Effect of Shot Peening Parameters to Residual Stress Profiles and Barkhausen Noise
The production of gear components includes numerous manufacturing operations which are carried out to ensure proper surface characteristics of components to deal with wear and fatigue. Surface shot peening is one way to increase the compressive residual stresses on the surface and thus ensure better wear and fatigue resistance. An experimental plan for shot peening was conducted to produce samples with varying surface characteristics. Residual stress profile and Barkhausen noise measurements were carried out for the samples. The objective of the study was to evaluate the interactions between the shot peening parameters studied, the residual stress profiles and the Barkhausen noise measurements. A multivariable regression analysis was applied for the task. Some remarkable correlations were found between the shot peening parameters, residual stress profile and Barkhausen noise features. The most important finding was that when the shot peening intensity was high enough, over 0.5 mmA, it dominated the shot peening coverage density parameter and thus no correlations could be gained. On the other hand, if the intensity parameter was lower than the limit of 0.5 mmA, the correlation between residual stress and Barkhausen noise measurements was remarkable. This means that the surface Barkhausen noise measurements could be used for the evaluation of the stress gradient in the shot peening process.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Materials Science, Research group: Materials Characterization
Authors: Sorsa, A., Santa-aho, S., Wartiainen, J., Suominen, L., Vippola, M., Leiviskä, K.
Number of pages: 11
Publication date: 23 Jan 2018
Peer-reviewed: Yes

Publication information
Journal: Journal of Nondestructive Evaluation
Volume: 37
Issue number: 10
ISSN (Print): 0195-9298
Ratings:
- Scopus rating (2016): CiteScore 2.02 SJR 0.698 SNIP 1.59
- Scopus rating (2015): SJR 0.856 SNIP 1.574 CiteScore 1.87
- Scopus rating (2014): SJR 0.665 SNIP 1.902 CiteScore 1.7
- Scopus rating (2013): SJR 0.443 SNIP 1.473 CiteScore 1.27
- Scopus rating (2012): SJR 0.541 SNIP 1.558 CiteScore 1.27
- Scopus rating (2011): SJR 0.497 SNIP 1.701 CiteScore 1.21
- Scopus rating (2010): SJR 0.395 SNIP 1.344
- Scopus rating (2009): SJR 0.379 SNIP 1.666
- Scopus rating (2008): SJR 0.317 SNIP 0.952
- Scopus rating (2007): SJR 0.425 SNIP 1.783
- Scopus rating (2006): SJR 0.561 SNIP 1.164
- Scopus rating (2005): SJR 0.189 SNIP 0.806
- Scopus rating (2004): SJR 0.132 SNIP 0.452
- Scopus rating (2003): SJR 0.223 SNIP 0.537
- Scopus rating (2002): SJR 0.612 SNIP 1.994
- Scopus rating (2001): SJR 0.382 SNIP 0.717
- Scopus rating (2000): SJR 0.503 SNIP 1.509
- Scopus rating (1999): SJR 0.254 SNIP 1.001
Original language: English
Keywords: Barkhausen noise, shot peening, nondestructive testing
DOIs: 10.1007/s10921-018-0463-7
Research output: Scientific - peer-review › Article

1.4 µm continuous-wave diamond Raman laser
The longest wavelength (~1.4 µm) emitted by a diamond Raman laser pumped by a semiconductor disk laser (SDL) is reported. The output power of the intracavity-pumped Raman laser reached a maximum of 2.3 W with an optical conversion efficiency of 3.4% with respect to the absorbed diode pump power. Narrow Stokes emission (FWHM <0.1 nm) was attained using etalons to limit the fundamental spectrum to a single etalon peak. Tuning of the Raman laser over >40 nm was achieved via rotation of an intracavity birefringent filter that tuned the SDL oscillation wavelength.
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 1.4509, 1.4521) 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 (FeCrSi)2(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 (MnCr)3O4 spinel oxide at the surface above Cr2O3 are strongly suppressed.
Structured Metal/Polymer Back Reflectors for III-V Solar Cells
We report on fabrication of microstructured metal/polymer back reflectors for light trapping in III-V solar cells. The asymmetric triangular grating provided the highest diffraction of the light when compared to half sphere and cylinder reflectors.

Multi-material bio-printing facilities
Dispenser printing provides a method to produce 2D and 3D patterns from basically any liquid phase material. Dispensing considered here is a form of extrusion of material through a narrow diameter needle. An advantage of dispensing technique over conventional printing techniques is the avoidance of complicated ink formulation, which generally requires hazardous organic solvents that may be harmful to biological objects. Dispensing also allows materials with rather different properties such as different viscosity to be printed in the same process. Combining the dispensing printing of liquid phase materials and 3D printing of solid materials, complex structures with new functional properties can be fabricated, which is very challenging if not impossible using conventional manufacturing techniques.

Recycling mine tailings in chemically bonded ceramics - A review
Mine tailings account for most of the environmental incidents related to the extractive industry, with risks increasing due to steadily rising tonnage of low-grade ore and extreme weather events. Recycling of tailings in raw-material-intensive applications presents an interesting alternative to costly tailings management with associated restoration efforts. Chemically bonded ceramics may offer a route to upgrading mine tailings into raw materials for ceramics. In this review such chemically bonded ceramic methods that may be used to recycle mine tailings as raw materials, are reviewed while focusing in particular on two methods: 1) geopolymerization/alkali activation and 2) chemically bonded phosphate ceramics. The aim of the review is not to give exhaustive review on the wide topic, but to scope the required boundary conditions that need to be met for such utilization. According to the findings, alkali activation has been studied for 28 separate silicate minerals in the scientific literature, and presents a viable method, which is already in commercial use in calcium-rich cement-like binder applications. Phosphate bonding literature is more focused on phosphate containing minerals and waste encapsulation. Very little work has been done on low-calcium tailings utilization with either technology,

and more knowledge is needed on the effect of different pre-treatment methods to increase reactivity of mine tailings in chemically bonded ceramics.

**General information**
State: E-pub ahead of print
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Materials Science, Research group: Ceramic materials, University of Oulu
Authors: Kinnunen, P., Ismailov, A., Solismaa, S., Sreenivasan, H., Räisänen, M., Levänen, E., Illikainen, M.
Publication date: 26 Oct 2017
Peer-reviewed: Yes

**Publication information**
Journal: Journal of Cleaner Production
Volume: 174
ISSN (Print): 0959-6526
Ratings:
Scopus rating (2016): CiteScore 5.83 SJR 1.615 SNIP 2.382
Scopus rating (2015): SJR 1.609 SNIP 2.383 CiteScore 5.57
Scopus rating (2014): SJR 1.661 SNIP 2.477 CiteScore 4.6
Scopus rating (2013): SJR 1.644 SNIP 2.581 CiteScore 4.47
Scopus rating (2012): SJR 1.706 SNIP 2.328 CiteScore 4.07
Scopus rating (2011): SJR 1.461 SNIP 1.825 CiteScore 3.19
Scopus rating (2010): SJR 1.419 SNIP 1.742
Scopus rating (2009): SJR 0.942 SNIP 1.544
Scopus rating (2008): SJR 0.813 SNIP 1.354
Scopus rating (2007): SJR 0.942 SNIP 1.489
Scopus rating (2006): SJR 0.842 SNIP 1.543
Scopus rating (2005): SJR 0.544 SNIP 1.357
Scopus rating (2004): SJR 0.753 SNIP 1.818
Scopus rating (2003): SJR 0.501 SNIP 1.152
Scopus rating (2002): SJR 0.481 SNIP 1.103
Scopus rating (2001): SJR 0.419 SNIP 0.85
Scopus rating (2000): SJR 0.694 SNIP 0.888
Scopus rating (1999): SJR 0.276 SNIP 0.775
Original language: English
DOIs:
10.1016/j.jclepro.2017.10.280
Research output: Scientific - peer-review › Article

**Soft tissue compatibility of Li, Sr and B doped bioactive glasses**
Bioactive glasses are in clinical use in many bone-related applications. The main advantage of these materials comes from the ease of introducing any ions having potential therapeutic effects and controlling their release in the medium. However, little is known about their reactions with soft tissue. In this study, human adipose stem cells (hASC), human lung fibroblasts and urethral epithelium cells were cultured for 14 days in mediums based on 13-93 bioactive glass extracts doped with lithium, strontium or boron. The cell viability, proliferation and phenotype were studied and the ion concentrations in the extract-based mediums were quantified using ICP-OES. The initial results show that the hASC and the fibroblasts remain viable in the extracts and the 13-93 and Li-doped glasses perform as well as the basic medium with hASC. According to the live-dead images, the other glasses slow down the cells proliferation, but these results will be confirmed with the quantitative analysis. Culturing the hASC and fibroblasts in the boron-containing extract seems to increase the cell size. The extracts had a very distinct effect on the morphology of the urethral epithelium cells, especially the Li-containing extract resulted in a very different cell morphology compared to the reference medium. This is most likely due to the high calcium concentration in the extract, which is not well tolerated by epithelial cells.

**General information**
State: Published
Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Biomaterials and Tissue Engineering Group
Authors: Lyyra, I., Sartoneva, R., Kellomäki, M., Miettinen, S., Massera, J.
Publication date: 26 Oct 2017
Peer-reviewed: Unknown
Effect of Carbide Dissolution on Chlorine Induced High Temperature Corrosion of HVOF and HVAF Sprayed Cr3C2-NiCrMoNb Coatings

Highly corrosion- and wear-resistant thermally sprayed chromium carbide (Cr3C2)-based cermet coatings are nowadays a potential highly durable solution to allow traditional fluidized bed combustors (FBC) to be operated with ecological waste and biomass fuels. However, the heat input of thermal spray causes carbide dissolution in the metal binder. This results in the formation of carbon saturated metastable phases, which can affect the behavior of the materials during exposure. This study analyses the effect of carbide dissolution in the metal matrix of Cr3C2-50NiCrMoNb coatings and its effect on chlorine-induced high-temperature corrosion. Four coatings were thermally sprayed with HVOF and HVAF techniques in order to obtain microstructures with increasing amount of carbide dissolution in the metal matrix. The coatings were heat-treated in an inert argon atmosphere to induce secondary carbide precipitation. As-sprayed and heat-treated self-standing coatings were covered with KCl, and their corrosion resistance was investigated with thermogravimetric analysis (TGA) and ordinary high-temperature corrosion test at 550 °C for 4 and 72 h, respectively. High carbon dissolution in the metal matrix appeared to be detrimental against chlorine-induced high-temperature corrosion. The microstructural changes induced by the heat treatment hindered the corrosion onset in the coatings.
Comparison of laboratory wear test results with the in-service performance of cutting edges of loader buckets

The in-service cutting edge of a mining loader bucket was investigated and its wear behavior compared with samples tested in the laboratory to assess how well the wear testing methods correlate with the in-service conditions. The examined in-service cutting edge of a bucket had been run in an underground mine with quarry gravel and it was made of wear resistant steel. The wear behavior of the cutting edge was simulated in the laboratory scale with several application oriented abrasive and impact-abrasive wear testing methods. In addition to the contact mode, high loads, large abrasive size, abrasive type, and the comminution of the abrasive formed the basis for the design of the laboratory experiments. The wear surfaces and cross-sections of the original cutting edge and the test samples were characterized, and the wear behaviors were compared with each other. Work hardening of the steels occurred in all cases, but the amount of plastic deformation and the depth of the wear scars varied.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Materials Science, Research group: Materials Characterization
Authors: Valtonen, K., Ratia, V., Ojala, N., Kuokkala, V.
Pages: 93-100
Publication date: 15 Oct 2017
Peer-reviewed: Yes

Publication information
Journal: Wear
Volume: 388-389
ISSN (Print): 0043-1648
Ratings:
Scopus rating (2016): CiteScore 3 SJR 1.558 SNIP 2.071
Scopus rating (2015): SJR 1.527 SNIP 2.017 CiteScore 2.73
Scopus rating (2014): SJR 1.715 SNIP 2.38 CiteScore 2.46
Scopus rating (2013): SJR 1.319 SNIP 2.416 CiteScore 2.37
Scopus rating (2012): SJR 1.36 SNIP 2.178 CiteScore 1.85
Scopus rating (2011): SJR 1.547 SNIP 2.865 CiteScore 2.43
Scopus rating (2010): SJR 1.509 SNIP 2.153
Scopus rating (2009): SJR 1.684 SNIP 2.07
Scopus rating (2008): SJR 1.597 SNIP 1.863
Scopus rating (2007): SJR 1.286 SNIP 1.889
Scopus rating (2006): SJR 1.435 SNIP 2.036
Scopus rating (2005): SJR 1.473 SNIP 2.007
Scopus rating (2004): SJR 1.335 SNIP 1.965
Scopus rating (2003): SJR 1.104 SNIP 1.788
Scopus rating (2002): SJR 0.958 SNIP 1.365
Scopus rating (2001): SJR 0.937 SNIP 1.47
Scopus rating (2000): SJR 1.069 SNIP 1.149
Scopus rating (1999): SJR 0.848 SNIP 1.338
Original language: English
Keywords: Wear testing, Abrasion, Impact wear, Steel, Mining
ASJC Scopus subject areas: Materials Science(all), Metals and Alloys
Electronic versions:
Valtonen_Wear 2017_PRE-PRINT
DOIs:
10.1016/j.wear.2017.06.005
Links:
Research output: Scientific › peer-review › Article

High power VECSEL prototype emitting at 625 nm
We demonstrate an OP-VECSEL prototype emitting more than 6W of CW output power at 625 nm. We employ dilute nitride (GalnNAs) quantum wells emitting fundamentally at 1250 nm together with intracavity frequency doubling.
Passivation of GaInP and AlInP surfaces for III-V solar cells

General information
State: Published
Organisations: Photonics, Research group: ORC
Authors: Raappana, M., Polojärvi, V., Aho, T., Aho, A., Isoaho, R., Tukiainen, A., Guina, M.
Publication date: 27 Sep 2017
Peer-reviewed: Unknown
Research output: Scientific › Paper, poster or abstract

Barkhausen noise Potcore sensor simulations with Comsol

General information
State: Published
Organisations: Research group: Materials Characterization, Materials Science, Stresstech Oy
Authors: Laitinen, A., Santa-aho, S., Lukinmaa, H., Suominen, L., Vippola, M.
Number of pages: 11
Pages: 97-107
Publication date: 24 Sep 2017

Barkhausen noise response of fatigue tested super duplex stainless steel

General information
State: Published
Organisations: Materials Science
Authors: Santa-aho, S., Lindgren, M. J., Björk, T., Vippola, M.
Number of pages: 11
Pages: 159-169
Publication date: 24 Sep 2017
Case depth prediction of nitrided components

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Materials Science
Authors: Sorsa, A., Santa-aho, S., Aylott, C., Shaw, B., Vippola, M., Leiviskä, K.
Number of pages: 8
Pages: 65-72
Publication date: 24 Sep 2017

Host publication information
Title of host publication: 12th International Conference on Barkhausen Noise and Micromagnetic Testing
Publisher: ICBM
ISBN (Print): 978-952-68852-0-9
Keywords: Barkhausen noise
Research output: Scientific > Conference contribution

IDDRG 2017 konferenssi Munchenissä - Materials Modelling for Sheet Metal Forming

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Research group: Metals Technology, Materials Science
Authors: Peura, P.
Number of pages: 3
Pages: 7-9
Publication date: 20 Sep 2017
Peer-reviewed: Unknown

Publication Information
Journal: Ohutlevy-lehti
Issue number: 2
ISSN (Print): 1239-4122
Original language: Finnish
Research output: Professional > Article

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.

General information
State: E-pub ahead of print
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Photonics, Research group: ORC, Department of Physics and Astronomy, University of Turku, Helmholtz Zentrum Berlin Mat & Energie, Helmholtz Association, Helmholtz-Zentrum Berlin (HZB)
Number of pages: 7
Publication date: 19 Sep 2017
Peer-reviewed: Yes

Publication Information
Journal: Advanced Materials Interfaces
Article number: 1700722
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.

A high speed electron-beam lithography technique (Dots-On-The-Fly) was used to fabricate arrays of thin, plasmonic gold structures, which then acted as a directing template for the self-assembly of asymmetric poly(styrene-b-2-vinyl pyridine) (PS-P2VP). 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.

Nanocomposite Polypropylene For DC Cables And Capacitors: A New European Project

This paper presents the scientific background of a new European project, GRIDABLE, which was launched at the beginning of 2017 and has to deliver results in manufacturing and characterization of LV-MV capacitors and MV-HV cables for DC application. The innovation is in the development of nanostructured materials based on polypropylene and silica, and the relevant capacitor and cable manufacturing procedures. The initial results regarding the electrical properties of PP-SiO2 materials, which have brought to the proposal of this project, are presented in this paper, focusing on breakdown strength and space charge measurements performed on nanofilled PP films for capacitors.
Method for adding a graphene-based additive to target material used in the coating applying laser ablation

In the present invention there is presented a manufacturing method for producing target material pieces (17) which are used in a laser ablation process and which make possible a more efficient coating process by blending an additive suspension (12, 13) prepared in a special way with a powder (11) used as the raw material for the target material. The suspension (14) consisting of the additive (12), raw materials (11) and liquid (13) is heated and after this sintered so that a solid target material piece (17) is produced. The piece (17) produced in this way can advantageously be used as a target in the laser ablation process.

Optically pumped VECSELS: review of technology and progress

Vertical-external-cavity surface-emitting lasers (VECSELS) are the most versatile laser sources, combining unique features such as wide spectral coverage, ultrashort pulse operation, low noise properties, high output power, high brightness and compact form-factor. This paper reviews the recent technological developments of VECSELS in connection with the new milestones that continue to pave the way towards their use in numerous applications. Significant attention is devoted to the fabrication of VECSEL gain mirrors in challenging wavelength regions, especially at the yellow and red wavelengths. The reviewed fabrication approaches address wafer-bonded VECSEL structures as well as the use of hybrid mirror structures. Moreover, a comprehensive summary of VECSEL characterization methods is presented; the discussion covers different stages of VECSEL development and different operation regimes, pointing out specific characterization techniques for each of them. Finally, several emerging applications are discussed, with emphasis on the unique application objectives that VECSELS render possible, for example in atom and molecular physics, dermatology and spectroscopy.
Scopus rating (2009): SJR 1.283 SNIP 1.337
Scopus rating (2008): SJR 1.446 SNIP 1.563
Scopus rating (2007): SJR 1.385 SNIP 1.633
Scopus rating (2005): SJR 1.203 SNIP 1.466
Scopus rating (2004): SJR 1.123 SNIP 1.442
Scopus rating (2003): SJR 0.9 SNIP 1.2
Scopus rating (2002): SJR 0.99 SNIP 1.221
Scopus rating (2001): SJR 0.901 SNIP 1.205
Scopus rating (2000): SJR 0.79 SNIP 1.133
Scopus rating (1999): SJR 0.925 SNIP 1.249
Original language: English
Electronic versions:
Optically pumped VECSELs
DOIs:
10.1088/1361-6463/aa7bfd
Links:
http://urn.fi/URN:NBN:fi:tty-201709251960
Research output: Scientific - peer-review › Review Article

Tunable narrow-linewidth VECSELs for atomic and molecular physics

General information
State: Published
Organisations: Photonics, National Institute of Standards and Technology, Time and Frequency Division, Boulder, Colorado
Authors: Penttinen, J., Leinonen, T., Burd, S., Guina, M.
Publication date: 23 Aug 2017
Peer-reviewed: Unknown
Event: Paper presented at The 25th Colloquium on High-Resolution Molecular Spectroscopy, Helsinki, Finland.
ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics
Keywords: VECSEL
Electronic versions:
HRMS_2017_Penttinen_abstract
Links:
Research output: Scientific › Paper, poster or abstract

VECSEL: a versatile laser tool for ion trappers

General information
State: Published
Organisations: Photonics, National Institute of Standards and Technology, Time and Frequency Division, Boulder, Colorado
Authors: Penttinen, J., Leinonen, T., Burd, S. C., Allcock, D. T., Leibfried, D., Guina, M.
Publication date: 16 Aug 2017
Peer-reviewed: Unknown
Keywords: VECSEL
ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics
Electronic versions:
nacti_abstract_penttinen
Research output: Scientific › Paper, poster or abstract

High power broadband superluminescent diode for compact gas sensor

Tunable mid-infrared semiconductor light sources are of particular interest for molecular spectroscopy; for example, CO2 and other atmospheric gases have strong absorption lines in this wavelength range. Currently, to detect multiple gases simultaneously one needs several continuous-wave (CW) operated mid-infrared laser diodes (LDs) with wide tuning range. For a miniaturized gas sensing system, a single high power and broadband light source is desired. To this end, we have proposed a novel, programmable/tunable light source for gas detection utilizing broadband superluminescent diode (SLD) and Si-based photonic integrated components [1]. When it comes to light source development, the preferred
material system for reaching the 2-3 μm wavelength range is GaSb. Even though the performance of GaSb-based devices [2] are superior to InP-based emitters [3] in this wavelength range, the development of GaSb-based SLD have not been notable until recently [4].

**General information**
State: Published
Organisations: Photonics, Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Research group: ORC, Facilities and Infrastructure
Authors: Zia, N., Viheriälä, J., Koskinen, R., Aho, A., Suomalainen, S., Guina, M.
Number of pages: 1
Publication date: 27 Jun 2017
Peer-reviewed: Unknown
DOIs: 10.1109/CLEOE-EQEC.2017.8086409
Research output: Scientific › Paper, poster or abstract

**Enabling High-Efficiency InAs/GaAs Quantum Dot Solar Cells by Epitaxial Lift-Off and Light Management**

**General information**
State: Published
Organisations: Photonics, Politecnico di Torino, University College London
Publication date: 25 Jun 2017
Peer-reviewed: Unknown
Research output: Scientific › Paper, poster or abstract

**Progress in Power Scaling and Wavelength Coverage of VECSELs**
The main concepts and recent results underpinning the rapid development of verticalexternal-cavity surface-emitting lasers (VECSELs) are reviewed. In particular, we focus on developments addressing new wavelength domains and emerging applications.

**General information**
State: Published
Organisations: Photonics, Research group: Ultrafast and intense lasers
Authors: Guina, M., Penttinen, J., Rantamäki, A. J., Kantola, E. L.
Publication date: 23 Jun 2017
Peer-reviewed: Unknown
Event: Additional files:
LIC’17_MGuina_VECSELs_invited
Research output: Scientific › Paper, poster or abstract

**Edge and particle embedment effects in low- and high-stress slurry erosion wear of steels and elastomers**
Slurry transportation via pumping is an increasingly viable alternative for the conventional fine particle pumping, but there are also many applications involving larger particles. However, most of the published studies on slurry erosion have been conducted with fine particle sizes. In this work, also large particle slurry erosion of commercial wear resistant materials is studied. A high speed slurry-pot wear tester was used with edge protected samples to simulate the wear conditions in industrial slurry applications where edge wear is minimal. Two wear resistant steels together with natural rubber and polyurethane lining materials were tested, and the results were compared with the results of the same materials tested without sample edge protection. The tests were performed using 15 m/s speed, two sample angles, and slurry concentrations with particle size ranging from large 8/10 mm granite to fine 0.1/0.6 mm quartz. In all conditions, the steel samples showed stable wear behavior, whereas the elastomers gave notably inconsistent results in different test conditions. In general, steels exhibited better wear performance with large particles and elastomers with fine particles, and the wear losses were 40-95 % lower when edge wear was inhibited. With increasing abrasive size, the edge wear becomes more dominant and the particle embedment decreases.

**General information**
State: E-pub ahead of print
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Materials Science, Research group: Materials Characterization
Chlorine-Induced High Temperature Corrosion of Inconel 625 Sprayed Coatings Deposited with Different Thermal Spray Techniques

Ni-based coatings of the type Inconel 625 sprayed with high-kinetic spray processes are applied as protective coatings in many industrial fields where high corrosion resistance is required. Among the high-kinetic spray processes HVOF (High-Velocity Oxygen-Fuel) is an affirmed technology while HVAF (High-Velocity Air-Fuel) and cold spray are promising technologies for the depositon of thick and dense coatings, able to extend the service life of components subjected to harsh corrosive conditions. This study aims to assess the effect of the different high-kinetic spray technologies on the chlorine-induced high temperature corrosion behaviour of the coatings. The coatings were exposed to the test condition of 550°C in the presence of KCl salt deposits under air flow with 12 % of specific humidity for 168 h. The corrosion behaviour of the coatings was evaluated and compared with a reference wrought Inconel 625. Corrosion products and coatings were analysed and characterised in order to define the corrosion/oxydation mechanisms.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Surface Engineering, Valmet Technologies Oy
Authors: Fantozzi, D., Matikainen, V., Uusitalo, M., Koivuluoto, H., Vuoristo, P.
Number of pages: 11
Pages: 233-243
Publication date: 25 May 2017
Pyrolysed cellulose nanofibrils and dandelion pappus in supercapacitor application

Dandelion pappus and wood based nanocellulose fibrils were combined to form films that were subsequently pyrolyzed under low-pressure conditions in a carbon monoxide (CO) rich atmosphere to make supercapacitor electrode material. The electrodes were prepared from these materials and pyrolysed under low-pressure conditions in a carbon monoxide-rich atmosphere. The electrode materials and assembled supercapacitors were electrically and structurally characterized. The assembled six supercapacitors showed specific capacitances per electrode ranging from 1 to 6 F/g and surface resistance of pyrolyzed electrodes ranging from 30 to 170 Ω/□. Finally, equivalent series resistance and leakage current measurements were conducted for three samples, resulting values from 125 to 500 Ω and from 0.5 to 5.5 µA, respectively.

General information
State: E-pub ahead of print
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Faculty of Biomedical Sciences and Engineering, Research area: Microsystems, Electronics and Communications Engineering, Materials Science, Research group: Plastics and Elastomer Technology, Research group: Sensor Technology and Biomeasurements (STB), BioMediTech, BioMediTech Institute and Faculty of Biomedical Sciences and Engineering
Authors: Virtanen, J., Pammo, A., Keskinen, J., Sarlin, E., Tuukkanen, S.
Number of pages: 11
Publication date: 24 May 2017
Peer-reviewed: Yes
Engineering and Characterization of Bacterial Nanocellulose Films as Low Cost and Flexible Sensor Material

Some bacterial strains such as Komagataëibacter xylanus are able to produce cellulose as an extracellular matrix. In comparison to wood-based cellulose, bacterial cellulose (BC) holds interesting properties such as biodegradability, high purity, water-holding capacity, and superior mechanical and structural properties. Aiming toward improvement in BC production titer and tailored alterations to the BC film, we engineered K. xylanus to overexpress partial and complete bacterial cellulose synthase operon that encodes activities for BC production. The changes in cell growth, end metabolite, and BC production titers from the engineered strains were compared with the wild-type K. xylanus. Although there were no significant differences between the growth of wild-type and engineered strains, the engineered K. xylanus strains demonstrated faster BC production, generating 2–4-fold higher production titer (the highest observed titer was obtained with K. xylanus-bcsABCD strain producing 4.3 ± 0.46 g/L BC in 4 days). The mechanical and structural characteristics of cellulose produced from the wild-type and engineered K. xylanus strains were analyzed with a stylus profilometer, in-house built tensile strength measurement system, a scanning electron microscope, and an X-ray diffractometer. Results from the profilometer indicated that the engineered K. xylanus strains produced thicker BC films (wild type, 5.1 μm, and engineered K. xylanus strains, 6.2–10.2 μm). Scanning electron microscope revealed no principal differences in the structure of the different type BC films. The crystallinity index of all films was high (from 88.6 to 97.5%). All BC films showed significant piezoelectric response (5.0–20 pC/N), indicating BC as a promising sensor material.
Effect of Carbide Dissolution in the Metal Matrix of HVOF and HVAF Sprayed Cr3C2-NiCrMoNb Coatings on the Initial Stage of Chlorine High Temperature Corrosion

Highly corrosion and wear resistant thermally sprayed chromium carbide (Cr3C2) based cermet coatings are nowadays a potential highly durable solution to allow traditional fluidised bed combustors (FBC) to be operated with ecological waste and biomass fuels. However, the heat input of thermal spraying processes causes carbide dissolution in the metal binder. This alters the coating structure and forms carbon saturated amorphous and nanocrystalline metastable areas, which can affect the behaviour of the materials under the corrosive chlorides containing environment of the flue gases. This study analyses the effect of carbide dissolution in the metal matrix of MMC coatings and its effect on the onset of chlorine induced high temperature corrosion. Four Cr3C2-NiCrMoNb coatings were thermally sprayed with high-velocity air-fuel (HVAF) and high-velocity oxygen-fuel (HVOF) spray processes in order to obtain microstructures with increasing amount of carbide dissolution in the metal matrix. The specimens were heat treated in an inert argon atmosphere at 700°C for 5 hours to induce secondary carbide precipitation. As-sprayed and heat-treated self-standing coatings were covered with KCl and their corrosion resistance was investigated with thermogravimetric analysis (TGA) at 550°C for 4 hours. High carbon dissolution in the metal matrix appeared to be a detrimental factor in the initial stage of corrosion. The microstructural changes induced by the heat treatment hindered the corrosion onset in the coatings. Moreover, an optimal amount of oxides and melting degree seemed beneficial.

Enhanced harvesting of thin-film quantum dot solar cells through light trapping techniques

General information
State: Published
Organisations: Photonics, Thales Alenia Space
Publication date: 26 Apr 2017
Aspects of moisture ingress in polymer housed surge arresters

Polymers have been extensively applied in the industry, especially in energy systems e.g. due to their good processability and insulation properties. However, all polymers are permeable to different extents, which requires a good knowledge about the process of permeation through these materials. In this study the moisture dynamics of four different surge arresters were studied in several ways,—at first by analysing the moisture diffusion properties of the housing polymers and finally by testing the full arrester structures against moisture ingress. Housing polymer composites were evaluated using thermogravimetric analysis and differential scanning calorimetry while the polymers’ ability to withstand moisture diffusion was studied by water vapor transmission rate measurements. Moisture ingress behavior of the full surge arresters was examined by daily measurements of internal resistive leakage current as a function of 30 days immersion test. Although correlations were found between the material composition and the diffusivity through the polymer, the moisture dynamic is deemed to be much more complex in the full surge arrester. Moisture permeation through separate housing material samples was typically high compared to internal leakage current formed in real arresters which highlights the main conclusion drawn,—internal structures and long term quality of interfaces are the key issues in preventing moisture induced degradation in metal oxide surge arresters.

General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Electrical Energy Engineering, Research area: Power engineering, University of Campinas
Authors: Da Silva, D. A., Lahti, K., Buontempo, R. C., Filho, J. P.
Number of pages: 9
Pages: 162-170
Publication date: 6 Apr 2017
Peer-reviewed: Yes

Publication information

Journal: Electric Power Systems Research
Volume: 148
ISSN (Print): 0378-7796
Ratings:
Scopus rating (2016): SJR 1.167 SNIP 1.515 CiteScore 3.32
Scopus rating (2015): SJR 1.063 SNIP 1.663 CiteScore 2.74
Scopus rating (2014): SJR 1.129 SNIP 1.918 CiteScore 2.86
Scopus rating (2013): SJR 1.23 SNIP 1.941 CiteScore 2.92
Scopus rating (2012): SJR 1.211 SNIP 2.185 CiteScore 3.13
Scopus rating (2011): SJR 0.942 SNIP 2.157 CiteScore 2.97
Scopus rating (2010): SJR 1.004 SNIP 1.795
Scopus rating (2009): SJR 0.88 SNIP 1.561
Scopus rating (2008): SJR 0.574 SNIP 1.302
Scopus rating (2007): SJR 0.529 SNIP 1.281
Scopus rating (2006): SJR 0.535 SNIP 0.889
Scopus rating (2005): SJR 0.633 SNIP 1.136
Scopus rating (2004): SJR 0.38 SNIP 1.109
Scopus rating (2003): SJR 0.988 SNIP 0.894
Scopus rating (2002): SJR 0.678 SNIP 0.721
Scopus rating (2001): SJR 0.485 SNIP 0.414
Scopus rating (2000): SJR 0.271 SNIP 0.609
Scopus rating (1999): SJR 0.231 SNIP 0.446
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
DOIs: 10.1016/j.epsr.2017.03.025
Research output: Scientific - peer-review » Article

Effect of growth parameters on the properties of GaAsBi
Collagen-immobilized polyimide membranes for retinal pigment epithelial cell adherence and proliferation

Degenerative retinal diseases are a leading cause of visual loss and irreversible blindness, particularly in the developed world. Retinal pigment cell (RPE) transplantation is nowadays considered the most promising therapeutic approach for certain retinal diseases, and the presence of a supportive scaffold has been considered essential to ensure the success of the implant. In this work, collagen IV was covalently immobilized to the surface of polyimide membranes, with the purpose of developing scaffold materials for RPE cell culture. The covalent modification method involved four steps: argon-plasma treatment, acrylic acid graft polymerization, surface activation, and finally immobilization of collagen type IV. Collagen-modified membranes did not become more rough but became significantly more hydrophilic than the unmodified and dipcoated controls. ARPE-19 cell morphology and attachment were studied by immunofluorescence staining and confocal microscopy. Covalently modified surfaces showed cell attachment and cell properties comparable to the uncoated and dipcoated controls. This work demonstrated the potential of collagen IV-immobilized polyimide membranes as substrates for the growth of ARPE-19 cells.

Investigation of the structural anisotropy in a self-assembling glycinate layer on Cu(100) by scanning tunneling microscopy and density functional theory calculations

Self-assembling organic molecule-metal interfaces exhibiting free-electron like (FEL) states offers an attractive bottom-up approach to fabricating materials for molecular electronics. Accomplishing this, however, requires detailed understanding of the fundamental driving mechanisms behind the self-assembly process. For instance, it is still unresolved as to why the adsorption of glycine ([NH2(CH2)COOH]) on isotropic Cu(100) single crystal surface leads, via deprotonation and self-assembly, to a glycinate ([NH2(CH2)COO−]) layer that exhibits anisotropic FEL behavior. Here, we report on bias-dependent scanning tunneling microscopy (STM) experiments and density functional theory (DFT) calculations for glycine adsorption on Cu(100) single crystal surface. We find that after physical vapor deposition (PVD) of glycine on Cu(100), glycinate self-assembles into an overlayer exhibiting c(2x4) and p(2x4) symmetries with non-identical adsorption sites. Our findings underscore the intricacy of electrical conductivity in nanomolecular organic overlayers and the critical role the structural anisotropy at molecule-metal interface plays in the fabrication of materials for molecular electronics.
Langmuir-Schaefer film deposition onto honeycomb porous films for retinal tissue engineering

Age-related macular degeneration (AMD) is the leading cause of vision loss in senior citizens in the developed world. The disease is characterised by the degeneration of a specific cell layer at the back of the eye – the retinal pigment epithelium (RPE), which is essential in retinal function. The most promising therapeutic option to restore the lost vision is considered to be RPE cell transplantation. This work focuses on the development of biodegradable biomaterials with similar properties to the native Bruch’s membrane as carriers for RPE cells. In particular, the breath figure (BF) method was used to create semi-permeable microporous films, which were thereafter used as the substrate for the consecutive Langmuir-Schaefer (LS) deposition of highly organised layers of collagen type I and collagen type IV. The newly developed biomaterials were further characterised in terms of surface porosity, roughness, hydrophilicity, collagen distribution, diffusion properties and hydrolytic stability. Human embryonic stem cell-derived RPE cells (hESC-RPE) cultured on the biomaterials showed good adhesion, spreading and morphology, as well as the expression of specific protein markers. Cell function was additionally confirmed by the assessment of the phagocytic capacity of hESC-RPE. Throughout the study, microporous films consistently showed better results as cell culture materials for hESC-RPE than dip-coated controls. This work demonstrates the potential of the BF-LS combined technologies to create biomimetic prosthetic Bruch’s membranes for hESC-RPE transplantation.
Multi-wavelength mid-IR light source for gas sensing

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Publication date: 20 Feb 2017

Host publication information
Title of host publication: Proc. SPIE 10110 : Photonic Instrumentation Engineering IV
Volume: 10110
Publisher: SPIE
Article number: 101100P
ISBN (Print): 9781510606616
ISBN (Electronic): 9781510606623

Publication series
Name: Proceedings of SPIE
Volume: 10110
ISSN (Print): 0277-786X
ISSN (Electronic): 1996-756X
DOI: 10.1117/12.2249126
Research output: Scientific - peer-review » Conference contribution

Roll-to-roll manufacturing of disposable surface-enhanced Raman scattering (SERS) sensors on paper based substrates

We present two cost-effective routes for roll-to-roll (R2R) manufacturing of silver nanoparticle based surface-enhanced Raman scattering (SERS) active substrates on paper utilizing either inkjet printing or liquid flame spray (LFS) nanoparticle deposition. Paper is cost-effective, renewable, recyclable, and biodegradable that can easily be disposed after the SERS analysis. Paper based substrates can have a strong luminescence that can overshadow the rather weak SERS signal. Two solutions are presented here that solve the luminescence issue of the base paper substrate. A full silver coverage by inkjet printing or alternatively a simple flexography carbon coating can suppress the background luminescence allowing a reliable SERS characterization. The detection limit of the sample analyte crystal violet was 100 nM corresponding to 100 fmol in a 1 µl sample volume. These approaches can provide a cost-effective route towards disposable, point-of-care SERS active substrates.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Physics, Research area: Aerosol Physics, Research group: Aerosol Synthesis, Photonics, Research group: Nanophotonics, Laboratory of Paper Coating and Converting, Center for Functional Materials, Abo Akademi University, Turku, Center for Functional Materials at Biological Interfaces (FUNMAT), Faculty of Engineering, Hokkai-Gakuen University
Authors: Saarinen, J. J., Valtakari, D., Sänden, S., Haapanen, J., Salminen, T., Mäkelä, J., Uozumi, J.
Number of pages: 7
Pages: 222-228
Publication date: 1 Jan 2017
Peer-reviewed: Yes

Publication information
Volume: 32
31% European InGaP/GaAs/InGaNAs Solar Cells For Space Application

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., Viheriäälä, J.
Publication date: 2017
Peer-reviewed: Unknown
Research output: Scientific › Paper, poster or abstract

Comportamiento Dinámico en Tracción a Alta Temperatura De Titanio Ensayado Por Dos Métodos Distintos

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Materials Science
Authors: Hueto, F., Sancho, R., Hokka, M., Galvez, F.
Publication date: 2017
Host publication information
Title of host publication: Grupo Español de Fractura
Research output: Professional › Conference contribution

Composition and Bandgap determination of MBE-grown GaInNAsSb

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
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
Research output: Professional › Conference contribution

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 $1 \times 10^{16}$ 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 $1 \times 10^{16}$ 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
Research output: Scientific › Paper, poster or abstract
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.
Research output: Scientific → Paper, poster or abstract

Digital Image Correlation as a Measurement Tool for Heart Surgery

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Materials Science
Authors: Hokka, M.
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the Annual Meeting of the International Digital Image Correlation Society, Barcelona
Research output: Professional → Conference contribution

Dilute Nitride Solar Cells - Technology Developments Towards 50% Efficiency

General information
State: Published
Organisations: Photonics
Authors: Guina, M., Tukiainen, A., Aho, A., Polojärvi, V.
Publication date: 2017
Peer-reviewed: Unknown
Research output: Scientific → Paper, poster or abstract

Dispenser system for nanocellulose 3D printing
A 3D-printed stepper motor dispenser assembly for a 10ml plastic syringe was constructed. This dispenser assembly was used to run a set of calibration experiments to evaluate its suitability to dose nanocellulose mass. The control of the dosing was done with a Labview software along with an Arduino Uno board. A set of dosing trials was conducted with three different dosing speeds and two different dosing volumes to verify the accuracy and repeatability of the constructed system in the nanocellulose mass dosing. The average dosing accuracy of the system was estimated to be at acceptable level for the application.

