScience Center
Publication date: 6 Jul 2016
Peer-reviewed: Yes

Publication information
Journal: Scientific Reports
Volume: 6
Article number: 29324
ISSN (Print): 2045-2322

Ratings:
Scopus rating (2016): CiteScore 4.63 SJR 1.625 SNIP 1.401
Scopus rating (2015): SJR 2.057 SNIP 1.684 CiteScore 5.3
Scopus rating (2014): SJR 2.103 SNIP 1.544 CiteScore 4.75
Scopus rating (2013): SJR 1.886 SNIP 1.51 CiteScore 4.06
Scopus rating (2012): SJR 1.458 SNIP 0.896 CiteScore 2.44
Original language: English
Electronic versions:
hynninen et al - Improved antifouling properties and selective biofunctionalization

DOIs:
10.1038/srep29324
We present a widely scalable, high temperature post-growth annealing method for converting ultra-thin films of TiO$_2$ grown by atomic layer deposition to topographically microstructured titanium silicide (TiSi). The photoemission electron microscopy results reveal that the transformation from TiO$_2$ to TiSi at 950 °C proceeds via island formation. Inside the islands, TiO$_2$ reduction and Si diffusion play important roles in the formation of the highly topographically microstructured TiSi interface with laterally nonuniform barrier height contact. This is advantageous for efficient charge transfer in Si-based heterostructures for photovoltaic and photoelectrochemical applications.

**General information**

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Surface Science, Research group: Nanophotonics, MAX IV Laboratory, Lund University
Number of pages: 6
Pages: 76-81
Publication date: Jul 2016
Peer-reviewed: Yes

**Publication information**

Journal: Scripta Materialia
Volume: 119
ISSN (Print): 1359-6462
Ratings:
Scopus rating (2016): SJR 1.901 SNIP 1.696 CiteScore 3.71
Scopus rating (2015): SJR 2.3 SNIP 1.876 CiteScore 3.54
Scopus rating (2014): SJR 2.744 SNIP 2.124 CiteScore 3.55
Scopus rating (2013): SJR 2.347 SNIP 1.975 CiteScore 3.19
Scopus rating (2012): SJR 2.309 SNIP 2.022 CiteScore 3.01
Scopus rating (2011): SJR 2.333 SNIP 2.108 CiteScore 3.21
Scopus rating (2010): SJR 2.445 SNIP 2.125
Scopus rating (2009): SJR 2.574 SNIP 2.02
Scopus rating (2008): SJR 2.634 SNIP 2.128
Scopus rating (2007): SJR 2.229 SNIP 2.174
Scopus rating (2006): SJR 2.1 SNIP 1.915
Scopus rating (2005): SJR 1.831 SNIP 1.915
Scopus rating (2004): SJR 1.464 SNIP 1.731
Scopus rating (2003): SJR 1.499 SNIP 1.709
Scopus rating (2002): SJR 1.509 SNIP 1.345
Scopus rating (2001): SJR 1.301 SNIP 1.361
Scopus rating (2000): SJR 1.268 SNIP 1.123
Scopus rating (1999): SJR 1.53 SNIP 1.162
Original language: English
Keywords: Atomic layer deposition (ALD), X-ray photoelectron spectroscopy (XPS), Transition metal silicides, Semiconductors, Surface modification
DOIs:
10.1016/j.scriptamat.2016.03.016
Links:
Research output: Scientific - peer-review » Article

**High-efficiency GaInP/GaAs/GaInNAs solar cells grown by combined MBE-MOCVD technique**

Triple-junction GaInP/GaAs/GaInNAs solar cells with conversion efficiency of ~29% at AM0 are demonstrated using a combination of molecular beam epitaxy (MBE) and metal-organic chemical vapor deposition (MOCVD) processes. The bottom junction made of GaInNAs was first grown on a GaAs substrate by MBE and then transferred to an MOCVD system for subsequent overgrowth of the two top junctions. The process produced repeatable cell characteristics and uniform efficiency pattern over 4-inch wafers. Combining the advantages offered by MBE and MOCVD opens a new
perspective for fabrication of high-efficiency tandem solar cells with three or more junctions.

**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed

Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, CESI S.p.A.

Authors: Tukiainen, A., Aho, A., Gori, G., Poloijärvi, V., Casale, M., Greco, E., Isoaho, R., Aho, T., Raappana, M., Campesato, R., Guina, M.

Number of pages: 6

Pages: 914-919

Publication date: 17 Jun 2016

Peer-reviewed: Yes

**Publication information**

Journal: Progress in Photovoltaics: Research and Applications

Volume: 24

Issue number: 7

Article number: PIP2784

ISSN (Print): 1062-7995

Ratings:

Scopus rating (2016): SJR 2.224 SNIP 2.694 CiteScore 6.54

Scopus rating (2015): SJR 2.78 SNIP 3.33 CiteScore 7.31

Scopus rating (2014): SJR 3.279 SNIP 3.874 CiteScore 7.7

Scopus rating (2013): SJR 3.974 SNIP 5.653 CiteScore 8.93

Scopus rating (2012): SJR 3.478 SNIP 5.082 CiteScore 6.81

Scopus rating (2011): SJR 3.251 SNIP 5.999 CiteScore 6.81

Scopus rating (2010): SJR 3.749 SNIP 4.317

Scopus rating (2009): SJR 3.18 SNIP 3.256

Scopus rating (2008): SJR 2.537 SNIP 2.473

Scopus rating (2007): SJR 1.711 SNIP 2.124

Scopus rating (2006): SJR 1.55 SNIP 2.881

Scopus rating (2005): SJR 1.774 SNIP 3.07

Scopus rating (2004): SJR 0.852 SNIP 1.671

Scopus rating (2003): SJR 0.763 SNIP 1.489

Scopus rating (2002): SJR 1.658 SNIP 1.742

Scopus rating (2001): SJR 1.651 SNIP 1.714

Scopus rating (2000): SJR 0.934 SNIP 1.567

Scopus rating (1999): SJR 0.673 SNIP 1.076

Original language: English

Keywords: multijunction solar cells, molecular beam epitaxy, metal-organic chemical vapor deposition, dilute nitride semiconductors

DOI: 10.1002/pip.2784

**Bibliographical note**

INT=orc,"Isoaho, Riku"

Research output: Scientific - peer-review › Article

**Finite temperature path-integral modeling of quantum dot cellular automata**

**General information**

State: Published

Organisations: Department of Physics, Research group: Semiconductor Technology and Applications, Optoelectronics Research Centre, Research area: Computational Physics, Research group: Electronic Structure Theory

Authors: Tiihonen, J., Schramm, A., Kylänpää, I., Rantala, T.

Publication date: 29 Mar 2016

Peer-reviewed: Unknown

Event: Paper presented at PHYSICS DAYS / FYSIIKAN PÄIVÄT: ANNUAL MEETING OF THE FINNISH PHYSICAL SOCIETY.