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Micro and Nanosystems Research Group, Research area: Microsystems, Research group: Sensor Technology and Biomeasurements (STB), BioMediTech Institute and Faculty of Biomedical Sciences and Engineering
Authors: Virtanen, J., Kallio, P., Tuukkanen, S.
Number of pages: 6
Pages: 1-6
Publication date: 2017

Host publication information
Title of host publication: Automaatiopäivät22 Proceedings
Publisher: Suomen Automaatioseura
Article number: 46
Keywords: 3D printing, nanocellulose, dispenser, syringe
Electronic versions:
Automation_days_full_paper_FINAL
Dynamic Fracture and Fragmentation of Heat Shocked Granites

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Materials Science
Authors: Hokka, M., Mardoukhi, A., Kuokkala, V.
Publication date: 2017

Host publication information
Title of host publication: 14th International conference of Fracture: Proceedings of ICF 14
Place of publication: Rhodes, Greece
ISBN (Print): 978-1-53611-848-3
Research output: Scientific - peer-review » Conference contribution

Four Junction Dilute Nitride Solar Cells for Next Generation CPV-systems

General information
State: Published
Organisations: Photonics
Authors: Aho, A., Isoaho, R., Aho, T., Raappana, M., Polojärvi, V., Tukiainen, A., Guina, M.
Publication date: 2017
Peer-reviewed: Unknown
Research output: Scientific » Paper, poster or abstract

High-stress abrasion of wear resistant steels in the cutting edges of loader buckets
To simulate the wear behavior of the cutting edge of the mining load-haul-dumper bucket, high-stress abrasion laboratory wear tests were conducted and compared to the in-service tests. The effects of test parameters and different abrasives on the wear rates and wear mechanisms of wear resistant steels were studied using the high-speed slurry-pot with a dry abrasive bed (dry-pot) and in the actual in-service use as a cutting edge. The laboratory wear tests produced results that are well comparable with the in-service case observations. Especially at the higher sample rotation speed with granite as an abrasive, the wear rates were quite similar as determined from the cutting edge of a loader bucket that had been used in a mine.

General information
State: E-pub ahead of print
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Materials Science, Research group: Materials Characterization, Lapland University of Applied Sciences
Authors: Valtonen, K., Keltamäki, K., Kuokkala, V.
Pages: 707-720
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Tribology International
Volume: 119
ISSN (Print): 0301-679X
Ratings:
Scopus rating (2016): CiteScore 3.16 SJR 1.382 SNIP 2.094
Scopus rating (2015): SJR 1.437 SNIP 2.04 CiteScore 2.61
Scopus rating (2014): SJR 1.545 SNIP 2.5 CiteScore 2.44
Scopus rating (2013): SJR 1.473 SNIP 2.793 CiteScore 2.51
Scopus rating (2012): SJR 1.406 SNIP 2.331 CiteScore 1.96
Scopus rating (2011): SJR 1.247 SNIP 2.209 CiteScore 1.89
Scopus rating (2010): SJR 1.394 SNIP 2.159
Scopus rating (2009): SJR 1.294 SNIP 2.09
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 Concepts for High-efficiency lightweight space solar cells

One of the key issues in the design and development of a satellite Photovoltaic Assembly (PVA) is the trade-off to be made between the available volume located to the PVA, its mass and the total amount of power that the solar panels have to guarantee to the spacecraft. The development of high-efficiency, flexible, lightweight solar cells is therefore instrumental to the design of future satellites providing enhanced missions and services. Based on the consolidated development of GaAs-based single junction and lattice matched triple-junction solar cells, several research efforts are being pursued worldwide to further increase the efficiency and reduce mass. Promising approaches include thin-film technologies such as Inverted Metamorphic and Epitaxial Lift-Off (ELO), and the use of nanostructures or highly mismatched alloys grown by MBE. We propose here an alternative path towards the development of lightweight GaAs-based solar cells with the potential to exceed the Shockley-Queisser (SQ) limit of single junction cells. Our approach is based on the synergistic combination of thin-film design, quantum dots (QDs) absorption, and photonic nanostructures. Challenges and opportunities offered by the use of QDs are discussed. A cost-effective and scalable fabrication process including ELO technology and nanoimprint lithography is outlined. Finally, a proof-of-concept design, based on rigorous electromagnetic and physics-based simulations, is presented. Efficiency higher than 30% and weight reduction close to 90% - owing to the substrate removal - makes the proposed device to rank record power-to-weight ratio, with the potential to become a cost-effective, attractive option for next generation space solar cells.
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 - peer-review › Conference contribution

Performance 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.
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 µA/cm²/°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.

General information
State: Published
Organisations: Photonics
Authors: Isoaho, R., Aho, A., Tukiainen, A., Guina, M.
Publication date: 2017
Peer-reviewed: Unknown
Event:
Research output: Scientific › Paper, poster or abstract

The Ageing of Glass Fibres Used in Polymeric Composites

Glass fibre composites are utilized widely as a lighter and corrosion resistant alternative for metals, in applications such as reactor and chemical transportation tanks, marine applications and wind turbines. Failure cases have however been reported and the reasons of failure range from errors during manufacture to stress corrosion or other forms of ageing in the composite.

The aim of this study, presented in my Master’s thesis, was to compile and add upon the existing knowledge of the chemical processes which result in property loss in glass fibre reinforced polymer composites. The changes in the composition and structure of the glass were found to be significant and likely have an effect on the ageing of the composite as a whole.

General information
State: Published
Organisations: Materials Science
Authors: Laurikainen, P.
Number of pages: 1
Publication date: 2017
Peer-reviewed: Unknown
Electronic versions:
Poster_Laurikainen
Research output: Scientific › Paper, poster or abstract

Enhancement of Photocurrent in GaInNAs Solar Cells using Ag/Cu Double-Layer Back Reflector

General information
State: E-pub ahead of print
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Research group: Nanophotonics
Authors: Aho, T., Aho, A., Tukiainen, A., Polojärvi, V., Salminen, T., Raappana, M., Guina, M.
Publication date: 22 Dec 2016
Peer-reviewed: Yes

Publication information
Volume: 109
Article number: 251104
ISSN (Print): 0003-6951
Ratings:
Enhancement of photocurrent in GaInNAs solar cells using AgCu double-layer back reflector

Scopus rating (2016): CiteScore 2.67 SJR 1.132 SNIP 0.996
Scopus rating (2015): SJR 1.085 SNIP 0.983 CiteScore 2.47
Scopus rating (2014): SJR 1.799 SNIP 1.462 CiteScore 3.25
Scopus rating (2013): SJR 2.149 SNIP 1.652 CiteScore 3.77
Scopus rating (2012): SJR 2.554 SNIP 1.754 CiteScore 3.76
Scopus rating (2011): SJR 2.805 SNIP 1.94 CiteScore 4.04
Scopus rating (2010): SJR 2.926 SNIP 1.789
Scopus rating (2009): SJR 2.857 SNIP 1.848
Scopus rating (2008): SJR 2.934 SNIP 1.83
Scopus rating (2007): SJR 3.039 SNIP 1.913
Scopus rating (2006): SJR 3.457 SNIP 2.288
Scopus rating (2005): SJR 3.709 SNIP 2.382
Scopus rating (2004): SJR 3.904 SNIP 2.38
Scopus rating (2003): SJR 3.765 SNIP 2.27
Scopus rating (2002): SJR 3.917 SNIP 2.365
Scopus rating (2001): SJR 4.111 SNIP 2.212
Scopus rating (2000): SJR 4.277 SNIP 2.013
Scopus rating (1999): SJR 4.35 SNIP 2.11

Original language: English
Electronic versions:
Enhancement of photocurrent in GaInNAs solar cells using AgCu double-layer back reflector
DOIs:
10.1063/1.4972850
Links:
http://urn.fi/URN:NBN:fi:tty-201612234915
Research output: Scientific - peer-review › Article

Thermal Modification of ALD Grown Titanium Oxide Ultra Thin Film for Photoanode Applications

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Surface Science
Authors: Hannula, M. K., Lahtonen, K. T., Isotalo, T. J., Saari, J. S., Valden, M. O.
Publication date: 15 Dec 2016
Peer-reviewed: Unknown
Event: Paper presented at Symposium on Future Prospects for Photonics, Tampere, Finland.
ASJC Scopus subject areas: Renewable Energy, Sustainability and the Environment, Surfaces, Coatings and Films, Surfaces and Interfaces, Atomic and Molecular Physics, and Optics
Keywords: Titanium dioxide, titanium silicide, Atomic layer deposition (ALD), photoemission electron microscopy, PEEM, hydrogen energy
Research output: Scientific › Paper, poster or abstract

Evaluation of Rotary Screen Printed High Density Interconnects for R2R Fabricated Hybrid Systems

With the burgeoning development of the internet of everything (IoE), research involving high-speed, low cost, and large volume electronics manufacturing is highly attractive. Hybrid electronic systems, involving flexible printed and traditional silicon components, present early enablers for the large scale fabrication of printed electronics with a high level of computational power. With this possibility, there may be a way to produce the trillions of sensors needed for the fruition of the IoE.

Of particular interest, is the ease at which rotary screen printing can be utilized in the roll-to-roll (R2R) fabrication process of flexible electronics. However, there are challenges to be overcome regarding the printed line resolution and hybrid integration utilizing high speed rotary screen printed backplanes. Our study, focused on R2R screen printed high density interconnects on PET, utilizing commercially available silver pastes. To evaluate the hybrid integration, we designed symmetrical daisy chain bare dies with 80 pads and varying pitch sizes of 150, 175, and 200 µm. Initially we investigated the use of anisotropically conductive adhesives and the comparison of native and gold stud bumped chips. Subsequently, we investigated the optimization of the printed traces via calendaring in an effort to improve the flip-chip attachment. The R2R calendaring was used to increase the line height uniformity of the printed traces and decrease the interconnects surface roughness.

General information
State: Published
VECSEL systems for the generation and manipulation of trapped magnesium ions

Experiments in atomic, molecular, and optical (AMO) physics rely on lasers at many different wavelengths and with varying requirements on the spectral linewidth, power, and intensity stability. Vertical external-cavity surface-emitting lasers (VECSELs), when combined with nonlinear frequency conversion, can potentially replace many of the laser systems currently in use. Here, we present and characterize VECSEL systems that can perform all laser-based tasks for quantum information processing experiments with trapped magnesium ions. For the photoionization of neutral magnesium, 570.6 nm light is generated with an intracavity frequency-doubled VECSEL containing a lithium triborate crystal. External frequency doubling produces 285.3 nm light for a resonant interaction with the 1S0→1P1 transition of neutral Mg. Using an externally frequency-quadrupled VECSEL, we implement Doppler cooling of Mg25+ on the 279.6 nm 2S1/2→2P3/2 cycling transition, repumping on the 280.4 nm 2S1/2→2P1/2 transition, coherent state manipulation, and resolved sideband cooling close to the motional ground state. Our systems serve as prototypes for applications in AMO requiring single-frequency, power-scalable laser sources at multiple wavelengths.
mineral crushing and grinding, screening, loader buckets, and rock drilling. The key design features of the test method are the possibility to use up to 10 millimeter sized large abrasives and sample speeds up to 20 m/s in conditions ranging from wet slurry environments to dry sand or gravel.

The work has been done in FIMECC DEMAPP and DIMECC BSA projects, the focus is in the application oriented wear testing of materials intended for demanding wear related applications.

General information
State: Published
Organisations: Department of Materials Science, Research group: Materials Characterization
Authors: Ojala, N.
Publication date: Nov 2016
Peer-reviewed: Unknown
Event: Paper presented at DIMECC 9th Annual Seminar, Helsinki, Finland.
ASJC Scopus subject areas: Mechanics of Materials, Metals and Alloys, Polymers and Plastics, Industrial and Manufacturing Engineering
Keywords: Wear testing, Application oriented, Steels, Polymer, Mining, mineral processing, Field test
Links:
https://www.researchgate.net/publication/310160912_Application_oriented_wear_testing_of_wear_resistant_steels_in_minining_industry
Research output: Scientific › Paper, poster or abstract

The effect of computational parameters on the performance of a combined CZM-VCCT method

General information
State: Published
Organisations: Research group: Plastics and Elastomer Technology, Department of Materials Science
Authors: Kanerva, M., Jokinen, J.
Number of pages: 4
Pages: 1-4
Publication date: 26 Oct 2016
Peer-reviewed: Unknown
Event:
Keywords: fracture, cohesive zone modelling, virtual crack closure technique

Bibliographical note
October 26-28, ISSN 1652-8549
Source: Bibtex
Source-ID: urn:357de723d566c0c58f764fd8ad766295
Research output: Scientific › Paper, poster or abstract

Elastic-Plastic Transition In MBE-Grown GaSb Semiconducting Crystal Examined by Nanoindentation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Univ Helsinki, University of Helsinki, Dept Phys, Aalto University, Department of Materials Science and Engineering, Institute of Materials Science, University of Silesia, 75 Pulku Piechoty 1, 45-500 Chorzów, Poland, Institute of Physics, University of Silesia, 75 Pulku Piechoty 1, 45-500 Chorzów, Poland
Authors: Majtyka, A., Trębala, M., Tukiainen, A., Chrobak, D., Borgiel, W., Räisänen, J., Nowak, R.
Number of pages: 3
Pages: 1131-1133
Publication date: 1 Oct 2016
Peer-reviewed: Yes

Publication information
Journal: Acta Physica Polonica A
Volume: 130
Issue number: 4
ISSN (Print): 0587-4246
Ratings:
Modelling and Simulation of Radial Spruce Compression to Optimize Energy Efficiency in Mechanical Pulping

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mechanical Engineering and Industrial Systems, Department of Automation Science and Engineering, Research area: Dynamic Systems, Research area: Measurement Technology and Process Control
Authors: Moilanen, C., Björkqvist, T., Ovaska, M., Koivisto, J., Miksic, A., Engberg, B., Salminen, L., Saarenrinne, P., Alava, M.
Number of pages: 18
Pages: 53-70
Publication date: 26 Sep 2016

Host publication information
Title of host publication: 2016 International Mechanical Pulping (IMPC) Conference Proceedings, Monday, September 26 - Wednesday, September 28, Jacksonville, Florida, USA
Place of publication: USA
Publisher: TAPPI
Article number: 1.3
ISBN (Print): 978-1-59510-250-7
Electronic versions:
Modelling and simulation of radial spruce compression
Links:
http://urn.fi/URN:NBN:fi:ttty-201708281835
Research output: Scientific - peer-review » Conference contribution

Plastic deformation of powder metallurgy tungsten alloy foils for satellite enclosures
Radiation shielding is one of the most crucial features of enclosure materials in spacecraft. The attenuation of electron radiation in hybrid materials, which consist mainly of carbon-fiber-reinforced plastics (CFRP), can be improved by laminating thin tungsten foils between the CFRP layers. In this paper, we study tensile behavior of thin foils to understand the plastic deformation of pure tungsten (W) foils and sintered tungsten heavy alloy (WHA) foils. The performed tests are simulated using the finite element (FE) method. Full 3-D FE models of tungsten and CFRP hybrids are generated to study the non-linearity response of different tungsten material models.
Stat: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Aalto University, School of Engineering, Department of Mechanical Engineering
Authors: Kanerva, M., Sarlin, E., Hållbro, A., Jokinen, J.
Publication date: Sep 2016

Host publication information
Title of host publication: 30th Congress of the International Council of the Aeronautical Sciences ICAS (Proceedings)
Place of publication: Daejeon, South Korea
ISBN (Print): 978-3-932182-85-3
Keywords: Hybrid, tungsten, CFRP, residual stresses, FEM
Links:

Bibliographical note
September 23-30
Source: Bibtex
Source-ID: urn:9abe813d07acae5f3ed924363ae34add
Research output: Scientific - peer-review › Conference contribution

Hot-Dip Galvanized Press Hardening Steels

General information
State: Published
Organisations: Department of Materials Science, Research group: Metals Technology
Authors: Järvinen, H.
Publication date: 15 Aug 2016
Peer-reviewed: Unknown
Research output: Scientific › Paper, poster or abstract

Menetelmä ja laitteisto selluloosapitoisten materiaalien fibrilloimiseksi; Förfarande och anordning för fibrillering av cellulosahaltiga materialer

General information
State: Published
Ministry of Education publication type: H1 Granted patent
Authors: Björkqvist, T., Gustafsson, H., Koskinen, T., Nuopponen, M., Vehniäinen, A., Fredrikson, A.
Publication date: 15 Aug 2016

Publication information
IPC: D21D 1/20, D21B 1/04, D21H 11/18
Patent number: FI126206
Priority date: 23/06/11
Priority number: FI20110005667
Original language: Finnish
Links:
https://patent.prh.fi/patdocs/certificate.jsp?app=20115667
Source: espacenet
Source-ID: FI20115667
Research output: Scientific › Patent

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-biotin overlayer 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.

Fabrication of topographically microstructured titanium silicide interface for advanced photonic applications

We present a widely scalable, high temperature post-growth annealing method for converting ultra-thin films of TiO2 grown by atomic layer deposition to topographically microstructured titanium silicide (TiSi). The photoemission electron microscopy results reveal that the transformation from TiO2 to TiSi at 950 °C proceeds via island formation. Inside the islands, TiO2 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.
Hybrid Stick-it-on Devices: Enablers of the Internet of Everything

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics
Authors: Kraft, T., Mäntysalo, M.
Number of pages: 1
Pages: 33
Publication date: Jul 2016
Peer-reviewed: Unknown

Publication information
Journal: Organic and Printed Electronics Journal
Volume: 6
Issue number: 16/2016
ISSN (Print): 2366-8040
Original language: English
Links:
http://www.c2-magazines.com/digital_issue/opejournal/#32
Research output: Professional › Article

Optically Enhanced GaInNAs Solar Cell

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Aho, T. A., Aho, A., Tukiainen, A., Polojärvi, V., Raappana, M., Guina, M.
Publication date: 20 Jun 2016
Peer-reviewed: Unknown
Research output: Scientific › Paper, poster or abstract

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., Polojärvi, 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

**DOIs:**

10.1002/pip.2784

**Bibliographical note**

INT=orc,”Isoaho, Riku”

Research output: Scientific - peer-review › Article

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**Potential Ways to Manufacture Wearable Metal Electrodes for the Long-term Biosignal Monitoring**

Currently in wearable welfare and healthcare products are used textile and polymer electrodes. Thus these soft electrodes are easy to integrate, product maintaining is simple and they are reasonably comfortable to wear, their measurement reliability will deteriorate over time. They are vulnerable to motion artefacts, the conductive material wears out in washings, and in addition material wetting causes signal changes. In this study, similar electrodes than is in common heartrate straps were manufactured. The aim was to find a substitute material for the reliable long-term electrode. We chose untreated and micro-etched steel, silver, electroplated platinum, gold, rhodium and screen-printed silver and compared them with commercial available textile and polymer electrodes. Different non-textile material choices and manufacturing methods for the electrodes are discussed. According to our research, metal electrodes have the potential to act as long-term monitoring electrodes; materials keep moisture on the skin and the electrode interface, without irritating skin.
Development of Magnetic Losses During Accelerated Corrosion Tests for Nd-Fe-B Magnets Used in Permanent Magnet Generators

Sintered Nd-Fe-B magnets are critical components in permanent magnet wind generators. They are the strongest permanent magnets available and thus enable the construction of light and effective devices, but their stability in corrosive environments is limited. In this work, the formation of corrosion losses in two types of Nd-Fe-B alloys was studied. Magnets were in a magnetized state during the corrosion test, enabling monitoring of the development of losses in magnetic flux along with those in weight. Parallel flux and weight loss measurements conducted during corrosion tests showed that percentage weight losses were lower than the total flux losses. Scanning electron microscope studies of corroded specimens disclosed that the magnets first underwent dissolution of the grain-boundary phase, followed by the detachment and movement of the loosened grains in the magnetic field. The degradation was accelerated by oxidation of the matrix phase, which introduced further damage by volume expansion.
Comparison of laboratory wear test results with the in-service performance of cutting edges of loader buckets

The in-service cutting edge of a mining loader bucket was investigated and its wear behavior compared with samples tested in the laboratory to assess how well the wear testing methods correlate with the in-service conditions. The examined in-service cutting edge of a bucket had been run in an underground mine with quarry gravel and it was made of wear resistant steel. The wear behavior of the cutting edge was simulated in the laboratory scale with several application oriented abrasive and impact-abrasive wear testing methods. In addition to the contact mode, high loads, large abrasive size, abrasive type, and the comminution of the abrasive formed the basis for the design of the laboratory experiments. The wear surfaces and cross-sections of the original cutting edge and the test samples were characterized, and the wear behaviors were compared with each other. Work hardening of the steel occurred in all cases, but the amount of plastic deformation and the depth of the wear scars varied.

Correlation of wear and work in dual pivoted jaw crusher tests

A laboratory sized jaw crusher with uniform movement of the jaws, the Dual Pivoted Jaw Crusher (DPJC), was used to determine the relationship between wear and work. Wear was concentrated on the jaw plates opposing each other and was measured as mass loss of the specimens. Work was measured directly from the force and the displacement of the instrumented jaw, which allowed work to accumulate only from the actual crushing events. The tests were conducted with several jaw geometries and with two motional settings, where the relation of compressive and sliding motion between the jaws was varied.

The comminution of rock is presumed to be irreversible, meaning that the energy used for crack formation in the rock particles eventually results in the fracture of the particles. Therefore, the amount of energy needed to comminute rock particles should be roughly constant and not dependent on the loading conditions, if the speed of the loading contact is not changed. The DPJC test method allows the separation of work components into comminution specific work and sliding specific work. The results can be used to compare the crushability of minerals without the influence of the used test geometry or the selected jaw plate materials. The sliding work can be used for the comparison of the wear of the jaw plate materials.

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Materials Science, Research group: Materials Characterization
Authors: Valtonen, K., Ratia, V., Ojala, N., Kuokkala, V.
Number of pages: 12
Publication date: Jun 2016
Edge effect in high speed slurry erosion wear tests of steels and elastomers

While the slurry transportation via pumping is an increasingly viable alternative for the conventional fine particle pumping, there are also many applications involving larger particles. However, the published studies on slurry erosion have mainly been conducted with fine particle sizes. In this work, both fine and large particle high speed slurry erosion of commercial wear resistant materials is studied.

The high speed slurry-pot wear tester was used with edge protected samples to simulate the wear conditions in industrial slurry applications, such as tanks and pipelines. Two quenched wear resistant steels together with natural rubber and polyurethane lining materials were tested, and the results were compared with the results of the same materials tested without sample edge protection. The tests were performed using 15 m/s speed, 45° and 90° sample angles, and 9 wt% and 33 wt% slurry concentrations with particle size ranging from large 8/10 mm granite to fine 0.1/0.6 mm quartz.

With or without edge protection, the steel samples showed stable wear behavior, whereas the elastomers gave notably inconsistent results in different test conditions. Steels exhibited better wear performance with large particles and elastomers with fine particles. In general, the wear losses were 40 – 95 % lower without edge wear, except for elastomers tested with fine quartz at the 45° sample angle, which yielded 25 – 75 % higher weight losses when the sample edges were protected. With increasing abrasive size, the edge wear becomes more dominant.

Erosive and abrasive wear performance of carbide free bainitic steels – comparison of field and laboratory experiments

Carbide free bainitic (CFB) steels have been tested in two heat treated conditions and compared with currently used quenched and tempered (QT) steel in an industrial mining application subjected to erosive-abrasive wear. A conventional sliding abrasion and a new application oriented high-stress erosion wear tests were performed in laboratory. The results of the erosion and the field tests were compared. The microstructural changes were investigated by optical and scanning electron microscopy. The hardness and hardness profiles of the steels were measured. The results showed that in the laboratory tests, the abrasion and erosion wear rates of the CFB steels were 35 and 45 % lower respectively in comparison to the QT steel. In the field test, the mass losses of the CFB steels were about 80 % lower in comparison with the QT steel. The improved wear resistance of the CFB steel can be explained by its higher hardness and higher work hardening. The erosion wear test was able to simulate the work hardening effect and the wear mechanisms observed in the field test samples.
Processing and Wear Testing of Novel High-Hardness Wear-Resistant Steel

Novel high-hardness medium carbon martensitic laboratory steel has been produced and tested for wear resistance. Different finish rolling temperatures (FRT) and quenching finish temperatures (QFT) were utilized. Composition was selected based on earlier experiments and carbon content was set to 0.35 % to obtain surface hardness of approximately 600 HB. FRT was varied to investigate the effect of prior austenite deformation on the mechanical properties. Direct quenching was implemented in the laboratory rolling trials. Plates were either quenched to room temperature or quenching was finished at 250 °C. The interrupted quenching was tested in order to improve the toughness of the steel via autotempering and possible austenite retention without drastic loss of hardness. The steel samples were tested for hardness and impact toughness. Material characterization included SEM and optical microscopy for microstructural inspection. Direct quenched steel samples exceeded the desired 600 HB surface hardness, but interrupted quenching to 250 °C resulted in lower hardness values. In contrast, the impact toughness was improved with latter quenching method. Impact-abrasion wear testing was conducted for the experimental steels to understand the effect of rolling and quenching parameters on wear resistance. Impeller-tumbler tests were carried out at Tampere Wear Center using natural granite as the abrasive. The results indicate that surface hardness is the main controlling factor of wear, and samples with the highest surface hardness showed the lowest mass loss.
High-Power Tapered Distributed Bragg Reflector Laser Diodes Emitting at 1550 nm

Compact LiDAR systems work in the near infrared (NIR) area, more specifically at wavelengths around 800 nm to 900 nm. In adverse weather the measurement range decreases dramatically as the light is attenuated by rain drops or fog. The penetration length can be improved by increasing the optical peak power of the lasers, but in the NIR spectral range the maximum emission power permitted due to eye safety is very limited and almost reached by the current systems. A significantly higher optical power can be used in the short wave infrared (SWIR) range. LiDAR systems working, for example, at 1550 nm are employed in military applications. However, these LiDAR systems are very bulky. This paper presents a compact high-power single-mode 1.55 µm laser diode for LiDAR applications.

The AlGaInAs/InP distributed Bragg reflector (DBR) lasers comprise a passive DBR section, an active ridge waveguide (RWG) section and tapered gain-guided sections of different lengths and have been fabricated without regrowth. Measurements indicate that the output power scales with the length of the tapered section and hint that one of the limiting factors for power scaling with the tapered section length is the non-uniform heating of the chip. According to thermal simulations, the non-uniform heating seems to cause devices with a long tapered section to roll-over at a much lower average power density than devices with a shorter tapered section.

Typical devices emit up to 560 mW in single-mode continuous wave operation at room temperature with a high spectral purity (38 dB side-mode suppression ratio, SMSR, at maximum power). By changing the length of the tapered section from 0.5 mm to 4.0 mm the maximum power could be increased from 125 mW to 560 mW. The tapered section and the RWG section are driven with separate currents. The maximum power was achieved with 10 A current to the tapered section and 350 mA current to the RWG section. The peak emission wavelength can be tuned by more than 2 nm either by changing the tapered section current (at a rate of about 0.4 nm/A) or by changing the temperature (at a rate of about 0.1 nm/ºC, between 10 ºC to 40 ºC).

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Nanophotonics, Research group: Semiconductor Technology and Applications, University of Turku
Publication date: 18 May 2016
Peer-reviewed: Unknown
Event: Paper presented at Optics and Photonics days, Tampere, Finland.
Research output: Scientific › Paper, poster or abstract

High-resolution x-ray diffraction and photoluminescence study of high-quality self-catalyzed GaAs nanowires

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Koivusalo, E. S., Hakkarainen, T. V., Guina, M.
Publication date: 17 May 2016
Peer-reviewed: Unknown
Event: Paper presented at Optics and Photonics days, Tampere, Finland.
Keywords: GaAs nanowires, Self-catalyzed, X-ray diffraction, Photoluminescence
Research output: Scientific › Paper, poster or abstract

Articular cartilage repair with recombinant human type II collagen/polylactide scaffold in a preliminary porcine study

The purpose of this study was to investigate the potential of a novel recombinant human type II collagen/polylactide scaffold (rhCo-PLA) in the repair of full-thickness cartilage lesions with autologous chondrocyte implantation technique (ACI). The forming repair tissue was compared to spontaneous healing (spontaneous) and repair with a commercial porcine type I/III collagen membrane (pCo). Domestic pigs (4-month-old, n = 20) were randomized into three study groups and a circular full-thickness chondral lesion with a diameter of 8 mm was created in the right medial femoral condyle. After 3 weeks, the chondral lesions were repaired with either rhCo-PLA or pCo together with autologous chondrocytes, or the lesion was only debrided and left untreated for spontaneous repair. The repair tissue was evaluated 4 months after the...
second operation. Hyaline cartilage formed most frequently in the rhCo-PLA treatment group. Biomechanically, there was a trend that both treatment groups resulted in better repair tissue than spontaneous healing. Adverse subchondral bone reactions developed less frequently in the spontaneous group (40%) and the rhCo-PLA treated group (50%) than in the pCo control group (100%). However, no statistically significant differences were found between the groups. The novel rhCo-PLA biomaterial showed promising results in this proof-of-concept study, but further studies will be needed in order to determine its effectiveness in articular cartilage repair.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Research group: Computational Biophysics and Imaging Group, BioMediTech
Pages: 745-753
Publication date: 1 May 2016
Peer-reviewed: Yes

Publication information
Journal: Journal of Orthopaedic Research
Volume: 34
Issue number: 5
ISSN (Print): 0736-0266
Ratings:
Scopus rating (2016): SJR 1.212 SNIP 1.082 CiteScore 2.8
Scopus rating (2015): SJR 1.509 SNIP 1.365 CiteScore 3.22
Scopus rating (2014): SJR 1.414 SNIP 1.416 CiteScore 3.14
Scopus rating (2013): SJR 1.491 SNIP 1.352 CiteScore 3.21
Scopus rating (2012): SJR 1.422 SNIP 1.401 CiteScore 3.31
Scopus rating (2011): SJR 1.426 SNIP 1.402 CiteScore 3.15
Scopus rating (2010): SJR 1.59 SNIP 1.529
Scopus rating (2009): SJR 1.446 SNIP 1.389
Scopus rating (2008): SJR 1.532 SNIP 1.388
Scopus rating (2007): SJR 1.532 SNIP 1.447
Scopus rating (2006): SJR 1.774 SNIP 1.812
Scopus rating (2005): SJR 1.74 SNIP 1.796
Scopus rating (2004): SJR 1.405 SNIP 1.497
Scopus rating (2003): SJR 1.373 SNIP 1.233
Scopus rating (2002): SJR 1.361 SNIP 1.024
Scopus rating (2001): SJR 1.481 SNIP 1.33
Scopus rating (2000): SJR 1.508 SNIP 1.625
Scopus rating (1999): SJR 1.302
Original language: English
DOIs:
10.1002/jor.23099
Research output: Scientific - peer-review › Article

Tuntemalla olosuhteet voit optimoida materiaalit kulutussovelluksiin

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science, Research group: Materials Characterization
Authors: Ratia, V., Ojala, N., Valtonen, K., Heino, V.
Pages: 16-20
Publication date: May 2016
Peer-reviewed: Unknown

Publication information
Journal: Promaint
Volume: 3
Strain rate change tests with the Split Hopkinson Bar method

In this paper, methods to produce rapid strain rate changes for strain rate sensitivity measurements in Split Hopkinson Bar arrangements are presented and discussed. Two different cases are considered: a strain rate change test within the high strain rate region in compression, and a tension test incorporating a large strain rate jump directly from the low strain rate region to high strain rates. The former method is based on the loading wave amplitude manipulation, while the latter method is based on the incorporation of a low strain rate loading device into a Tensile Split Hopkinson Bar apparatus.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization
Authors: Isakov, M., Kokkonen, J., Östman, K., Kuokkala, V.
Pages: 231-242
Publication date: 1 Apr 2016
Peer-reviewed: Yes

Publication information
Journal: European Physical Journal. Special Topics
Volume: 225
Issue number: 2
ISSN (Print): 1951-6355
Ratings:
Scopus rating (2016): CiteScore 1.94 SJR 0.601 SNIP 0.96
Scopus rating (2015): SJR 0.627 SNIP 0.981 CiteScore 1.68
Scopus rating (2014): SJR 0.654 SNIP 0.808 CiteScore 1.44
Scopus rating (2013): SJR 0.939 SNIP 0.946 CiteScore 1.84
Scopus rating (2012): SJR 0.912 SNIP 0.745 CiteScore 1.44
Scopus rating (2011): SJR 0.748 SNIP 0.715 CiteScore 1.17
Scopus rating (2010): SJR 0.643 SNIP 0.539
Scopus rating (2009): SJR 0.422 SNIP 0.414
Scopus rating (2008): SJR 0.36 SNIP 0.424
Scopus rating (2007): SJR 0.235 SNIP 0.218
Scopus rating (2006): SJR 0.268 SNIP 0.375
Scopus rating (2005): SJR 0.24 SNIP 0.242
Scopus rating (2004): SJR 0.15 SNIP 0.15
Scopus rating (2003): SJR 0.137 SNIP 0.147
Scopus rating (2002): SJR 0.152 SNIP 0.118
Scopus rating (2001): SJR 0.156 SNIP 0.155
Scopus rating (2000): SJR 0.209 SNIP 0.223
Scopus rating (1999): SJR 0.245 SNIP 0.227
Original language: English
ASJC Scopus subject areas: Physics and Astronomy(all), Materials Science(all), Physical and Theoretical Chemistry
DOIs: 10.1140/epjst/e2015-99999-x
Source: Scopus
Source-ID: 84941343460
Research output: Scientific - peer-review › Article
Synthesis and Characterization of Linear and Tri-Block PLLA-PEG-PLLA Blends

This study was conducted to synthesize poly(L-Lactide)–poly(ethylene glycol)–poly(L-Lactide) triblock copolymer (PEGLA) with different PLLA block length, and explore its applicability in a blend with linear PLLA (3051D NatureWorks) with the intention of improving heat-seal and adhesion properties at extrusion coating on paperboard. PLLA-PEG-PLLA was obtained by ring opening polymerization (ROP) of L-lactide using PEG (molecular weight 6000 g mol−1) as an initiator and stannous octoate as catalyst. The structures of the PEGLAs were characterized by proton nuclear magnetic resonance spectroscopy (1H-NMR). The melt flow and thermal properties of all PEGLAs and their blends were evaluated using dynamic rheology, and differential scanning calorimeter (DSC). All blends containing 10 wt% of PEGLAs displayed similar zero shear viscosities to neat PLLA, while blends containing 30 wt% of PEGLAs showed slightly higher zero shear viscosity. However, all blends displayed higher shear thinning and increased melt elasticity (based on tan delta). No major changes in thermal properties were distinguished from differential scanning calorimetric studies. High molecular weight PEGLAs could be used in extrusion coating with 3051D without problems.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging, Tampere University of Technology
Authors: Kuusipalo, J., Khajeheian, M., Kotkamo, S., Rosling, A.
Number of pages: 12
Pages: 379-390
Publication date: 3 Mar 2016
Peer-reviewed: Yes
Early online date: 3 Nov 2015

Publication information
Journal: Polymer-Plastics Technology and Engineering
Volume: 55
Issue number: 4
ISSN (Print): 0360-2559
Ratings:
Scopus rating (2016): SJR 0.389 SNIP 0.57 CiteScore 1.34
Scopus rating (2015): SJR 0.481 SNIP 0.66 CiteScore 1.52
Scopus rating (2014): SJR 0.663 SNIP 1.129 CiteScore 2.52
Scopus rating (2013): SJR 0.597 SNIP 1.089 CiteScore 2.08
Scopus rating (2012): SJR 0.624 SNIP 1.027 CiteScore 1.57
Scopus rating (2011): SJR 0.464 SNIP 0.881 CiteScore 1.26
Scopus rating (2010): SJR 0.335 SNIP 0.594
Scopus rating (2009): SJR 0.288 SNIP 0.526
Scopus rating (2008): SJR 0.277 SNIP 0.559
Scopus rating (2007): SJR 0.243 SNIP 0.425
Scopus rating (2006): SJR 0.252 SNIP 0.67
Scopus rating (2005): SJR 0.321 SNIP 0.588
Scopus rating (2004): SJR 0.305 SNIP 0.679
Scopus rating (2003): SJR 0.331 SNIP 0.554
Scopus rating (2002): SJR 0.356 SNIP 0.757
Scopus rating (2001): SJR 0.46 SNIP 0.978
Scopus rating (2000): SJR 0.253 SNIP 0.536
Scopus rating (1999): SJR 0.307 SNIP 0.553
Original language: English
DOIs:
10.1080/03602559.2015.1055502

Bibliographical note
AUX=mol,"Khajeheian, M.B. ",

Research output: Scientific › peer-review › Article

Modeling of Hysteresis Losses in Ferromagnetic Laminations under Mechanical Stress

A novel approach for predicting magnetic hysteresis loops and losses in ferromagnetic laminations under mechanical stress is presented. The model is based on combining a Helmholtz free energy-based anhysteretic magnetoelastic constitutive law to a vector Jiles-Atherton hysteresis model. This paper focuses only on unidirectional and parallel magnetic fields and stresses, albeit the model is developed in full 3-D configuration in order to account also for strains.
perpendicular to the loading direction. The model parameters are fitted to magnetization curve measurements under compressive and tensile stresses. Both the hysteresis loops and losses are modeled accurately for stresses ranging from −50 to 80 MPa.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering, Department of Mechanical Engineering and Industrial Systems, Research area: Applied Mechanics, Research group: Teknillinen mekaniikka ja lujuusoppi, Aalto University
Authors: Rasilo, P., Singh, D., Aydin, U., Martin, F., Kouhia, R., Belahcen, A., Arkkio, A.
Number of pages: 4
Publication date: Mar 2016
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Magnetics
Volume: 52
Issue number: 3
Article number: 7300204
ISSN (Print): 0018-9464
Ratings:
Scopus rating (2016): CiteScore 1.47 SJR 0.48 SNIP 0.915
Scopus rating (2015): SJR 0.565 SNIP 1.207 CiteScore 1.77
Scopus rating (2014): SJR 0.715 SNIP 1.491 CiteScore 1.68
Scopus rating (2013): SJR 0.608 SNIP 1.424 CiteScore 1.75
Scopus rating (2012): SJR 0.788 SNIP 1.574 CiteScore 1.89
Scopus rating (2011): SJR 0.829 SNIP 1.445 CiteScore 1.69
Scopus rating (2010): SJR 0.698 SNIP 1.134
Scopus rating (2009): SJR 0.644 SNIP 1.098
Scopus rating (2008): SJR 0.788 SNIP 1.165
Scopus rating (2007): SJR 0.71 SNIP 1.152
Scopus rating (2006): SJR 0.913 SNIP 1.232
Scopus rating (2005): SJR 1.024 SNIP 1.258
Scopus rating (2004): SJR 0.813 SNIP 1.129
Scopus rating (2003): SJR 1.056 SNIP 1.094
Scopus rating (2002): SJR 1.078 SNIP 1.027
Scopus rating (2001): SJR 0.707 SNIP 1.007
Scopus rating (2000): SJR 0.831 SNIP 1.022
Scopus rating (1999): SJR 0.918 SNIP 1.249
Original language: English
Keywords: Helmholtz free energy, magnetic hysteresis, magnetoelasticity, magnetostriction, strain, stress
Electronic versions:
Rasilo2015
DOIs:
10.1109/TMAG.2015.2468599
Links:
Research output: Scientific - peer-review › Article

Wear resistance of HVOF sprayed coatings from mechanically activated thermally synthesized Cr3C2–Ni spray powder
In the current study a Cr3C2–Ni spray powder was produced by mechanically activated thermal synthesis. The following aspects were studied: (a) production and characteristics of spray powders, (b) spraying and characteristics of coatings by HVOF, and (c) abrasive wear resistance. A HVOF spray system Diamond Jet Hybrid 2700 (propane hybrid gun from Sulzer Metco) was used for deposition. Coating thickness was approximately 350–400 μm. The structure and composition of the coatings were determined by SEM and the phase composition by XRD methods. Coating surface hardness and microhardness in the cross-section were measured. Abrasive rubber-wheel wear (ARWW) and abrasive erosive wear (AEW) were tested. The wear resistance of the coatings produced from an experimental powder was comparable to that of a similar commercial one.

General information
State: Published
High strain rate radial compression of Norway spruce earlywood and latewood

The mechanical properties of Norway spruce were studied and a compression model for mechanical pulping was developed. The split-Hopkinson pressure bar technique was combined with high-speed photography to analyse local radial compression. Data analysis focussed on the differences between mechanical properties of earlywood and latewood. Measurements were conducted at both room temperature and 135 °C. The effect of pre-fatigue treatment was also studied. A simple material model was defined linearly in parts and fitted to the measurement data to quantify the differences. New results were found on the differences in inelastic behaviour of earlywood and latewood at large deformations. In addition, other results were in line with previously published results.
Corrosion testing of anisotropic conductive adhesive interconnections on FR4, liquid crystal polymer and polyimide substrates

Anisotropic conductive adhesive films (ACF) have been widely studied for numerous applications. However, their resistance to corrosion in highly corrosive environments has been studied only very little. This study investigated the reliability and behaviour of ACFs in corrosive salt spray environment. ACF was used to attach flip chip (FC) components on FR4, liquid crystal polymer (LCP) and polyimide (PI) substrates and the FC packages were subjected to a salt spray test lasting 3000 h. The FC packages had daisy chain structures which were measured continuously in real time during testing. After testing cross sections of the tested packages were examined using an optical microscope and a scanning electron microscope (SEM). Most components failed during the test and the results showed significant differences between the various substrate materials. The LCP substrate performed considerably better than the other substrates and the PI substrate proved to have the poorest reliability. Corrosion of the pads on the substrates as well as open joints was seen in all substrate materials. The corrosion behaviour as well as the differences between the substrates showed that the substrate structure and material are critical factors in corrosive environments and should be carefully considered. The reliability of the ACF FC package with the LCP substrate was found to be good, as the test was very severe and no failures occurred during the first 625 h of testing and only 20% failed during the first 1000 h.
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.
Color Bricks: Building Highly Organized and Strongly Absorbing Multicomponent Arrays of Terpyridyl Perylenes on Metal Oxide Surfaces

Terpyridine-substituted perylenes containing cyclic anhydrides in the peri position were synthesized. The anhydride group served as an anchor for assembly of the terpyridyl-crowned chromophores as monomolecular layers on metal oxide surfaces. Further coordination with Zn²⁺ ions allowed for layer-by-layer formation of supramolecular assemblies of perylene imides on the solid substrates. With properly selected anchor and linker molecules it was possible to build high quality structures of greater than ten successive layers by a simple and straightforward procedure. The prepared films were stable and had a broad spectral coverage and high absorbance. To demonstrate their potential use, the synthesized dyes were employed in solid-state dye-sensitized solar cells, and electron injection from the perylene antennas to titanium dioxide was observed.
1550 nm high-power tapered DBR-laser diodes

This paper reports the DBR-RWG surface grating design, the fabrication process, and the output characteristics of tapered DBR laser diodes for applications such as LIDAR and range finding that require eye-safe high-power single-mode coherent light sources. The regrowth-free AlGaInAs/InP DBR 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. By changing the length of the tapered section from 0.5 mm to 4.0 mm, the maximum CW power could be scaled from 125 mW to 560 mW at room temperature.

Accelerated deactivation studies of the natural-gas oxidation catalyst-Verifying the role of sulfur and elevated temperature in catalyst aging

Accelerated deactivation, caused by thermal aging (TA) and/or sulfur+water poisoning (SW), of the PtPd/γ-Al2O3 natural-gas oxidation catalyst was studied. Thermal aging and poisoning treatments were performed separately and with varied combinations and comprehensive characterization of the catalyst was carried out after each step. The fresh catalyst has small, oxidized PtPd particles (<5nm) uniformly distributed in the γ-alumina washcoat. After the SW-treatment, a small amount of bulk aluminum sulfate was observed near the slightly grown noble metal particles. During the thermal aging, γ-alumina changed to δ- and α-alumina. In addition, total decomposition of oxidized Pt and partly decomposition of oxidized Pd occurred resulting in the formation of the grown noble metal particles with a bimetallic PtPd core and a polycrystalline PdO shell. Also few, small (~5nm) bimetallic PtPd particles were still detected. In the TA+SW-treated
catalyst with grown noble metal particles, a small amount of bulk aluminum sulfate was detected and it was randomly distributed over the noble metal particles and washcoat. The activity in the terms of methane conversion over the TA-, SW-, and SW+TA-treated catalysts was similar but it was decreased compared to the fresh catalyst. The activity of the TA+SW-treated catalyst was drastically decreased compared to the fresh catalyst due to significant morphological changes and aluminum sulfate formation.

**General information**

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, University of Oulu, Aalto University, Chalmers University of Technology, Dinex Ecocat Oy
Number of pages: 10
Pages: 439-448
Publication date: 2016
Peer-reviewed: Yes
Early online date: 1 Oct 2015

**Publication information**

Journal: Applied Catalysis B-Environmental
ISSN (Print): 0926-3373
Ratings:
Scopus rating (2016): SJR 2.583 SNIP 2.12 CiteScore 8.86
Scopus rating (2015): SJR 2.26 SNIP 2.081 CiteScore 7.72
Scopus rating (2014): SJR 2.232 SNIP 2.164 CiteScore 6.92
Scopus rating (2013): SJR 2.345 SNIP 2.134 CiteScore 6.42
Scopus rating (2012): SJR 2.629 SNIP 2.236 CiteScore 6.08
Scopus rating (2011): SJR 2.585 SNIP 2.345 CiteScore 6.14
Scopus rating (2010): SJR 2.461 SNIP 1.895
Scopus rating (2009): SJR 2.301 SNIP 2.232
Scopus rating (2008): SJR 2.455 SNIP 2.275
Scopus rating (2007): SJR 2.493 SNIP 2.5
Scopus rating (2006): SJR 2.284 SNIP 2.229
Scopus rating (2005): SJR 2.095 SNIP 2.233
Scopus rating (2004): SJR 2.393 SNIP 2.41
Scopus rating (2003): SJR 1.979 SNIP 2.259
Scopus rating (2002): SJR 2.304 SNIP 1.847
Scopus rating (2001): SJR 2.781 SNIP 2.441
Scopus rating (2000): SJR 2.687 SNIP 2.13
Scopus rating (1999): SJR 2.18 SNIP 1.874
Original language: English
ASJC Scopus subject areas: Catalysis, Process Chemistry and Technology, Environmental Science(all)
Keywords: Deactivation, Palladium, Platinum, Sulfur poisoning, Thermal aging
Electronic versions:
Honkanen et al_revised manuscript. Embargo ended: 1/10/17
DOIs: 10.1016/j.apcatb.2015.09.054
Source: Scopus
Source-ID: 84943638016
Research output: Scientific - peer-review › Article

A novel micro-robotic approach to study the environmental degradation of matrix and fibre materials

**General information**

State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Department of Automation Science and Engineering, Research area: Microsystems, Outotec Research Center
Corrosion Behavior of WC-FeCrAl Coatings Deposited by HVOF and HVAF Thermal Spraying Methods

The present work compares the mechanical properties and corrosion resistance of WC-FeCrAl coatings manufactured using high-velocity oxygen fuel (HVOF) technology equipped with DJ2700 spraying gun and high-velocity air fuel (HVAF) equipment using M3 supersonic spraying gun. The results indicated that decarburization of carbide phase occurred in both. It was found out that the deposition velocity is an important factor influencing the density of the coating and thus the amount of porosity. The HVAF sprayed WC-FeCrAl coating revealed the lowest degree of porosity, higher hardness and lower degree of decarburization, achieving the best properties in terms of electrochemical corrosion resistance compared to HVOF sprayed coating.

Corrosion Losses in Sintered (Nd,Dy)-Fe-B Magnets vs. Magnet geometry

Sintered Nd-Fe-B magnets with cube and flat geometries were exposed to pressurized heat-humidity corrosion tests for the durations of 96 and 240 hours. Parallel measurements of weight and flux losses were performed after the corrosion tests. The corroded specimens were further characterized using scanning electron microscopy and optical profilometry. The microcrystalline anisotropy of sintered magnets gave rise to heterogeneous corrosion behavior, where the pole faces degraded preferentially to the side faces. The magnetic field by the magnet itself thus contributed to the amount and location of detached ferromagnetic grains. The magnets with cube geometry suffered greater losses than the flat magnets, even though the flat magnets had a higher relative amount of the pole face. The higher total flux (due to a larger volume) of the cube-shaped magnets led to the higher overall losses. In the flat magnets, the corrosion concentrated heavily on areas near the corners.
Corrosion propagation phase studies on Finnish reinforced concrete facades

This work discusses a research project on active corrosion as a part of the service life of concrete facade panels in Nordic climate. The objective of the studies was to contribute to the knowledge on the corrosion propagation phase in these structures under actual long term weather exposure and to generate data for its modelling purposes. The project combined statistical analysis of a large database of condition investigation data to the more in-depth analysis of twelve case buildings and field measurement data on reinforcement corrosion. Corrosion rate was tied to long term weather data representing the geographical location of the buildings. As one of the results it was shown that, although carbonation resistance remains as the primary factor in ensuring proper service life, the modelling of active corrosion may provide a considerable extension to it.
Dilute Nitride Four-Junction Solar Cell

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Optoelectronics Research Centre, Tampere University of Technology
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

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
State: Published
Ministry of Education 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, Åbo Akademi University, Paroc Group Oy, Åbo Akademi University
Authors: Hupa, L., Fagerlund, S., Massera, J., Björkvik, L.
Number of pages: 6
Pages: 41-46
Electrical isolation of dilute nitride solar cells by wet etching

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

Electrical isolation of high-efficiency dilute nitride multijunction solar cells

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Raappana, M., Polojärvi, V., Aho, T., Aho, A., Tukiainen, A., Hytönen, L., Isoaho, R., Guina, M.
Publication date: 2016

Host publication information
Title of host publication: Physics days 2016 : Proceedings of the 50th annual conference of the Finnish Physical Society
Place of publication: Oulu
Publisher: Finnish Physical Society
Experimental and numerical study of a drill bit drop tests on Kuru Granite

General information
State: E-pub ahead of print
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization
Authors: Fourmeau, M., Kane, A., Hokka, M.
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Philosophical Transactions of the Royal Society A: Mathematical Physical and Engineering Sciences
ISSN (Print): 1364-503X
Ratings:
Scopus rating (2016): SJR 0.874 SNIP 1.024 CiteScore 2.26
Scopus rating (2015): SJR 0.78 SNIP 0.985 CiteScore 2.08
Scopus rating (2014): SJR 0.847 SNIP 1.256 CiteScore 2.39
Scopus rating (2013): SJR 1.12 SNIP 1.534 CiteScore 3.12
Scopus rating (2012): SJR 1.068 SNIP 1.387 CiteScore 2.89
Scopus rating (2011): SJR 0.964 SNIP 1.297 CiteScore 2.65
Scopus rating (2010): SJR 1.095 SNIP 1.365
Scopus rating (2009): SJR 1.068 SNIP 1.309
Scopus rating (2008): SJR 0.867 SNIP 1.016
Scopus rating (2007): SJR 0.683 SNIP 0.685
Scopus rating (2006): SJR 0.856 SNIP 0.888
Scopus rating (2005): SJR 0.843 SNIP 0.824
Scopus rating (2004): SJR 0.651 SNIP 0.834
Scopus rating (2003): SJR 0.527 SNIP 0.765
Scopus rating (2002): SJR 0.368 SNIP 0.631
Scopus rating (2001): SJR 0.296 SNIP 0.4
Scopus rating (2000): SJR 0.315 SNIP 0.393
Scopus rating (1999): SJR 0.436 SNIP 0.297
Original language: English
DOIs:
10.1098/rsta.2016.0176
Research output: Scientific - peer-review › Article

Experimental Investigation of the Internal Heating of Metals in a Wide Range of Strain Rates Using Simultaneous Digital Image Correlation and High Speed Infrared Imaging

Internal heating of plastically deforming materials has been studied quite extensively, in particular to determine the fractions of external work energy that are converted to heat or stored in the internal defect structure of the material. For the fraction of the energy converted to heat, the results from both theoretical considerations and experimental studies range widely from some tens of percent to full 100%, depending on the studied material, applied methodologies and experimental techniques, and assumptions and simplifications made in the calculations and manipulation of the experimental data. As recently many of the experimental techniques used in materials research have developed enormously, completely new possibilities for the research of the above mentioned questions now exist. In this work, the plastic deformation behavior and related thermal response of austenitic stainless steels were studied using simultaneous full-field digital image correlation and thermal mapping of the surface strains and temperatures of the specimens.

General information
State: Published
Organisations: Department of Materials Science, Research group: Materials Characterization, The Ohio State University, Columbus, OH, USA, Department of Mechanical Engineering
Authors: Kuokkala, V., Smith, J., Seidt, J., Gliat, A.
Failure analysis of a leaching reactor made of glass-fiber reinforced plastic

This paper reports a failure analysis of a leaching reactor in a zinc plant that suffered from a catastrophic failure after less than two years of operation. During normal operation the bottom of the reactor fell out suddenly, releasing the contents, a high-temperature acidic solution, into the surroundings in an uncontrollable manner. The reactor was made of glass-fiber reinforced plastic. Microscopy, thermal analysis, mechanical testing and finite element analyses were employed to investigate the causes of the failure. There were several contributing factors but the root cause was poor adhesion between the bottom and the joint laminate, which was caused by insufficient grinding during the surface preparation stage of the joint.

General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Outotec Research Center, Bergman Polymer Corrosion AB, Outotec (Finland) Oy, Aalto University
Authors: Lindgren, M., Bergman, G., Kakkonen, M., Lehtonen, M., Jokinen, J., Wallin, M., Saarela, O., Vuorinen, J.
Pages: 117-136
Publication date: 2016
Peer-reviewed: Yes
Early online date: 17 Nov 2015

Publication information

Journal: Engineering Failure Analysis
Volume: 60
ISSN (Print): 1350-6307
Ratings:
Scopus rating (2016): SJR 0.972 SNIP 1.681 CiteScore 2.06
Scopus rating (2015): SJR 0.904 SNIP 1.586 CiteScore 1.84
Scopus rating (2014): SJR 0.916 SNIP 2.05 CiteScore 1.55
Scopus rating (2013): SJR 0.853 SNIP 2.074 CiteScore 1.48
Scopus rating (2012): SJR 0.878 SNIP 1.786 CiteScore 1.2
Scopus rating (2011): SJR 0.921 SNIP 2.027 CiteScore 1.47
Scopus rating (2010): SJR 0.813 SNIP 1.585
Scopus rating (2009): SJR 0.722 SNIP 1.927
Scopus rating (2008): SJR 0.599 SNIP 1.131
Scopus rating (2007): SJR 0.64 SNIP 1.58
Scopus rating (2006): SJR 0.537 SNIP 1.182
Scopus rating (2005): SJR 0.826 SNIP 1.142
Scopus rating (2004): SJR 0.273 SNIP 0.775
Scopus rating (2003): SJR 0.297 SNIP 1.115
Scopus rating (2002): SJR 0.542 SNIP 1.019
Scopus rating (2001): SJR 0.187 SNIP 0.299
Scopus rating (2000): SJR 0.173 SNIP 1.194
Scopus rating (1999): SJR 0.155 SNIP 0.168
Original language: English
Keywords: Composites, Environmental interaction, Failure analysis, Process-plant failures, Tank
ASJC Scopus subject areas: Materials Science(all), Engineering(all)
DOIs:
10.1016/j.engfailanal.2015.11.026
Source: Scopus
Source-ID: 84947714105
Research output: Scientific - peer-review Article
Functionalizing Surface Electrical Potential of Hydroxyapatite Coatings

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Surface Engineering, Riga Technical University, University of Adelaide
Authors: Pluduma, L., Freimanis, E., Gross, K., Koivuluoto, H., Algate, K., Haynes, D., Vuoristo, P.
Number of pages: 6
Pages: 12-17
Publication date: 2016

Host publication information
Title of host publication: 11th International Conference Medical Applications of Novel Biomaterials and Nanotechnology
Volume: 102
ISBN (Print): 978-3-0357-1125-7

Publication series
Name: Advances in Science and Technology
Volume: 102
ISSN (Print): 1661-819X

Bibliographical note
JUFOID=75599
Research output: Scientific - peer-review → Conference contribution

HCl-based wet etching of III-V dilute nitride materials for multijunction solar cells

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Publication date: 2016
Peer-reviewed: Unknown
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 unused 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, Essential 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 % per 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 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 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.
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.
Increasing the quantum efficiency of GaInNAs solar cells by advanced optical design

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Aho, T. A., Aho, A., Tukiainen, A., Polojärvi, V., Raappana, M., Guina, M.
Publication date: 2016
Peer-reviewed: Unknown
Event: Paper presented at Optics and Photonics days, Tampere, Finland.
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
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-8fbe1d85fe7
Links: https://www.maxlab.lu.se/node/2032#I311-PEEM_
Research output: Professional › Commissioned report

Influence of multiwalled carbon nanotubes on the processing behavior of epoxy powder compositions and on the mechanical properties of their fiber reinforced composites
This study reports the preparation of advanced carbon fiber composites with a nanocomposite matrix prepared by dispersing multiwall carbon nanotubes (CNTs) in a powder type epoxy oligomer with two different processing techniques (1) master batch dilution technique and (2) direct mixing (with the help of twin-screw extruder in both cases). The master batch technique shows a better efficiency for the dispersion of the CNTs aggregates. The rheological results demonstrate that the incorporation of the CNTs into the epoxy oligomer leads, as expected, to a marked increase in the viscosity and of the presence of a yield stress point that also depends on the processing technique adopted. Carbon fiber (CFRP) and glass fiber (GFRP) composite materials were produced by electrostatic spraying of the epoxy matrix formulations on the carbon and glass fabric, respectively, followed by calendering and mold pressing. The mechanical properties of the obtained epoxy/CNT-matrix composite materials, such as interlaminar fracture toughness, flexural strength, shear storage and loss moduli are discussed in terms of the processing techniques and fabric material. The incorporation of 1 wt% CNTs in the epoxy matrix results in a relevant increase of the fracture toughness, flexural strength and modulus of both CFRP and GFRP. POLYM. COMPOS., 2015. © 2015 Society of Plastics Engineers

General information
State: Published
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology
Authors: Vaganov, G., Yudin, V., Vuorinen, J., Molchanov, E.
Pages: 2377-2383
Publication date: 2016
Peer-reviewed: Yes
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
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Surface Engineering, Research group: Materials Characterization, University of Helsinki
Authors: Kotilainen, M., Honkanen, M., Mizohata, K., Vuoristo, P.
Number of pages: 10
Pages: 323-332
Publication date: 2016
Peer-reviewed: Yes
In vivo genotoxic effects of uncoated and coated CeO2 NPs administrated to mice by pharyngeal aspiration

General information
State: Published
Organisations: Department of Materials Science, Research group: Materials Characterization, Työterveyslaitos, University of Zaragoza, Leitat Tecnologico Center
Authors: Catalan, J., Aimonen, K., Hartikainen, M., Vippola, M., Moreno, C., Cabellos, J., Janer, G., Vazquez-Campos, S., Wolff, H., Savolainen, K., Norppa, H.
Number of pages: 1
Publication date: 2016
Peer-reviewed: Unknown
Research output: Scientific › Paper, poster or abstract

Machine-coated starch-based dispersion coatings prevent mineral oil migration from paperboard

Mineral oil migration through paperboard presents a safety risk in modern food packaging. This study aimed to enhance the safety of fiber-based packaging by utilizing a bio-based composite barrier layer to protect against mineral oil. Starch-clay composite coatings on paperboard were created via dispersion coating. Thermal analysis of the coating components and field emission scanning electron microscopy imaging were performed to ascertain the physicochemical properties and morphology of the coatings. Coating functionality was evaluated using contact angles and transmission rate (water and oxygen) measurements. The packaging safety focus was implemented by measuring the gas phase migration of heptane and analyzing the migration of liquid mineral oil through the coated paperboards with FTIR. The functional properties of the coated paperboards were maintained or improved. The studied coatings were effective barriers against the migration of mineral oil and could hence improve the barrier properties and safety of fiber-based primary food packaging.

General information
State: Published
Modelling and Analysis of Elastic and Thermal Deformations of a Hydrodynamic Radial Journal Bearing

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Tribology and Machine Elements
Authors: Linjamaa, A., Lehtovaara, A., Kallio, M., Söchting, S.
Number of pages: 6
Pages: 127-132
Publication date: 2016
Peer-reviewed: Yes
Early online date: 1 Jan 2015

Publication information
Journal: Key Engineering Materials
Volume: 674
ISSN (Print): 1013-9826
Ratings:
Scopus rating (2016): CiteScore 0.24 SJR 0.163 SNIP 0.253
Scopus rating (2015): SJR 0.171 SNIP 0.228 CiteScore 0.21
Scopus rating (2014): SJR 0.212 SNIP 0.349 CiteScore 0.23
Scopus rating (2013): SJR 0.19 SNIP 0.308 CiteScore 0.21
Scopus rating (2012): SJR 0.172 SNIP 0.377 CiteScore 0.19

Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging
Authors: Koivula, H. M., Jalkanen, L., Saukkonen, E., Ovaska, S., Lahti, J., Christophliemk, H., Mikkonen, K. S.
Pages: 173-181
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Progress in Organic Coatings
Volume: 99
ISSN (Print): 0300-9440
Ratings:
Scopus rating (2016): SJR 0.852 SNIP 1.3 CiteScore 2.89
Scopus rating (2015): SJR 0.849 SNIP 1.39 CiteScore 2.84
Scopus rating (2014): SJR 0.992 SNIP 1.566 CiteScore 2.8
Scopus rating (2013): SJR 1.03 SNIP 1.663 CiteScore 2.58
Scopus rating (2012): SJR 1.043 SNIP 1.862 CiteScore 2.39
Scopus rating (2011): SJR 0.884 SNIP 1.606 CiteScore 2.34
Scopus rating (2010): SJR 0.983 SNIP 1.537
Scopus rating (2009): SJR 0.867 SNIP 1.333
Scopus rating (2008): SJR 0.829 SNIP 1.298
Scopus rating (2007): SJR 1.088 SNIP 1.362
Scopus rating (2006): SJR 1.243 SNIP 1.598
Scopus rating (2005): SJR 0.928 SNIP 1.168
Scopus rating (2004): SJR 0.692 SNIP 1.121
Scopus rating (2003): SJR 0.604 SNIP 1.497
Scopus rating (2002): SJR 1.037 SNIP 1.312
Scopus rating (2001): SJR 0.619 SNIP 0.92
Scopus rating (2000): SJR 0.857 SNIP 1.132
Scopus rating (1999): SJR 0.723 SNIP 1.167
Original language: English
Keywords: Mineral oil migration; Barrier; Dispersion coating; Paperboard; Food packaging
DOIs:
10.1016/j.porgcoat.2016.05.017
Research output: Scientific - peer-review › Article
Normal displacements in non-Coulomb friction conditions during fretting

Non-Coulomb friction may occur in gross sliding fretting conditions, in which the tangential force increases as the fretting movement approaches its extreme position and produces 'hooked' fretting loops. Uncertainties in frictional behaviour make the design of highly loaded contacts against fretting a challenging task. Experiments were made with quenched and tempered steel, and cyclic normal displacements were discovered during non-Coulomb friction conditions. Normal displacement and non-Coulomb friction were caused by tangential fretting scar interactions between protrusions and depressions formed by material transfer. Tangential interlocking leads to inclined sliding conditions, which produce loading components in both tangential and normal directions; this explains most non-Coulomb friction.
Optimizing iron alloy catalyst materials for photoelectrochemical water splitting: Passivation of FeCr alloy surface by water vapour using near-ambient-pressure photoelectron spectroscopy

Performance of a Polymer-Based Sensor Package at Extreme Temperature

There is an increasing need for inexpensive packaging structures for demanding industrial electronics applications. This paper studies the usability of a polymer-based sensor package at very high temperatures. Resistance-based temperature sensors were attached with polymer-based electrically conductive adhesives (ECAs) onto flexible polyimide (PI) printed circuit boards (PCB). The materials used in the structure were not specifically designed for high temperature use. However, they were all commercial materials, easily available and typically reliable under normal use conditions of consumer electronics. The samples were aged at 240°C and electrically monitored during the test. Electrically, the sensor samples were observed to fail after 100 h of aging. However, material characterisation revealed that the materials started to degrade much earlier. The adhesive layer in the PI PCB and the ECA materials started to degrade after just 30 h of aging at 240°C, and mechanically the materials were observed to become brittle, making them prone to cracking and delamination. The results showed that such a polymer package is usable at 240°C for relatively short exposure times, but under longer exposure times the mechanical reliability of the package deteriorates and this needs to be taken into account.
Photoluminescence properties of novel GaAsBi compounds fabricated by molecular beam epitaxy

Planar fluidic channels on TiO2 nanoparticle coated paperboard

Planar fluidic channels on TiO2 nanoparticle coated paperboard
A new design for permanent, low-cost, and planar fluidic channels on TiO2 nanoparticle coated paperboard is demonstrated. Initially superhydrophobic TiO2 nanoparticle coatings can be converted to hydrophilic by ultraviolet (UVA) light, and fluidic channels can be generated. A simple water treatment after the UVA illumination converts the channels permanent when nanoparticles are removed from the illuminated and wetted areas as shown by water contact angle, FE-SEM, XPS, and ToF-SIMS analysis. This suggests new routes for inexpensive, easy to use point-of-care diagnostics based on planar fluidic channels.
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


Links:


Research output: Scientific › Paper, poster or abstract

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

Ministry of Education 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

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 › Conference contribution

The Characterization of Flame Cut Heavy Steel – The Residual Profiling of Heat Affected Surface Layer

Flame cutting is commonly used thermal cutting method in metal industry when processing thick steel plates. Cutting is performed with controlled flame and oxygen jet, which burns steel and forms cutting edge. Flame cutting process is based on controlled chemical reaction between steel and oxygen at elevated temperature. Flame cutting of thick wear-resistant steels is challenging while it can result in cracks on and under the cut edge. Flame cutting causes uneven temperature distribution in the plate, which can introduce residual stresses. In addition, heat affected zone (HAZ) is formed and there both volume and microstructural changes as well as hardness variations are taking place. Therefore flame cutting always causes thermal stress, shape changes and consequently residual stresses to the material. Material behaviour under thermal and mechanical loading depends on the residual stress state of the material. Due to this, it is important to be able to measure the residual stresses. The aim of this study was to examine residual stresses on the cutting edge as a function of flame cutting parameters. Also resulting microstructures and hardness values were verified. Varying parameters were the cutting speed, preheating and post heating procedures. Flame cut samples were investigated with X-ray diffraction method to produce residual stress profiles of the heat affected surface layer. Results indicated that different cutting parameters provide different residual stress profiles and that these profiles can be modified by changing the cutting speed and pre- or post-treatment procedures. Cutting parameters also affect the depth of the reaustenized region in the surface. The results correlate well with the actual industrial flame cutting and thus they provide an effective tool for optimizing the flame cutting process parameters.

**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed
The effects of microstructure on erosive-abrasive wear behavior of carbide free bainitic and boron steels

The wear resistance of carbide free bainitic (CFB) microstructures have shown to be excellent in sliding, sliding-rolling and erosive-abrasive wear. Whereas, boron steels are often an economically favorable alternative used in applications subjected to erosive and abrasive wear. In this study the erosive-abrasive wear resistance of CFB and boron steels with different heat treatments were compared and the effect of microstructure on wear was investigated. An application oriented dry-pot laboratory test method with 8-10 mm granite gravel was used to produce erosive-abrasive wear environment. The tested materials were CFB and boron steels. The CFB steels had hardness values of 500 and 600 HV. The boron steels, both quenched and quenched and tempered, had a hardness of 500 HV. The influence of the microstructures on wear was studied by wear test results as well as by optical and scanning electron microscopy. The phase compositions were determined by XRD. The effect of wear, in addition to weight loss was also characterized by surface profilometry, hardness and hardness profile determinations. The wear resistance of the steels was compared with results achieved in a field test in an industrial mining application. Moreover, the effect of the different microstructures on wear behavior is discussed. The carbide free bainitic steels showed better wear performance than the martensitic boron steels. The boron steels were subjected to microcutting and microploughing, whereas the CFB steels exhibited more shallow impact craters with thin platelets.
The role of microstructure in high stress abrasion of white cast irons

The abrasion wear resistance of white cast irons can be controlled primarily by adjusting the size, size distribution, and volume fraction of the carbide phase. The main physical property of white cast irons correlating with abrasion resistance is hardness. This study concentrates on the evaluation of hardened and stress relieved, normalized, self-hardened, and as-cast states of high chromium white cast irons in high stress abrasion. The correct size and orientation of the carbides were found to be crucial for the wear resistance of white cast irons in high stress abrasive conditions. The different annealing procedures affected the formation of the carbide structure and its distribution, as well as the microstructure of the matrix. The austenite-to-martensite ratio together with a beneficial carbide structure was found to have a strong effect on the abrasion wear resistance of WCI specimens.

Towards material excellence: Evaluation of Tekes' programmes on materials

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Virebit Oy
Authors: Timonen, J., Antikainen, M., Das, A., Sarlin, E., Vuorinen, J.
Number of pages: 61
Publication date: 2016

Publication Information
Publisher: Tekes
Original language: English
Links:
http://www.tekes.fi/tekes/julkaisut1/towards-material-excellence--42016/
Research output: Professional › Commissioned report

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

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, Research group: Nanophotonics
Number of pages: 2
Publication date: 2016

Publication Information
Place of publication: Lund
Uniform and electrically conductive biopolymer-doped polypyrrole coating for fibrous PLA

Three-dimensional, fibrous scaffolds can be easily fabricated from polylactide (PLA) using melt spinning and textile techniques. However, the surface properties of PLA scaffolds are not ideal for tissue engineering purposes. Furthermore, electrically conducting scaffolds are required to deliver electrical stimulation to cells. In this study, uniform, electrically conducting polypyrrole (PPy) coatings were fabricated on biodegradable PLA fibers. Biopolymer dopants-hyaluronic acid (HA) and chondroitin sulfate (CS)-were compared, and a PPy/CS composition was analyzed further. The effect of the oxidative polymerization conditions on the PLA fibers and CS counterion was studied. Furthermore, the initial molecular weight of CS and its degree of polymerization were determined. Our experiments showed that the molecular weight of CS decreases under oxidizing conditions but that the decay is not significant with the short polymerization process we used. The coating process was transferred to nonwoven PLA fabrics, and the stability of PPy/CS coating was studied during in vitro incubation in phosphate buffer solution at physiological temperature. The conductivity and surface roughness of the coating decayed during the 20-day incubation. The mechanical strength, however, remained at the initial level. Thus, the fabricated structures are suitable for short-term electrical stimulation adequate to promote cell functions in specific cases.
Wear and impact behaviour of High Velocity Air-Fuel sprayed Fe-Cr-Ni-B-C alloy coatings
The tribological properties of High Velocity Air-Fuel sprayed Fe-31Cr-12Ni-3.6B-0.6C (wt%) coatings are studied as a function of the deposition parameters. At room temperature, ball-on-disk sliding against Al₂O₃ is controlled by abrasive grooving and interlamellar cracking, with some tribo-oxidation. Interlamellar crack propagation also controls the coatings response to cavitation erosion and cyclic impact tests. Coatings deposited with higher powder feed rate exhibit poorer performance under all conditions, because of weaker interlamellar cohesion. At 700 °C, sliding wear rates are levelled out, and they are one order of magnitude higher than at room temperature, because of severe abrasive grooving.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Surface Engineering, University of Modena and Reggio Emilia
Authors: Bolelli, G., Milanti, A., Lusvarghi, L., Trombi, L., Koivuluoto, H., Vuoristo, P.
Pages: 372-390
Publication date: 2016
Peer-reviewed: Yes
Early online date: 30 Nov 2015

Publication information
Journal: Tribology International
Volume: 95
ISSN (Print): 0301-679X
Ratings:
Scopus rating (2016): CiteScore 3.16 SJR 1.382 SNIP 2.094
Scopus rating (2015): SJR 1.437 SNIP 2.04 CiteScore 2.61
Scopus rating (2014): SJR 1.545 SNIP 2.5 CiteScore 2.44
Scopus rating (2013): SJR 1.473 SNIP 2.793 CiteScore 2.51
Scopus rating (2012): SJR 1.406 SNIP 2.331 CiteScore 1.96
Scopus rating (2011): SJR 1.247 SNIP 2.209 CiteScore 1.89
Scopus rating (2010): SJR 1.394 SNIP 2.159
Scopus rating (2009): SJR 1.294 SNIP 2.09
Scopus rating (2008): SJR 1.365 SNIP 1.823
Scopus rating (2007): SJR 1.195 SNIP 1.766
Scopus rating (2006): SJR 1.082 SNIP 1.744
Scopus rating (2005): SJR 0.916 SNIP 1.809
Scopus rating (2004): SJR 1.062 SNIP 1.541
Scopus rating (2003): SJR 1.256 SNIP 1.567
Scopus rating (2002): SJR 0.68 SNIP 1.137
Scopus rating (2001): SJR 0.768 SNIP 1.041
Scopus rating (2000): SJR 0.731 SNIP 0.966
Scopus rating (1999): SJR 0.778 SNIP 0.985
Original language: English
Keywords: Cavitation damage, Impact wear, Sliding contact, Thermally-sprayed coating
ASJC Scopus subject areas: Mechanical Engineering, Mechanics of Materials, Surfaces, Coatings and Films, Surfaces and Interfaces
DOIs:
10.1016/j.triboint.2015.11.036
Source: Scopus
Source-ID: 84949804098
Research output: Scientific - peer-review › Article

Wear performance of quenched wear resistant steels in abrasive slurry erosion
Three commercially available quenched wear resistant steel grades were compared with a structural steel and four elastomer materials to reveal the differences in their behavior in slurry erosion conditions and to find the best solutions for demanding applications. A slurry-pot tester, allowing simulation of various wear conditions with different minerals, particle sizes (up to 10 mm), abrasive concentrations, and sample angles were used to simulate different industrial slurry applications. In this study, granite and quartz with concentrations of 9 and 33 wt% were used as abrasives in tests conducted at 45° and 90° sample angles. The performance of the studied steels was evaluated with respect to their material properties such as hardness and microstructure. Furthermore, the cross-sections and wear surfaces of the test
samples were analyzed to reveal the possible differences in the mechanical behavior of the materials during slurry erosion. The wear surface analyses show that abrasion is the dominating wear mechanism already for the smallest particle size of 0.1/0.6 mm. In low-stress abrasive slurry erosion with the smallest particles, the elastomers showed better wear resistance than the steels, whereas in demanding high-stress abrasive slurry erosion conditions the quenched wear resistant steels can well compete with elastomers in wear resistance. The relative wear performance of the steels increased with increasing abrasive size, while for the elastomers it decreased.