Links:
Numerical and Experimental Study on Inertial Impactors

One of the most important physical properties that defines the behavior of an aerosol particle is its size. Size defines to a great extent how particles behave in physical and chemical processes. Applying experimental and numerical methods, this thesis studies the fundamentals of the operation of impactors, the instruments that are used to measure the size of aerosol particles.

The first part of the thesis develops a CFD simulation approach, which is suitable for low pressure impactors and their verification. The CFD model is then used to study the parameters that affect the shape of a low pressure impactor's collection efficiency curve. The second part focuses on the applications of these findings by introducing two new impactors: a variable nozzle area impactor (VNAI), designed for detailed study of particle behavior in collisions, and a high-resolution low-pressure cascade impactor (HRLPI), used in combination with electrical detection to measure nanoparticle size distribution.

Simulations showed that the steepness of the collection efficiency curve depends on the uniformity of the impaction conditions in the impactor jet. Conditions were defined in terms of static pressure, velocity, and particle stopping distance profiles in the cross section of the jet. Uniform impaction conditions and a steep cut-curve were achieved at a short throat, low pressure impactor stage.

In the devised VNAI impactor, particles showed very uniform impaction velocities, a fact that was used to examine the critical velocity of the rebound of spherical silver particles. The critical velocities were several orders of magnitude lower than those for micron sized particles. This may be explained by a different material pair used in the experiments and previous studies. The HRLPI was designed based on instrument response simulations to gain maximum information on aerodynamic size distribution and to guarantee robust inversion characteristics in real-time measurement. This was achieved with roughly ten stages per size decade and with slit type, short-throat nozzles.

This thesis sheds light on some still unanswered questions in impactor theory and successfully applies the theory to practise by introducing new high resolution impactors for nanoparticle research.

General information
State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Physics, Research area: Aerosol Physics
Authors: Arffman, A.
Number of pages: 57
Publication date: 19 Feb 2016

Publication information
Publisher: Tampere University of Technology
Original language: English

Publication series
Name: Tampere University of Technology. Publication
Publisher: Tampere University of Technology
Volume: 1372
ISSN (Print): 1459-2045
Electronic versions: arffman_1372

Bibliographical note
Awarding institution:Tampere University of Technology
Research output: Collection of articles » Doctoral Thesis

Site-controlled InAs quantum dot chains coupled to surface plasmons
Plasmonic hybrid nanostructures are material combinations where the plasmonic metal structure enables optical field confinement, while the other ingredients provide additional functionality, such as emission, absorption or optical nonlinearity. In particular, epitaxial InAs quantum dots (QD) embedded in a single-crystal GaAs matrix are highly efficient quantum emitters that can be integrated as plasmonic-semiconductor hybrids to realize various on-chip functions. In this letter, we demonstrate QD-plasmon coupling in a hybrid structure consisting of site-controlled InAs/GaAs quantum dot
chains (QDC) in the proximity of an Ag film. The optical properties of the QDC-plasmon system are investigated using a cleaved-edge photoluminescence (PL) geometry, which allows us to probe the vertical and horizontal polarizations of the PL emission. We demonstrate plasmonic enhancement of both PL decay rate and vertical polarization of the PL emission with decreasing separation of the QDCs and the Ag film. The ability to couple site-controlled InAs QDCs with surface plasmons is a significant step towards exploitation of high quality epitaxial quantum dots as gain or loss compensation in subwavelength plasmonic metal structures, such as waveguide networks, quantum plasmonic structures, and metamaterials.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Research group: Laboratory for Future Electronics, Research group: Nanophotonics
Authors: Hakkarainen, T., Tommila, J., Schramm, A., Simonen, J., Niemi, T., Strelow, C., Kipp, T., Kontio, J., Guina, M.
Number of pages: 4
Pages: 139-142
Publication date: 2 Feb 2016
Peer-reviewed: Yes

Publication information
Journal: Optica
Volume: 3
Issue number: 2
ISSN (Print): 2334-2536
Ratings:
Scopus rating (2016): CiteScore 8.05 SJR 5.003 SNIP 3.77
Scopus rating (2015): SNIP 2.943 SJR 4.669 CiteScore 7
Original language: English
DOIs:
10.1364/OPTICA.3.000139
Research output: Scientific - peer-review » Article

Exact modeling of finite temperature and quantum delocalization effects on reliability of quantum-dot cellular automata
A thorough simulation study is carried out on thermal and quantum delocalization effects on the feasibility of a quantum-dot cellular automata (QCA) cell. The occupation correlation of two electrons is modeled with a simple four-site array of harmonic quantum dots (QD). QD sizes range from 20 nm to 40 nm with site separations from 20 nm to 100 nm, relevant for state-of-the-art GaAs/InAs semiconductor technology. The choice of parameters introduces QD overlap, which is only simulated properly with exact treatment of strong Coulombic correlation and thermal equilibrium quantum statistics. These are taken into account with path integral Monte Carlo approach. Thus, we demonstrate novel joint effects of quantum delocalization and decoherence in QCA, but also highly sophisticated quantitative evidence supporting the traditional relations in pragmatic QCA design. Moreover, we show the effects of dimensionality and spin state, and point out the parameter space conditions, where the 'classical' treatment becomes invalid.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Physics, Research group: Semiconductor Technology and Applications, Optoelectronics Research Centre, Research area: Computational Physics, Research group: Electronic Structure Theory
Authors: Tiihonen, J., Schramm, A., Kylänpää, I., Rantala, T. T.
Publication date: 11 Jan 2016
Peer-reviewed: Yes

Publication information
Volume: 49
Issue number: 6
Article number: 065103
ISSN (Print): 0022-3727
Ratings:
Scopus rating (2016): CiteScore 2.07 SJR 0.645 SNIP 0.917
Scopus rating (2015): SJR 0.693 SNIP 1.046 CiteScore 2.1
Scopus rating (2014): SJR 1.069 SNIP 1.383 CiteScore 2.53
Scopus rating (2013): SJR 1.18 SNIP 1.469 CiteScore 2.6
Scopus rating (2012): SJR 1.244 SNIP 1.394 CiteScore 2.31
Dilute Nitride Four-Junction Solar Cell

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Publication date: 2016
Peer-reviewed: Unknown
Event: Research output: Scientific › Paper, poster or abstract

Dilute Nitride Multijunction Cells: Recent progress and Future Outlook

General information
State: Published
Organisations: Photonics
Publication date: 2016
Peer-reviewed: Unknown
Event: Paper presented at Optics and Photonics days, Tampere, Finland.
Research output: Scientific › Paper, poster or abstract

Dilute nitride solar cells fabricated by combined MBE-MOCVD epitaxy

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Publication date: 2016
Peer-reviewed: Unknown
Event: Paper presented at 12th International Conference on Concentrator Photovoltaics (CPV-12), Freiburg, Germany.
Electronic versions: CPV-12_Guina_MBE-MOCVD_update
Research output: Scientific › Paper, poster or abstract

High efficiency dilute nitride solar cells: Simulations meet experiments
Parameter extraction procedure and simulation of dilute nitride solar cells are reported. Using PC1D simulation and fitting to experimental current-voltage and external quantum efficiency data, we retrieve the phenomenological material parameters for GaInNAs solar cells. Based on these, we have constructed a model that can explain the changes in short
circuit current and open circuit voltage of n-i-p solar cells subjected to rapid thermal annealing. The model reveals that non-annealed MBE-grown GaInNAs material has an n-type doping that evolves to p-type upon rapid thermal annealing. The change of doping type and the shift of the physical location of the pn-junction were confirmed by Kelvin-probe force microscopy. The PC1D modelling was found to work well also for GaInNAs p-i-n solar cells with opposite polarity. It was also found that the GaInNAs lower doping levels in p-i-n solar cells grown at lowered As/III flux ratios were associated with increased carrier lifetimes.