ZnFe Coated 22MnB5 Steels in Direct Press Hardening: the Relationships between Coating Structure and Process Parameters

Abstract. Two types of press hardening experiments were carried out to investigate the behavior of ZnFe coated 22MnB5 steel in direct press hardening process. The coating properties were studied using variable process temperatures and times with a flat-die and a forming tool. Coatings were analyzed with optical and scanning electron microscopes. The results indicated that steels that have low coating weights (40/40 and 50/50 g/m²) may be processed successfully with short dwell times. For high coating weights (70/70 and 80/80 g/m²) a significantly longer dwell time is needed. The behavior of ZnFe coating in hot press forming experiments was in line with literature and the findings of the flat-die experiments. Thus, the feasibility of the experimental press hardening equipment was confirmed.
SESAM mode-locked Tm:CALGO laser at 2 µm
GaSb-based SESAM is successfully employed for passive mode locking of a Tm3+:CaGdAlO4 laser operating near 2 µm. The pulse duration is around 650 fs at a repetition rate ~100 MHz.
Laser sintering of copper nanoparticles on top of silicon substrates
This study examines the sintering of inkjet printed nanoparticle copper ink in a room environment using a laser as a high speed sintering method. Printed patterns were sintered with increasing laser scanning speed up to 400 mm s⁻¹. The resistivities of the sintered structures were measured and plotted against the scanning speeds. Increased resistivity seems to correlate with increased scanning speed. A selection of analytical methods was used to study the differences in microstructure and composition of the sintered structures. Based on the results, no discernable difference in the microstructure was noticed between the structures sintered using 20 mm s⁻¹ to 400 mm s⁻¹ scanning speeds; only the structure scanned using 5 mm s⁻¹ speed showed a vastly different microstructure and no resistivity was measurable on this structure. Compositional studies revealed that, apart from the structure scanned with 5 mm s⁻¹ speed which contained the highest oxygen, the rest of the structures showed a steady oxygen increase with increased scanning speed.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Augmented Human Activities (AHA), Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Department of Materials Science, Research group: Materials Characterization
Authors: Soltani, A., Khorramdel, B., Mardoukhi, A., Mäntysalo, M.
Number of pages: 5
Publication date: 9 Dec 2015
Peer-reviewed: Yes

Publication information
Journal: Nanotechnology
Volume: 27
Issue number: 3
Article number: 035203
ISSN (Print): 0957-4484
Ratings:
Scopus rating (2016): CiteScore 2.74 SJR 1.082 SNIP 1.287
Scopus rating (2015): SJR 1.406 SNIP 1.411 CiteScore 3.07
Scopus rating (2014): SJR 1.546 SNIP 1.653 CiteScore 3.17
Scopus rating (2013): SJR 1.761 SNIP 2.378 CiteScore 3.42
Scopus rating (2012): SJR 1.625 SNIP 1.831 CiteScore 2.58
Original language: English
Keywords: inkjet, sintering, Resistance, Nanoparticles
Thermal Cycling Reliability Analysis of an Anisotropic Conductive Adhesive Attached Large-Area Chip with Area Array Configuration

The reliability of adhesive flip chip attachments was studied. A large-area chip with a great number of contacts was attached onto a flexible polyimide substrate using anisotropic conductive adhesive film (ACF). The test samples were manufactured using various bonding forces and the reliability of the assemblies was examined using a thermal cycling test. Two temperature change rates were used in the cycling test to study the effect of the change rate on the observed failure times and modes. The results show that the ACF flip chip attachment of large-area chips with matrix array interconnections is an applicable technique. Furthermore, a significant increase in the reliability of the assemblies was obtained by increasing the bonding force. However, early failures were observed in all the samples, especially in the outermost adhesive interconnections. Failure analysis performed on the samples exhibiting early failures showed signs of adhesive delamination and silicon chip cracking. No clear differences in the results between the two temperature cycling tests used were observed. However, the faster temperature change rate seemed to cause a higher number of early failures.

Thermal flow permeametry - A rapid method for finding local changes in flow channels

Solid bodies with flow channels can have very heterogeneous structure, whose local variations are difficult to analyze. Yet, this can play an important role affecting characteristics, such as, fluid flow property, strength and heat conductivity. This article presents a method named thermal flow permeametry (TFP) that is applicable for a quick analysis of variations in flow channels, even in meter-sized structures. For illustrating the method, we analyzed the local permeability levels of a large and extremely complex fiber structure. In TFP, hot air is ejected through a structure, while thermal camera measures local surface temperature variations during heating. Gray values of the thermal image are then plotted versus the structures local thickness, density and permeability. We showed that gray values link with local permeability, affected by thickness, density and flow channel tortuosity. We also found out that TFP is very sensitive to local changes in flow channels.
Corrosion products of carbonation induced corrosion in existing reinforced concrete facades

Active corrosion in reinforced concrete structures is controlled by environmental conditions and material properties. These factors determine the corrosion rate and type of corrosion products which govern the total achieved service life. The type and critical amount of corrosion products were studied by electron microscopy and X-ray diffraction on concrete and reinforcement samples from existing concrete facades on visually damaged locations. The corrosion products in outdoor environment exposed concrete facades are mostly hydroxides (Feroxyhite, Goethite and Lepidocrocite) with a volume ratio to Fe of approximately 3. The results can be used to calibrate calculation of the critical corrosion penetration of concrete facade panels.
Enhanced pre-treatment of cellulose pulp prior to dissolution into NaOH/ZnO

As a result of the constantly growing demand for textile fibres interest in utilising cellulose pulps for manufacturing regenerated cellulose fibres is growing. One promising water-based process for the manufacture of regenerated cellulose products is the Biocelol process based on an NaOH/ZnO solvent system. The drawback of the Biocelol process is the need for pre-treatment of the pulp, i.e. long mechanical pre-treatment (up to 5 h) followed by a 2–3-h enzymatic hydrolysis utilising a rather high amount of cellulolytic enzymes. In this work more efficient conditions to carry out the pre-treatment of cellulose pulp prior to dissolution into NaOH/ZnO are presented. Based on the results, cellulase treatment, when carried out in an extruder, can be used to effectively open up and fibrillate the fibres without completely destroying the fibre structure. The molar mass of the pulp treated enzymatically in an extruder was 14 % lower as compared to the state-of-the-art-treated cellulose. As a consequence, the alkaline solutions prepared from the pulp treated enzymatically in an extruder had clearly lower dope viscosities regarding the cellulose content than the solutions prepared from the state-of-the-art-treated pulp. This enabled increasing the cellulose content in the dope up to 7 % (w/w) without increasing the dope viscosity.
Polypyrrole coating on poly-(lactide/glycolide)-β-tricalcium phosphate screws enhances new bone formation in rabbits

Polypyrrole (PPy) has gained interest as an implant material due to its multifunctional properties and its high compatibility with several cell and tissue types. For the first time, the biocompatibility and osteointegration of PPy coating, incorporated with chondroitin sulfate (CS), were studied in vivo by implanting PPy-coated bioabsorbable bone fixation composite screws of poly-(lactide/glycolide) copolymer (PLGA) and β-tricalcium phosphate (TCP) into New Zealand white rabbits. Uncoated bioabsorbable polymer composite screws and commercially available stainless steel cortical screws were used as reference implants. The rabbits were euthanized 12 and 26 weeks after the implantation. The systemic effects were evaluated from food and water consumption, body weight, body temperature, clinical signs, blood samples, internal organ weights, and histological examination. Local effects were studied from bone tissue and surrounding soft tissue histology. New bone formation was evaluated by micro-computed tomography, tetracycline labeling and torsion tests. Torsion tests were performed in order to capture the peak value of the torsion force during the course of the screw's loosening. The coated screws induced significantly more bone formation than the uncoated screws. In addition, none of the implants induced any systemic or local toxicity. The results suggest that PPy is biocompatible with bone tissue and is a potential coating for enhancing osteointegration in orthopedic implants.
Cracking resistance of Cr3C2–NiCr and WC–Cr3C2–Ni thermally sprayed coatings under tensile bending stress

The cracking behaviour of Cr3C2–25(Ni20Cr) and WC–20Cr3C2–7Ni thermally sprayed coatings during tensile load in 3-point bending tests was studied by Acoustic Emission (AE) monitoring and microstructure post-analysis. The AE monitoring reveals a superior resistance against cracking in the WC–Cr3C2–Ni coatings compared to Cr3C2–NiCr. The incorporation of tungsten carbides beneficially affects the residual stress state of the coatings and has an impact on the detailed fracture mode. The results hold for both as-sprayed as well as ground and polished coatings.
Behavior of Martensitic Wear Resistant Steels in Abrasion and Impact Wear Testing Conditions

Wear is a complex phenomenon present in both small and large scale in the industry, but also in our everyday life. The ability of a material to resist wear is not an intrinsic mechanical property, as it depends on the tribosystem as a whole, including all the environmental and operational factors. One of the aims of this work is to analyze the wear testing methods used for abrasive, impact, and impact-abrasive wear performance assessment of materials and thus to add to the current understanding of the wear testing in such conditions.

In this work, wear tests with various test devices were conducted on wear resistant martensitic steels. The tests include high-stress abrasive wear tests with crushing pin-on-disc and uniaxial crusher, impact-abrasive tests with impeller-tumbler, and impact tests with single and continuous impact testers. The impeller-tumbler method was analyzed in more detail by examining the effects of sample angle and test duration as well as the effects of testing procedures on the test results. In high-stress wear tests, the amount of wear was determined through mass loss measurements, while in the impact tests measurements of the impact scars were made. The wear surfaces were characterized with optical and electron microscopy, optical profilometry and residual stress measurements. Moreover, the behavior and changes in the subsurface and microstructure of the materials were studied from prepared cross sections with optical and electron microscopy, microhardness measurements and electron backscatter diffraction.

In wear testing, selection of correct parameters is important, as they affect the wear mechanisms present on the sample surfaces. In abrasive wear, abrasive properties and even indirect counterparts have an influence on the forming wear mechanisms, which finally govern the severity of material removal. On the other hand, some similarities in the wear behavior of wear resistant steels in different abrasive contact conditions of sliding, gouging and impacting could be observed: the harder steels presented more scratching, which can be correlated to their lower ability of plastic deformation and higher amount of cutting. To ensure reaching the correct (steady) state of wear, tests should be of adequate duration, as the response of materials to many contact conditions may be nonlinear and reveal certain evolution of microstructures only after longer exposure.

Wear tests enable the comparison of materials in controlled conditions, but close attention on the test procedures must be paid also when conducting seemingly robust wear tests, especially when the differences to be detected are small. As the tests themselves constitute a tribosystem, local changes in the conditions due to the test procedures, such as sample placement, must be properly understood in order to obtain reliable results. Understanding the concept of a tribosystem and the major interdependencies involved is essential for all wear testing methods and proper analysis of the experimental test results.
Processing and characterization of phosphate glasses containing CaAl$2$O$_4$:Eu$2+$,Nd$3+$ and SrAl$2$O$_4$:Eu$2+$,Dy$3+$ microparticles

In this paper, phosphate based glasses with persistent luminescence properties were processed using standard melting process in air by adding SrAl$2$O$_4$:Eu$2+$,Dy$3+$ or CaAl$2$O$_4$:Eu$2+$,Nd$3+$ in the glass batch before melting. All produced glasses were characterized using SEM/EDXA, Raman spectroscopy and photoluminescence. We discuss the effect of melting conditions (temperature and duration of the melting) on the persistent luminescence properties of the microparticles containing glasses. It is demonstrated that the melting in air allows for the preparation of glasses with persistent luminescence if the melting conditions are carefully controlled.
A survey of printable piezoelectric sensors

Availability of solution-processable piezoelectric sensor and electrode materials enable low-cost and high-throughput fabrication of fully printable piezoelectric sensors. Results obtained with piezoelectric polymer (polyvinylidene fluoride, PVDF), cellulose nanofibril (CNF) and cellulose nanocrystal (CNC) films as sensor materials are presented here. These sensor materials can be processed in solution and used in combination with printed electrodes to obtain full printability of the sensors. A commercial PVDF film and in-house fabricated CNF and CNC film are used as sensor materials. In addition, conducting polymer, graphene and carbon nanotube (CNT) based inks are used as solution-processable electrode materials in the sensors, whereas conventional metallic electrodes are used as reference electrode material. The sensor operation of the fabricated sensors is evaluated through piezoelectric sensitivity measurements. The sensor sensitivity measurements revealed mean sensitivities from 2 pC/N to 42 pC/N in transverse direction, depending on set of the sensor and electrode materials used.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Tuukkanen, S., Rajala, S.
Number of pages: 4
Pages: 1426-1429
Publication date: 27 Oct 2015

Host publication information
Title of host publication: IEEE Sensors 2015 Conference Proceedings
Publisher: IEEE
ISBN (Electronic): 978-1-4799-8202-8
Electronic versions:
Tuukkanen_IEEE_Sensors_2015
DOI:
10.1109/ICSENS.2015.7370542
Links:
http://urn.fi/URN:NBN:fi tty-201603183701

Bibliographical note
Versio ja lupa kunnossa 14.1.2016 KK
Research output: Scientific - peer-review Conference contribution
Digital image correlation method in hydro turbine shaft torque and vibration monitoring

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Mechanical Engineering and Industrial Systems, Research group: Kokeellinen virtaustekniikka, Research area: Applied Mechanics, Department of Materials Science, Research group: Tribology and Machine Elements, Fortum Power and Heat Oy
Authors: Saarenrinne, P., Miettinen, J., Ylönen, M., Kokko, V.
Number of pages: 8
Publication date: 27 Oct 2015

Host publication information
Title of host publication: Proceedings of the Hydro 2015 Bordeaux 26-28 October 2015
Publisher: Hydro Power & Dams
Article number: 08.06
Links:
http://www.hydropower-dams.com/index.php#nogo

Bibliographical note
ISBN puuttuu, kysytty / TL

ORG=mei,0.5
ORG=mol,0.5
Research output: Professional › Conference contribution

Organic Molecular Films as Light-Emitting and Light-Confining Material in Rolled-Up AlInP Semiconductor Microtube Resonators
A hybrid inorganic/organic microcavity system is presented in which an AlInP-based rolled-up microtube resonator is combined with a thin film of naphthyl end-capped bithiophene molecules. The film is laterally structured into stripes on top of the AlInP layer system before the roll-up process. During the process, the strained bilayer together with the organic molecular stripes rolls up, and a hybrid microtube is formed. The stripes act as visible-light emitters inside the otherwise passive microtube. Furthermore, they induce a light confinement in the axial direction of the microtube, additional to the radial and azimuthal confinement that is intrinsic to a microtube. As the organic material defines the cavity and represents the emitter at the same time, an efficient light coupling into the three-dimensionally confined optical modes of the microtube resonator is ensured. The hybrid microtubes open up the opportunity for novel experiments on the light–molecule interaction as well as their application in optical components.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Augmented Human Activities (AHA), Frontier Photonics, Institute of Physical Chemistry, University of Hamburg
Number of pages: 7
Pages: 1532-1538
Publication date: 27 Oct 2015
Peer-reviewed: Yes

Publication information
Journal: ACS Photonics
Volume: 2
Issue number: 11
ISSN (Print): 2330-4022
Ratings:
Scopus rating (2016): CiteScore 6.48 SJR 3.516 SNIP 1.996
Scopus rating (2015): SJR 3.069 SNIP 1.616 CiteScore 5.71
Original language: English
DOIs:
10.1021/acsphotonics.5b00349
Links:
http://pubs.acs.org/doi/abs/10.1021/acsphotonics.5b00349
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 0.40 eV above the valence band maximum, while the defect-free BaO/Ge(100) interface has a flat band structure.

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, Department of Physics and Astronomy, University of Turku, Russian Academy of Sciences, University of Turku, Turun Yliopisto/Turun Biomateriaalikeskus
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 (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
ASJC Scopus subject areas: Condensed Matter Physics, Electronic, Optical and Magnetic Materials
DOI:
10.1103/PhysRevB.92.165311
Links:
http://www.scopus.com/inward/record.url?scp=84944790567&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84944790567
Research output: Scientific - peer-review » Article

Comparison of laboratory rolling-sliding wear tests with in-service wear of nodular cast iron rollers against wire ropes
The present work describes the wear behaviour of nodular cast iron in rolling-sliding contact with steel wire ropes and steel wires in laboratory and in-service conditions. In each of the studied examples, the wear had proceeded through a
surface fatigue process, in which inter-nodular crack propagation and simultaneous deformation in a thin sub-surface zone had resulted in the formation of ferrous scales consisting of material from the metal matrix of the cast iron. The scale layers of the wear surface were oriented towards the direction of the sliding component of the motion, and the spalling of the scales was identified as the dominating mechanism for material removal from the wear surface. The initiation behaviour of the inter-nodular cracks was analysed by crack measurements and statistical analysis of the depths and initiation angles of the cracks in relation to the wear surface. The initiation depths of the cracks increased with increasing contact pressure. Roller samples from in-service and from the component wear tests showed closely similar distributions of the crack depths and crack initiation angles. The sample from the twin-disc test showed aspects of cracking behaviour that were typical of both the rolling and the sliding direction of the roller samples.

750 nm 1.5 W frequency-doubled semiconductor disk laser with a 44 nm tuning range

We demonstrate 1.5 W of output power at the wavelength of 750 nm by intracavity frequency doubling a wafer-fused semiconductor disk laser diode-pumped at 980 nm. An optical-to-optical efficiency of 8.3% was achieved using a
bismuth borate crystal. The wavelength of the doubled emission could be tuned from 720 to 764 nm with an intracavity birefringent plate. The beam quality parameter M2 of the laser output was measured to be below 1.5 at all pump powers. The laser is a promising tool for biomedical applications that can take advantage of the large penetration depth of light in tissue in the 700–800 nm spectral range.

Characterization of thermally aged polyetheretherketone fibres: Mechanical, thermal, rheological and chemical property changes

This paper investigates the effects of thermal degradation on polyetheretherketone (PEEK) fibres. PEEK samples were aged at a constant temperature of 250 °C for 1-128 days and characterized with mechanical tests, FTIR (Fourier Transform Infrared Spectroscopy), DSC (Differential Scanning Calorimetry), rheology, TGA (Thermogravimetric Analysis), SEM (Scanning Electron Microscopy), and UV-Vis diffuse reflectance spectroscopy. The short-term thermal annealing had a positive effect on the mechanical properties, due to the formation and growth of secondary crystals. Crosslinking in the material was verified by rheological inspections. The crosslinking increased the mechanical strength and modulus but reduced the elongation at break of the fibres. FTIR tests showed that carbonyl and hydroxyl groups were slowly formed on the surface of the fibres while ring opening reactions took place. The thermal ageing reduced the thermal stability of PEEK. The decreased stability was observed in the decomposition onset temperature after 8 d and in the melting point and the glass transition temperature after 32 d. The first signs of degradation, crosslinking, embrittlement, and reduced thermal stability, were visible roughly after 8 d of ageing, whereas the deterioration in general usability occurred after 64 d.
Erbium-doped borosilicate glasses containing various amounts of P2O5 and Al2O3: Influence of the silica content on the structure and thermal, physical, optical and luminescence properties
Production of sulfonated polyetheretherketone/polypropylene fibers for photoactive textiles

New photocatalytic fibers made of sulfonated polyetheretherketone (SPEEK)/polypropylene (PP) are melt compounded and melt spun, first on laboratory scale and then on a semi-industrial scale. Fiber spinnability is optimized and the fibers are characterized using mechanical testing, electron paramagnetic resonance (EPR) spectroscopy, and scanning electron microscopy (SEM). According to the results, the fiber spinnability remains at a good level up to 10 wt % SPEEK concentration. Optimal processing temperature is 200°C due to the thermal degradation at higher temperatures. EPR measurements show good and long-lasting photoactivity after the initial irradiation but also decay in the radical intensity during several irradiation cycles. Mechanical tenacity of the SPEEK/PP 5:95 fiber is approximately 20% lower than for otherwise similar PP fiber. The fiber is a potential alternative to compete against TiO2-based products but more research needs to be done to verify the real-life performance.
Adhesive Behavior Study Between Cellulose and Borosilicate Glass Using Colloidal Probe Technique

Cellulose-glass fiber hybrid composites have been introduced to introduce weight and price benefits compared to glass composites. However, the interactions between glass and cellulose have not been extensively studied. Understanding the interactions between these two materials will help to improve the mechanical properties of the cellulose hybrid composites. In this paper, by employing the colloidal probe technique, we investigated the interaction forces between glass and cellulose material. A silicon probe with a borosilicate glass microsphere attached as the probe tip was implemented into an atomic force microscope (AFM) to complete the task. Cellulose membranes were used as experiment samples. By pressing and releasing the colloidal probe against the cellulose membrane, the adhesion force and the adhesion energy were directly obtained through the measurements. The interfacial energy was revealed by applying the Johnson-Kendall-Roberts (JKR) model, and a theoretical calculation of the material stiffness was conducted.
The Effect of Phosphorus Exposure on Diesel Oxidation Catalysts-Part II: Characterization of Structural Changes by Transmission Electron Microscopy

Phosphorus poisoning and its effect on the diesel oxidation catalysts morphology was studied by transmission electron microscopy (TEM). The studied catalyst samples were PtPd or Pt supported on the alumina-based washcoat including additives. The laboratory-scale phosphorus exposures were carried out with two different phosphorus concentrations. The cross-sectional TEM samples were prepared from the fresh and phosphorus-treated catalysts. After phosphorus exposures, significant structural changes were observed compared to the fresh catalysts. The shape of the noble metal particles had changed from irregular to more spherical-shaped particles. In addition, phosphorus was detected throughout the catalyst TEM samples but the amount varied depending on the local composition of the support. Phosphorus accumulated mainly in the alumina-containing areas of the support and indications of dense and amorphous aluminium phosphates were found. Based on the results gained, cross-sectional TEM characterization is essential to observe these kinds of morphological changes in the catalysts caused e.g. by phosphorus exposures. In addition, cross-sectional TEM samples are needed to study the effect of local variation in the support composition on the phosphorus accumulation.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Univ Oulu, University of Oulu, Fac Technol Mass & Heat Transfer Proc Engr, Aalto University, Dinex Ecocat Oy
Authors: Honkanen, M., Kärkkäinen, M., Heikkinen, O., Kallinen, K., Kolli, T., Huuhtanen, M., Lahtinen, J., Keiski, R. L., Lepistö, T., Vippola, M.
Number of pages: 6
Pages: 971-976
Publication date: Oct 2015
Peer-reviewed: Yes

Publication information
Journal: Topics in Catalysis
Volume: 58
Issue number: 14
ISSN (Print): 1022-5528
Ratings:
Scopus rating (2016): CiteScore 2.55 SJR 0.974 SNIP 0.878
Scopus rating (2015): SJR 0.945 SNIP 0.789 CiteScore 2.41
Scopus rating (2014): SJR 0.989 SNIP 0.862 CiteScore 2.29
Scopus rating (2013): SJR 1.125 SNIP 0.837 CiteScore 2.67
Scopus rating (2012): SJR 1.196 SNIP 0.851 CiteScore 2.49
Scopus rating (2011): SJR 1.346 SNIP 0.977 CiteScore 2.89
Scopus rating (2010): SJR 1.492 SNIP 0.91
Scopus rating (2009): SJR 1.269 SNIP 0.907
Scopus rating (2008): SJR 1.225 SNIP 1.015
Scopus rating (2007): SJR 1.522 SNIP 1.382
Scopus rating (2006): SJR 1.59 SNIP 1.202
Scopus rating (2005): SJR 1.444 SNIP 1.17
Scopus rating (2004): SJR 1.374 SNIP 1.136
Scopus rating (2003): SJR 1.229 SNIP 0.915
Scopus rating (2002): SJR 1.233 SNIP 0.874
Scopus rating (2001): SJR 1.451 SNIP 1.087
Scopus rating (2000): SJR 2.482 SNIP 1.684
Scopus rating (1999): SJR 1.43 SNIP 1.163
Original language: English
Keywords: Diesel oxidation catalyst, Phosphorus poisoning, Structural characterization, Transmission electron microscopy, 3-WAY CATALYST, DEACTIVATION, MECHANISMS, EXHAUST, IMPACT
Detecting lateral composition modulation in dilute Ga(As,Bi) epilayers

The ability to characterize a structure into the finest details in a quantitative manner is a key issue to understanding and controlling nanoscale phase separation in novel nanomaterials. In this work, we consider the detectability of lateral composition modulation (LCM), a type of nanoscale phase separation in GaAs$_{1-x}$Bi$_x$ epilayers, by x-ray diffraction (XRD). We show that the satellite peaks due to LCM are hardly detectable in reasonable time with a lab x-ray diffractometer for GaAs$_{1-x}$Bi$_x$ samples with an average $x$ up to 25% and relative modulation up to 50%. This is in contrast to LCM reported in other III-V combinations, where the intensity of the satellite peak is relatively high and can be easily detected. Our theoretical considerations are complemented experimentally using highly brilliant synchrotron radiation. The results are in good agreement with the predictions. This work provides a guideline for the systematic characterization of LCM in zincblende III-V semiconductor epilayers and points to the critical role of quantitative characterization of nanoscale phase separation.

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
Authors: Wu, M., Hanke, M., Luna, E., Puustinen, J., Guina, M., Trampert, A.
Publication date: 30 Sep 2015
Peer-reviewed: Yes

Publication information
Journal: Nanotechnology
Volume: 26
Issue number: 42
Article number: 425701
ISSN (Print): 0957-4484
Ratings:
- Scopus rating (2016): CiteScore 2.87 SJR 1.096 SNIP 0.814
- Scopus rating (2015): SJR 1.18 SNIP 0.966 CiteScore 3.07
- Scopus rating (2014): SJR 1.465 SNIP 1.258 CiteScore 3.09
- Scopus rating (2013): SJR 1.585 SNIP 1.244 CiteScore 2.74
- Scopus rating (2012): SJR 1.846 SNIP 1.306 CiteScore 3.34
- Scopus rating (2011): SJR 1.892 SNIP 1.461 CiteScore 3.86
- Scopus rating (2010): SJR 1.844 SNIP 1.259
- Scopus rating (2009): SJR 1.819 SNIP 1.28
- Scopus rating (2008): SJR 1.875 SNIP 1.333
- Scopus rating (2007): SJR 1.91 SNIP 1.36
- Scopus rating (2006): SJR 1.934 SNIP 1.378
- Scopus rating (2005): SJR 1.925 SNIP 1.445
- Scopus rating (2004): SJR 1.849 SNIP 1.477
- Scopus rating (2003): SJR 1.427 SNIP 1.371
- Scopus rating (2002): SJR 0.962 SNIP 0.993
- Scopus rating (2001): SJR 0.901 SNIP 0.94
- Scopus rating (2000): SJR 0.881 SNIP 0.891
- Scopus rating (1999): SJR 1.131 SNIP 0.953
Original language: English
DOIs:
10.1088/0957-4484/26/42/425701
Research output: Scientific - peer-review › Article
Strontium- and calcium-containing, titanium-stabilised phosphate-based glasses with prolonged degradation for orthopaedic tissue engineering

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, BioMediTech, Integrated Technologies for Tissue Engineering Research (ITTE), BioMediTech - Institute of Biosciences and Medical Technology, Adult Stem Cell Group, CREST - University College London, Division of Biomaterials and Tissue Engineering, UCL Eastman Dental Institute, Faculty of Mathematical and Physical Sciences, Department of Nanobiomedical Science, BK21 Plus NBM Global Research Center for Regenerative Medicine, Dankook University, Institute of Tissue Regeneration Engineering, College of Dentistry, Unit of Orthodontics, Department of Craniofacial Growth and Development
Authors: Al Qaysi, M., Walters, N. J., Foroutan, F., Owens, G. J., Kim, H. W., Shah, R., Knowles, J. C.
Number of pages: 11
Pages: 300-310
Publication date: 24 Sep 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Biomaterials Applications
Volume: 30
Issue number: 3
ISSN (Print): 0885-3282
Ratings:
Scopus rating (2016): SJR 0.554 SNIP 0.76 CiteScore 2.24
Scopus rating (2015): SJR 0.634 SNIP 0.755 CiteScore 2.15
Scopus rating (2014): SJR 0.659 SNIP 1.004 CiteScore 2.53
Scopus rating (2013): SJR 0.72 SNIP 1.026 CiteScore 2.35
Scopus rating (2012): SJR 0.792 SNIP 0.958 CiteScore 2.08
Scopus rating (2011): SJR 0.804 SNIP 1.089 CiteScore 2.16
Scopus rating (2010): SJR 0.921 SNIP 1.068
Scopus rating (2009): SJR 0.67 SNIP 1.082
Scopus rating (2008): SJR 0.603 SNIP 0.758
Scopus rating (2007): SJR 0.682 SNIP 0.801
Scopus rating (2006): SJR 0.585 SNIP 0.823
Scopus rating (2005): SJR 0.327 SNIP 0.591
Scopus rating (2004): SJR 0.354 SNIP 0.446
Scopus rating (2003): SJR 0.436 SNIP 0.514
Scopus rating (2002): SJR 0.597 SNIP 0.875
Scopus rating (2001): SJR 0.553 SNIP 0.896
Scopus rating (2000): SJR 0.417 SNIP 0.583
Scopus rating (1999): SJR 0.228 SNIP 0.556
Original language: English
Keywords: biomaterial, calcium, Phosphate-based glass, strontium, tissue engineering
ASJC Scopus subject areas: Biomedical Engineering, Biomaterials
DOIs:
10.1177/0885328215588898
Source: Scopus
Source-ID: 84942088463
Research output: Scientific - peer-review › Article

Ionic Modification Turns Commercial Rubber into a Self-Healing Material
Invented by Charles Goodyear, chemical cross-linking of rubbers by sulfur vulcanization is the only method by which modern automobile tires are manufactured. The formation of these cross-linked network structures leads to highly elastic properties, which substantially reduces the viscous properties of these materials. Here, we describe a simple approach to converting commercially available and widely used bromobutyl rubber (BIIR) into a highly elastic material with extraordinary self-healing properties without using conventional cross-linking or vulcanising agents. Transformation of the bromine functionalities of BIIR into ionic imidazolium bromide groups results in the formation of reversible ionic associates.
that exhibit physical cross-linking ability. The reversibility of the ionic association facilitates the healing processes by temperature- or stress-induced rearrangements, thereby enabling a fully cut sample to retain its original properties after application of the self-healing process. Other mechanical properties, such as the elastic modulus, tensile strength, ductility, and hysteresis loss, were found to be superior to those of conventionally sulfur-cured BIIR. This simple and easy approach to preparing a commercial rubber with self-healing properties offers unique development opportunities in the field of highly engineered materials, such as tires, for which safety, performance, and longer fatigue life are crucial factors.

General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Engineering materials science and solutions (EMASS), Leibniz-Institut für Polymerforschung Dresden E.V.
Authors: Das, A., Sallat, A., Böhme, F., Suckow, M., Basu, D., Wießner, S., Stöckelhuber, K. W., Voit, B., Heinrich, G.
Number of pages: 8
Pages: 20623-20630
Publication date: 23 Sep 2015
Peer-reviewed: Yes

Publication information

Journal: ACS Applied Materials and Interfaces
Volume: 7
Issue number: 37
ISSN (Print): 1944-8244
Ratings:
Scopus rating (2016): CiteScore 7.6 SJR 2.524 SNIP 1.528
Scopus rating (2015): SJR 2.299 SNIP 1.568 CiteScore 7.38
Scopus rating (2014): SJR 2.126 SNIP 1.64 CiteScore 6.88
Scopus rating (2013): SJR 1.979 SNIP 1.543 CiteScore 6.05
Scopus rating (2012): SJR 2.18 SNIP 1.309 CiteScore 4.94
Scopus rating (2011): SJR 2.017 SNIP 1.396 CiteScore 4.41
Scopus rating (2010): SJR 1.571 SNIP 0.931
Original language: English
Keywords: bromobutyl rubbers, elastomers, ionic associations, network structures, self-healing
ASJC Scopus subject areas: Materials Science(all)
DOIs: 10.1021/acsami.5b05041
Links:
http://www.scopus.com/inward/record.url?scp=84942291962&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84942291962
Research output: Scientific - peer-review › Article

Wear Properties of Thermally Sprayed Tungsten-Carbide Coatings in Paper Machine Environments

Thermally sprayed tungsten-carbide (WC) coatings have proven to be one of the most wear resistant coatings available and a respectable replacement for hard-chromium coatings. They are used in paper machine parts such as calender rolls. However, improved lifetime and performance are continuing considerations, as well as finding more economical alternatives. This study researched the wear phenomena of tungsten-carbide coatings in a paper machine environment. To achieve this, five different feedstock materials and coatings manufactured from these were compared by electron microscopy as well as dry abrasion-, high-speed slurry abrasion- and cavitation erosion tests. Improvements in ductility by changing the matrix material were found, while changing the particle strength had no effect on the behavior of the coatings. The findings suggest further research on altering the matrix of the feedstock could lead to overall improvements in coating quality and component lifetime.

General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Surface Engineering, Valmet Technologies Oy
Authors: Kiilakoski, J., Eronen, V., Vuoristo, P.
Number of pages: 35
Pages: 29
Publication date: 21 Sep 2015
Peer-reviewed: Yes

Publication information
Influence of application method and sintering temperature on porosity and thermal conductivity of two commercial silicon carbide based castables

Information about thermal conductivity of refractory castables is crucial in heat conducting structures. Two commercial castables were studied to find out the effect of silicon carbide content (58-67 %) and installation method on thermal conductivity. One castable was designed to be installed by casting and the other one was shotcrete castable. The shotcrete castable was casted and shotcreted in to metal mold sized 200x200x50 mm. The other castable was casted in laboratory conditions and on site. Porosities and thermal conductivities were measured from samples after heat treatment at 400, 600, 800 and 1000 °C. Thermal conductivities were measured by transient plane source method, porosities were measured by Archimedes' method and microstructures were characterized by scanning electron microscopy. Thermal conductivities varied from 6.8-16.3 W/mK and porosities 12.74-21.92 %. Thermal conductivity of measured samples increased with SiC content and higher heat treatment temperature as expected. Porosities and thermal conductivities in castables casted in laboratory and on site varied only slightly. In shotcrete castable applied by casting the porosity and thermal conductivity were higher than in shotcreted sample. So the interconnection between low porosity and high thermal conductivity was not as clear as expected.
Validity of traditional barrier-testing methods to predict the achievable benefits of the new generation water based barrier coatings for packaging materials

In the study, Next Gen WBBC materials were evaluated both in laboratory and pilot scale. Analyses were done for KIT, oxygen, water vapour, grease and oil barrier. The applicability of the testing methods was tested and compared to PE-coated ice cream boxes and fluorocarbon coated quick food packages, which both have different barrier demands.

As a result, some of the test methods did not characterize well enough the barrier properties of WBBC materials. The Next Gen WBBC solutions had excellent grease and water vapour resistance even with low KIT values. For example the behaviour of WBBC materials in the oil resistance test was different compared to fluorocarbon coated packages, which also creates a need to further develop the test method and target setting.

The Next Gen WBBC materials can be used to replace PE-coatings, waxes and fluorocarbons in some of the common packaging applications. The future challenge is to commonly agree on and develop the accepted test methods for novelty WBBC products to evidence their performance and achievable benefits in barrier application areas.