High-efficiency III-V solar cells: From drawing board to real devices
The record solar cell conversion efficiency of 46% at concentrated sunlight has been demonstrated by direct bonding technique [1]. Regardless of the high efficiencies obtained using the direct wafer bonding technique, the conventional monolithic approach used in commercial solar cell production has several benefits, including production technology and cost-related factors. And yet, there is a high un-used potential, particularly in new materials that can be grown lattice-matched onto GaAs or Ge substrates. For example, by utilizing dilute nitride materials in multijunction solar cell structures with more than three junctions and by carefully optimizing structural elements and manufacturing technology, efficiencies exceeding 50% is a realistic target [2]. Here we review our theoretical and experimental work carried out on development of various parts of high-efficiency multijunction solar cells based on GaInNAsSb-based materials, i.e., dilute nitrides. First of all, we have developed a molecular beam epitaxy process for GaInNAsSb sub-junction with very high external quantum efficiency exceeding 90%. This building block is essential for achieving high conversion efficiency for GaInP/GaAs/GaInNAsSb triple-junction solar cells. Secondly, the use of a variety of electro-optical simulation tools such as Crosslight APSYS, Silvaco TCAD, PC1D, Es-sential MacLeod and semi-empirical analytical models combined with experimental work on numerous test samples have helped in fabricating ultra-low specific resistivity tunnel junctions and high-quality sub-junctions based on conventional III-V materials such as GaInP and GaAs to be integrated with the dilute nitride sub-junction. Thirdly, we have also extracted important material specific physical parameters such as carrier lifetimes, mobilities and concentrations for dilute nitrides by matching the simulations to experimental solar cell device characteristics [3]. The extracted parameters are used for refining the simulation models which provide deeper understanding of the device physics. The work done so far has led to a rapid increase in conversion efficiency of our GaInP/GaAs/GaInNAsSb triple-junction solar cells – at a pace of ~5 %points/year since 2012. High-efficiency solar cells with efficiencies of 29% and 31% at one sun (AM0 and AM1.5G, respectively) and 36–39% under concentrated sunlight (at ~70 suns) have already been demonstrated [4,5]. Additionally, the effects of various optical and structural design elements related to fabrication of real III-V multijunction solar cells will be critically reviewed. Especially, we will concentrate on the pros and cons of backside reflector structure architectures – including various planar reflector types and Lambertian scatterers – and nanostructured antireflection coatings [6] which are currently widely employed for solar
cell photon management. The consequences of adding such elements to the fabrication process and impact on improving the conversion efficiency towards >50% efficiency are assessed.

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Tukiainen, A., Aho, A., Polojärvi, V., Aho, T., Raappana, M., Isoaho, R., Guina, M.
Publication date: 2016
Peer-reviewed: Unknown
Event: Paper presented at Optics and Photonics days, Tampere, Finland.
Electronic versions: OPD2016_abstract_Tukiainen
Research output: Scientific › Paper, poster or abstract

Influence of age-precipitation of Nb-Ti stabilized FeCr alloy on the initial stages of oxide film formation at 650 °C

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Organisations: Optoelectronics Research Centre, Research group: Surface Science, MAX IV Laboratory, Lund University
Authors: Ali-Löytty, H., Hannula, M., Niu, Y., Zakharov, A., Valden, M.
Publication date: 2016

Publication information
Publisher: Lund University, MAX IV Laboratory
Original language: English
Links: https://www.maxlab.lu.se/cmis/display?id=workspace%3A%2F%2FSpacesStore%2Fbd7dec7f-b5c5-478a-af1e-8fbe1d875fe7
Links: https://www.maxlab.lu.se/node/2032#I311-PEEM_
Research output: Professional › Commissioned report

Optimizing iron alloy catalyst materials for photoelectrochemical water splitting: Passivation of FeCr alloy surface by water vapour using near-ambient-pressure photoelectron spectroscopy

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Organisations: Optoelectronics Research Centre, Research group: Surface Science, MAX IV Laboratory, Lund University
Authors: Lahtonen, K., Hannula, M., Ali-Löytty, H., Hirsimäki, M., Urpelainen, S., Valden, M.
Number of pages: 2
Publication date: 2016

Publication information
Place of publication: Lund, Sweden
Publisher: Lund University, MAX IV Laboratory
Original language: English
Keywords: Synchrotron, Steel, photoelectrochemical water splitting, Passivation, near-ambient-pressure photoelectron spectroscopy, APXPS
Links: https://www.maxlab.lu.se/cmis/display?id=workspace%3A%2F%2FSpacesStore%2Fa92d6a04-214f-4072-9777-93aedd805058
Links: https://www.maxlab.lu.se/node/2032 (Reports 2015 - Synchrotron Radiation)
Research output: Professional › Commissioned report

Photoluminescence properties of novel GaAsBi compounds fabricated by molecular beam epitaxy

General information
State: Published
Organisations: Photonics, Research group: ORC
Site-controlled InAs Quantum Dots Coupled to Surface Plasmons

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Research group: Nanophotonics
Authors: Hakkarainen, T. V., Tommila, J. T., Schramm, A., Simonen, J. P. J., Niemi, K. T., Strelow, C., Kipp, T., Kontio, J. M., Guina, M.
Publication date: 2016
Peer-reviewed: Unknown
Event: Paper presented at 19th International Conference on Molecular-Beam Epitaxy
Research output: 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
State: Published
Organisation: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Research group: Laboratory for Future Electronics, Research group: Nanophotonics
Authors: 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
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: Scientific - peer-review

Transformation of ALD grown TiO2 film to topographically microstructured titanium silicide for photonics applications

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Surface Science, Research group: Nanophotonics
Number of pages: 2
Publication date: 2016

Publication information
Place of publication: Lund
Publisher: Lund University, MAX IV Laboratory
Original language: English
Keywords: titanium silicide, Synchrotron, photoemission electron microscopy
Links: https://www.maxlab.lu.se/cmis/display?id=workspace%3A%2F%2FSpacesStore%2F80e2da54-8373-4d0c-a4af-8b53b81b0ca3
X-ray photoelectron spectroscopy of electrochemical interfaces for solar fuel production

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Surface Science
Authors: Ali-Löytty, H., Valden, M.
Number of pages: 1
Pages: 114
Publication date: 2016
Peer-reviewed: Unknown
Event: Paper presented at Physics days 2016, Oulu, Finland.
Research output: Scientific › Paper, poster or abstract