Effect of spraying parameters on the microstructural and corrosion properties of HVAF-sprayed Fe-Cr-Ni-B-C coatings

Thermally sprayed Fe-based coatings have been extensively studied as future solution in order to replace more expensive, harmful and environmentally dangerous Ni- and WC-based coatings for several industrial applications where high corrosion and wear resistance are required. The aim of the present study is to investigate the effect of spraying parameters on the microstructure and the corrosion resistance of Fe-based coatings manufactured with the High Velocity Air Fuel (HVAF) thermal spray process. Six sets of thermal spraying parameters have been chosen and their effect on the overall quality of coatings was investigated. All HVAF coatings showed comparably dense microstructure with near-zero oxidation, proving the high quality of the deposition process. However, higher anti-corrosion and mechanical properties were achieved by increasing the spraying air pressure and decreasing the particle feeding rate without altering the thickness and the overall deposition rate. Powder feeding rate was reported to have a remarkable effect on microstructure and corrosion properties. Coatings with beneficial compressive residual stresses were successfully obtained by increasing air pressure during spraying which resulted in improved microstructural and corrosion properties.
Wet-spinning of cellulosic fibres from water-based solution prepared from enzyme-treated pulp

The demand for textile fibres is increasing constantly due to the growing population and improving standard of living. Currently, 64 % of the fibres produced globally are synthetic man-made fibres from oil-based raw materials, 29 % is cotton and the rest are man-made cellulosic fibres, wool and other natural fibres. The production of synthetic fibres and cotton cannot be increased in the future, thus creating a gap between the fibre demand and the production. One candidate to fill the gap is the viscose fibre which production covers currently 96 % of the man-made cellulosic fibres. However, the viscose process is challenging due to the occupational health and environmental issues relating to the use of carbon disulphide.

As a consequence, there is a need of such fibres that are made from the renewable resources (vs. oil), do not compete with the food production (as cotton) and do not need hazardous chemicals (as viscose).

This work introduces a new cellulosic fibre process which attempts to respond the need described. In the process, a dissolving grade wood pulp is treated with enzymes, dissolved in water-based solvent and regenerated to fibres using a wet spinning method. Thus the raw material is renewable, which growth does not use arable land, and the carbon disulphide needed in the viscose process is here replaced with enzymes.

Dissolution of the enzyme-treated pulp into aqueous sodium zincate and the regeneration of the solution into cellulosic fibres were demonstrated first. Thereafter, the preparation of the spin dope and the wet spinning of the fibres were studied in more detailed. The enzyme-treated cellulose was dissolved either by mixing-procedure or by freezing-thawing cycle. Both methods resulted in high quality solution for the spinning trials. However, the alkali ratio of the solution prepared by freezing-thawing cycle was lower (1.1 vs. 1.3) thus requiring less sulphuric acid during the coagulation. The spinneret draw ratio and the stretching ratio during the spinning exhibited negative correlation. This was due to the rapid coagulation
of the solution. The coagulation rate decreased significantly when the sulphuric acid spin bath was replaced with an acetic acid bath. Equally, the stretching ratio of the fibres increased, but unexpectedly the tenacity of the fibres did not increase. It was found that the acetic acid spun fibres shrunk during the drying and thus the orientation gained during the stretching was lost.

Another route to modify the fibre properties was explored through the chemical modification of enzyme-treated cellulose with allyl glycidyl ether. The treatment resulted in the pulp with low amount of 3-allyloxy-2-hydroxypropyl groups (DSA 0.05) which had higher solubility in aqueous sodium zincate than the un-substituted enzyme-treated pulp. The 100 % solution from the modified pulp did not form fibres in acidic bath, thus the fibres were spun from the solutions containing 25 % and 10 % of the modified pulp. The 3-allyloxy-2-hydroxypropyl groups provide reactive C=C double bonds in the fibre structure, thus allowing the further functionalization to gain new properties for the fibres.

It was shown that the production of regenerated cellulosic fibres in an environmental manner is possible, thus providing one option to fill the gap between the fibre demand and the production in the following decades.

General information
State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Materials Science, Research group: Fibre Materials
Authors: Vehviläinen, M.
Number of pages: 81
Publication date: 4 Sep 2015

Publication information
Place of publication: Tampere
Publisher: Tampere University of Technology
ISBN (Print): 978-952-15-3555-0
Original language: English

Publication series
Name: Tampere University of Technology. Publication
Publisher: Tampere University of Technology
Volume: 1312
ISSN (Print): 1459-2045
Electronic versions:
vehvilainen_1312
Links:

Bibliographical note
Awarding institution:Tampere University of Technology
Versio ok 16.12.2015
Research output: Collection of articles › Doctoral Thesis

Hard Rock (- ei Hallelujah, vaan) Tribology: Pohjoismainen kaivosteollisuuden kulumisongelmiin keskittyvä kurssi ja seminaari Tampereella

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science, Research group: Materials Characterization
Authors: Valtonen, K., Tiainen, T.
Pages: 30-33
Publication date: 2 Sep 2015
Peer-reviewed: Unknown

Publication information
Journal: Materia
Volume: 2015
Issue number: 1
ISSN (Print): 1459-9694
Original language: Finnish
Links:
http://www.vuorimiesyhdistys.fi/julkaisut/materia
Enhanced photoactive and photoelectrochemical properties of TiO2 sol-gel coated steel by the application of SiO2 intermediate layer

Photocatalysis is a promising solution for purifying air and water from pollutants, yet more efficient photocatalytic materials are needed. A new approach is proposed in this paper for enhancing the photoactive and photoelectrical properties of anatase TiO2 films by applying an intermediate SiO2 film between the TiO2 film and the stainless steel substrate. TiO2 and SiO2 coatings are synthesized by a sol-gel method and the thickness of TiO2 film is varied in order to obtain improved understanding on the role of thickness in photocatalytic and electrochemical performance. The obtained coatings are systematically characterized in terms of microstructure using such techniques as field-emission scanning electron microscopy (FE-SEM), Raman spectroscopy and X-ray diffraction (XRD), that demonstrate, e.g., the anatase phase structure of the TiO2 films. The enhanced photocatalytic properties of SiO2/TiO2 coatings as compared to TiO2 films are verified using methylene blue (MB) discoloration tests, while the improved photoelectrochemical properties are shown by potentiodynamic i-V scans, open circuit potential (OCP) monitoring and electrochemical impedance spectroscopy (EIS). We attribute the beneficial effect of the intermediate SiO2 film on the photocatalytic and photoelectrochemical performance to the high electrical resistance of the SiO2 that imposes a high-energy barrier for electron transfer and, therefore, (partly) insulates the TiO2 film from the substrate and acts as a capacitor for photo-generated electrons under illumination. The presented results show an effective way of enhancing the photocatalytic performance of anatase TiO2 films.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Ceramic materials, Optoelectronics Research Centre, Research group: Nanophotonics, Research group: Surface Engineering, Research group: Materials Characterization, Engineering materials science and solutions (EMASS), Frontier Photonics, Optoelectronics Research Centre, Tampere University of Technology, VTT Technical Research Centre of Finland
Number of pages: 11
Pages: 533-543
Publication date: 1 Sep 2015
Peer-reviewed: Yes

Publication information
Journal: Applied Catalysis B-Environmental
Volume: 174-175
ISSN (Print): 0926-3373
Ratings:
Scopus rating (2016): SJR 2.583 SNIP 2.12 CiteScore 8.86
Scopus rating (2015): SJR 2.26 SNIP 2.081 CiteScore 7.72
Scopus rating (2014): SJR 2.232 SNIP 2.164 CiteScore 6.92
Scopus rating (2013): SJR 2.345 SNIP 2.134 CiteScore 6.42
Scopus rating (2012): SJR 2.629 SNIP 2.236 CiteScore 6.08
Scopus rating (2011): SJR 2.585 SNIP 2.345 CiteScore 6.14
Scopus rating (2010): SJR 2.461 SNIP 1.895
Scopus rating (2009): SJR 2.301 SNIP 2.232
Scopus rating (2008): SJR 2.455 SNIP 2.275
Scopus rating (2007): SJR 2.493 SNIP 2.5
Scopus rating (2006): SJR 2.284 SNIP 2.229
Scopus rating (2005): SJR 2.095 SNIP 2.233
Scopus rating (2004): SJR 2.393 SNIP 2.41
Scopus rating (2003): SJR 1.979 SNIP 2.259
Scopus rating (2002): SJR 2.304 SNIP 1.847
Scopus rating (2001): SJR 2.781 SNIP 2.441
Scopus rating (2000): SJR 2.687 SNIP 2.13
Scopus rating (1999): SJR 2.18 SNIP 1.874
Original language: English
ASJC Scopus subject areas: Catalysis, Process Chemistry and Technology, Environmental Science (all)
Keywords: Electrical resistance, Electrochemical impedance spectroscopy, Photocatalysis, Substrate, Titanium dioxide
DOIs:
Highly Nonlinear Dispersion Increasing Fiber for Femtosecond Pulse Generation

The optical pulse evolution in a highly nonlinear normal dispersion-increasing fiber has been considered, both experimentally and theoretically. It was found that large spectral broadening in tapered waveguides could occur without temporal instabilities and impose the linear frequency modulation, i.e., chirp, required for high-quality pulse compression. The pedestal-free pulses have been demonstrated after dechirping in a standard single-mode fiber.
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

Automated Microrobotic Manipulation of Paper Fiber Bonds
This paper presents a novel method for automated manipulation of individual paper fiber bonds using a microrobotic platform, a computer vision algorithm and a robotic software framework. This is a challenging task due to the three-dimensional, heterogeneous and complex morphology of the fiber bonds. The goal is to automatically grasp the fiber bond,
and break it by pulling apart the fibers it consists of. We present the components of the microrobotic platform, and the different rules utilized in detecting suitable grasp points from a 3D reconstruction of the bond generated from an image pair. We demonstrate the functionality of the approach with bond breaking experiments of seven fiber bonds. The time required for grasping and breaking of a bond is 10 – 15 seconds making the approach much faster than the current state-of-the-art testing, which is based on manual manipulation. The success rate of the tests is as high as 80 %.

**General information**

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Hirvonen, J., Essen von, M., Kallio, P.
Number of pages: 6
Pages: 784-789
Publication date: Sep 2015

**Host publication information**

Publisher: IEEE
ISBN (Print): 978-1-4799-9994-1
Electronic versions:
IROS_post_print
DOIs:
10.1109/IROS.2015.7353461
Links:
hp://urn.fi/URN:NBN:fi:tty-201603243756
Research output: Scientific - peer-review › Conference contribution

**Effects of surface cracks and strain rate on the tensile behavior of Balmoral Red granite**

This paper presents an experimental procedure for studying the effects of surface cracks on the mechanical behavior of Balmoral Red granite under dynamic and quasi-static loading. Three different thermal shocks were applied on the surface of the Brazilian Disc test samples by keeping a flame torch at a fixed distance from the sample surface for 10, 30, and 60 seconds. Microscopy clearly shows that the number of the surface cracks increases with the duration of the thermal shock. After the thermal shock, the Brazilian Disc tests were performed using a servohydraulic materials testing machine and a compression Split Hopkinson Pressure Bar (SHPB) device. The results show that the tensile strength of the rock decreases and the rate sensitivity of the rock increases as more cracks are introduced to the structure. The DIC analysis of the Brazilian disc tests shows that the fracture of the sample initiates at the center of the samples or slightly closer to the incident bar contact point. This is followed by crushing of the samples at both contact points with the stress bars.

**General information**

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Materials Characterization, Engineering materials science and solutions (EMASS)
Authors: Mardoukhi, A., Hokka, M., Kuokkala, V.
Publication date: Sep 2015

**Host publication information**

Title of host publication: 11th International Conference on the Mechanical and Physical Behaviour of Materials Under Dynamic Loading
Publisher: EDP Sciences
Article number: 02007
ISBN (Print): 978-2-7598-1817-4
Links:
Research output: Scientific - peer-review › Conference contribution

**Er3+-Al2O3 nanoparticles doping of borosilicate glass**

Novel borosilicate glasses were developed by adding in the glass batch Er3+-Al2O3 nanoparticles synthetized by using a soft chemical method. A similar nanoparticle doping with modified chemical vapour deposition (MCVD) process was developed to increase the efficiency of the amplifying silica fibre in comparison to using MCVD and solution doping. It was shown that with the melt quench technique, a Er3+-Al2O3 nanoparticle doping neither leads to an increase in the Er3+ luminescence properties nor allows one to control the rare-earth chemical environment in a borosilicate glass. The site of
Er3+ in the Er3+-Al2O3 nanoparticle containing glass seems to be similar as in glasses with the same composition prepared using standard raw materials. We suspect the Er3+ ions to diffuse from the nanoparticles into the glass matrix. There was no clear evidence of the presence of Al2O3 nanoparticles in the glasses after melting.

**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Frontier Photonics, Integrated Technologies for Tissue Engineering Research (ITTE), Light Corporation, CNRS, Université de Bordeaux, ICMCB, Johan Gadolin Process Chemistry Centre, Abo Akademi University

Authors: Massera, J., Petit, L., Koponen, J., Glorieux, B., Hupa, L., Hupa, M.

Number of pages: 4
Pages: 1407-1410
Publication date: Sep 2015
Peer-reviewed: Yes

**Publication information**

Journal: Bulletin of Materials Science
Volume: 38
Issue number: 5
ISSN (Print): 0250-4707

Ratings:

- Scopus rating (2016): SJR 0.3 SNIP 0.486 CiteScore 0.9
- Scopus rating (2015): SJR 0.358 SNIP 0.703 CiteScore 1.11
- Scopus rating (2014): SJR 0.437 SNIP 0.982 CiteScore 1.31
- Scopus rating (2013): SJR 0.402 SNIP 0.866 CiteScore 1.09
- Scopus rating (2012): SJR 0.317 SNIP 0.811 CiteScore 1.04
- Scopus rating (2011): SJR 0.448 SNIP 0.955 CiteScore 1.14
- Scopus rating (2010): SJR 0.493 SNIP 0.784
- Scopus rating (2009): SJR 0.426 SNIP 0.681
- Scopus rating (2008): SJR 0.415 SNIP 0.812
- Scopus rating (2007): SJR 0.439 SNIP 0.7
- Scopus rating (2006): SJR 0.318 SNIP 0.715
- Scopus rating (2005): SJR 0.409 SNIP 1.021
- Scopus rating (2004): SJR 0.378 SNIP 0.708
- Scopus rating (2003): SJR 0.345 SNIP 0.705
- Scopus rating (2002): SJR 0.341 SNIP 0.576
- Scopus rating (2001): SJR 0.302 SNIP 0.653
- Scopus rating (2000): SJR 0.278 SNIP 0.367
- Scopus rating (1999): SJR 0.191 SNIP 0.529

Original language: English

ASJC Scopus subject areas: Materials Science(all), Mechanics of Materials

Keywords: Glass, optical fibre, IR photoluminescence, nanoparticles, doping, LUMINESCENCE, IONS

DOIs: 10.1007/s12034-015-1028-3

Source: Scopus
Source-ID: 84942788436
Research output: Scientific - peer-review › Article

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**General information**

State: Published

Ministry of Education publication type: D1 Article in a trade journal

Organisations: Department of Materials Science, Research group: Metals Technology

Authors: Peura, P.

Number of pages: 3
Pages: 10-12
Publication date: Sep 2015
Peer-reviewed: Unknown
Effects of thinning and heating for TiO2/AlInP junctions

TiO2/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
State: Published
Ministry of Education 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
Authors: Mäkelä, J., Tuominen, M., Yasir, M., Poloijärvi, V., Aho, A., Tukiainen, A., Kuzmin, M., Punkkinen, M. P. J., Laukkonen, P., Kokko, K., Guina, M.
Number of pages: 4
Pages: 6-9
Publication date: 24 Aug 2015
Peer-reviewed: Yes
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 μm. 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
State: Published
Ministry of Education 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
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 (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
Scopus rating (2009): SJR 1.775 SNIP 1.804
Scopus rating (2008): SJR 2.081 SNIP 1.818
Scopus rating (2007): SJR 2.345 SNIP 1.566
Scopus rating (2006): SJR 2.112 SNIP 1.884
Scopus rating (2005): SJR 2.97 SNIP 2.454
Scopus rating (2004): SJR 3.286 SNIP 2.716
Scopus rating (2003): SJR 3.44 SNIP 2.467
Scopus rating (2002): SJR 3.566 SNIP 2.117
Scopus rating (2001): SJR 3.519 SNIP 1.678
Scopus rating (2000): SJR 2.345 SNIP 1.202
Scopus rating (1999): SJR 2.44 SNIP 1.302

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

Links:
http://www.scopus.com/inward/record.url?scp=84937146617&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84937146617
Research output: Scientific - peer-review › Article
Evaluation of crushing strength of spray-dried MgAl\textsubscript{2}O\textsubscript{4} granule beds

The crushing strengths of four different experimental magnesium aluminate spinel (MgAl\textsubscript{2}O\textsubscript{4}) granule beds were monitored with the axial die pressing test after heat treatments. Precursor, magnesium hydroxide (Mg(OH)\textsubscript{2}) and magnesium oxide (MgO) as Mg precursor and aluminium oxide hydroxide Al(O)OH and α-Al\textsubscript{2}O\textsubscript{3} 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)\textsubscript{2} as Mg precursor.
Dual-Mode Multi-Section Lasers with Nanoscale Surface Gratings

Dual-mode multi-section distributed-feedback lasers with surface gratings have been fabricated using UV nanoimprint lithography. Frequency differences from 14GHz to 1.3THz for different longitudinal structures and frequency difference modulation speed up to 500MHz have been measured.

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Research group: Nanophotonics
Authors: Dumitrescu, M., Uusitalo, T., Virtanen, H., Viheriälä, J., Salmi, J., Aho, A.
Number of pages: 2
Publication date: Aug 2015

Host publication information
Title of host publication: Lasers and Electro-Optics Pacific Rim (CLEO-PR), 2015 11th Conference on Volume: 2
Place of publication: United States
Publisher: IEEE
ISBN (Print): 978-1-4673-7109-4
DOIs: 10.1109/CLEOPR.2015.7376054
Links: https://www.osapublishing.org/conferences.cfm

Bibliographical note
AUX=orc,"Aho, A.T."
Research output: Scientific › Conference contribution

Microrobotic platform with integrated force sensing microgrippers for characterization of fibrous materials: Case study on individual paper fibers

Mechanical characterization of micro-scale fibrous materials determines the key parameters which affect the quality of products such as composites, textile and paper. The current laboratory tests are mainly based on bulk measurements. This thesis introduces a microrobotic platform to handle and to characterize micro-scale fibers (MF), with the dimensions of few micrometers to hundreds of micrometers, at individual fiber level. The platform facilitates handling and specimen preparation of micro-scale fibrous material. A major challenge in mechanical characterization of MF is lack of proper force sensing microgrippers in the market. MF do not need a lot of force to manipulate, but their ultimate tensile strength is high and relatively large forces are required to perform a micro-tensile test. In this thesis, three force sensing microgrippers are developed and they are integrated into the mentioned microrobotic platform. Two of them are developed to measure the bonding forces between individual pulp fibers, normal to the bonded area (Z-direction) and parallel to the bonded area (shear-mode). Their force sensing solution is based on bending polyvinylidene fluoride (PVDF) films and their force range is up to 10mN. The third one, with the force range of 20mN, is developed to perform micro-tensile tests on MF. It uses a microspring and a magnetic encoder to measure the force. The force range of this force sensing microgripper can easily be increased by changing its microspring to a stiffer one. This feature makes the proposed force sensing approach adaptable to a wide range of MF. Even though pulp and paper fibers are used as a case study in this thesis, the applications of microrobotic solutions presented here are not limited to pulp and paper fibers for the following reason: pulp and paper fibers are natural fibers with random morphology, therefore if a microrobotic solution is capable of handling these morphologically challenging fibers, it is easily adaptable to synthetic fibers which have uniform morphology. The prototypes of all three force sensing microgrippers are calibrated and their performance are validated.

General information
State: Published
Ministry of Education publication type: G4 Doctoral dissertation (monograph)
Authors: Saketi, P.
Number of pages: 116
Publication date: 21 Jul 2015

Publication information
Place of publication: Tampere
Publisher: Tampere University of Technology
Improved dimensional stability with bioactive glass fibre skeleton in poly(lactide-co-glycolide) porous scaffolds for tissue engineering

Abstract Bone tissue engineering requires highly porous three-dimensional (3D) scaffolds with preferable osteoconductive properties, controlled degradation, and good dimensional stability. In this study, highly porous 3D poly(d,l-lactide-co-glycolide) (PLGA) - bioactive glass (BG) composites (PLGA/BG) were manufactured by combining highly porous 3D fibrous BG mesh skeleton with porous PLGA in a freeze-drying process. The 3D structure of the scaffolds was investigated as well as in vitro hydrolytic degradation for 10 weeks. The effect of BG on the dimensional stability, scaffold composition, pore structure, and degradation behaviour of the scaffolds was evaluated. The composites showed superior pore structure as the BG fibres inhibited shrinkage of the scaffolds. The BG was also shown to buffer the acidic degradation products of PLGA. These results demonstrate the potential of these PLGA/BG composites for bone tissue engineering, but the ability of this kind of PLGA/BG composites to promote bone regeneration will be studied in forthcoming in vivo studies.
Lithography-free oxide patterns as templates for self-catalyzed growth of highly uniform GaAs nanowires on Si(111)

We report self-catalyzed growth of GaAs nanowires (NWs) on Si/SiO$_x$ patterns fabricated by a lithography-free method. The patterns are defined using droplet epitaxy of GaAs nanocrystals, spontaneous oxidation, and thermal annealing. We investigate the influence of the size and density of the nucleation sites on the NW growth process and show that this approach enables the fabrication of highly uniform GaAs NWs with controllable density. The pattern fabrication and NW growth process are studied and discussed in relation to the surface morphology and chemical properties of the Si/SiO$_x$ patterns. Furthermore, the optical quality of the NWs is investigated by photoluminescence experiments performed for GaAs-AlGaAs core-shell NWs.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Augmented Human Activities (AHA), Frontier Photonics, Department of Physics and Astronomy, University of Turku, University of Turku
Authors: Hakkarainen, T. V., Schramm, A., Mäkelä, J., Laukkanen, P., Guina, M.
Publication date: 18 Jul 2015
Peer-reviewed: Yes

Publication information
Journal: Nanotechnology
Volume: 26
Issue number: 27
Article number: 275301
ISSN (Print): 0957-4484
Ratings:
Scopus rating (2016): CiteScore 2.87 SJR 1.096 SNIP 0.814
Scopus rating (2015): SJR 1.18 SNIP 0.966 CiteScore 3.07
Scopus rating (2014): SJR 1.465 SNIP 1.258 CiteScore 3.09
Scopus rating (2013): SJR 1.585 SNIP 1.244 CiteScore 2.74
Scopus rating (2012): SJR 1.846 SNIP 1.306 CiteScore 3.34
Scopus rating (2011): SJR 1.892 SNIP 1.461 CiteScore 3.86
Scopus rating (2010): SJR 1.844 SNIP 1.259
Scopus rating (2009): SJR 1.819 SNIP 1.28
Scopus rating (2008): SJR 1.875 SNIP 1.333
Scopus rating (2007): SJR 1.91 SNIP 1.36
Scopus rating (2006): SJR 1.934 SNIP 1.378
Scopus rating (2005): SJR 1.925 SNIP 1.445
Scopus rating (2004): SJR 1.849 SNIP 1.477
Scopus rating (2003): SJR 1.427 SNIP 1.371
Scopus rating (2002): SJR 0.962 SNIP 0.993
Scopus rating (2001): SJR 0.901 SNIP 0.94
Scopus rating (2000): SJR 0.881 SNIP 0.891
Scopus rating (1999): SJR 1.131 SNIP 0.953
Bioactive glass ions as strong enhancers of osteogenic differentiation in human adipose stem cells

Bioactive glasses are known for their ability to induce osteogenic differentiation of stem cells. To elucidate the mechanism of the osteoinductivity in more detail, we studied whether ionic extracts prepared from a commercial glass S53P4 and from three experimental glasses (2-06, 1-06 and 3-06) are alone sufficient to induce osteogenic differentiation of human adipose stem cells. Cells were cultured using basic medium or osteogenic medium as extract basis. Our results indicate that cells stay viable in all the glass extracts for the whole culturing period, 14 days. At 14 days the mineralization in osteogenic medium extracts was excessive compared to the control. Parallel to the increased mineralization we observed a decrease in the cell amount. Raman and Laser Induced Breakdown Spectroscopy analyses confirmed that the mineral consisted of calcium phosphates. Consistently, the osteogenic medium extracts also increased osteocalcin production and collagen Type-I accumulation in the extracellular matrix at 13 days. Of the four osteogenic medium extracts, 2-06 and 3-06 induced the best responses of osteogenesis. However, regardless of the enhanced mineral formation, alkaline phosphatase activity was not promoted by the extracts. The osteogenic medium extracts could potentially provide a fast and effective way to differentiate human adipose stem cells in vitro.
Application of Biopolymer Doped Polypyrroles in Biomedical Implants and Electrical Stimulation Devices

Organic conductive polymers are emerging new materials for biomedical engineering. They offer surface properties which are attractive for many biomedical applications, such as surface coatings on metallic or biodegradable polymeric implants, tissue engineering scaffolds, implantable electronic tissue stimulation devices and microelectromechanical systems for the manipulation of single living cells in vitro, for example. Owing to the proven compatibility with tissues and cells, conductive polypyrrole (PPy) has been intensively investigated for bone and neural stimulation applications. A salient feature of PPy is its easy modification with bioactive molecules and macromolecules, such as the extracellular matrix (ECM) components of animal tissues. This work assessed the ECM components hyaluronic acid (HA) and chondroitin sulfate (CS) as dopants, which we incorporated into the PPy during the syntheses by electrochemical and oxidative chemical polymerization.

Biopolymer doped PPys have been earlier reported to be good substrates for cell cultures. Furthermore, preceding implantation studies have shown promising results. However, considering clinical application and registration of PPy as a biomaterial in commercial cell culturing or tissue engineering products, there are still many practical aspects requiring more attention, such as the establishment of feasible synthetic routes, sterilizability, preservation of the electronic properties during storage and during the incubation in physiological conditions, possible biodegradation mechanisms, stability and biological elimination of the degradation products in vivo, for example. Mass spectroscopy of the hydrolysis products of polylactide (PLA) fibers coated with layer of PPy, suggested that the PPy was biostable in water at neutral pH. Electrical conductivity measurements and Raman spectroscopy showed that the PPy chain was prone to de-doping, and hence the lost its conductivity under biological conditions, but these effects were partly reversible by acid doping and positively biased electrochemical potential. The electrochemical redox activity and electromechanical actuation property of the biopolymer doped PPys was thoroughly studied. It was shown that the biopolymer doped PPy had significant and reversible redox activity, which could be potentially utilized in microelectromechanical stimulation of cells and implantable microscopic actuators.

Practical and reproducible polymerization protocols were developed during this work. We took novel approaches and suggested a relatively simple "one-pot" chemical polymerization scheme, avoiding the complications of biological functionalization using potentially toxic click-chemistry. The developed methods were successfully applied in the deposition of electrically conductive, biopolymer doped PPy coatings on polylactide (PLA) nonwoven tissue engineering scaffolds and commercial poly(lactide-co-glycolide)-β-tricalcium phosphate (PLGA-β-TCP) bone fixation screws.

The physical properties and cell response of HA and CS doped PPys (PPyHA and PPyCS) electrode coatings were investigated by atomic force microscopy (AFM) and electrochemical methods. Drastically different behaviour of adipose stem cells (hASC) was found on the different electrode coatings, highlighting the sensitivity of the hASCs on the nanoscopic and microscopic surface properties of the PPy substrate, such as surface roughness, elasticity and surface potential distribution, factors which could be engineered during the synthesis and affected by external stimuli during incubation in cell culture medium.

In conclusion, the results of this thesis supported the use of PPy coatings in bone tissue engineering. The electropolymerized films and also the chemically polymerized PPyHA and PPyCS coatings on bioabsorbable polymer were highly compatible with hASCs, supported cell adhesion and could be utilized in delivering direct electrical stimulation in vitro. There is also future potential in designing permanently implantable scaffolds and microstimulation devices, but still further insight into the biodegradation mechanism and biological elimination of PPy in vivo is needed.
Fretting-induced friction and wear in large flat-on-flat contact with quenched and tempered steel

Fretting may cause severe surface damage and lead to unexpected fatigue failure. Our test apparatus was designed based on reciprocating, large, annular flat-on-flat contact without any edge effects in the direction of the fretting movement. Fretting wear tests were run with quenched and tempered steel with different normal pressures and sliding amplitudes under gross sliding conditions. The development of the friction coefficient and total wear mass depended mostly on the accumulated sliding distance. Initially, friction and wear were highly adhesive but gradually changed to abrasive due to third body accumulation in the interface.
Rheology and FTIR spectroscopy are compared as methods to study the degree of photodegradation in polypropylene (PP) and polystyrene (PS) sheets. The materials are hot pressed, artificially photo-aged with fluorescent lights for 4-2048 h and then measured with a rotational rheometer and FTIR. Both materials show a tendency for chain scission which can be seen as a reduction in viscosity. Changes in PP can be observed with both methods after 256 h of irradiation. Changes in PS become significant in rheology after 64 h but in FTIR only after 1024 h of irradiation. Due to the different chemical nature of the materials, the degradation of PS is rather linear with exposure, whereas the degradation of PP is more exponential. Using the zero shear viscosities obtained through extrapolations of the Cole-Cole and Carreau-Yasuda models, relative molecular weights are estimated with the aid of the power-law relationship between these two. These results are compared with the carbonyl indices determined from the FTIR spectra. Rheology is found to be a viable alternative for FTIR in certain situations.
Effects of thermal aging on the characteristic breakdown behavior of Nano-SiO2-BOPP and BOPP films

Decontamination of Wearable Textile Electrodes for Medical and Health Care Applications

In the medical and health care environment “intelligent” clothing must endure all the same treatments and procedures as standard hospital textile; that is laundry, disinfection and sterilization. The decontamination level depends on the end-use of the product. The smart garment system for long term body monitoring must be like any other technical underwear; fit well, be comfortable, elastic, vapor permeable, and have easy-care properties capable of enduring multiple cycles of laundry washing. Thus the use of man-made fibers, instead of traditionally used natural fibers, in a body monitoring garment would be more reasonable.

The research focuses on disinfected and sterilized textile electrodes which are applicable for long term body monitoring. As high elasticity, comfort and good vapor permeability are needed, the research concentrates on the electrical and mechanical properties of knitted sensors after sterilization, disinfection and water-repellent treatment. The most important mechanical features of elastic textile electrodes are elongation recovery and dimensional stability. Before sterilization the textile must be cleaned properly from body fluids like blood and sweat. Improving the easy-clean properties would consequently be desirable. By improving the stain repellent or easy cleaning properties, the need for washing can be decreased and a more protective, lower temperature program during laundry washing can be used. These factors not only save energy but also lengthen the lifetime of textile electronics.

The textile surface electric resistance, abrasion resistance, dimensional change and elastic properties following decontamination processes were studied, including the evaluation of water repellent-treated electrode properties. In addition, the mechanical properties of conventional knits and elastic woven bands were observed after treatment in order to assess their use in smart wearable systems.

In addition to electrodes, the research results can be applied to many other textile electronics components such as conductors, antennae, heat elements, switchers and detectors, because all these components can be achieved with same elements; conventional textile fibers combined with conductive fibers or coatings. The obvious application areas for body monitoring by using textile electrodes are hospitals, health care centers and medical research centers. The textile electrodes are more comfortable and invisible for long time body monitoring which is needed, for example, in rehabilitation after surgery or detection of chronic diseases, where they are more effective than conventional gel (Ag / AgCl) electrodes.
In conclusion it can be stated that silver-plated PA fiber in a knitted or woven structure with added repellent treatment provides a highly conductive and durable solution for wearable electronics in medical and health care applications. The steel fiber and textile mixture cannot tolerate mechanical stress caused by disinfection, washing, or repellent treatment. The knitted textile with silver coating cannot tolerate sterilization, either electrically or mechanically. Based on the results of the study, the use of woven bands as an electrode would be recommended instead of knitted material because they are dimensionally more stable. The electrode dimensional changes might negatively affect the measurement quality. On the other hand, the knitted electrodes have additional useful properties like softness and flexibility, thus compromises must be made in using textile electrodes in wearable technology. All materials in the study, woven and knitted, elastic and inelastic, coated and non-coated showed clear shrinkage in the sterilization process. However, using only one heat treatment makes them much more stable. For this reason it can be assumed that man-made fibers are more useful for medical products as they are more resistant to being sterilized or disinfected than are natural fibers. The elastane fiber can be used for improving bi-directional textile material recovery, but the unrecovered elongation as a function of sterilization must be considered. The variation in unrecovered elongation (stretching) might be extremely high and success depends on raw materials and textile structures.
High power GaInNAs VECSEL emitting at 1230/615 nm
We report a frequency-doubled VECSEL operating at 1230/615 nm. The gain chip was grown by plasma-assisted MBE and comprised 10 GaInNAs quantum wells. Preliminary experiments show an output power of >8 W at 615 nm.

General information
State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Penttinen, J., Leinonen, T., Korpijärvi, V., Kantola, E., Guina, M.
Publication date: 22 Jun 2015

Host publication information
Title of host publication: The European Conference on Lasers and Electro-Optics 2015
Publisher: OSA
ISBN (Print): 978-1-4673-7475-0
Links: https://www.osapublishing.org/abstract.cfm?uri=cleo_europe-2015-CB_P_1&origin=search
Research output: Scientific - peer-review › Conference contribution

Fabrication of Single Wall Carbon Nanotube Saturable Absorber in the Micro-grooved Single Mode Fiber
We describe technological solution for fabrication of single wall carbon nanotube (SWCNT) based saturable absorber. The mode-locking of Tm/Ho fiber laser with the fiber-integrated SWCNT saturable absorber was confirmed.
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.
Formability of paper and its improvement

Paper and paperboard are the most utilized packaging materials in the world. This position has been achieved due to several advantageous features of paper such as: renewability, biodegradability, recyclability, and unmatched printability. Paper can be produced anywhere in the world, using local resources and at relatively low cost, which also makes it the most sustainable packaging material. Despite these beneficial features, paper packaging is in tough competition with plastic materials. The competitiveness of paper is mitigated by barrier properties, sensitivity to moisture, and limited ability to be converted into advanced 3D shapes with added functionality. The ability of paper and paperboard to be formed into 3D shapes is described as formability, or sometimes, mouldability.

Formability can be defined as the ability of paper to be formed into 3D shapes without defects in appearance and functionality. Formability as a mechanical property represents a group of parameters which vary according to the type of forming process used. The primary objective of this thesis is to improve the formability of paper by increasing its extensibility. An additional objective is the characterization of formability as a mechanical property of paper and the development of a testing platform for the evaluation of formability.

It was found that the formability of paper in fixed blank forming processes is governed by the extensibility and tensile strength of paper. On the other hand, in sliding blank forming processes, it is dependent on the compressive properties of paper, elastic recovery, and the paper-to-metal coefficient of friction. The criteria of good formability are also different in these two cases, as fixed blank process formability is evaluated via the maximum depth of the shape, i.e. the deeper the shape, the better the formability. In the sliding blank process, formability is evaluated via the visual appearance of the shapes, i.e. the shapes with less profound compressive wrinkles and defects reflect good formability of paper. These results were established by comprehensive investigation of different forming processes and comparison of the outcome with the mechanical properties of paper.

Taking into account the hypothesis that the formability of paper is governed by the extensibility of paper, a set of methods for its improvement was suggested. These methods included combined high- and low-consistency treatment of fibres, spraying of agar and gelatine, in-plane compaction of paper and unrestrained drying. High-consistency treatment of fibres under elevated temperature induces permanent deformations to fibres such as microcompressions and dislocations, which in turn may decrease the axial stiffness of fibres, promoting shrinkage of paper and fibres. The low-consistency treatment straightens the fibres and induces the fibrillation of fibres to promote bonding, while microcompressions in fibres still exist. The spraying of agar and gelatine is likely to modify the character of the fibre joints by making them more deformable, and the drying shrinkage is also increased due to polymer addition. Finally, the fibre network was subjected to in-plane compaction and drying shrinkage which lead to buckling and fibre and network compression.

As a result of these treatments, the extensibility of unrestrained dried paper was increased from 4% points (untreated fibres) to 15–18% points (mechanical treatment and addition of polymers). The extensibility can be increased further by up to 30% points in one direction by compaction. This corresponds to tray-like shapes with a depth of 2–3 cm, depending on the curvature. Such values of formability are the highest reported so far in the scientific literature. The approach for the production of formable paper developed in this thesis work allows the production of a paper-based material with unmatched formability, which can replace certain types of plastic packaging. Replacement of plastics with paper improves the sustainability of packaging in general, and reduces the harmful environmental impact of non-degradable and non-renewable packaging.

General information

State: Published
Optimising polylactide melt spinning using real-time monitoring

Polylactide (PLA) is a synthetic biodegradable polyester and it is usually processed into fibres by two-step melt spinning, which comprises of (i) melting the raw material and pushing the melt through small orifices and (ii) stretching and heat treating the fibre to increase its mechanical properties. However, processing biodegradable polymers is challenging because the polymer degrades thermally which narrows the choice of the processing parameters. Real-time monitoring allows monitoring of the key properties of the material during the production of the fibre.

There were two objectives for this work: (i) upscaling the production of 4-filament PLA fibre with an updated set-up with real-time monitoring and (ii) studying the hydrolytic degradation of PLA fibres manufactured with the conventional set-up. The updated set-up comprised of high-speed spinning plants and a twin-screw extruder equipped with a slit die for later real-time monitoring of parameters related to thermal degradation of the polymer. The processing conditions of polylactide melt spinning were optimised by two sets of trials; initial trials with a packaging grade PLA and a second set of trials with GMP grade poly(L/D)lactide with an L/D ratio of 96/4.