Structure of amorphous Ag/Ge/S alloys: experimentally constrained density functional study
Density functional/molecular dynamics simulations have been performed to determine structural and other properties of amorphous Ag/Ge/S and Ge/S alloys. In the former, the calculations have been combined with experimental data (x-ray and neutron diffraction, extended x-ray absorption fine structure). Ag/Ge/As alloys have high ionic conductivity and are among the most promising candidates for future memristor technology. We find excellent agreement between the experimental results and large-scale (500 atoms) simulations in Ag/Ge/S, and we compare and contrast the structures of Ge/S and Ag/Ge/S. The calculated electronic structures, vibrational densities of states, ionic mobilities, and cavity distributions of the amorphous materials are discussed and compared with data on crystalline phases where available. The high mobility of Ag in solid state electrolyte applications is related to the presence of cavities and can occur via jumps to a neighbouring vacant site.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Physics, Research group: Materials and Molecular Modeling, Computational Science X (CompX)
Authors: Akola, J., Beuneu, B., Jones, R. O., Jóvári, P., Kaban, I., Kolář, J., Voleská, I., Wágner, T.
Publication date: 9 Dec 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Physics: Condensed Matter
Volume: 27
Issue number: 48
Article number: 485304
ISSN (Print): 0953-8984
Ratings:
Scopus rating (2016): CiteScore 1.89 SJR 0.881 SNIP 0.754
Scopus rating (2015): SJR 0.824 SNIP 0.754 CiteScore 1.65
Scopus rating (2014): SJR 1.217 SNIP 0.951 CiteScore 1.99
Scopus rating (2013): SJR 1.297 SNIP 1.022 CiteScore 2.11
Scopus rating (2012): SJR 1.659 SNIP 1.166 CiteScore 2.33
Scopus rating (2011): SJR 1.627 SNIP 1.166 CiteScore 2.31
Scopus rating (2010): SJR 1.654 SNIP 1.053
Scopus rating (2009): SJR 1.529 SNIP 1.019
Scopus rating (2008): SJR 1.475 SNIP 1.08
Scopus rating (2007): SJR 1.564 SNIP 1.15
Scopus rating (2006): SJR 1.665 SNIP 1.216
Scopus rating (2005): SJR 1.67 SNIP 1.189
Scopus rating (2004): SJR 1.518 SNIP 1.169
Scopus rating (2003): SJR 1.338 SNIP 0.966
Scopus rating (2002): SJR 1.299 SNIP 1.119
Scopus rating (2001): SJR 1.232 SNIP 1.007
Finite-size effects and interactions in artificial graphene formed by repulsive scatterers

We carry out a numerical real-space study on electrons confined in a two-dimensional triangular lattice of repulsive scattering centres. The system represents a qualitative model of molecular graphene, where the electron gas is confined between the scattering molecules in a hexagonal configuration. Our main interest is, on one hand, in the comparability of a finite system (flake) and a fully periodic one, and, on the other hand, in the role of the Coulombic electron-electron interactions and the relative strength of the scattering centres. Our real-space study shows in detail how the density of states of the fully periodic system-containing the Dirac point-is gradually formed as the size of the flake is increased. Good qualitative agreement with the experimental density of states is obtained. Our study confirms the minor role of the electron-electron interactions with selected system parameters, and shows in detail that large scattering amplitudes are required to obtain a distinctive Dirac point in the density of states.
Unintentional boron contamination of MBE-grown GaInP/AlGaInP quantum wells

The effects of unintentional boron contamination on optical properties of GaInP/AlGaInP quantum well structures grown by molecular beam epitaxy (MBE) are reported. Photoluminescence and secondary-ion mass spectrometry (SIMS) measurements revealed that the optical activity of boron-contaminated quantum wells is heavily affected by the amount of boron in GaInP/AlGaInP heterostructures. The boron concentration was found to increase when cracking temperature of the phosphorus source was increased. Boron incorporation was enhanced also when aluminum was present in the material.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics, VTT Technical Research Centre of Finland
Authors: Tukiainen, A., Likonen, J., Toikkanen, L., Leinonen, T.
Pages: 60-63
Publication date: 1 Sep 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Crystal Growth
Volume: 425
ISSN (Print): 0022-0248
Ratings:
Scopus rating (2016): SJR 0.735 SNIP 1.175 CiteScore 1.69
Scopus rating (2015): SJR 0.716 SNIP 1.174 CiteScore 1.63
Scopus rating (2014): SJR 0.795 SNIP 1.184 CiteScore 1.69
Scopus rating (2013): SJR 0.831 SNIP 1.221 CiteScore 1.78
Scopus rating (2012): SJR 0.956 SNIP 1.246 CiteScore 1.68
Scopus rating (2011): SJR 0.96 SNIP 1.425 CiteScore 1.89
Scopus rating (2010): SJR 1.163 SNIP 1.206
Scopus rating (2009): SJR 1.068 SNIP 1.202
Scopus rating (2008): SJR 1.161 SNIP 1.236
Scopus rating (2007): SJR 1.237 SNIP 1.32
Scopus rating (2006): SJR 1.001 SNIP 1.211
Scopus rating (2005): SJR 1.105 SNIP 1.403
Scopus rating (2004): SJR 1.211 SNIP 1.292
Scopus rating (2003): SJR 0.956 SNIP 1.11
Scopus rating (2002): SJR 1.16 SNIP 1.262
Scopus rating (2001): SJR 1.108 SNIP 1.067
Scopus rating (2000): SJR 1.044 SNIP 1.045
Scopus rating (1999): SJR 1.404 SNIP 1.003
Original language: English
ASJC Scopus subject areas: Condensed Matter Physics, Materials Chemistry, Inorganic Chemistry
DOIs:
10.1016/j.jcrysgro.2015.02.048
Links:
Source: Scopus
Source-ID: 84951561374
Research output: Scientific - peer-review › Article

Aging scaled Brownian motion

Scaled Brownian motion (SBM) is widely used to model anomalous diffusion of passive tracers in complex and biological systems. It is a highly nonstationary process governed by the Langevin equation for Brownian motion, however, with a power-law time dependence of the noise strength. Here we study the aging properties of SBM for both unconfined and confined motion. Specifically, we derive the ensemble and time averaged mean squared displacements and analyze their
behavior in the regimes of weak, intermediate, and strong aging. A very rich behavior is revealed for confined aging SBM depending on different aging times and whether the process is sub- or superdiffusive. We demonstrate that the information on the aging factorizes with respect to the lag time and exhibits a functional form that is identical to the aging behavior of scale-free continuous time random walk processes. While SBM exhibits a disparity between ensemble and time averaged observables and is thus weakly nonergodic, strong aging is shown to effect a convergence of the ensemble and time averaged mean squared displacement. Finally, we derive the density of first passage times in the semi-infinite domain that features a crossover defined by the aging time.