The obtained fibres were characterised by tensile testing and the temperature-induced chain scission was evaluated by inherent viscosity (i.v.) measurements. Goal values were established to enable the post-processing of the fibres. Mechanically adequate fibre was produced in the initial trials regarding the material used and the filament diameters fulfilled the requirements. The packaging grade PLA did not degrade during extrusion but the i.v. of the GMP grade PLA was decreased by one third. The filament diameter and the strain values were at an acceptable level in half of the spools produced in the GMP grade trials. In the initial trials there was a problem with the fluctuation of the filament diameters but it was largely solved by a change of the feeding equipment in the GMP grade trials. There is a need for further optimisation of the mechanical properties. This should be done by increasing the draw ratio. However, the ultimate tensile strength of the fibre was close to the required value.

In addition a 48-week hydrolysis study was conducted on the fibre produced with the conventional set-up. The molecular, rheological, thermal and mechanical properties of gamma irradiated and non-irradiated fibres were measured. The molecular weights and inherent viscosities of both fibres decreased steadily, but the irradiated fibre degraded more prominently. The mechanical performance of the non-irradiated fibre showed no changes but the irradiated fibre could no longer be tested after 28 weeks. In conclusion, the results of the hydrolytic degradation studies were mainly in line with earlier studies. These results can be used as a reference for the future hydrolytic degradation studies for the fibre manufactured with the upgraded set-up.
A method for stereoscopic strain analysis of the right ventricle by digital image correlation during coronary bypass surgery: Short communication

Perioperative cardiocirculatory management of volume therapy remains one of the challenging tasks in cases of patients with severe heart disease. Early detection of congestive cardiac failure prevents subsequent low output and worse outcome. An effective method for controlling extracorporeal circulation is created by developing a non-invasive intraoperative method for right ventricular strain analysis through digital image contrast correlation.

General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Engineering materials science and solutions (EMASS), Heart Surgery, Univesitätsschiklinikum Giessen und Marburg GMBH, Germany, LaVision GmbH, Biochemisch Pharmakologisches Zentrum, Philips-University Marburg, Cardiovascular Research Lab
Number of pages: 5
Pages: 257-261
Publication date: 1 Jun 2015
Peer-reviewed: Yes

Publication information

Journal: Biomedizinische Technik
Volume: 60
Issue number: 3
ISSN (Print): 0013-5585
Ratings:
Scopus rating (2016): CiteScore 0.4 SJR 0.178 SNIP 0.191
Scopus rating (2015): CiteScore 0.4 SJR 0.184 SNIP 0.228
Scopus rating (2014): CiteScore 0.45 SJR 0.192 SNIP 0.448
Scopus rating (2013): CiteScore 0.56 SJR 0.183 SNIP 0.276
Scopus rating (2012): CiteScore 0.66 SJR 0.199 SNIP 0.376
Scopus rating (2011): CiteScore 0.79 SJR 0.235 SNIP 0.568
Scopus rating (2010): SJR 0.201 SNIP 0.383
Scopus rating (2009): SJR 0.23 SNIP 0.505
Scopus rating (2008): SJR 0.186 SNIP 0.256
Scopus rating (2007): SJR 0.251 SNIP 0.528
Scopus rating (2006): SJR 0.184 SNIP 0.31
Scopus rating (2005): SJR 0.239 SNIP 0.438
Scopus rating (2004): SJR 0.189 SNIP 0.326
Scopus rating (2003): SJR 0.165 SNIP 0.456
Scopus rating (2002): SJR 0.244 SNIP 0.456
Scopus rating (2001): SJR 0.174 SNIP 0.381
Scopus rating (2000): SJR 0.235 SNIP 0.505
Scopus rating (1999): SJR 0.213 SNIP 0.637
Original language: English
ASJC Scopus subject areas: Biomedical Engineering
Keywords: Digital image correlation, Heart surgery, Right ventricular strain analysis
DOIs:
10.1515/bmt-2014-0123
Chitosan membranes in a rat model of full-thickness cutaneous wounds: Healing and IL-4 levels

Objective: The aim of this study was to examine the effect of chitosan membrane on wound healing. Method: The effect of chitosan membranes was evaluated in an experimental rat model. On day 0, circular full-thickness skin sections were excised from the scalps of rats. The wounds were then measured and the surrounding area tattooed. Rats were sacrificed either immediately after excision, or randomised into control and chitosan groups and followed up on day 3, 7, 14 or 21. Control group wounds were covered with Aquacel (wound dressing). Chitosan group wounds were covered with chitosan membranes and the wound dressing. Wounds and the distances between the tattooed marks were measured on follow-up, the wound sites were harvested and histologically examined, and serum interleukin (IL-4) levels were analysed.

Results: A total of 54 rats were examined and all time points included 6 control and 6 chitosan treated animals, except for day 0 which consisted of control animals only. On day 3, wounds in the chitosan group were significantly (p<0.05) smaller (60 ± 6% versus 78 ± 19% of the original wound area) than in the control group. Chitosan membranes were found to degrade at the wound sites between days 7 and 14. Leukocyte counts were lower in the chitosan group than in the control group on day seven (p<0.05). IL-4 levels were significantly higher on day 7 (p<0.001) and 14 (p<0.001) in the chitosan group. Conclusion: According to our results chitosan membrane may promote early wound healing, reduce inflammation and affect the IL-4 pathway, however, the membrane degrades at the wound site after day 7.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, BioMediTech, Integrated Technologies for Tissue Engineering Research (ITTE), Tampere University Hospital, BioMediTech, Department of Plastic Surgery
Authors: Nordback, P. H., Miettinen, S., Kääriäinen, M., Haaparanta, A. M., Kellomäki, M., Kuokkanen, H., Seppänen, R.
Number of pages: 7
Pages: 245-251
Publication date: 1 Jun 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Wound Care
Volume: 24
Issue number: 6
ISSN (Print): 0969-0700

Ratings:
Scopus rating (2016): SJR 0.526 SNIP 0.725 CiteScore 1.13
Scopus rating (2015): SJR 0.509 SNIP 1.085 CiteScore 1.06
Scopus rating (2014): SJR 0.527 SNIP 0.964 CiteScore 1.07
Scopus rating (2013): SJR 0.655 SNIP 1.129 CiteScore 1.19
Scopus rating (2012): SJR 0.943 SNIP 1.576 CiteScore 1.64
Scopus rating (2011): SJR 0.759 SNIP 1.087 CiteScore 1.58
Scopus rating (2010): SJR 0.573
Scopus rating (2009): SJR 0.281
Scopus rating (2008): SJR 0.332
Scopus rating (2007): SJR 0.301
Scopus rating (2006): SJR 0.283
Scopus rating (2005): SJR 0.214
Scopus rating (2004): SJR 0.143
Scopus rating (2003): SJR 0.132
Scopus rating (2002): SJR 0.139
Scopus rating (2001): SJR 0.146
Scopus rating (2000): SJR 0.154
Scopus rating (1999): SJR 0.144

Original language: English
Keywords: Chitosan, Chitosan membrane, Full-thickness, IL-4, Wound healing
ASJC Scopus subject areas: Nursing (miscellaneous), Fundamentals and skills
Mechanical characterization of fiber ceramics: Effect of temperature

Fibrous ceramic structures are used in thermal insulators and filters in high-temperature processes. Their mechanical properties are surprisingly complex, being governed by force fields transmitting in the net of fibers. Examining how the fibers link to each other sheds light to this quandary. Extent of linking is defined by the fiber free length (deep red), which is the distance between the closest contact points (green) of a fiber. Decrease of free length, as neighboring fibers (blue) develop contacts, explains why these structures turn rigid with heat. When analyzed with grit blasting, this can be used to discover the structure's thermal history.

Dissolution of enzyme-treated cellulose using freezing thawing method and the properties of fibres regenerated from the solution
The rapid coagulation of NaOH-based cellulose solution during the wet spinning process leads to a low stretching ratio and, consequently, the low mechanical properties of the fibres. The aim of this work was to slow down the coagulation by replacing the sulphuric acid spin bath with an acetic acid bath. The spin dope was prepared by dissolving the enzyme-treated dissolving pulp in aqueous sodium zinicate using a freezing thawing method. The optimal zinc oxide and sodium hydroxide concentrations were studied first. The most thermally stable cellulose solution contained 6.5 wt% NaOH and 1.3 wt% ZnO with 6 wt% enzyme-treated dissolving pulp. The spin dope was prepared accordingly. Coagulation of the cellulose solution slowed down in the acetic acid bath, resulting in a significantly higher stretching ratio for the fibres than with the sulphuric acid bath. However, the acetic acid spun fibres shrunk strongly during drying, and the possibly aligned order of the molecular chains due to the high stretch was partly lost. As a consequence, the high stretch was not transferred to high tenacity of the fibres in this study. However, the result suggests attractive potential to develop processing conditions to increase fibre tenacity.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Authors: Vehviläinen, M., Kamppuri, T., Gronqvist, S., Rissanen, M., Maloney, T., Honkanen, M., Nousiainen, P.
Number of pages: 22
Pages: 1653-1674
Publication date: Jun 2015
Peer-reviewed: Yes

Publication information
Journal: Cellulose
Volume: 22
Issue number: 3
ISSN (Print): 0969-0239
Ratings:
Scopus rating (2016): CiteScore 3.68 SJR 1.126 SNIP 1.144
Scopus rating (2015): SJR 1.153 SNIP 1.24 CiteScore 3.55
Scopus rating (2014): SJR 1.071 SNIP 1.334 CiteScore 3.58
Scopus rating (2013): SJR 1.127 SNIP 1.48 CiteScore 3.83
Scopus rating (2012): SJR 1.179 SNIP 1.71 CiteScore 3.74
Scopus rating (2011): SJR 1.354 SNIP 1.795 CiteScore 3.99
Scopus rating (2010): SJR 0.873 SNIP 1.384
Scopus rating (2009): SJR 1.038 SNIP 1.219
Scopus rating (2008): SJR 0.926 SNIP 1.123
Scopus rating (2007): SJR 0.754 SNIP 1.034
Scopus rating (2006): SJR 0.699 SNIP 1.15
Scopus rating (2005): SJR 1.112 SNIP 1.318
Scopus rating (2004): SJR 0.855 SNIP 1.072
Scopus rating (2003): SJR 0.81 SNIP 1.02
Scopus rating (2002): SJR 0.649 SNIP 0.689
Scopus rating (2001): SJR 0.602 SNIP 0.785
Scopus rating (2000): SJR 0.583 SNIP 0.773
Scopus rating (1999): SJR 0.67 SNIP 1.14
Original language: English
Keywords: Cellulose dissolution, Dissolving pulp, Enzymatic treatment, Wet spinning, Regenerated fibres, Biocellos, NAOH/UREA AQUEOUS-SOLUTION, SODIUM-HYDROXIDE, DISSOLVING PULP, WET-SPUN, TEMPERATURE, MULTIFILAMENT, CARBAMATE, MECHANISM, SYSTEM
DOIs:
10.1007/s10570-015-0632-0
Source: WOS
Source-ID: 000354193000015
Research output: Scientific › peer-review › Article

Dual-Mode Behavior in Multi-Section DFB Semiconductor Lasers with Laterally-Coupled Ridge-Waveguide Surface Gratings
Education and Materials Joining Research methods at Tampere University of Technology
At Tampere University of Technology (TUT), education and research related to joining technologies are performed by two university departments, the Department of Materials Science (DMS) and the Department of Mechanical Engineering and Industrial Systems (MEI). Many of the research activities are conducted via close collaboration between these two units.

Effect of Strain Rate on the Martensitic Transformation During Plastic Deformation of an Austenitic Stainless Steel
The effect of strain rate on the plastic deformation and phase transformation behavior of metastable austenitic stainless steel EN 1.4318 was studied. Strain rate jump tests were used to distinguish the direct effects of strain rate from the effects of adiabatic heating. Test results are analyzed from the viewpoint of both stress- and strain-induced martensitic transformation.

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Impact of mechanical and enzymatic pretreatments on softwood pulp fiber wall structure studied with NMR spectroscopy and X-ray scattering

Dissolution of wood pulp can be enhanced by applying certain pretreatments before exposing the fibers to solvents. We have analyzed the effect of mechanical and enzymatic pretreatments on softwood fiber wall structure using nuclear magnetic resonance (NMR) spectroscopic methods, small and wide angle X-ray scattering (SAXS, WAXS). NMR diffusometry was used to estimate the effect of pretreatments on average pore sizes at micrometer size scale and for the connectivity of the porous network. A proton NMR experiment was used to quantify the nonfreezing water content inside the fiber wall, and solid state NMR C-13 cross polarization (CP) magic angle spinning (MAS) spectroscopy was used to observe the effect of pretreatments on crystallinity and lateral fibril dimensions of cellulose fibrils, and in combination with fiber saturation point measurement to calculate the average pore size at nanometer size scale. Both WAXS and CP MAS NMR experiments confirmed that there were no changes in crystallinity nor in fibril lateral dimensions due to pretreatments. The pretreatments caused an increase in the amount of nonfreezing water, suggesting an opening of the pore system. According to diffusion experiments there are only minor changes in micrometer scale pore network due to pretreatments. SAXS results indicated that enzymatic treatment increased the microfibrillar distance, and there was also an increase in cross relaxation rate of magnetization from water to cellulose protons as observed by NMR. These were interpreted to be due to opening of microfibrillar bundles, leading to an increased accessibility of water.
Interface modification of glass fibre-polyester composite-composite joints using peel plies

This work includes an investigation of six different surface treatments for joining composites by overlamination. The durability of the pre-treated glass fibre-unsaturated polyester composite joints is investigated accounting for a 200-day water immersion at 64 +/- 1 degrees C. Degradation due to accelerated aging, by water and elevated temperature, is analysed using Fourier transform infrared spectroscopy (FTIR), water absorption measurement, tensile testing and a systematic sequence of four different fracture test methods. Based on the fracture tests, the mechanical abrading treatment outperformed all other treatments yet suffered an adverse effect due to the combined moisture and elevated temperature. We observed irreversible chemical degradation in the bulk composite in terms of permanent 23% weight loss. The softening and plasticization of the polyester matrix seemed to have played a fundamental role in the rupture of adhesion at the peel ply and tear ply pre-treated overlamination interfaces. However, the adhesion loss was partly reversible and it was concluded to signify the domination of mechanical interlocking at peel ply and tear ply modified interfaces. (C) 2015 Elsevier Ltd. All rights reserved.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Engineering materials science and solutions (EMASS), Aalto Univ, Aalto University, Sch Engr, Dept Appl Mech, Aalto University
Authors: Kanerva, M., Sarlin, E., Hoikkanen, M., Rämö, K., Saarela, O., Vuorinen, J.
Number of pages: 13
Pages: 40-52
Publication date: Jun 2015
Peer-reviewed: Yes

Publication information
Journal: International Journal of Adhesion and Adhesives
Microchip laser Q-switched with GaInNAs/GaAs SESAM emitting 204 ps pulses at 1342 nm

A 1342 nm Nd:YVO4 microchip laser is reported, Q-switched with a dilute nitride GaInNAs/GaAs saturable absorber mirror. The laser produced optical pulses as short as 204 ps with 2.3 MHz repetition rate and 24 mW average output power. In comparison to conventional InP-based saturable absorber mirrors, the advantage of the proposed approach is the availability of excellent Bragg mirror materials that enable high reflectivity and more flexibility in designing the nonlinear parameters owing to the use of lattice matched GaInNAs/GaAs quantum wells.

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
Authors: Nikkinen, J., Korpijärvi, V. M., Leino, I., Härkönen, A., Guina, M.
Number of pages: 3
Pages: 850-852
Publication date: 28 May 2015
Peer-reviewed: Yes
The Role of Groove Periodicity in the Formation of Site-Controlled Quantum Dot Chains

Structural and optical properties of InAs quantum dot (QD) chains formed in etched GaAs grooves having different periods from 200 to 2000 nm in [010] orientation are reported. The site-controlled QDs were fabricated by molecular beam epitaxy on soft UV-nanoimprint lithography-patterned GaAs(001) surfaces. Increasing the groove periods decreases the overall QD density but increases the QD size and the linear density along the groove direction. The effect of the increased QD size with larger periods is reflected in ensemble photoluminescence measurements as redshift of the QD emission. Furthermore, we demonstrate the photoluminescence emission from single QD chains.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research group: Semiconductor Technology and Applications, Optoelectronics Research Centre, Augmented Human Activities (AHA), Frontier Photonics
Authors: Schramm, A., Hakkarainen, T. V., Tommila, J., Guina, M.
Number of pages: 6
Pages: 1-6
Publication date: 28 May 2015
Peer-reviewed: Yes

Publication information
Journal: Nanoscale Research Letters
Volume: 10
Article number: 242
ISSN (Print): 1556-276X
Ratings:
Scopus rating (2016): SJR 0.589 SNIP 0.746 CiteScore 2.15
Scopus rating (2015): SJR 0.538 SNIP 0.653 CiteScore 1.69
Scopus rating (2014): SJR 0.748 SNIP 1.019 CiteScore 2.15
Scopus rating (2013): SJR 0.79 SNIP 0.967 CiteScore 2.23
Scopus rating (2012): SJR 1.049 SNIP 1.073 CiteScore 2.58
Scopus rating (2011): SJR 1.04 SNIP 1.124 CiteScore 2.88
Scopus rating (2010): SJR 1.062 SNIP 1.007
Scopus rating (2009): SJR 1.063 SNIP 1.01
Scopus rating (2008): SJR 0.828 SNIP 0.632
Scopus rating (2007): SJR 1.458 SNIP 0.71
Original language: English
Microrobotic system for multi-rate measurement of bio-based fibres Z-directional bond strength

The core content of this study is micro-testing of microscale objects - an emerging application area for microrobotics - where microrobotics has been used in paper industry for measuring properties at the single fibre level. Pulp and paper scientists are interested to have experimental data of single fibre-fibre bond strength distribution of paper/board products in different loading modes and rates. Meeting this demand is quite challenging since the system should be able to measure the bond strength i) in the individual fibre level, ii) in different loading modes, and iii) in different loading rates. The current methods of measurement do not satisfy all these three requirements. Among the four different loading modes, the Z-directional behaviour of paper/board products is a matter of high significance for papermaking and paper converting companies. The Z-directional properties influence compressive properties, and accordingly the performance of structural paper/board products. According to the literature, there is not any reported method to facilitate the measurement of Z-directional strength at the single fibre level in different loading rates. This paper reports an in-depth study of a measurement method for experimental evaluation of Z-directional individual fibre-fibre bond strength in multiple loading rates using microrobotics and a Polyvinylidene fluoride (PVDF) film microforce sensor. The results from the measurement system are promising. In summary, the first concept for multi-rate measurement of Z-directional bond strength at the individual fibre level is developed during this work which has a high practical impact on the fibre characterization research field.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Research area: Microsystems, Research area: Measurement Technology and Process Control
Authors: Latifi, S. K., Saketi, P., Kallio, P.
Number of pages: 14
Pages: 13-26
Publication date: 24 May 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Micro-Bio Robotics
Volume: 10
Issue number: 1
Article number: 1
ISSN (Print): 2194-6418
Ratings:
Scopus rating (2016): SJR 0.352 SNIP 0.646 CiteScore 1.7
Scopus rating (2015): SJR 0.336 SNIP 1.025 CiteScore 1
Scopus rating (2014): SJR 0.105 SNIP 0.02
Original language: English
Keywords: Microrobotics, Micro-testing, Multi-rate microforce sensing, Polyvinylidene fluoride (PVDF), Z-directional strength
ASJC Scopus subject areas: Engineering(all)
DOIs: 10.1007/s12213-015-0080-9
Research output: Scientific - peer-review Article

Compression model for radial compression of Norway spruce earlywood and latewood

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Authors: Moilanen, C., Björkqvist, T., Saarenninne, P.
Publication date: 19 May 2015
High temperature oxidation tests for the high velocity solution precursor flame sprayed manganese-cobalt oxide spinel protective coatings on SOFC interconnector steel

High velocity solution precursor flame spray process was used to deposit MnCo1.9Fe0.1O4 and Mn1.5Co1.5O4 coatings on Crofer 22 APU ferritic stainless steel samples. The solution precursors were manufactured by diluting metal nitrates into deionized water. The as-sprayed coatings were oxidized at 850 degrees C for 500 h to evaluate Cr-barrier and electrical properties.

The post-mortem studies were performed with various qualitative and quantitative elemental analysis methods and a four-point measurement was used for the area specific resistance studies. The as-sprayed coatings were formed of single crystallite nanoparticles (10-20 nm) and polycrystalline sub-micron particles (100-500 nm). The small particle and crystallite size showed strong sintering behavior during the oxidation cycle. Cr-migration was fully prevented thought the oxidized coatings. The surface topography and grain growth dominated the electrical properties during the test cycle. Copyright (C) 2015, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Surface Engineering, Research group: Materials Characterization, Research group: Ceramic materials, Engineering materials science and solutions (EMASS), Univ Toronto, University of Toronto, Dept Mat Sci & Engr, Univ Toronto, University of Toronto, Dept Mech & Ind Engn
Authors: Puranen, J., Laakso, J., Honkanen, M., Heinonen, S., Kylmälahti, M., Lugowski, S., Coyle, T. W., Kesler, O., Vuoristo, P.
Number of pages: 12
Pages: 6216-6227
Publication date: 18 May 2015
Peer-reviewed: Yes

Publication information
Volume: 40
Issue number: 18
ISSN (Print): 0360-3199
Ratings:
Scopus rating (2016): CiteScore 3.74 SJR 1.142 SNIP 1.286
Scopus rating (2015): SJR 1.294 SNIP 1.319 CiteScore 3.46
Scopus rating (2014): SJR 1.212 SNIP 1.494 CiteScore 3.54
Scopus rating (2013): SJR 1.278 SNIP 1.467 CiteScore 3.38
Scopus rating (2012): SJR 1.515 SNIP 1.729 CiteScore 3.96
Scopus rating (2011): SJR 1.456 SNIP 1.837 CiteScore 4.42
Scopus rating (2010): SJR 1.589 SNIP 1.871
Scopus rating (2009): SJR 1.333 SNIP 1.885
Scopus rating (2008): SJR 1.401 SNIP 2.096
Scopus rating (2007): SJR 1.279 SNIP 2.201
Scopus rating (2006): SJR 1.073 SNIP 2.161
Scopus rating (2005): SJR 1.107 SNIP 1.787
Scopus rating (2004): SJR 1.225 SNIP 1.626
Scopus rating (2003): SJR 1.003 SNIP 1.319
Scopus rating (2002): SJR 0.763 SNIP 1.157
Scopus rating (2001): SJR 0.487 SNIP 1.185
Scopus rating (2000): SJR 0.518 SNIP 0.866
Scopus rating (1999): SJR 0.382 SNIP 0.897
Original language: English
Keywords: High velocity solution precursor flame spray, SOFC interconnect, Protective coating, FUEL-CELLS, ELECTRICAL-CONDUCTIVITY, SOLID-SOLUTION, MN
Microstructure-based thermo-mechanical modelling of thermal spray coatings

This paper demonstrates how microstructure-based finite element (FE) modelling can be used to interpret and predict the thermo-mechanical behaviour of thermal spray coatings. Validation is obtained by comparison to experimental and/or literature data.

Finite element meshes are therefore constructed on SEM micrographs of high velocity oxygen-fuel (HVOF)-sprayed hardmetals (WC-CoCr, WC-FeCrAl) and plasma-sprayed Cr2O3, employed as case studies. Uniaxial tensile tests simulated on high-magnification micrographs return micro-scale elastic modulus values in good agreement with depth-sensing Berkovich micro-indentation measurements. At the macro-scale, simulated and experimental three-point bending tests are also in good agreement, capturing the typical size-dependency of the mechanical properties of these materials. The models also predict the progressive stiffening of porous plasma-sprayed Cr2O3 due to crack closure under compressive loading, in agreement with literature reports.

Refined models of hardmetal coatings, accounting for plastic behaviours and failure stresses, predict crack initiation locations as observed by indentation tests, highlighting the relevance of stress concentrations around microstructural defects (e.g. oxide inclusions).

Sliding contact simulations between a hardmetal surface and a small spherical asperity reproduce the fundamental processes in tribological pairings. The experimentally observed "wavy" morphologies of actual wear surfaces are therefore explained by a mechanism of micro-scale plastic flow and matrix extrusion. (C) 2015 Elsevier Ltd. All rights reserved.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Surface Engineering, Engineering materials science and solutions (EMASS), Univ Modena & Reggio Emilia, Universita di Modena e Reggio Emilia, Dept Engn Enzo Ferrari
Authors: Bolelli, G., Candelli, A., Koivuluoto, H., Lusvarghi, L., Manfredini, T., Vuoristo, P.
Number of pages: 15
Pages: 20-34
Publication date: 15 May 2015
Peer-reviewed: Yes

Publication information
Journal: Materials and Design
Volume: 73
ISSN (Print): 0264-1275
Ratings:
Scopus rating (2016): CiteScore 4.9 SJR 1.751 SNIP 2.481
Scopus rating (2015): SJR 1.885 SNIP 2.654 CiteScore 4.51
Scopus rating (2014): SJR 2.418 SNIP 3.474 CiteScore 4.36
Scopus rating (2013): SJR 2.045 SNIP 3.269 CiteScore 3.8
Scopus rating (2012): SJR 1.988 SNIP 3.212 CiteScore 3.31
Scopus rating (2011): SJR 1.406 SNIP 2.521 CiteScore 2.63
Scopus rating (2010): SJR 1.07 SNIP 1.822
Scopus rating (2009): SJR 0.93 SNIP 1.81
Scopus rating (2008): SJR 0.973 SNIP 1.361
Scopus rating (2007): SJR 0.846 SNIP 1.68
Scopus rating (2006): SJR 0.666 SNIP 1.415
Scopus rating (2005): SJR 0.739 SNIP 1.373
Scopus rating (2004): SJR 0.52 SNIP 1.167
Scopus rating (2003): SJR 0.565 SNIP 1.201
Scopus rating (2002): SJR 0.574 SNIP 1.165
Scopus rating (2001): SJR 0.374 SNIP 0.59
Scopus rating (2000): SJR 0.242 SNIP 0.716
Scopus rating (1999): SJR 0.192 SNIP 0.339
Original language: English
Keywords: Thermal spray, Coatings, Finite element simulation, Microstructure based model, Elastic properties, Contact simulation, METAL-MATRIX COMPOSITES, DUAL-PHASE STEEL, BARRIER COATINGS, ALUMINA COATINGS, ELASTIC-MODULUS, BEHAVIOR, MECHANISMS, INDENTATION, CONDUCTIVITY, SIMULATION
Spontaneous formation of nanostructures by surface spinodal decomposition in GaAs$_{1-x}$Bi$_x$ epilayers

We report on the spontaneous formation of lateral composition modulations (LCMs) in Ga(As, Bi) epilayers grown by low-temperature (<300 degrees C) molecular beam epitaxy (MBE) on GaAs(001). Both cross-section and plan-view transmission electron microscopy techniques are used to investigate the nature of the LCMs, consisting of Bi-rich cylinder-like nanostructures lying along the [001] growth direction. The observed LCMs are the consequence of a two-dimensional phase separation process occurring at the surface of the growing epilayers, and their columnar nature is consistent with a surface-directed spinodal decomposition process. Although LCMs are thermodynamically driven, we show how they can be kinetically controlled, in particular, through the As/Ga flux ratio and the substrate temperature. This is a result of LCMs developing from surface atomic diffusion processes, since the atomic dimer configurations on the surface alter adatom diffusivity. The significant role of the surface reconstructions is also discussed. (c) 2015 AIP Publishing LLC.
Characterization Of High-Velocity Single Particle Impacts On Thermally Sprayed Ceramic Coatings

High-velocity impact wear may have a significant effect on the lifetime of thermally sprayed coatings in multiple applications, e.g. in process- and aero industries. An experimental impact study was performed on thermally sprayed coatings with a high velocity particle impactor (HVPI) in oblique angles to investigate the damage, failure and deformation of the coating. The impact site was characterized with a profilometer, optical microscopy and SEM. Furthermore, the connection between the microstructural details and impact behaviour were studied to reveal the damage and failure characteristics in a more comprehensive level. Additionally, traditional dry-erosion behaviour with small particles and different angles was compared with the high-velocity single particle impact phenomena. Differences in wear volume and deformation of the impact site and in absorbance of kinetic energy were also studied, focusing on the effect of material properties as well as the impact characteristics.

General information
State: Unpublished
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Surface Engineering, Research group: Materials Characterization
Authors: Kiilakoski, J., Lindroos, M., Matikainen, V., Apostol, N., Koivuluoto, H., Vuoristo, P.
Publication date: 13 May 2015

Host publication information
Title of host publication: International Thermal Spray Conference & Exposition 2015
ISBN (Print): 978-1-62708-093-4
ASJC Scopus subject areas: Surfaces, Coatings and Films
Links:
https://asm.confex.com/asm/itsc15/webprogram/Paper38348.html

Bibliographical note
Conference presentation, unpublished in proceedings.
Research output: Scientific - peer-review › Conference contribution

Regeneration of fibres from alkaline solution containing enzyme-treated 3-allyloxy-2-hydroxypropyl substituted cellulose

The aim of this study was to regenerate fibres from the alkaline cellulose solution containing 3-allyloxy-2-hydroxypropyl substituents. Enzyme-treated cellulose was modified in alkaline aqueous tert-butanol (tBuOH) using allyl glycidyl ether (AGE) as the modification reagent. 3-allyloxy-2-hydroxypropyl substituted (AHP) enzyme-treated cellulose with DS<sup>+</sup><sub>inf</sub> 0.05 was obtained. Enzyme-treated cellulose without (reference) and with substituents were dissolved in sodium zincate using the freezing-thawing cycle. The reference solution alone and the mixture solutions containing 10 or 25 % of the AHP cellulose were regenerated into cellulosic fibres using the wet spinning technique. The solutions containing 100 or 50 % of the AHP cellulose did not form fibres in acidic bath. The 10 % share of AHP cellulose did not affect the mechanical properties of the fibres (1.5 cN dtex<sup>−1</sup>), while the 25 % share decreased the tenacity slightly (1.3 cN dtex<sup>−1</sup>). Elongation of the fibres ranged from 18 to 22 %. The 10 and 25 % shares of AHP cellulose increased the water holding ability of fibres by 12 and 33 %, respectively. According to FESEM the fibre structures are composed of nanosized fibrils.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Fibre Materials, Research group: Materials Characterization, Engineering materials science and solutions (EMASS), VTT Technical Research Centre of Finland
Authors: Vehviläinen, M., Kamppuri, T., Setälä, H., Grönqvist, S., Rissanen, M., Honkanen, M., Nousiainen, P.
Number of pages: 12
Pages: 2271-2282
Publication date: 10 May 2015
Peer-reviewed: Yes

Publication information
Journal: Cellulose
Volume: 22
Issue number: 4
ISSN (Print): 0969-0239
Ratings:
Scopus rating (2016): CiteScore 3.68 SJR 1.126 SNIP 1.144
Photoelastic Stress Evaluation and Mechanical Testing of Hybrids

To produce parts having complicated geometry with low cost and fast processing hybrid structures of metals embedded in polymer offer advantages. Such structures which can be regarded as macrocomposites need good understanding of the interfacial properties and residual stresses in order to be used in demanding applications. We used photoelastic stress analysis and strain gauge measurements to examine internal stresses in a stainless steel-epoxy hybrid component, internal stresses include both the residual stresses due to cure shrinkage of the resin and the changing internal stress state during mechanical loading. The effect of adhesion between steel inserts and epoxy on the durability under static and impact loading was studied. Internal digital image correlation (DIC) technique was also developed and used to evaluate deformation behavior and fracture mechanisms of the hybrids. We used epoxy block samples with thin stainless steel plate inserts that were fabricated by resin casting into flexible molds fabricated from a 3D-printed model of needed geometry.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Engineering materials science and solutions (EMASS)
Authors: Orell, O., Kakkonen, M., Vuorinen, J.
Pages: 1913-1924
Publication date: May 2015

Host publication information
Publisher: Society for the Advancement of Material and Process Engineering
Source: Scopus
Source-ID: 84987617947
Research output: Scientific - peer-review › Conference contribution

Wear and corrosion resistant laser coatings for hydraulic piston rods
Hydraulic piston rods on oil & gas drilling platforms, hydro-power stations, chemical plants and underground mines are exposed to severe tribo-corrosive conditions under static and dynamic mechanical loads. Piston rods made of carbon,
quenched & tempered (QT) and stainless steels are frequently surface coated with methods such as thermal spraying, hard chrome plating and overlay welding. Unfortunately, several premature failures have been reported particularly in marine applications due to insufficient coating properties. Laser cladding has recently drawn lot of attention in this field due to high coating quality and significant improvements in productivity. In this study, several potential Fe-, Ni- and Co-based alloys were laser clad on carbon and QT steels. Their corrosion and mechanical performances were explored in long-term salt spray, immersion, hardness, abrasive wear and 4-point bending fatigue tests. Most of the laser coatings outperformed hard chrome in corrosion properties but hardness values were somewhat lower. In single point abrasion tests (scratch tests), the hardest laser coatings, however, outperformed hard chrome due to brittle nature of hard chrome layers. Post-machining induced significant superficial hardness increase in laser coatings, which was the main reason for good wear performance. Fatigue performance was strongly dependent on material pairs, presence of cladding defects and applied loads.

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Surface Engineering, Research group: Tribology and Machine Elements, Engineering materials science and solutions (EMASS), Technology Centre Ketek Ltd.
Authors: Tuominen, J., Nääkki, J., Pajukoski, T., Miettinen, J., Peltola, T., Vuoristo, P.
Number of pages: 12
Pages: 022009-1 - 022009-12
Publication date: May 2015
Peer-reviewed: Yes

**Publication information**
Journal: Journal of Laser Applications
Volume: 27
Issue number: 2
Article number: 022009
ISSN (Print): 1042-346X
Ratings:
Scopus rating (2016): SJR 0.648 SNIP 1.097 CiteScore 1.56
Scopus rating (2015): SJR 0.489 SNIP 1.143 CiteScore 1.71
Scopus rating (2014): SJR 0.7 SNIP 1.298 CiteScore 1.69
Scopus rating (2013): SJR 0.672 SNIP 0.964 CiteScore 1.32
Scopus rating (2012): SJR 0.245 SNIP 0.685 CiteScore 0.49
Scopus rating (2011): SJR 0.321 SNIP 0.801 CiteScore 0.74
Scopus rating (2010): SJR 0.422 SNIP 0.852
Scopus rating (2009): SJR 0.576 SNIP 1.069
Scopus rating (2008): SJR 0.378 SNIP 0.73
Scopus rating (2007): SJR 0.498 SNIP 1.099
Scopus rating (2006): SJR 0.537 SNIP 1.053
Scopus rating (2005): SJR 0.406 SNIP 0.917
Scopus rating (2004): SJR 0.524 SNIP 1.018
Scopus rating (2003): SJR 0.52 SNIP 0.95
Scopus rating (2002): SJR 0.526 SNIP 1.525
Scopus rating (2001): SJR 0.68 SNIP 1.762
Scopus rating (2000): SJR 0.874 SNIP 1.327
Scopus rating (1999): SJR 0.396 SNIP 1.211
Original language: English
ASJC Scopus subject areas: Materials Science(all), Engineering(all)
Keywords: laser cladding, hydraulic, corrosion, wear, fatigue, remanufacturing, additive manufacturing
DOIs:
10.2351/1.4914503
Source: WOS
Source-ID: 000352319600009
Research output: Scientific - peer-review › Article

**Engineered nanomaterials reduce but do not resolve life cycle environmental impacts of power capacitors**
Abstract Engineered nanomaterials are used to improve the properties of products. Often this results in size reduction or increased functionality, which may result in reduced environmental impacts. At the same time the manufacturing and disposal of the nanomaterials increases the life cycle impacts of the product. In this study the effects of using nano-silica polymers in power capacitors were investigated through life cycle assessment (LCA). The analysis was based on existing
production technology which was modified to represent a prototype using nanomaterials. Based on the results, the nanomaterials would reduce impacts by c.a. 20% in the most relevant environmental life cycle impact categories. The main impact categories of the power capacitors were in metal depletion, land transformation and ecotoxicity. Although the nanomaterial based capacitor had slightly lower impacts, it did not resolve the main problems in these categories. Contribution analysis revealed that most of the impact is caused by only a few processes in the life cycle, especially raw materials supply for tin solders and waste treatment of insulating oil. Ecodesign alternatives for targeting the identified environmental hotspots are discussed.

Erosive wear of various stainless steel grades used as impeller blade materials in high temperature aqueous slurry
Two austenitic stainless steel grades, 316L and 904L, and three duplex stainless steel grades, LDX 2101, 2205, and 2507, were erosion tested as impeller blade materials for hydrometallurgical applications. Samples were attached to the pressure and suction sides of an impeller and were tested for 72 h at 80 °C and 95 °C in a small-scale reactor using quartz sand slurry. Based on the mass losses measured, the steel grades could be ranked into two distinct categories; LDX 2101 and 2507 comprising the category with the better erosion resistance. The categories were the same for the pressure and suction side tests even though the erosion mechanism differed. In most cases, erosion was more severe in the suction side samples, which has practical implications for wear protection design. In the pressure side samples, the
variation in the erosion mass loss with different experimental parameters was in line with earlier reported findings. In contrast, in the suction side samples, under some experimental conditions, increasing tip speed and increasing particle size were found to reduce erosion mass loss. This emphasizes the fact that the erosivity of particles for the impeller suction side cannot be deduced solely based on particle size. The reasons for the observed behavior are discussed.

**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed

Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Engineering materials science and solutions (EMASS), Outotec Research Center

Authors: Lindgren, M., Suihkonen, R., Vuorinen, J.