Controlled high-fidelity navigation in the charge stability diagram of a double quantum dot
We propose an efficient control protocol for charge transfer in a double quantum dot. We consider numerically a two-dimensional model system, where the quantum dots are subjected to time-dependent electric fields corresponding to experimental gate voltages. Our protocol enables navigation in the charge stability diagram from a state to another through controllable variation of the fields. We show that the well-known adiabatic Landau-Zener transition—when supplemented with a time-dependent field tailored with optimal control theory—can remarkably improve the transition speed. The results also lead to a simple control scheme obtained from the experimental charge stability diagram that requires only a single parameter. Eventually, we can achieve the ultrafast performance of the composite pulse protocol that allows the system to be driven at the quantum speed limit.
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.
Second-harmonic generation imaging of semiconductor nanowires with focused vector beams

We use second-harmonic generation (SHG) with focused vector beams to investigate individual vertically aligned GaAs nanowires. Our results provide direct evidence that SHG from oriented nanowires is mainly driven by the longitudinal field along the nanowire growth axis. Consequently, focused radial polarization provides a superior tool to characterize such nanowires compared to linear polarization, also allowing this possibility in the native growth environment. We model our experiments by describing the SHG process for zinc-blende structure and dipolar bulk nonlinearity.
Fabrication and characterization of superluminescent diodes for 2–3 μm wavelength

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre, Research group: Nanophotonics, Research group: Semiconductor Technology and Applications, Optoelectronics Research Centre, Tampere University of Technology
Authors: Zia, N., Viheriälä, J., Koskinen, R., Koskinen, M., Suomalainen, S., Guina, M.
Publication date: 2015

Host publication information
Title of host publication: Northern Optics and Photonics 2015 : June 2-4, 2015, Lappeenranta
Research output: Scientific » Conference contribution

Facilitation of polymer looping and giant polymer diffusivity in crowded solutions of active particles
We study the dynamics of polymer chains in a bath of self-propelled particles (SPP) by extensive Langevin dynamics simulations in a two-dimensional model system. Specifically, we analyse the polymer looping properties versus the SPP activity and investigate how the presence of the active particles alters the chain conformational statistics. We find that SPPs tend to extend flexible polymer chains, while they rather compactify stiffer semiflexible polymers, in agreement with previous results. Here we show that higher activities of SPPs yield a higher effective temperature of the bath and thus facilitate the looping kinetics of a passive polymer chain. We explicitly compute the looping probability and looping time in a wide range of the model parameters. We also analyse the motion of a monomeric tracer particle and the polymer’s centre of mass in the presence of the active particles in terms of the time averaged mean squared displacement, revealing a giant diffusivity enhancement for the polymer chain via SPP pooling. Our results are applicable to rationalising the dimensions and looping kinetics of biopolymers at constantly fluctuating and often actively driven conditions inside biological cells or in suspensions of active colloidal particles or bacteria cells.
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 (∼500 A/cm<sup>2</sup>) the EL intensity of the structures is comparable for all substrate orientations. Opposite to the (100)-grown strictures, the EL spectra of (211) and (311)-grown devices are shifted towards shorter wavelengths (∼550 nm at room temperature). At high current densities (>1 kA/cm<sup>2</sup>) 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 kA/cm<sup>2</sup>, whereas no saturation is revealed for (211)-grown structures up to the current densities above 14 kA/cm<sup>2</sup>. 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 (Al<sub>0.8</sub>Ga<sub>0.2</sub>)<sub>0.5</sub>In<sub>0.5</sub>P cladding layers.
Long-term corrosion protection by a thin nano-composite coating

Abstract We report and discuss the corrosion protective properties of a thin nano-composite coating system consisting of an 11 µm thick polyester acrylate (PEA) basecoat, covered by an approximately 1–2 µm thick layer of TiO2 nanoparticles carrying a 0.05 µm thick hexamethyl disiloxane (HMDSO) top coat. The corrosion protective properties were evaluated on carbon steel substrates immersed in 3 wt% NaCl solution by open circuit potential (OCP) and electrochemical impedance spectroscopy (EIS) measurements. The protective properties of each layer, and of each pair of layers, were also evaluated to gain further understanding of the long-term protective properties offered by the nano-composite coating. The full coating system showed excellent corrosion protective properties in the corrosive environment of 3 wt% NaCl-solution for an extended period of 100 days, during which the coating impedance, at the lower frequency limit (0.01 Hz), remained above 108 Ω cm2. We suggest that the excellent corrosion protective properties of the complete coating system is due to a combination of (i) good adhesion and stability of the PEA basecoat, (ii) the surface roughness and the elongated diffusion path provided by the addition of TiO2 nanoparticles, and (iii) the low surface energy provided by the HMDSO top coat.
Measurements of particulates and gas phase precursors emissions from fresh ship plumes during the Big Glenn 2014 Campaign

Self-consistent total-energy approximation for electron gas systems

Employing a local formula of Parr [J. Chem. Phys. 93, 3060 (1988)] for the electron-electron interaction energy, we derive a self-consistent approximation for the total energy of a general N-electron system. Our scheme works as a local variant of the Thomas-Fermi approximation and yields the total energy and density as a function of the external potential, the number of electrons, and the chemical potential determined upon normalization. Our tests for Hooke's atoms, jellium, and model atoms up to ~1500 electrons show that reasonable total energies can be obtained with almost negligible computational cost. Our approximation may serve as a useful tool to provide initial results for more advanced approaches that also include binding.
Triboelectric charging of fungal spores during resuspension and rebound

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Physics, Research area: Aerosol Physics, Research group: The Instrumentation, Emissions, and Atmospheric Aerosols Group
Authors: Kuuluvainen, H., Saari, S., Mensah-Attipoe, J., Pasanen, P., Reponen, T., Keskinen, J.
Publication date: 2015

Host publication information
Title of host publication: EAC 2015, European Aerosol Conference, 6-11 September, 2015, Milan, Italy

Bibliographical note
ISBN kysytty, HO.
Ei ole, HO.
Research output: Professional › Conference contribution

Ultrasmall microdisk and microring lasers based on InAs/InGaAs/GaAs quantum dots

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, St. Petersburg State Polytechnical University, St. Petersburg Academic University, ITMO University, University of Eastern Finland
Publication date: 13 Dec 2014
Peer-reviewed: Yes
Biofunctional hybrid materials: bimolecular organosilane monolayers on FeCr alloys

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Surface Science, Frontier Photonics, Multi-scaled biodata analysis and modelling (MultiBAM)
Authors: Vuori, L., Leppiniemi, J., Hannula, M., Lahtonen, K., Hirsimäki, M., Nömmiste, E., Costelle, L., Hytönen, V. P., Valden, M.
Number of pages: 10
Pages: 1-10
Publication date: 2014
Peer-reviewed: Yes
Construction of the B88 Exchange-Energy Functional in Two Dimensions