Number of pages: 10

Pages: 391-400

Publication date: 5 Apr 2015

Peer-reviewed: Yes

**Publication information**

Journal: Wear

Volume: 328-329

ISSN (Print): 0043-1648

Ratings:

Scopus rating (2016): CiteScore 3 SJR 1.558 SNIP 2.071

Scopus rating (2015): SJR 1.527 SNIP 2.017 CiteScore 2.73

Scopus rating (2014): SJR 1.715 SNIP 2.38 CiteScore 2.46

Scopus rating (2013): SJR 1.319 SNIP 2.416 CiteScore 2.37

Scopus rating (2012): SJR 1.36 SNIP 2.178 CiteScore 1.85

Scopus rating (2011): SJR 1.547 SNIP 2.865 CiteScore 2.43

Scopus rating (2010): SJR 1.509 SNIP 2.153

Scopus rating (2009): SJR 1.684 SNIP 2.07

Scopus rating (2008): SJR 1.597 SNIP 1.863

Scopus rating (2007): SJR 1.286 SNIP 1.889

Scopus rating (2006): SJR 1.435 SNIP 2.036

Scopus rating (2005): SJR 1.473 SNIP 2.007

Scopus rating (2004): SJR 1.335 SNIP 1.965

Scopus rating (2003): SJR 1.104 SNIP 1.788

Scopus rating (2002): SJR 0.958 SNIP 1.365

Scopus rating (2001): SJR 0.937 SNIP 1.47

Scopus rating (2000): SJR 1.069 SNIP 1.149

Scopus rating (1999): SJR 0.848 SNIP 1.338

Original language: English

ASJC Scopus subject areas: Condensed Matter Physics, Surfaces and Interfaces, Materials Chemistry, Surfaces, Coatings and Films, Mechanics of Materials

Keywords: Erosion, Impellers, Mixing, Slurry, Stainless steels, Wear

DOIs:

10.1016/j.wear.2015.03.014

Links:

http://www.scopus.com/inward/record.url?scp=84926200934&partnerID=8YFLogxK (Link to publication in Scopus)

Source: Scopus

Source-ID: 84926200934

Research output: Scientific - peer-review › Article

The effect of impact conditions on the wear and deformation behavior of wear resistant steels

The deformation and wear behavior of four high strength wear resistant steels were studied in various impact conditions to evaluate their performance in applications involving heavy impacts and impact-abrasion. In the normal direction impacts, the studies were conducted with single and repeated (multiple) drop tests. To better simulate the actual application conditions, the samples were positioned at an angle relative to the impact direction in the tests with the high velocity particle impactor (HVPI) device. The effect of strain rate was investigated using constant size projectiles made from materials with different density but keeping the impact energy constant by varying the incident projectile velocity. The effect of surface hardening on the wear resistance of the high strength steels was determined by impacting the same surface area multiple times at a constant velocity using spherical high velocity projectiles. Regardless of the rather similar hardness of the studied three martensitic steel grades, the impact behavior showed differences in wear rate and damage mechanisms in each case due to the microstructural characteristics of the materials. The adiabatic shear bands forming in
the martensitic steels at higher loading rates were found to increase the wear rate. Moreover, the carbide reinforced steel performed in general better than the martensitic grades but showed more brittle behavior and generation of crack networks that can affect the wear performance of the material.

193-GHz 53-W Subpicosecond Pulse Source
We present a light source that can generate a pulse train with an extremely high repetition rate, tens of watts of average output power, and a low-divergence output beam. This unique combination of system characteristics is achieved with single-stage amplification of a passively harmonically mode-locked semiconductor disk laser in a tapered Yb-doped double-clad fiber. With the short-length tapered fiber amplifier an amplification factor >17 dB is reached, while preserving the 930-fs pulse duration of the semiconductor disk laser. The demonstrated pulse source with a beam quality factor...
Publication information
Journal: IEEE Photonics Technology Letters
Volume: 27
Issue number: 7
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
Scopus rating (2009): SJR 1.775 SNIP 1.804
Scopus rating (2008): SJR 2.081 SNIP 1.818
Scopus rating (2007): SJR 2.345 SNIP 1.566
Scopus rating (2006): SJR 2.112 SNIP 1.884
Scopus rating (2005): SJR 2.97 SNIP 2.454
Scopus rating (2004): SJR 3.286 SNIP 2.716
Scopus rating (2003): SJR 3.44 SNIP 2.467
Scopus rating (2002): SJR 3.566 SNIP 2.117
Scopus rating (2001): SJR 3.519 SNIP 1.678
Scopus rating (2000): SJR 2.345 SNIP 1.202
Scopus rating (1999): SJR 2.44 SNIP 1.302
Original language: English
Keywords: Semiconductor disk lasers, optical fiber amplifiers, tapered double-clad fibers, SEMICONDUCTOR DISK LASER, HIGH-POWER, FREQUENCY COMB, TAPERED FIBER, MODE-LOCKING, GHZ, PICOSECOND
DOIs:
10.1109/LPT.2015.2392155
Source: WOS
Source-ID: 000350877700025
Research output: Scientific - peer-review › Article

Muottikarkaisuksen terästen kehityslinjat

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science, Research group: Metals Technology
Authors: Järvinen, H., Peura, P., Järvenpää, M.
Number of pages: 3
Pages: 10-12
Publication date: Apr 2015
Peer-reviewed: Unknown

Publication information
Journal: Ohutlevy-lehti
Volume: 2015
Issue number: 1
ISSN (Print): 1239-4122
Original language: Finnish
Effect of rheological properties of dissolved cellulose/microfibrillated cellulose blend suspensions on film forming

Enzymatically treated cellulose was dissolved in a NaOH/ZnO solvent system and mixed together with microfibrillated cellulose (MFC) in order to find the threshold in which MFC fibers form a percolation network within the dissolved cellulose solution and in order to improve the properties of regenerated cellulose films. In the aqueous state, correlations between the rheological properties of dissolved cellulose/MFC blend suspensions and MFC fiber concentrations were investigated and rationalized. In addition, rheological properties of diluted MFC suspensions were characterized and a correlation with NaOH concentration was found, thus partly explaining the flow properties of dissolved cellulose/MFC blend suspensions. Finally, based on results from Dynamic Mechanical Analysis (DMA), MFC addition had strengthening/plasticizing effect on regenerated cellulose films if low concentrations of MFC, below the percolation threshold (5.5-6 wt%, corresponding to 0.16-0.18 wt% of MFC in the blend suspensions), were used.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Fibre Materials, PolymerTechnology, Department of Biotechnology and Chemical Technology, Aalto University
Authors: Saarikoski, E., Rissanen, M., Seppälä, J.
Number of pages: 9
Pages: 62-70
Publication date: 30 Mar 2015
Peer-reviewed: Yes

Publication information
Journal: Carbohydrate Polymers
Volume: 119
ISSN (Print): 0144-8617
Ratings:
Scopus rating (2016): SJR 1.404 SNIP 1.745 CiteScore 5.15
Scopus rating (2015): SJR 1.46 SNIP 1.842 CiteScore 4.86
Scopus rating (2014): SJR 1.584 SNIP 1.969 CiteScore 4.69
Scopus rating (2013): SJR 1.346 SNIP 1.967 CiteScore 4.39
Scopus rating (2012): SJR 1.409 SNIP 2.045 CiteScore 3.93
Scopus rating (2011): SJR 1.287 SNIP 1.991 CiteScore 4.08
Scopus rating (2010): SJR 1.372 SNIP 1.808
Scopus rating (2009): SJR 1.43 SNIP 1.718
Scopus rating (2008): SJR 1.142 SNIP 1.515
Scopus rating (2007): SJR 0.879 SNIP 1.369
Scopus rating (2006): SJR 0.824 SNIP 1.424
Scopus rating (2005): SJR 0.816 SNIP 1.349
Scopus rating (2004): SJR 0.885 SNIP 1.538
Scopus rating (2003): SJR 0.937 SNIP 1.41
Scopus rating (2002): SJR 0.878 SNIP 1.372
Scopus rating (2001): SJR 0.828 SNIP 1.062
Scopus rating (2000): SJR 0.858 SNIP 1.086
Scopus rating (1999): SJR 0.764 SNIP 1.074
Original language: English
ASJC Scopus subject areas: Organic Chemistry, Materials Chemistry, Polymers and Plastics
Keywords: Blend, Dissolved cellulose, Microfibrillated cellulose, Rheology, Suspension
DOIs:
10.1016/j.carbpol.2014.11.033
Links:
http://www.scopus.com/inward/record.url?scp=84916613635&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84916613635
Research output: Scientific - peer-review › Article
Corrosion mechanisms of sintered Nd-Fe-B magnets in the presence of water as vapour, pressurised vapour and liquid

Corrosion behaviour of three commercial sintered Nd-Fe-B magnets exposed to environments containing water as vapour, pressurised vapour, and liquid was investigated in order to understand their overall corrosion performance under a range of conditions. Two types of heat humidity exposure tests, namely the 85/85 and pressure cooker test, and the immersion test combined with electrochemical measurements were used as corrosion tests. It was observed that varying the temperature, pressure, and the prevailing state of water in the exposure tests, different corrosion mechanisms were detected on the surface of Nd-Fe-B magnets. The surface finish of the magnet had an effect on the initiation of corrosion in mild heat-humidity exposure. Immersion in liquid water resulted in a corrosion topography where the Nd-rich grain-boundary phase did not corrode selectively as in the other accelerated corrosion tests but was retained intact while the matrix phase underwent corrosion. These results and the dominant corrosion mechanisms of sintered Nd-Fe-B magnets in different environments are presented and discussed in this paper.

General information
State: Published
Ministry of Education publication type: A1 Journal article-referred
Organisations: Department of Materials Science, Research group: Ceramic materials, Research group: Materials Characterization, Engineering materials science and solutions (EMASS), Prizztech Magnet Technology Centre, VTT Technical Research Centre of Finland
Authors: Isotahdon, E., Huttunen-Saarivirta, E., Heinonen, S., Kuokkala, V. T., Paju, M.
Number of pages: 11
Pages: 349-359
Publication date: 25 Mar 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Alloys and Compounds
Volume: 626
ISSN (Print): 0925-8388
Ratings:
Scopus rating (2016): CiteScore 3.05 SJR 0.961 SNIP 1.321
Scopus rating (2015): SJR 0.987 SNIP 1.43 CiteScore 3.03
Scopus rating (2014): SJR 1.135 SNIP 1.66 CiteScore 3.13
Scopus rating (2013): SJR 1.064 SNIP 1.597 CiteScore 2.73
Scopus rating (2012): SJR 1.249 SNIP 1.584 CiteScore 2.43
Scopus rating (2011): SJR 1.166 SNIP 1.479 CiteScore 2.41
Scopus rating (2010): SJR 1.07 SNIP 1.221
Scopus rating (2009): SJR 0.957 SNIP 1.367
Scopus rating (2008): SJR 0.899 SNIP 1.207
Scopus rating (2007): SJR 0.889 SNIP 1.216
Scopus rating (2006): SJR 0.897 SNIP 1.147
Scopus rating (2005): SJR 1.074 SNIP 1.212
Scopus rating (2004): SJR 0.903 SNIP 1.35
Scopus rating (2003): SJR 0.909 SNIP 1.04
Scopus rating (2002): SJR 0.797 SNIP 1.047
Scopus rating (2001): SJR 0.615 SNIP 0.967
Scopus rating (2000): SJR 0.738 SNIP 0.94
Scopus rating (1999): SJR 0.766 SNIP 0.927
Original language: English
Keywords: Corrosion, Electrochemical impedance spectroscopy, Permanent magnets, Rare-earth alloys and compounds, Scanning electron microscopy, SEM
ASJC Scopus subject areas: Mechanical Engineering, Mechanics of Materials, Materials Chemistry, Metals and Alloys
DOI:
10.1016/j.jallcom.2014.12.048
Links:
http://www.scopus.com/inward/record.url?scp=84920283616&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84920283616
Research output: Scientific - peer-review > Article
Monolithic GaInNAsSb/GaAs VECSEL Operating at 1550 nm
The first monolithic GaAs-based vertical-external-cavity surface-emitting laser (VECSEL) operating at 1550 nm is reported. The VECSEL operation is based on a gain mirror which was grown in a single growth run by plasma-assisted molecular beam epitaxy. The gain mirror comprised eight GaInNAsSb/GaAs quantum wells with a photoluminescence peak at 1505 nm and an AlAs/GaAs distributed Bragg reflector ensuring high reflectivity. The VECSEL chip was pumped with an 808-nm diode laser that had a large quantum defect in respect to the lasing wavelength. An output power of 80 mW in continuous wave mode and 210 mW in pulsed pump mode are demonstrated close to room temperature.

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
Authors: Korpijärvi, V., Kantola, E. L., Leinonen, T., Isoaho, R., Guina, M.
Publication date: 20 Mar 2015
Peer-reviewed: Yes

Publication information
Journal: IEEE Journal of Selected Topics in Quantum Electronics
Volume: 21
Issue number: 6
Article number: 1700705
ISSN (Print): 1077-260X
Ratings:
Scopus rating (2016): CiteScore 2.96 SJR 1.139 SNIP 1.322
Scopus rating (2015): SJR 1.449 SNIP 1.393 CiteScore 3.03
Scopus rating (2014): SJR 1.889 SNIP 2.072 CiteScore 3.49
Scopus rating (2013): SJR 2.258 SNIP 2.38 CiteScore 4.55
Scopus rating (2012): SJR 2.742 SNIP 2.661 CiteScore 4.35
Scopus rating (2011): SJR 2.367 SNIP 2.845 CiteScore 3.87
Scopus rating (2010): SJR 2.217 SNIP 2.599
Scopus rating (2009): SJR 2.964 SNIP 2.869
Scopus rating (2008): SJR 2.476 SNIP 2.433
Scopus rating (2007): SJR 2.428 SNIP 1.746
Scopus rating (2006): SJR 2.131 SNIP 2.383
Scopus rating (2005): SJR 2.93 SNIP 2.594
Scopus rating (2004): SJR 2.827 SNIP 2.62
Scopus rating (2003): SJR 3.121 SNIP 3.103
Scopus rating (2002): SJR 2.664 SNIP 2.508
Scopus rating (2001): SJR 2.25 SNIP 1.926
Scopus rating (2000): SJR 2.37 SNIP 1.335
Scopus rating (1999): SJR 3.466 SNIP 1.611
Original language: English
DOIs: 10.1109/JSTQE.2015.2415200

Bibliographical note
AUX=orc,“Isoaho, Riku”
Research output: Scientific - peer-review › Article

Scaling the Power and Tailoring the Wavelength of Semiconductor Disk Lasers
Optically pumped semiconductor disk lasers (SDLs) provide a unique combination of high output power, high beam quality and possible emission wavelengths spanning from the ultraviolet to the mid-infrared spectral range. In essence, SDLs combine the wavelength versatility of semiconductor gain media with the power scaling principles of optically pumped solid state disk lasers. The emission wavelength of SDLs can be tailored to match the desired application simply by altering the composition of the gain material. High power operation, however, requires efficient thermal management, which can be realized using thin structures that are integrated with industrial diamond heat spreaders. The main objective of this thesis was to develop methods for increasing the output power of optically pumped SDLs, especially in challenging wavelength regions. The work included integrating SDL gain elements onto diamond heat spreaders using thin intermediate gold layers. This configuration enabled 45–50 % higher output powers than conventional bonding with indium solder. In
addition, the reflectivity of the SDL gain mirror was enhanced using a semiconductor-dielectric-metal compound mirror. This procedure enabled 30% thinner mirror structures when compared with the conventional design, where the reflectivity of the semiconductor mirror is enhanced with a metal layer. Finally, thin GaAs-based semiconductor mirrors were integrated with InP-based active regions. Such integration is necessary for high power operation in the spectral range 1.3–1.6 µm, because InP-based compounds for a highly reflective thin mirror section are not available. The configuration enabled record-high output powers of 6.6 W and 4.6 W at the wavelengths of 1.3 µm and 1.58 µm, respectively. The second objective of this thesis was to generate high output powers in single-frequency operation and via intracavity frequency-doubling. In single-frequency operation, record-high output powers of 4.6 W and 1 W were demonstrated at the wavelengths of 1.05 µm and 1.56 µm, respectively. Such light sources are required for numerous applications including free-space communications and high resolution spectroscopy. In addition, second-harmonic generation was demonstrated with SDLs emitting at 1.3 µm and 1.57 µm. The output powers reached 3 W at 650 nm and 1 W at 785 nm, which represent record-high output powers from SDLs in this wavelength range. These types of lasers could be especially useful in biophotonics and medical applications.

General information
State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers
Authors: Rantamäki, A.
Number of pages: 85
Publication date: 20 Mar 2015

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

Publication series
Name: Tampere University of Technology, Publication
Publisher: Tampere University of Technology
Volume: 1286
ISSN (Print): 1459-2045
Electronic versions:
rantamaki_1286
Links:

Bibliographical note
Awarding institution: Tampereen teknillinen yliopisto - Tampere University of Technology<br/>Submitter: Submitted by Antti Rantamäki (antti.rantamaki@tut.fi) on 2015-03-13T07:42:18Z
No. of bitstreams: 1
Rantamaki.pdf: 2583464 bytes, checksum: 6137b49021cccb64e7f104548211cb8b5 (MD5)<br/>Submitter: Approved for entry into archive by Kaisa Kulkki (kaisa.kulkki@tut.fi) on 2015-03-13T10:17:22Z (GMT) No. of bitstreams: 1
Rantamaki.pdf: 2583464 bytes, checksum: 6137b49021cccb64e7f104548211cb8b5 (MD5)<br/>Submitter: Made available in DSpace on 2015-03-13T10:17:22Z (GMT). No. of bitstreams: 1
Rantamaki.pdf: 2583464 bytes, checksum: 6137b49021cccb64e7f104548211cb8b5 (MD5)
Source: researchoutputwizard
Source-ID: 123456789/22842
Research output: Collection of articles › Doctoral Thesis

MODEL FOR N INCORPORATION RATE INTO GaInNAs

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Aho, A. J., Korpijärvi, V., Puustinen, J. P. P., Tukiainen, A. K., Guina, M.
Publication date: 15 Mar 2015

Host publication information
Title of host publication: 18th European Molecular Beam Epitaxy Workshop
Place of publication: Canazei, Italy

Bibliographical note
xposter
Tribology of HVOF- and HVAF-sprayed WC-10Co4Cr hardmetal coatings: A comparative assessment

This paper provides a comprehensive assessment of the sliding and abrasive wear behaviour of WC-10Co4Cr hardmetal coatings, representative of the existing state-of-the-art. A commercial feedstock powder with two different particle size distributions was sprayed onto carbon steel substrates using two HVOF and two HVAF spray processes. Mild wear rates of $<10^{-7}\text{mm}^3/(\text{Nm})$ and friction coefficients of $\approx0.5$ were obtained for all samples in ball-on-disk sliding wear tests at room temperature against $\text{Al}_2\text{O}_3$ counterparts. WC-10Co4Cr coatings definitely outperform a reference electrolytic hard chromium coating under these test conditions. Their wear mechanisms include extrusion and removal of the binder matrix, with the formation of a wavy surface morphology, and brittle cracking. The balance of such phenomena is closely related to intra-lamellar features, and rather independent of those properties (e.g. indentation fracture toughness, elastic modulus) which mainly reflect large-scale inter-lamellar cohesion, as quantitatively confirmed by a principal component analysis. Intra-lamellar dissolution of WC into the matrix indeed increases the incidence of brittle cracking, resulting in slightly higher wear rates. At 400°C, some of the hardmetal coatings fail because of the superposition between tensile residual stresses and thermal expansion mismatch stresses (due to the difference between the thermal expansion coefficients of the steel substrate and of the hardmetal coating). Those which do not fail, on account of lower residual stresses, exhibit higher wear rates than at room temperature, due to oxidation of the WC grains. The resistance of the coatings against abrasive wear, assessed by dry sand-rubber wheel testing, is related to inter-lamellar cohesion, as proven by a principal component analysis of the collected dataset. Therefore, coatings deposited from coarse feedstock powders suffer higher wear loss than those obtained from fine powders, as brittle inter-lamellar detachment is caused by their weaker interparticle cohesion, witnessed by their systematically lower fracture toughness as well.
Oxidation of the GaAs semiconductor at the Al₂O₃/GaAs junction

Atomic-scale understanding and processing of the oxidation of III-V compound-semiconductor surfaces are essential for developing materials for various devices (e.g., transistors, solar cells, and light emitting diodes). The oxidation-induced defect-rich phases at the interfaces of oxide/III-V junctions significantly affect the electrical performance of devices. In this study, a method to control the GaAs oxidation and interfacial defect density at the prototypical Al₂O₃/GaAs junction grown via atomic layer deposition (ALD) is demonstrated. Namely, pre-oxidation of GaAs(100) with an In-induced c(8 × 2) surface reconstruction, leading to a crystalline c(4 × 2)-O interface oxide before ALD of Al₂O₃, decreases band-gap defect density at the Al₂O₃/GaAs interface. Concomitantly, X-ray photoelectron spectroscopy (XPS) from these Al₂O₃/GaAs interfaces show that the high oxidation state of Ga (Ga₂O₃ type) decreases, and the corresponding In₂O₃ type phase forms when employing the c(4 × 2)-O interface layer. Detailed synchrotron-radiation XPS of the counterpart c(4 × 2)-O oxide of InAs(100) has been utilized to elucidate the atomic structure of the useful c(4 × 2)-O interface layer and its oxidation process. The spectral analysis reveals that three different oxygen sites, five oxidation-induced group-III atomic sites with core-level shifts between -0.2 eV and +1.0 eV, and hardly any oxygen-induced changes at the As sites form during the oxidation. These results, discussed within the current atomic model of the c(4 × 2)-O interface, provide insight into the atomic structures of oxide/III-V interfaces and a way to control the semiconductor oxidation.

General information

State: Published
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics, Department of Physics and Astronomy, University of Turku, MAX IV Laboratory, Lund University, University of Turku
Authors: Tuominen, M., Yasir, M., Lång, J., Dahl, J., Kuzmin, M., Mäkelä, J., Punkkinen, M., Laukkasen, P., Kokko, K., Schulte, K., Punkkinen, R., Korpjärvi, V., Polojärvi, V., Guina, M.
Number of pages: 7
Publication date: 14 Mar 2015
Peer-reviewed: Yes
Journal: Physical Chemistry Chemical Physics
Volume: 17
Issue number: 10
ISSN (Print): 1463-9076
Ratings:
Scopus rating (2016): CiteScore 4.06 SJR 1.678 SNIP 1.117
Scopus rating (2015): SJR 1.771 SNIP 1.244 CiteScore 4.45
Scopus rating (2014): SJR 1.772 SNIP 1.253 CiteScore 4.29
Scopus rating (2013): SJR 1.715 SNIP 1.216 CiteScore 4.05
Scopus rating (2012): SJR 1.916 SNIP 1.184 CiteScore 3.67
Scopus rating (2011): SJR 1.697 SNIP 1.203 CiteScore 3.6
Scopus rating (2010): SJR 1.802 SNIP 1.196
Scopus rating (2009): SJR 2.127 SNIP 1.369
Scopus rating (2008): SJR 2.158 SNIP 1.211
Scopus rating (2007): SJR 1.84 SNIP 1.138
Scopus rating (2006): SJR 1.467 SNIP 1.128
Scopus rating (2005): SJR 1.389 SNIP 1.104
Scopus rating (2004): SJR 1.173 SNIP 1.007
Scopus rating (2003): SJR 1.093 SNIP 0.925
Scopus rating (2002): SJR 1.122 SNIP 0.973
Scopus rating (2001): SJR 1.09 SNIP 0.914
Bioabsorbable fabrics for musculoskeletal scaffolds
This chapter discusses how woven, braided, and knitted scaffolds have been used in bone, cartilage, tendon, and ligament tissue engineering (TE). First, we describe the different steps for manufacturing filaments, yarns, and bioabsorbable textiles. Then we discuss issues related to the characterization and modelling of fabrics and scaffolds. In separate sections, we also consider four different applications of experimental TE using textile scaffolds, and we list currently available commercial products.

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Authors: Kellomäki, M., Laine, K., Ellä, V., Annala, T.
Number of pages: 24
Pages: 67-90
Publication date: 11 Mar 2015

Host publication information
Title of host publication: Biomedical Textiles for Orthopaedic and Surgical Applications: Fundamentals, Applications and Tissue Engineering
Publisher: Woodhead Publishing
ISBN (Print): 9781782420262
ISBN (Electronic): 9781782420170
ASJC Scopus subject areas: Engineering(all), Materials Science(all)
Keywords: Bioabsorbable fabric, Bone, Cartilage, Ligament, Tendon, Textile scaffold
DOIs:
10.1016/B978-1-78242-017-0.00004-0
Source: Scopus
Source-ID: 84940051015
Research output: Scientific - peer-review › Chapter

The internet of Bio-Nano things
The Internet of Things (IoT) has become an important research topic in the last decade, where things refer to interconnected machines and objects with embedded computing capabilities employed to extend the Internet to many application domains. While research and development continue for general IoT devices, there are many application domains where very tiny, concealable, and non-intrusive Things are needed. The properties of recently studied nanomaterials, such as graphene, have inspired the concept of Internet of NanoThings (IoNT), based on the interconnection of nanoscale devices. Despite being an enabler for many applications, the artificial nature of IoNT devices can be detrimental where the deployment of NanoThings could result in unwanted effects on health or pollution. The novel paradigm of the Internet of Bio-Nano Things (IoBNT) is introduced in this paper by stemming from synthetic biology and nanotechnology tools that allow the engineering of biological embedded computing devices. Based on biological cells, and their functionalities in the biochemical domain, Bio-NanoThings promise to enable applications such as intra-body sensing and actuation networks, and environmental control of toxic agents and pollution. The IoBNT stands as a paradigm-shifting concept for communication and network engineering, where novel challenges are faced to develop efficient and safe techniques for the exchange of information, interaction, and networking within the biochemical domain, while enabling an interface to the electrical domain of the Internet.

General information
One of the testing methods used to simulate slurry erosion in laboratory conditions is the slurry-pot method. In this work, a novel high speed slurry-pot type erosion wear tester was constructed for testing of materials used in mining and other mineral handling applications. In the tester, the samples are attached to a vertical rotating shaft on four levels in a pin mill configuration. High speeds up to 20 m/s at the sample tip can be achieved also with large abrasive size up to 10 mm. In the tests, the equipment proved to be functional and durable even with the high loads created by the high speeds and large abrasive sizes. There are, however, variations in the slurry concentrations inside the pot during testing, leading to different wear rates at the different sample levels. Therefore, a sample rotation test method was developed. By rotating the samples evenly through all sample levels, the overall deviations between samples will be minimized. Furthermore, with the sample rotation method up to eight materials can be tested simultaneously. The slurry-pot is suitable for testing various materials, such as steels and rubbers.
Temperature-induced ageing of solar absorbers on plain and anodized aluminium substrates

The temperature-induced ageing mechanisms and long-term stability of solar thermal absorbers having aluminium substrate with and without anodized aluminium oxide layer were investigated. A thin Al layer was used to act as an IR reflector on anodized aluminum oxide layer. The absorbers studied were industrial, sputtered chromium-based absorber coatings. The absorbers were aged by means of prolonged and extended thermal accelerated ageing studies at 248-308 degrees C.

The ageing mechanisms and degradation of the absorbers were analysed by optical measurements (solar absorptance with a UV/Vis/NIR spectrophotometer and thermal emittance by FTIR spectrophotometry), microstructural analysis using transmission electron microscope (TEM) equipped with an energy dispersive X-ray spectrometer (EDS), composition by time-of-flight elastic recoil detection analysis (TOF-ERDA), and crystal structure by grazing incidence X-ray diffraction (XRD) before and after the ageing studies. The relation between optical degradation and ageing mechanisms was studied using optical modelling and simulation with CODE Coating Designer. The results clearly demonstrated the effect of substrate material on the long-term stability of the absorber at intermediate temperatures. (C) 2014 Elsevier B.V. All rights reserved.
Hydrofluoric-nitric-sulphuric-acid surface treatment of tungsten for carbon fibre-reinforced composite hybrids in space applications

Hybrid material systems, such as combinations of tungsten foils and carbon fibre-reinforced plastic (CFRP), are replacing metal alloy concepts in spacecraft enclosures. However, a good adhesion between the tungsten oxide scale and the epoxy resin used is required. Here, the effects of a hydrofluoric-nitric-sulphuric-acid (HFNS) treatment on tungsten oxides and subsequent adhesion to CFRP are analysed using atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS) and fracture testing. The work shows that HFNS treatment results in decreased oxygen content, over 50% thinner tungsten trioxide (WO3) layer and increased nano-roughness on thin tungsten foils. Fracture testing established a 39% increase in the average critical strain for tungsten-CFRP specimens after HFNS treatment was carried out on tungsten. The effect of the oxide scale modification regarding the critical strain energy release rate was \( \Delta G_c \approx 8.4 \) J/m\(^2\).

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General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Authors: Kanerva, M., Johansson, L. -., Campbell, J. M., Revitzer, H., Sarlin, E., Brander, T., Saarela, O.
Number of pages: 10
Pages: 418-427
Publication date: 15 Feb 2015
Peer-reviewed: Yes

Publication information

Journal: Applied Surface Science
Volume: 328
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
Keywords: surface treatments, XPS, Tungsten trioxide, Interface, Composites
DOIs: 10.1016/j.apsusc.2014.12.036

Bibliographical note
ORG=mol,0.5
ORG=elt,0.5
Source: WOS
Source-ID: 000349615800054
Research output: Scientific - peer-review › Article
Advanced coatings by novel high-kinetic thermal spray processes

Thermal spraying includes a group of coating processes in which metallic and non-metallic materials are spray deposited as fine particles in a molten or semi-molten condition, or even in fully solid state to form a coating. Thermal spraying allows deposition of relatively thick coatings, from some tens of micrometers up to several millimeters in thickness. Thermally sprayed coatings are used in different applications including protective and functional coatings in mechanical engineering, energy technology, biomedical, steel, automotive and aerospace technologies and in many other industrial sectors. Novel high-kinetic spray processes, e.g., the high velocity air-fuel (HVAF) technology are the latest developments in the area and therefore they are actively studied in the framework of the Hybrid Materials research program in collaboration with Finnish industrial and research partners. Novel multifunctional coatings are under development for specific industrial applications.
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
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering, Research area: Electromagnetics, Lappeenranta University of Technology, LUT Energy, Slovak Academy of Sciences
Authors: 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 (2016): CiteScore 1.42 SJR 0.395 SNIP 1.031
Scopus rating (2015): SJR 0.35 SNIP 0.935 CiteScore 1.27
Scopus rating (2014): SJR 0.47 SNIP 1.113 CiteScore 0.83
Scopus rating (2013): SJR 0.431 SNIP 1.171 CiteScore 1.32
Scopus rating (2012): SJR 0.575 SNIP 1.27 CiteScore 1.11
Scopus rating (2011): SJR 0.364 SNIP 1.063 CiteScore 1.16
Scopus rating (2010): SJR 0.468 SNIP 1.073
Scopus rating (2009): SJR 0.452 SNIP 1.033
Scopus rating (2008): SJR 0.878 SNIP 0.987
Scopus rating (2007): SJR 0.611 SNIP 1.104
Scopus rating (2006): SJR 0.731 SNIP 0.935
Scopus rating (2005): SJR 0.645 SNIP 0.996
Scopus rating (2004): SJR 0.867 SNIP 0.9
Scopus rating (2003): SJR 0.494 SNIP 1.045
Scopus rating (2002): SJR 0.849 SNIP 1.024
Scopus rating (2001): SJR 0.523 SNIP 1.336
Scopus rating (2000): SJR 0.799 SNIP 0.95
Scopus rating (1999): SJR 1.073 SNIP 2.106

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: Scientific - peer-review > Article

Sulfonated polyetheretherketone/polypropylene polymer blends for the production of photoactive materials
Sulfonated polyetheretherketone (SPEEK) was synthesized via a mono-substitution reaction of PEEK in concentrated sulphuric acid and was blended with polypropylene (PP) in 2-10% w/w concentration to be used for the production of photoactive thermoplastic products. SPEEK and SPEEK/PP blends were characterized using FTIR, DSC, TGA, NMR, rheology, SEM, and EPR. Under UV-Vis irradiation, stable benzophenone ketyl (BPK) radicals were generated by hydrogen extraction from PP. By increasing the amount of SPEEK in the polymer blend a linear increase in the BPK...
radicals was achieved according to the EPR data. DSC and TGA tests indicated weaknesses in the thermal stability of SPEEK but according to the rheological tests this should not have a major effect on processability. The optimal amount of SPEEK in the blend was obtained at 5%w/w. This concentration provided a good compromise between radical concentration, material processability, and cost.

**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed

Organisations: Department of Materials Science

Authors: Fatarelle, E., Mylläri, V., Ruzzante, M., Pogni, R., Baratto, M. C., Skrifvars, M., Syrjälä, S., Järvelä, P.

Publication date: 1 Feb 2015

Peer-reviewed: Yes

**Publication information**

Journal: Journal of Applied Polymer Science

Volume: 132

Issue number: 8

Article number: 41509

ISSN (Print): 0021-8995

Ratings:

- Scopus rating (2016): CiteScore 1.73 SJR 0.532 SNIP 0.724
- Scopus rating (2015): SJR 0.574 SNIP 0.827 CiteScore 1.74
- Scopus rating (2014): SJR 0.658 SNIP 0.964 CiteScore 1.76
- Scopus rating (2013): SJR 0.628 SNIP 1.085 CiteScore 1.71
- Scopus rating (2012): SJR 0.658 SNIP 1.081 CiteScore 1.57
- Scopus rating (2011): SJR 0.601 SNIP 0.965 CiteScore 1.45
- Scopus rating (2010): SJR 0.679 SNIP 0.909
- Scopus rating (2009): SJR 0.697 SNIP 0.825
- Scopus rating (2008): SJR 0.647 SNIP 0.822
- Scopus rating (2007): SJR 0.678 SNIP 0.931
- Scopus rating (2006): SJR 0.782 SNIP 1.145
- Scopus rating (2005): SJR 0.779 SNIP 0.912
- Scopus rating (2004): SJR 0.774 SNIP 0.962
- Scopus rating (2003): SJR 0.816 SNIP 1.067
- Scopus rating (2002): SJR 0.866 SNIP 1.084
- Scopus rating (2001): SJR 0.964 SNIP 1.157
- Scopus rating (2000): SJR 0.864 SNIP 1.157
- Scopus rating (1999): SJR 0.978 SNIP 1.277

Original language: English

ASJC Scopus subject areas: Materials Chemistry, Polymers and Plastics, Surfaces, Coatings and Films, Chemistry(all)

Keywords: Blends, Photochemistry, Polyolefins

DOIs: 10.1002/app.41509

Links:

http://www.scopus.com/inward/record.url?scp=84911985923&partnerID=8YFLogxK (Link to publication in Scopus)

**Bibliographical note**

Article first published online: 1 OCT 2014 ; (Volume 132, Issue 8, February 20, 2015)<br/>
Contribution: organisation=mol,FACT1=1<br/>
Portfolio EDEND: 2014-12-30<br/>
Publisher name: JohnWiley & Sons, Inc.