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Quantum Control and Dynamics, Department of Physics, Computational Science X (CompX)
Authors: Vilhena, J. G., Räsänen, E., Marques, M. A. L., Pittalis, S.
Number of pages: 6
Pages: 1837-1842
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Chemical Theory and Computation
Volume: 10
Issue number: 5
ISSN (Print): 1549-9618
Ratings:
Scopus rating (2016): SJR 2.801 SNIP 1.589 CiteScore 5.37
Scopus rating (2015): SJR 2.795 SNIP 1.748 CiteScore 5.65
Scopus rating (2014): SJR 2.777 SNIP 1.603 CiteScore 5.63
Scopus rating (2013): SJR 2.409 SNIP 1.578 CiteScore 5.41
Scopus rating (2012): SJR 2.744 SNIP 1.608 CiteScore 5.34
Scopus rating (2011): SJR 2.742 SNIP 1.815 CiteScore 5.82
Scopus rating (2010): SJR 2.372 SNIP 1.46
Scopus rating (2009): SJR 2.616 SNIP 1.273
Scopus rating (2008): SJR 2.367 SNIP 1.173
Scopus rating (2007): SJR 2.3 SNIP 1.401
Scopus rating (2006): SJR 1.77 SNIP 1.062
Original language: English
DOIs:
10.1021/ct4010728
Links:
http://pubs.acs.org/doi/full/10.1021/ct4010728

Bibliographical note
Contribution: organisation=orc,FACT1=1
Portfolio EDEND: 2014-10-17
Publisher name: Institute of Physics
Source: researchoutputwizard
Source-ID: 1773
Research output: Scientific - peer-review › Article
Controlling the synergetic effects in (3-aminopropyl) trimethoxysilane and (3-mercaptopropyl) trimethoxysilane coadsorption on stainless steel surfaces

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Surface Science, Frontier Photonics
Number of pages: 11
Pages: 856-866
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Applied Surface Science
Volume: 317
ISSN (Print): 0169-4332
Ratings:
Scopus rating (2016): CiteScore 3.37 SJR 0.951 SNIP 1.225
Scopus rating (2015): SJR 0.914 SNIP 1.3 CiteScore 3.13
Scopus rating (2014): SJR 0.958 SNIP 1.477 CiteScore 2.96
Scopus rating (2013): SJR 0.965 SNIP 1.488 CiteScore 2.78
Scopus rating (2012): SJR 0.918 SNIP 1.373 CiteScore 2.26
Scopus rating (2011): SJR 0.908 SNIP 1.402 CiteScore 2.27
Scopus rating (2010): SJR 0.924 SNIP 1.141
Scopus rating (2009): SJR 0.842 SNIP 1.023
Scopus rating (2008): SJR 0.899 SNIP 1.087
Scopus rating (2007): SJR 0.795 SNIP 0.945
Scopus rating (2006): SJR 0.852 SNIP 1.052
Scopus rating (2005): SJR 0.679 SNIP 0.946
Scopus rating (2004): SJR 0.964 SNIP 1.126
Scopus rating (2003): SJR 0.988 SNIP 1.027
Scopus rating (2002): SJR 0.921 SNIP 0.954
Scopus rating (2001): SJR 0.841 SNIP 0.796
Scopus rating (2000): SJR 0.866 SNIP 0.772
Scopus rating (1999): SJR 1.064 SNIP 0.907
Original language: English
DOIs:
10.1016/j.apsusc.2014.08.199

Bibliographical note
Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-12-31<br/>Publisher name: Elsevier
Source: researchoutputwizard
Source-ID: 1772
Research output: Scientific - peer-review › Article

Deep levels in 1 eV bandgap dilute nitride antimonide solar cells

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre
Authors: Polojärvi, V., Tukiainen, A., Aho, A., Raappana, M., Aho, T., Schramm, A., Guina, M.
Number of pages: 3
Pages: 1-3
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the 29th European Photovoltaic Solar Energy Conference and Exhibition, EU PVSEC 2014, September 22-26, 2014, Amsterdam, the Netherlands
Density-functional investigation of molecular graphene: CO on Cu(111)

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Quantum Control and Dynamics, Research group: Materials and Molecular Modeling, Department of Physics, Computational Science X (CompX)
Authors: Ropo, M., Paavilainen, S., Akola, J., Räsänen, E.
Number of pages: 5
Pages: 1-5
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Physical Review B
Volume: 90
Article number: 241401
ISSN (Print): 1098-0121
Ratings:
Scopus rating (2016): CiteScore 3.16 SJR 1.939 SNIP 1
Scopus rating (2015): SJR 1.943 SNIP 1.008 CiteScore 2.8
Scopus rating (2014): SJR 2.656 SNIP 1.302 CiteScore 3.3
Scopus rating (2013): SJR 2.804 SNIP 1.348 CiteScore 3.55
Scopus rating (2012): SJR 3.159 SNIP 1.397 CiteScore 3.57
Scopus rating (2011): SJR 3.306 SNIP 1.433 CiteScore 3.61
Scopus rating (2010): SJR 3.303 SNIP 1.45
Scopus rating (2009): SJR 3.116 SNIP 1.467
Scopus rating (2008): SJR 2.949 SNIP 1.525
Scopus rating (2007): SJR 2.925 SNIP 1.609
Scopus rating (2006): SJR 2.799 SNIP 1.56
Scopus rating (2005): SJR 2.748 SNIP 1.587
Scopus rating (2004): SJR 2.718 SNIP 1.583
Scopus rating (2003): SJR 2.71 SNIP 1.512
Scopus rating (2002): SJR 2.782 SNIP 1.704
Scopus rating (2001): SJR 2.968 SNIP 1.648
Scopus rating (2000): SJR 2.979 SNIP 1.629
Scopus rating (1999): SJR 3.077 SNIP 1.588
Original language: English
DOIs: 10.1103/PhysRevB.90.241401

Bibliographical note
Contribution: organisation=fys,FACT1=1
Portfolio EDEND: 2014-12-08
Publisher name: American Physical Society
Source: researchoutputwizard
Determination of the functionality of monolayers of aminopropyl trimethoxy silane and mercaptopropyl trimethoxy silane on stainless steel with SR-PES and chemical derivatization

General information
State: Published
Ministry of Education publication type: B2 Part of a book or another research book
Organisations: Optoelectronics Research Centre, Research group: Surface Science
Authors: Vuori, L., Hannula, M., Hirsimäki, M., Tönisoo, A., Nömmiste, E., Valden, M.
Number of pages: 2
Pages: 1-2
Publication date: 2014

Host publication information
Place of publication: Lund, Sweden
Publisher: MAX-LAB
Links: https://www.maxlab.lu.se/node/1913

Bibliographical note
Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-12-15
Source: researchoutputwizard
Source-ID: 1771
Research output: Scientific › Chapter

Dirac physics in flakes of artificial graphene in magnetic fields

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Quantum Control and Dynamics, Department of Physics, Computational Science X (CompX)
Authors: Aichinger, M., Janecek, S., Kylänpää, I., Räsänen, E.
Number of pages: 5
Pages: 235433-1 - 235433-5
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Physical Review B
Volume: 89
Issue number: 23
Article number: 235433
ISSN (Print): 1098-0121
Ratings:
Scopus rating (2016): CiteScore 3.16 SJR 1.939 SNIP 1
Scopus rating (2015): SJR 1.943 SNIP 1.008 CiteScore 2.8
Scopus rating (2014): SJR 2.656 SNIP 1.302 CiteScore 3.3
Scopus rating (2013): SJR 2.804 SNIP 1.348 CiteScore 3.55
Scopus rating (2012): SJR 3.159 SNIP 1.397 CiteScore 3.57
Scopus rating (2011): SJR 3.306 SNIP 1.433 CiteScore 3.61
Scopus rating (2010): SJR 3.303 SNIP 1.45
Scopus rating (2009): SJR 3.116 SNIP 1.467
Scopus rating (2008): SJR 2.949 SNIP 1.525
Scopus rating (2007): SJR 2.925 SNIP 1.609
Scopus rating (2006): SJR 2.799 SNIP 1.56
Scopus rating (2005): SJR 2.748 SNIP 1.587
Scopus rating (2004): SJR 2.718 SNIP 1.583
Electron magneto-tunneling through single self-assembled InAs quantum dashes

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Quantum Control and Dynamics, Department of Physics, Computational Science X (CompX)
Authors: Shibata, K., Pascher, N., Luukko, P. J. J., Räsänen, E., Schnez, S., Ihn, T., Ensslin, K., Hirakawa, K.
Number of pages: 4
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Applied Physics Express
Volume: 7
Issue number: 4
Article number: 045001
ISSN (Print): 1882-0778
Ratings:
Scopus rating (2016): CiteScore 2.08 SJR 0.812 SNIP 0.981
Scopus rating (2015): SJR 0.752 SNIP 0.82 CiteScore 1.83
Scopus rating (2014): SJR 1.248 SNIP 1.166 CiteScore 1.91
Scopus rating (2013): SJR 1.474 SNIP 1.369 CiteScore 1.8
Scopus rating (2012): SJR 1.808 SNIP 1.458 CiteScore 2.27
Scopus rating (2011): SJR 1.796 SNIP 1.473 CiteScore 2.42
Scopus rating (2010): SJR 1.501 SNIP 1.188
Scopus rating (2009): SJR 0.975 SNIP 1.18
Scopus rating (2008): SNIP 1.158
Scopus rating (2007): SNIP 1.153
Scopus rating (2006): SNIP 1.348
Scopus rating (2005): SNIP 1.183
Scopus rating (2004): SNIP 1.306
Scopus rating (2003): SNIP 1.276
Scopus rating (2002): SNIP 1.482
Scopus rating (2001): SNIP 1.498
Scopus rating (2000): SNIP 1.1
Scopus rating (1999): SNIP 1.157
Original language: English
DOIs:
10.7567/APEX.7.045001
High-Energy Anomaly in the Angle-resolved Photoemission spectra of Nd2-xCexCuO4: Evidence for a Matrix Element Effect

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Spectroscopies of Complex Materials, Department of Physics, Computational Science X (CompX)
Authors: Rienks, E., Ärrälä, M., Lindroos, M., Roth, F., Tabis, W., Yu, G., Greven, M., Fink, J.
Number of pages: 5
Pages: 1-5
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Physical Review Letters
Volume: 113
Article number: 137001
ISSN (Print): 0031-9007
Ratings:
Scopus rating (2016): CiteScore 6.33 SJR 3.56 SNIP 2.133
Scopus rating (2015): SJR 3.823 SNIP 2.205 CiteScore 5.76
Scopus rating (2014): SJR 5.027 SNIP 2.646 CiteScore 6.62
Scopus rating (2013): SJR 5.674 SNIP 2.796 CiteScore 7.46
Scopus rating (2012): SJR 6.243 SNIP 2.845 CiteScore 7.19
Scopus rating (2011): SJR 6.252 SNIP 2.886 CiteScore 7.02
Scopus rating (2010): SJR 6.418 SNIP 2.764
Scopus rating (2009): SJR 6.342 SNIP 2.94
Scopus rating (2008): SJR 6.223 SNIP 2.854
Scopus rating (2007): SJR 6.14 SNIP 2.862
Scopus rating (2006): SJR 5.645 SNIP 2.807
Scopus rating (2005): SJR 5.35 SNIP 2.938
Scopus rating (2004): SJR 5.312 SNIP 2.976
Scopus rating (2003): SJR 5.33 SNIP 2.93
Scopus rating (2002): SJR 5.441 SNIP 3.089
Scopus rating (2000): SJR 5.92 SNIP 3.111
Scopus rating (1999): SJR 6.185 SNIP 2.979
Original language: English
DOIs:
10.1103/PhysRevLett.113.137001

Incorporation model of N into GaInNAs alloys grown by radio-frequency plasma-assisted molecular beam epitaxy

General information
State: Published
Influence of surface hydroxylation on the oxidation of FeCr in O2 and air

General information
State: Published
Ministry of Education publication type: B2 Part of a book or another research book
Organisations: Optoelectronics Research Centre, Research group: Surface Science
Authors: Hirsimäki, M., Hannula, M., Lahtonen, K., Urpelainen, S., Valden, M.
Number of pages: 2
Pages: 1-2
Publication date: 2014

Host publication information
Title of host publication: Max-Lab Activity Report 2013. Reports 2013 Synchrotron Radiation. Beamline I511-1
Place of publication: Lund, Sweden
Publisher: MAX-LAB
Links:
https://www.maxlab.lu.se/node/1913
Moth eye antireflection coated GaInP/GaAs/GaInNAs solar cell

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre
Authors: Aho, A., Tommila, J., Tukiainen, A., Polojaervi, V., Niemi, T., Guina, M.
Number of pages: 4
Pages: 33-36
Publication date: 2014

Host publication information
Title of host publication: CPV-10 Proceedings, 10th International Conference on Concentrator Photovoltaic Systems, April 7-9, 2014, Albuquerque, NM, USA. AIP Conference Proceedings
Publisher: American Institute of Physics

Publication series
Name: AIP Conference Proceedings
Volume: 1616
ISSN (Print): 0094-243X
ISSN (Electronic): 1551-7616
DOIs:
10.1063/1.4897022

Optimal control of charge with local gates in quantum-dot lattices

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Quantum Control and Dynamics, Department of Physics, Computational Science X (CompX)
Authors: Mardoukhi, Y., Räsänen, E.
Number of pages: 6
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: European Physical Journal B
Volume: 87
Issue number: 6
Article number: 144
ISSN (Print): 1434-6028
Ratings:
Scopus rating (2016): SJR 0.452 SNIP 0.654 CiteScore 1.11
Scopus rating (2015): SJR 0.53 SNIP 0.744 CiteScore 1.13
Scopus rating (2014): SJR 0.657 SNIP 0.717 CiteScore 1.25
Scopus rating (2013): SJR 0.727 SNIP 0.805 CiteScore 1.42
Scopus rating (2012): SJR 0.851 SNIP 0.886 CiteScore 1.51
Scopus rating (2011): SJR 1.027 SNIP 0.924 CiteScore 1.6
Scopus rating (2010): SJR 1.087 SNIP 0.871
Prediction of quantum dot characteristics through universal scaling relations

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Quantum Control and Dynamics, Department of Physics, Computational Science X (CompX)
Authors: Odriazola, A., Gonzalez, A., Räsänen, E.
Number of pages: 5
Pages: 355501-1 - 355501-5
Publication date: 2014
Peer-reviewed: Yes

Publication Information
Journal: Journal of Physics: Condensed Matter
Volume: 26
Issue number: 35
Article number: 355501
ISSN (Print): 0953-8984
Ratings:
Scopus rating (2016): CiteScore 1.89 SJR 0.881 SNIP 0.754
Scopus rating (2015): SJR 0.824 SNIP 0.754 CiteScore 1.65
Scopus rating (2014): SJR 1.217 SNIP 0.951 CiteScore 1.99
Scopus rating (2013): SJR 1.297 SNIP 1.022 CiteScore 2.11
Scopus rating (2012): SJR 1.659 SNIP 1.166 CiteScore 2.33
Scopus rating (2011): SJR 1.627 SNIP 1.166 CiteScore 2.31
Scopus rating (2010): SJR 1.654 SNIP 1.053
Scopus rating (2009): SJR 1.529 SNIP 1.019
Scopus rating (2008): SJR 1.475 SNIP 1.08
Scopus rating (2007): SJR 1.564 SNIP 1.15
Scopus rating (2006): SJR 1.665 SNIP 1.216
Scopus rating (2005): SJR 1.67 SNIP 1.189
Scopus rating (2004): SJR 1.518 SNIP 1.169
Scopus rating (2003): SJR 1.338 SNIP 0.966
Scopus rating (2002): SJR 1.299 SNIP 1.119
Proton distribution and dynamics in Y- and Zn-doped BaZrO3

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Biological Physics and Soft Matter, Research group: Materials and Molecular Modeling, Department of Physics, Computational Science X (CompX)
Authors: Kitamura, N., Akola, J., Kohara, S., Fujimoto, K., Idemoto, Y.
Number of pages: 7
Pages: 18846-18852
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Physical Chemistry C
Volume: 118
Issue number: 33
ISSN (Print): 1932-7447
Ratings:
Scopus rating (2016): CiteScore 4.48 SJR 1.948 SNIP 1.181
Scopus rating (2015): SJR 1.917 SNIP 1.268 CiteScore 4.68
Scopus rating (2014): SJR 2.027 SNIP 1.448 CiteScore 5.08
Scopus rating (2013): SJR 2.134 SNIP 1.439 CiteScore 5.14
Scopus rating (2012): SJR 2.514 SNIP 1.46 CiteScore 4.98
Scopus rating (2011): SJR 2.32 SNIP 1.457 CiteScore 4.92
Scopus rating (2010): SJR 2.438 SNIP 1.356
Scopus rating (2009): SJR 2.128 SNIP 1.417
Scopus rating (2008): SJR 1.856 SNIP 1.033
Original language: English
DOIs:
10.1021/jp502455v

Bibliographical note
Contribution: organisation=fys,FACT1=1<br/>Portfolio EDEND: 2014-09-30<br/>Publisher name: Institute of Physics
Source: researchoutputwizard
Source-ID: 1176
Research output: Scientific - peer-review › Article

Structure and dynamics in liquid bismuth and Bi_n clusters: A density functional study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Biological Physics and Soft Matter, Research group: Materials and Molecular Modeling, Department of Physics, Computational Science X (CompX)
Structure, electronic, and vibrational properties of amorphous AsS2 and AgAsS2: Experimentally constrained density functional study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Biological Physics and Soft Matter, Research group: Materials and Molecular Modeling, Department of Physics, Computational Science X (CompX)
Authors: Akola, J., Jovari, P., Kaban, I., Voleska, I., Kolar, J., Wagner, T., Jones, O.
Number of pages: 9
Pages: 1-9
Publication date: 2014
Peer-reviewed: Yes
Optimization of interfacial oxidation properties of FeCr SOFC interconnect alloy

General information
State: Published
Ministry of Education publication type: B2 Part of a book or another research book
Organisations: Optoelectronics Research Centre, Research group: Surface Science
Authors: Ali-Löytty, H., Jussila, P., Hirsimäki, M., Valden, M.
Number of pages: 2
Pages: 1-2
Publication date: 2013

Host publication information
Place of publication: Lund, Sweden
Publisher: MAX-LAB
Links: https://www.maxlab.lu.se/cmis/display?id=workspace%3A%2F%2FSpacesStore%2F0f1d8b0b-533a-48e6-a4cf-a85090776f76
Scaling in the correlation energies of two-dimensional artificial atoms

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Computational Physics, Research group: Quantum Control and Dynamics, Department of Physics, Computational Science X (CompX)
Authors: Odriazola, A., Ervasti, M. M., Makkonen, I., Delgado, A., Gonzalez, A., Räsänen, E., Harju, A.
Number of pages: 5
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Journal of Physics: Condensed Matter
Volume: 25
Issue number: 50
Article number: 505504
ISSN (Print): 0953-8984
Ratings:
Scopus rating (2016): CiteScore 1.89 SJR 0.881 SNIP 0.754
Scopus rating (2015): SJR 0.824 SNIP 0.754 CiteScore 1.65
Scopus rating (2014): SJR 1.217 SNIP 0.951 CiteScore 1.99
Scopus rating (2013): SJR 1.297 SNIP 1.022 CiteScore 2.11
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Scopus rating (2010): SJR 1.654 SNIP 1.053
Scopus rating (2009): SJR 1.529 SNIP 1.019
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Scopus rating (2005): SJR 1.67 SNIP 1.189
Scopus rating (2004): SJR 1.518 SNIP 1.169
Scopus rating (2003): SJR 1.338 SNIP 0.966
Scopus rating (2002): SJR 1.299 SNIP 1.119
Scopus rating (2001): SJR 1.232 SNIP 1.007
Scopus rating (2000): SJR 1.436 SNIP 1.108
Scopus rating (1999): SJR 1.449 SNIP 1.132
Original language: English
DOIs: 10.1088/0953-8984/25/50/505504

Two-electron quantum dot in tilted magnetic fields: Sensitivity to the confinement model

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Effect of different annealing temperatures and SiO2/Si(100) substrate on the properties of nickel containing titania thin sol-gel films

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Physics, Research group: Surface Science, Frontier Photonics
Authors: Pärna, R., Joost, U., Nommiste, E., Käämbre, T., Kikas, A., Kuusik, I., Kink, I., Hirsimäki, M., Kisand, V.
Pages: 953-965
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Physica Status Solidi A: Applications And Materials Science
Volume: 209
Issue number: 5
ISSN (Print): 1862-6300
Ratings:
Scopus rating (2016): SJR 0.683 SNIP 0.849 CiteScore 1.69
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Original language: English

DOIs:
10.1002/pssa.201127641

**Bibliographical note**

Contribution: organisation=fys,FACT1=1<br/>
Publisher name: Wiley

Source: researchoutputwizard
Source-ID: 5020

Research output: Scientific - peer-review ◄ Article