Source: researchoutputwizard

Source-ID: 296

Research output: Scientific - peer-review › Article

**GaSb-based SESAM mode-locked Tm: YAG ceramic laser at 2 µm**

Tunable and mode-locked laser operation near 2 µm based on different Tm-doped YAG ceramics, 4 at.% and 10 at.%, is demonstrated. Several designs of GaSb-based surface-quantum-well SESAMs are characterized and studied as saturable absorbers for mode-locking. Best mode-locking performance was achieved using an antireflection-coated near-surface quantum-well SESAM, resulting in a pulse duration of ~3 ps and ~150 mW average output power at 89 MHz. All mode-locked Tm:YAG ceramic lasers operated at 2012 nm, with over 133 nm demonstrated tuning for continuous-wave operation.
Effect of Multiple Impacts on the Deformation of Wear-Resistant Steels

More durable materials enable reducing the downtime and maintenance costs by decreasing the number of replaced core components in various industrial applications. In this study, the behavior of three wear-resistant quenched martensitic steel grades and the S355 structural steel was examined in controlled impact conditions. The materials’ impact behavior was investigated by several methods including residual stress measurements and electron backscatter diffraction. For all studied materials, the size and depth of the impact marks correlate via a logarithmic function to the number of impacts mostly due to work hardening. The underlying deformation behavior of the material depends on the mechanical properties and microstructure of the material. At high impact counts, softer martensitic steel was found to behave differently when compared to the other tested materials as it underwent severe changes in its microstructure and exhibited marked hardening.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Engineering materials science and solutions (EMASS), AC2T Research GmbH
Authors: Ratia, V., Rojacz, H., Terva, J., Valtonen, K., Badisch, E., Kuokkala, V. T.
Binary TiO2/SiO2 nanoparticle coating for controlling the wetting properties of paperboard

We introduce a flame based aerosol method to fabricate thin films consisting of binary TiO2/SiO2 nanoparticles deposited directly from the flame onto the paperboard. Nanocoatings were prepared with Liquid Flame Spray (LFS) in a roll-to-roll process with the line speed of 50 m/min. Surface wetting behavior of nanocoated paperboard was studied for different Ti/Si ratios in the precursor, affecting TiO2/ SiO2 ratio in the coating. Wettability could be adjusted to practically any water contact angle between 10 and 160° by setting the Ti/Si ratio in the liquid precursor. Structure of the two component nanocoating was analysed with FE-SEM, TEM, EDS, XPS and XRD. The porous thin film coating was concluded to consist of ca. 10 nm sized mixed oxide nanoparticles with segregated TiO2 and SiO2 phases. Accumulation of carbonaceous compounds on the surface was seen to be almost linearly dependent on the Ti/Si ratio, indicating of each species being exposed in corresponding amount. However, wetting of the surface was observed to follow merely an S-shaped curve, caused by the roughness of the nanocoated surface. Reasons for the observed superhydrophobicity and superhydrophilicity of these binary nanocoatings on paperboard are discussed. (C) 2014 Elsevier B.V. All rights reserved.
Laser cladding allows the manufacturing of thick, dense and fusion bonded low diluted coatings, permitting its application in industry fields that require wear and corrosion protection. On the other hand, large residual stresses on the coating layer and noticeable changes in the substrate material may affect mechanical properties and fatigue strength. In this study, high load four-point bending fatigue tests were conducted, comparing the results to those of the substrate material alone and post-weld heat treated components. The fatigue test results were displayed with Wöhler curves. Two different substrate/coating couples are studied in this work: mild steel S355-J2 coated with Stellite21 cobalt based hard-facing alloy, and low-alloy steel 42CrMo4 coated with Inconel625 nickel based super alloy. In order to better define how the features of the materials change with the cladding direction and the post weld heat treatment, the specimens were analysed by SEM/EDS; verifying the presence of defects, and how dilution changes along the cladding direction. Chemical etched samples were observed by optical microscope to assess the effect of the laser treatment on materials microstructures. Hardness measurements and depth sensing nanoindentations are performed to evaluate mechanical properties of coatings, HAZ and substrate. After fatigue failure, every fractured surface was separated from the fatigue specimen and analysed by stereo microscope, SEM and EDS in order to identify the reasons and the mechanisms of the failure.
High performance wear and corrosion resistant coatings by novel cladding techniques

In the field of surface engineering, cladding or overlay welding is a group of coating methods used in manufacturing fusion-bonded thick metallic and metal matrix composite (MMC) coatings on a wide variety of metallic base materials with varying degree of deposition rate, dilution and heat input. Growing demands for more material-, energy- and cost-effective overlay welding processes as well as sustainable solutions for performance-critical applications have boosted to develop methods that are capable of producing low diluted and fusion-bonded single layer coatings with high deposition rates. Such novel cladding methods include for instance laser-based high power laser cladding, coaxial hot-wire laser cladding, laser-arc hybrid cladding, non-laser-based Cold Metal Transfer (CMT) cladding and methods that utilize high intensity infrared (IR) light. This paper introduces some of such highly innovative cladding techniques and highlights some microstructural and geometrical features, abrasion and sliding wear, and wet corrosion properties of Fe-, Ni- and Co-based metallic coatings manufactured by novel laser and CMT cladding methods. The research results evidence that with the choice of optimal processing parameters, novel cladding techniques are capable of manufacturing high performance weld overlays with the properties equivalent or near to corresponding wrought alloys and reference overlays with net deposition rates of approximately 5 kg/h and more. Overall, the presented work suggests that discussed methods have high potential in surfacing of new and remanufacturing of service-damaged surfaces in high value components, in building up complex features on existing components and also in near net shape additive manufacturing of functional 3D objects.

High Temperature 3-body Abrasive Wear of HVOF and HVAF Sprayed Cr3C2-NiCr Coatings

Wear protection is used in the industry to increase the lifetime of tribologically loaded components. One of the most widely applied wear protection is hard coating technology to protect the surface of a component from harsh wear conditions. Among them, thermal spraying is commonly adopted technique to deposit wear-resistant surface layers.
For wear protection at high service temperatures, chromium carbide based coatings deposited with high velocity oxy-fuel (HVOF) and high velocity air-fuel HVAF techniques are most suitable.

In this study, various Cr3C2-NiCr powders were sprayed with both HVOF and HVAF processes. The microstructure, porosity level and hardness values of the deposited coatings were measured. In addition, three-body abrasive wear resistance of these coatings was tested at 300°C, 500°C and 700°C. The wear tracks and cross sections of tested coatings were studied with scanning electron microscopy (SEM), in order to characterize the wear mechanisms at high temperatures.

The results show that at lower testing temperatures, powder selection and spraying process defines the wear rate of the coating. However, at maximum testing temperature, the differences in wear rates between tested coatings decreases. This is due to microstructural changes in coating at high temperatures.

**Microstructural and abrasion wear characteristics of tool steel coatings manufactured by laser cladding**

Tool steels are a class of complex carbon and alloy steels that are widely available as powders over a wide compositional range. In this work, several different tool steel grades were deposited on mild steel by the laser cladding process using a continuous wave 4.4 kW Nd:YAG laser in combination with a coaxial powder feeding technique. With bidirectional scanning pattern, most of the grades were deposited crack-free with hardness up to 1000 HV without additional preheating. A comparative study of 3-body abrasion and single point scratch wear behaviour was conducted on the obtained coatings. In a 3-body abrasion wear study, the laser clad Ralloy WR6 with significant portion of retained austenite exhibited superior abrasive wear resistance compared with the fully martensitic tool steel coatings (M2, M4, H13, HS-23, HS-30) and the reference material, Raex Ar500 wear resistant steel. The abrasion wear resistance of austenitic-martensitic WR6 tool steel was further enhanced by the external addition of 20% volume percentage of relatively large (45-106 µm) vanadium carbides. In single point scratch tests, fully martensitic tool steels outperformed austenitic-martensitic tool steels and Raex Ar500 wear resistant steel. The differences in wear performances were explained by different wear mechanisms and types of contact between the abrasive and the surface. These results show the potential of laser cladding in depositing hard and wear resistant tool steel coatings on easier to fabricate and less expensive base materials or remanufacturing of wear resistant steel grades for enhancing the service life of various components. Examples of such components are, for instance, rock and ground drilling bits in mining and construction and various blades and knives in pulp & paper industries.
Study of worn weld deposit with added tungsten carbide particles

Nowadays we can see the application of special protective surface layers, which perform many different functions. These protective layers are applied and used to protect components against wear that occurs in various forms in the construction, mining and metal industries. Among these so-called protective layers we can include special hard-facing, using metal matrix (in the context of this article alloyed iron matrix) in combination with tungsten carbide particles that can be assigned to a group of composite materials. High hardness of the carbides combined with the use of relatively tough matrix allows us to get high wear resistance. This resistance then considerably increases the service life of machine parts and significantly contributes to reducing the expenses of industrial companies to repair or replacement of the worn parts. The main focus of this article is to study characteristics of generated weld deposit with tungsten carbide reinforced iron matrix on common structural steel S235JR substrate. This includes the evaluation of hardness of formed layer and its resistance to the abrasive wear. Lower wear resistance of high boron A864 M layer with externally incorporated tungsten carbide particles was observed compared to standard F-Durit G iron based layer with microscopic tungsten carbide particles included in cored wire. This is the result of the fact that most of big tungsten carbide particles were placed on the bottom of the weld deposit and do not protect the surface of the weld deposit effectively.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Surface Engineering, VSB-Technical University Ostrava, Czech Republic
Authors: Hlavaty, I., Kozak, J., Tuominen, J.
Number of pages: 10
Pages: 139-148
Publication date: Jan 2015

Host publication information
Title of host publication: Surface Modification Technologies XXVIII : Proceedings of the 28th International Conference on Surface Modification Technologies
Publisher: Valardocs
Editors: Sudarshan, T., Vuoristo, P., Koivuluoto, H.
ISBN (Electronic): 978-81-926196-1-3
Research output: Scientific - peer-review → Conference contribution

The Role of Graphite in Sliding Bearing Braze Claddings

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Tribology and Machine Elements, Research group: Materials Characterization
Authors: Ruusila, V., Kallio, M. H., Uusitalo, M. A., Valtosen, K., Krappitz, H., Kuokkala, V., Lehtovaara, A.
Pages: 159-168
Publication date: Jan 2015

Host publication information
Title of host publication: Proc. of the Twenty Eighth International Conference on Surface Modification Technologies, Ed. T. S. Sudarshan, P. Vuoristo and H. Koivuluoto, Tampere University of Technology June 16-18, 2014
ISBN (Print): 978-81-926196-1-3
Research output: Scientific - peer-review → Conference contribution

Wear and Corrosion Behavior of HVAF Sprayed WC-10Ni and WC-20Cr3C2-6Ni Coatings

WC-10Ni and WC-20Cr3C2-6Ni coatings deposited by High Velocity Air-Fuel (HVAF) spraying were studied and compared in the present paper. A series of tribological tests and electrochemical measurements were carried out in order to examine the effect of coating composition on the abrasion, sliding wear and corrosion behavior. The experimental results revealed that the overall wear and corrosion resistance of the WC-10Ni coatings was superior to that of WC-20Cr3C2-6Ni due to denser microstructure, high hardness, and fewer microcracks which act in the coatings as infiltration path for the electrolyte. It was found out that the chemical composition, homogeneity and bonding between splats are important factors influencing the corrosion properties and impermeability of HVAF sprayed WC cermet based coatings in 3.5 wt.% NaCl solution.
1180 nm CW VECSEL emitting 50 W

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.

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.
50 W VECSEL emitting at 1180 nm

We report a 50 W VECSEL emitting at 1180 nm. The gain chip was grown by MBE and TEC-cooled. The maximum power was measured for a mount temperature of -15°C.

Advisory Professorship Model as a Tool for Practice-Based Regional University-Industry Cooperation

Abstract: The growing importance of “practice-based innovation models” has challenged the current consensus on the role of universities as main drivers of regional innovation systems. New models are needed to ensure the efficiency of cooperation between the region and universities. In this article, we present and analyse the effects of one practice-based innovation tool, the advisory professorship model, developed in the Lahti region, Finland. The Lahti region is relatively big by Finnish standards, but has no university of its own, which makes new types of knowledge transfer necessary. The empirical analysis is based on interviews of the companies that participated in the materials technology advisory professorship programme, developed and operated by Tampere University of Technology. In the analysis, we utilize the conceptual framework and analytical matrix developed by Tura et al. [(2008) Breaking inside the black box: Towards a dynamic evaluation framework of regional innovative capability, Science and Public Policy, 35(10), pp. 733–744] in the measuring of regional innovation capability. The study approach is based on regional and industrial viewpoints. In the light of the study, the programme had positive impacts on the innovation capability and innovation processes of companies. The advisory professorship model can be considered a useful practice-based innovation tool for regional university–industry co-operation with some limitations.
A new generation sweating thermal manikin for the evaluation of the thermal comfort of protective clothing in Arctic Conditions

Working or staying in cold conditions set high demands for the garments to sustain the thermal comfort of the wearer. The high thermal insulation needed in cold conditions, like in Arctic areas, can cause heat stress when working in high intensity and post exercise chill while the remaining moisture in the clothing layers due to sweating increases heat loss. The thermoregulatory properties of textiles from material level to garment level can be determined with a wide selection of test methods. Hot plates, water vapour permeability tests and a sweating thermal cylinder are used for planar textiles to determine thermal comfort properties on material level to be able to select the most suitable candidates for the garments for the required end use conditions. For garment level testing, the non-movable or movable thermal or sweating thermal manikins offer the most sophisticated objective methods. They simulate human body heat and sweat production and body movements in controlled ambient conditions for determining the thermal comfort properties either of a piece of garment or the whole clothing systems. The effect of garment design can be determined in addition to material properties.

An experimental and numerical study of the dynamic Brazilian disc test on Kuru granite

This paper deals with numerical modeling of the dynamic tensile strength of Kuru granite and corresponding experiments with the dynamic Brazilian Disc (BD) tests using the Split Hopkinson Pressure Bar apparatus (SHPB). It was found that the indirect tensile strength of the Kuru granite increased from the static value of 13 MPa to 36 MPa when the impact velocity reached 20 m/s. A numerical method was developed for simulations of these tests. The method includes a material model based on the rate-dependent isotropic compliance damage and embedded discontinuity concepts for rock and an FEM based explicit time marching technique for simulating the dynamics of the SHPB apparatus. Simulation results are in
A Novel Coaxially Laser-Assisted (COLA) Cold Spray System
Laser-assisted cold-spray has been recognized for over a decade as a technique capable of depositing high quality coatings. By laser heating (and hence softening) the surface being coated, deposition can occur at particle velocities lower than those normally associated with the cold spray process. This can be used to increase deposition rate. However, it can also be used to facilitate the deposition of higher hardness material combinations, normally more out of the reach of the conventional cold spray process. Laser heating can also reduce the requirements of the process on gas usage and gas heating for a given combination, making it more cost-effective. In the work reported below, the capability of a novel coaxially laser-assisted system (COLA) to deposit higher hardness materials, relevant to a range of different industrial applications, has been evaluated. This system can be retro-fitted to cold spray equipment.

Applying the digital image correlation method to fretting contact for slip measurement
Fretting is a consequence of small relative oscillatory movement between contacting parts and can cause serious damage to machine components. This paper describes the implementation of digital image correlation method to a fretting test device to measure the relative movement, i.e. slip, between the contacting parts. A complete contact fretting test device is used, in which two flat fretting pads are clamped against a cyclically loaded flat fretting specimen. The material used is quenched and tempered steel. Digital image correlation, equipped with a microscope, is employed to measure the local displacement field at the contact edge. The micrometer-level slip amplitude and the length of the slip region are determined at specific time intervals during a fretting fatigue test. Both of these quantities appear to decrease and stabilize during fretting fatigue testing. The slip decreases markedly during the initial cycles.
Ballistic and numerical simulation of impacting goods on conveyor belt rubber

Impact loading is an important process in the transport industry as it causes wear and failure of critical components. Conveyor belts are of particular importance as they are used in practically every industry where large quantities of goods are moved over short (<10 m) or long distances (>1 km). To investigate stress levels inside the material during impact loading, a gas gun was utilized to shoot 9 mm spherical steel balls onto the surface of a rubber conveyor belt. A high speed video recording system was employed in order to determine penetration depth and dissipated energy of the steel ball. Maximal penetration depths of up to 3.9 mm and maximal dissipated energies of up to 86.8 % were measured. Additionally, a numerical simulation using smooth particle applied mechanics was conducted and compared to the experimental results obtained with the gas gun. The calculated von Mises stresses affected the conveyor belts up to a maximum depth of 8.8 mm with at least 20 MPa. Maximum von Mises stresses were calculated to reach 60 MPa.
Barkhausen Noise Measurements for Detecting Surface Changes during Grinding Process

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Materials Characterization, University of Oulu
Authors: Santa-aho, S., Sorsa, A., Hakanen, M., Leiviskä, K., Lepistö, T. K., Vippola, M. S.
Number of pages: 15
Pages: 609-623
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the Twenty Eighth International Conference on Surface Modification Technologies
Publisher: Valardocs
Edition: 1st edition
ISBN (Print): 978-81-926196-1-3
Research output: Scientific - peer-review › Conference contribution

Behavior of Humidity Sensors Attached with Anisotropic Electrically Conductive Adhesives in Corrosive Environment

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering, Research area: Reliability
Authors: Mostofizadeh, M., Parviainen, A., Frisk, L.
Number of pages: 7
Biodegradable passive resonance sensor: Fabrication and initial testing

Biodegradable resonance circuits were studied. The circuits have a novel two-layer resonator structure without galvanic through hole vias. A patterned magnesium layers were evaporated on biodegradable PLA sheets by using a 3D printed mask. The circuits were assembled by heat sealing two magnesium patterned sheets together to encapsulate the circuit structure. An inductive link is used to wirelessly detect the resonance frequency of the circuit. The circuits were tested when immersed in de-ionised water and saline. According to the tests, the designed resonator structure can be measured in aqueous environment. The resonance of the tested circuit was observable at least for 51 hours. The concept still needs more development to extend degradation time and to increase the stability during immersion.
General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Fibre Materials, Research group: Materials Characterization, Engineering materials science and solutions (EMASS)
Authors: Kamppuri, T., Vehviläinen, M., Puolakka, A., Honkanen, M., Vippola, M., Rissanen, M.
Number of pages: 7
Pages: 396-402
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Coloration Technology
Volume: 131
Issue number: 5
ISSN (Print): 1472-3581
Ratings:
Scopus rating (2016): SJR 0.432 SNIP 0.761 CiteScore 1.35

Characterisation of novel regenerated cellulosic, viscose, and cotton fibres and the dyeing properties of fabrics
There is a global demand for constant increase in the production of textile fibres. Currently, the market for cellulosic fibres is dominated by cotton and viscose fibres. However, new alternative cellulosic fibres are being sought to meet the growing demand. The dyeing properties of novel fibres aiming at the marketplace are among the properties that determine their applicability to textiles. Recently, a novel process for producing cellulosic fibres, the Biocelsol process, has been scaled up so that the spinning of yarn from Biocelsol fibres is now possible. In this study, the reactive dye Levafix CA Blue was applied to cellulosic fabrics made from viscose, cotton, and Biocelsol yarns. The crystalline structure and morphology of the fibres were studied by Fourier transform infrared spectroscopy and field-emission scanning electron microscopy. The crystalline structure and morphology of the Biocelsol fibres resembled those of viscose fibres, but, owing to higher water absorption, the Biocelsol fabric had a higher dye exhaustion. The colour yield of the Biocelsol fabric was 62% and 41% higher than that of cotton and viscose fabrics respectively, suggesting that less dye is needed to gain a shade in Biocelsol fabric than in viscose and cotton fabrics.
DC ramp rate effect on the breakdown response of SiO2-BOPP nanocomposites

The effect of voltage ramp rate on the short-term dielectric breakdown strength of polymer nanocomposites is not well-documented. In this paper, the effect of DC field ramp rate on the large-area breakdown performance of melt-extruded bi-axially oriented polypropylene (BOPP) films incorporating 4.5 wt-% of nano-silica is studied. By utilizing a self-healing multi-breakdown measurement method with a variable DC voltage ramp rate, a statistically large amount of breakdown data was obtained from a large total sample film area as a function of DC field ramp rate (0.1–50 Vs−1µm−1). With a decreasing ramp rate, Weibull statistical analysis of the breakdown data suggests a systematically decreasing trend in the breakdown strength (Weibull α) and an increase in the Weibull shape parameter of time (>1) for the nanocomposite. The observed behavior is speculated to be attributable to highly altered internal charge dynamics of the silica-BOPP nanocomposite. The results exemplify the importance of careful breakdown strength assessment when dielectric films of more complex internal structure are studied.

Debonding and impact damage in stainless steel fibre metal laminates prior to metal fracture

An experimental drop-weight impact investigation was performed for stainless steel fibre metal laminates (FMLs) containing carbon-fibre and glass-fibre-reinforced epoxy layers. The purpose was to study the dependence of metal-composite debonding on the metal's surface morphology, as well as the interaction between debonding and internal damage caused to a composite. Three different steel surface morphologies were studied for the steel-carbon FMLs. Force-contact time and deflection profile measuring, as well as ultrasonic scanning and scanning electron microscopy imaging, were used for impact damage evaluation. Debonding was found to proceed either at the metal and adhesive film interface or cohesively inside the adhesive film. The steel's surface condition did not significantly influence impact response. The research also revealed that debonding between the lower metal sheet and composite part proceeded as mixed mode (I/II) fracture. Debonding was connected to the composite damages by several shear cracks located in the uppermost composite layer.
Dielectric Breakdown Strength of Thermally Sprayed Ceramic Coatings: Effects of Different Test Arrangements

Dielectric properties (e.g., DC resistivity and dielectric breakdown strength) of insulating thermally sprayed ceramic coatings differ depending on the form of electrical stress, ambient conditions, and aging of the coating, however, the test arrangements may also have a remarkable effect on the properties. In this paper, the breakdown strength of high velocity oxygen fuel-sprayed alumina coating was studied using six different test arrangements at room conditions in order to study the effects of different test and electrode arrangements on the breakdown behavior. In general, it was shown that test arrangements have a considerable influence on the results. Based on the results, the recommended testing method is to use embedded electrodes between the voltage electrode and the coating at least in DC tests to ensure a good contact with the surface. With and without embedded electrodes, the DBS was 31.7 and 41.8 V/µm, respectively. Under AC excitation, a rather good contact with the sample surface is, anyhow, in most cases acquired by a rather high partial discharge activity and no embedded electrodes are necessarily needed (DBS 29.2 V/µm). However, immersion of the sample in oil should strongly be avoided because the oil penetrates quickly into the coating affecting the DBS (81.2 V/µm).
**Diffusion of acidic solution through rubber at high temperature and its effect on metal-rubber interface degradation**

**General information**

State: Published

Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Teknikum Oy, Outotec Research Center

Authors: Sarlin, E., Rosling, A., Mustakangas, M., Laihonen, P., Lindgren, M., Vuorinen, J.

Publication date: 2015

**Host publication information**

Title of host publication: Proceedings of SAMPE Europe Conference

ISBN (Electronic): 978-90-821727-3-7

Research output: Scientific › Conference contribution

**Effect of alkali and silane surface treatments on regenerated cellulose fibre type (Lyocell) intended for composites**

Cellulose fibres have significant importance and potential for polymer reinforcement. It is essential to modify the surface of the fibre to obtain good fibre-matrix interface. Surface treatments can increase surface roughness of the fibre, change its chemical composition and introduce new moieties that can effectively interlock with the matrix, resulting in good mechanical properties in the composites. This is mainly due to improved fibre-matrix adhesion. The treatments may also reduce the water absorption rate by converting part of the hydroxyl groups on the fibre surface into other functional groups. Chemical modification of the surface of a regenerated cellulose fibre of the Lyocell type was carried out by alkali and silane treatments, which significantly changed the properties of the Lyocell fibres. Three parameters were considered when the fibre surface treatment was done: concentration (2–15 wt%), temperature (25 and 50 °C) and time (30 min–72 h). Fourier transform infrared spectroscopy and Raman spectroscopy were used for chemical analysis and qualitative analysis of the cellulose crystallinity due to the surface treatments; subsequently, mechanical strength of the fibres was tested by tensile testing. Weight loss, moisture regain and swelling measurements were taken before and after treatments, which showed the obvious changes in fibre properties on treatment. Heat capacity of the fibres was measured for untreated and treated fibres, and thermal degradation of fibres was examined to see the stability of fibres at elevated temperatures. Wettability and surface energies were measured using dynamic contact angle method in three wetting mediums. Scanning electron microscopy was used to study the morphological properties of the fibres.
Effects of different test profiles of temperature cycling tests on the reliability of RFID tags

Passive UHF radio-frequency identification (RFID) tags are used for object identification in various environmental conditions, which may affect the reliability of these tags. The effects of different environmental stresses can be studied with accelerated life tests (ALT). Choosing the most suitable test may be challenging: The results are needed as fast as possible, but the failure mechanisms must replicate those occurring in the real operating environment. Here the effects of different temperature cycling profiles were studied by altering temperature ranges, extreme temperatures, soak times to extreme temperatures and transition times between extreme temperatures. Failure times clearly differed between the tests. The test with the fastest transition time and the shortest soak time seemed to have the most acceleration. It was also observed that the different temperature cycling profiles affected the failure mechanisms detected. Cracking of the antenna was observed with lower temperature extremes or shorter soak and transition times. However, with longer soak and transition times, cracks were seen in the RFID interconnections. Both cases led to changes in the impedance matching and consequently to failures. The totally different failure mechanisms clearly demonstrate the importance of carefully determining the test parameters in order to achieve the correct failure mechanism.
Enhanced in-line detection, cleaning and repair of nano-scale defects in thin-films used for flexible photovoltaic and food packaging applications

General information
State: Published
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging
Authors: Lahti, J.
Publication date: 2015
Peer-reviewed: Unknown

Bibliographical note
poster
Research output: Scientific › Paper, poster or abstract
Enhanced in-line detection, cleaning and repair of nano-scale defects in thin-films used for flexible photovoltaic and food packaging applications

**General information**
State: Published
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging
Authors: Lahti, J. M. K.
Publication date: 2015
Peer-reviewed: Unknown

**Bibliographical note**
Poster
Research output: Scientific › Paper, poster or abstract

Enhanced In-line detection, cleaning and repair of nano-scale defects in thin-films used for flexible photovoltaic and food packaging applications

**General information**
State: Published
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging
Authors: Lahti, J. M. K.
Publication date: 2015
Peer-reviewed: Unknown

**Bibliographical note**
Poster
Research output: Scientific › Paper, poster or abstract

Erosion testing of filled and/or reinforced vinyl ester composites in water medium at elevated temperature

**General information**
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Outotec Research Center
Authors: Siljander, S., Kiviniemi, M., Sarlin, E., Lindgren, M., Suikkonen, R., Vuorinen, J.
Number of pages: 10
Publication date: 2015

**Host publication information**
Title of host publication: Proceedings of the 20th International Conference on Composite Materials
Links:
http://iccm20.org/fullpapers/file?f=BJk14rE0qP

**Bibliographical note**
ISBN kysytty, ei löydy / TL
Research output: Professional › Conference contribution

Erosion wear of glass fibre reinforced vinyl ester
This study evaluates the slurry-erosion wear of glass fibre reinforced vinyl ester composites (VE-FRP) using a high speed slurry-pot type wear tester. The wear rates of VE-FRP were compared using different abrasives, namely quartz, chromite, copper ore, zinc concentrate, and tailings. Furthermore, the effect of abrasive particle size and slurry concentration on the VE-FRP wear was studied. The erosion wear results of VE-FRP were compared to natural rubber (NR) and bromobutyl rubber (BR) as well as to few common thermoplastics, such as polypropylene (PP) and polyvinyl chloride (PVC).
Moreover, the failure characteristics of VE-FRP were analyzed. The results demonstrated that coarse quartz produced the largest wear rates on VE-FRP samples, while the zinc concentrate showed the lowest wear. Minor changes in the abrasive particle size had no effect on the wear results, only when the particle size was markedly raised, the wear started to increase. When comparing the wear rates of different materials, it was concluded that with all abrasive types, tested rubbers and thermoplastics had lower wear rates than VE-FRP.

**General information**
State: Published
Evaluation of repellency and cleanability properties of the multifunctional protective textiles treated with nanosol-based finishings

Rescue team workers in extreme weather conditions, in wildland fires and in first aid medical tasks confront various hazards in varying ambient conditions. Multifunctional properties in protective garments are needed such as waterproofness, mechanical durability, extended service life and self-cleaning. Flood waters may contain various contaminant agents like household chemicals, sewage, microbes and petroleum products. First aid workers are exposed to a wide variety of soils and liquids like blood, disinfectant agents, mud and oil based stains. Barrier properties of the materials prevent the liquid and particle penetration while the repellency and antimicrobial properties prevent the surface wetting and soiling and ease up cleaning thus extending the service life of the protective garment.

In SAFEPROTEX project the aim was to develop protective garments for rescue team workers imparting protection against multiple hazards with enhanced mechanical parameters and maintaining physiological comfort. Hydrofobic, self-cleaning and antimicrobial properties were achieved by applying alkoxysilane nanosol based finishing on selected fabric substrates for the protective prototypes. The repellency, self-cleaning and soil removal properties were tested using standard test method for spray test, roll-off angle test and an inhouse test for staining and cleanability receiving good and satisfactory results.

This paper presents the staining and cleanability test method using the end user specific staining agents and discusses the results.
Experimental study on the behavior of wear resistant steels under high velocity single particle impacts

High velocity solid particle erosion may cause severe damage and high wear rates in materials used for wear protection. An experimental work on the behavior of wear resistant steels, including three high-strength martensitic alloys and a carbide-reinforced metal matrix composite, was performed in high rate single impact conditions. Characterization of the mechanical behavior of the materials at high strain rates was conducted using the Hopkinson Split Bar technique to identify the effects of strain rate on strain hardening and the prevailing failure mechanisms. The high velocity impact experiments using spherical projectiles were carried out at various impact angles and projectile velocities. The effects of impact energy and impact angle were studied and discussed. Wear was analyzed as volume loss from the surface, but it was also presented in a more precise way by taking into account the actual energy spent on the plastic deformation and wear. In-situ high speed photography and post impact characterization of the impact craters were used to reveal the prevailing failure and wear mechanisms. Depending on the impact angle and impact energy, different wear mechanisms of plastic deformation, cutting, shear banding and fracture were identified. The martensitic steels exhibited adiabatic shear banding in the microstructure at high strain rates and impact velocities, which may accelerate the wear. The carbide reinforced steel was found susceptible to catastrophic fracturing especially at high impact angles.
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

Graphene–Rubber Nanocomposites

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology
Authors: Das, A., Heinrich, G.
Number of pages: 4
Pages: 894-897
Publication date: 2015

Host publication information
Title of host publication: Encyclopedia of Polymeric Nanomaterials
Place of publication: Berlin, Heidelberg
Publisher: Springer
Editors: Kobayashi, S., Müllen, K.
ISBN (Print): 978-3-642-29648-2
DOIs: 10.1007/978-3-642-36199-9_293-1
Research output: Scientific › peer-review › Chapter

>8W GaInNAs VECSEL emitting at 615 nm
We report a high-power VECSEL emitting >8W around 615 nm. The gain chip of the laser was grown by plasmaassisted 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 secondharmonic 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%.
High-gain 1.3 μm GainNAs semiconductor optical amplifier with enhanced temperature stability for all-optical signal processing at 10 Gb/s

We report on the complete experimental evaluation of a GainNAs/GaAs (dilute nitride) semiconductor optical amplifier that operates at 1.3 μm and exhibits 28 dB gain and a gain recovery time of 100 ps. Successful wavelength conversion operation is demonstrated using a pseudorandom bit sequence 2<sup>7</sup> - 1 non-return-to-zero bit streams at 5 and 10 Gb/s, yielding error-free performance and showing feasibility for implementation in various signal processing functionalities. The operational credentials of the device are analyzed in various operational regimes, while its nonlinear performance is examined in terms of four-wave mixing. Moreover, characterization results reveal enhanced temperature stability with almost no gain variation around the 1320 nm region for a temperature range from 20°C to 50°C. The operational characteristics of the device, along with the cost and energy benefits of dilute nitride technology, make it very attractive for application in optical access networks and dense photonic integrated circuits.
High power yellow-orange-red VECSELs for medical applications

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Kantola, E. L., Leinonen, T. P., Penttinen, J., Korpijärvi, V., Guina, M.
Publication date: 2015
Host publication information
Title of host publication: Northern Optics & Photonics 2015, 1.-4.6.2015, Saimaa, Finland: Oral presentation in Northern Optics & Photonics 2015, 1.-4.6.2015, Saimaa, Finland
Bibliographical note
Research output: Scientific - peer-review › Article

High-temperature slurry erosion of vinylester matrix composites – The effect of test parameters
Glass fibre (GF) reinforced vinylester composites (VE-FRP) are commonly used materials in hydrometallurgical reactors, the pulp and paper industry and waste water treatment plants, due to their excellent chemical resistance combined with good mechanical performance. In these applications, materials can be subjected to erosion, elevated temperatures (as high as 95 °C) and various chemical environments. However, studies on the slurry erosion of vinylester-based composites at high temperatures have not yet been reported. In this study, the erosion resistance of GF reinforced VE-FRP was investigated with a pilot-scale reactor. The effect of slurry concentration, erodent particle kinetic energy and slurry temperature was studied. The dominating wear mechanism was found to be abrasive wear. The VE-FRP structure was found to be prone to erosive turbulent flow and cavitation. Moreover, an increase in the erodent concentration of the slurry (10-20. wt%) or in the total kinetic energy of the erodent particles (30-770. kJ) increased the wear rate of the material (up to 6 times higher weight loss). However, the total effect of different interrelated parameters was found to be complex. Consequently, it is recommended that predictions of the erosion rate of VE-FRP components are based on tests carried out in conditions that simulate the actual service environment.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Engineering materials science and solutions (EMASS), Outotec Research Center
Authors: Sarlin, E. L., Lindgren, M., Suihkonen, R. J., Siljander, S. M. K., Kakkonen, M. M. S., Vuorinen, J. E.
Number of pages: 10
Pages: 488-497
High-Temperature Storage Testing of ACF Attached Sensor Structures

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering, Research area: Reliability, Department of Materials Science, Research group: Plastics and Elastomer Technology, Engineering materials science and solutions (EMASS)
Authors: Lahokallio, S., Hoikkanen, M., Vuorinen, J., Frisk, L.
Pages: 8641-8660
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Materials
Volume: 8
Issue number: 12
ISSN (Print): 1996-1944
Ratings:
Scopus rating (2016): CiteScore 3 SJR 0.834 SNIP 1.497
Scopus rating (2015): SJR 0.852 SNIP 1.495 CiteScore 3.11
Scopus rating (2014): SJR 0.777 SNIP 1.256 CiteScore 2.69
Scopus rating (2013): SJR 0.998 SNIP 1.673 CiteScore 3.12
Scopus rating (2012): SJR 0.838 SNIP 1.471
High Temperature Tension HSB Device Based on Direct Electrical Heating

The effects of strain rate and temperature on the mechanical properties of various engineering materials have been extensively studied within the past few decades. However, the high temperature high strain rate tension Hopkinson Split Bar (HSB) testing is still quite challenging to perform due to the need to fix the sample to the stress bars. Mechanical fixing of a sheet material sample is not very convenient and can produce low quality results. Therefore, the sheet samples are typically glued directly to the stress bars. This glue joint, however, loses strength rapidly if the temperature of the glue joint increases above room temperature, which makes the high temperature testing more difficult. In this paper, we present a tension Hopkinson Split Bar device with a high temperature system that allows the sample to be heated while keeping the glue joint at or close to room temperature. The sample is rapidly heated by a powerful low voltage high amperage DC pulse. When testing stainless steels, test temperatures between 400 and 800 °C are reached in less than one second, and even the melting temperature of the material is reached in less than 2 s. The system is fully computer controlled allowing accurate timing and control of the different actions during the test including heating of the sample, pneumatic manipulation of the heating electrodes, releasing of the striker bar, and recording of the test results. The results obtained with the current high temperature system are high quality and the obtained high temperature stress strain curves are essentially oscillation free. © The Society for Experimental Mechanics, Inc. 2015.
Image-Based Stress and Strain Measurement of Wood in the Split-Hopkinson Pressure Bar

The properties of wood must be considered when designing mechanical pulping machinery. The composition of wood within the annual ring is important. This paper proposes a novel image-based method to measure stress and planar strain distribution in soft, heterogeneous materials. The main advantage of this method in comparison to traditional methods that are based on strain gauges is that it captures local strain gradients and not only average strains. Wood samples were subjected to compression at strain rates of 1000-2500 s⁻¹ in an encapsulated split-Hopkinson device. High-speed photography captured images at 50 000-100 000 Hz and different magnifications to achieve spatial resolutions of 2.9 to 9.7 μm pixels⁻¹. The image-based analysis utilized an image correlation technique with a method that was developed for particle image velocimetry. The image analysis gave local strain distribution and average stress as a function of time. Two stress approximations, using the material properties of the split-Hopkinson bars and the displacement of the transmitter bar/sample interface, are presented. Strain gauges on the bars of the split-Hopkinson device give the reference average stress and strain. The most accurate image-based stress approximation differed from the strain gauge result by 5%.

General information
State: Published
Authors: Moilanen, C. S., Saarenrinne, P., Engberg, B. A., Björkqvist, T.
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Measurement Science and Technology
Volume: 26
Issue number: 8
Article number: 085206
ISSN (Print): 0957-0233

Ratings:
Scopus rating (2016): CiteScore 1.75 SJR 0.668 SNIP 1.173
Scopus rating (2015): SJR 0.687 SNIP 1.303 CiteScore 1.71
Scopus rating (2014): SJR 0.657 SNIP 1.319 CiteScore 1.58
Scopus rating (2013): SJR 0.555 SNIP 1.244 CiteScore 1.53
Scopus rating (2012): SJR 0.716 SNIP 1.529 CiteScore 1.65
Scopus rating (2011): SJR 0.844 SNIP 1.703 CiteScore 1.77
Scopus rating (2010): SJR 0.679 SNIP 1.462
Scopus rating (2009): SJR 0.919 SNIP 1.573
Scopus rating (2008): SJR 0.881 SNIP 1.494
Scopus rating (2007): SJR 0.823 SNIP 1.492
Scopus rating (2006): SJR 0.744 SNIP 1.58
Scopus rating (2005): SJR 0.82 SNIP 1.584
Scopus rating (2004): SJR 0.828 SNIP 1.64
Improving the extensibility of paper: Sequential spray addition of gelatine and agar

High extensibility of paper is of key importance for production of novel 3D-packaging materials. The application of agar onto a wet web has been shown to significantly improve the extensibility of dry paper as a result of shrinkage during drying while addition of gelatine strengthens inter-fibre bonding. In this work, these two bio-based materials were applied sequentially to yield paper with higher extensibility compared to that obtained by single component application. We studied the interactions between agar, gelatine and cellulose by using quartz crystal micro-gravimetry and atomic force microscopy. Agar adsorption was significantly improved after priming the cellulose surface with gelatine. This synergistic effect on extensibility only occurred if the protein was added first. It is hypothesized that the gelatine strengthens the interfibre bonds while the polysaccharide forms a film on the web surface, and reinforces it. The extensibility of webs treated with gelatine (4%) and agar (4%) was ca. 15% after unrestrained drying. Such remarkable level of extensibility allows production of tray-like shapes via conventional thermoforming machine to depths of up to 2 cm. Overall, a protocol based on the sequential application of two abundant biopolymers is proposed to enhance formability of paper.
Influence of Diffusion Barriers on Thermal Ageing Behaviour of Solar Absorber Coatings on Copper

The thermal stability of magnetron sputtered and electroplated solar absorber coatings were investigated at elevated temperatures of 200-500°C. Diffusion barriers of aluminium and nickel were studied towards thermal diffusion of copper substrate atoms.

The diffusion barriers studied were experimental magnetron sputtered Al layers and an industrial electroplated Ni layer between a Cu substrate and an absorber coating. The thicknesses of Al barriers were 0.1 µm and 0.5 µm, and a Ni barrier was 3 µm thick. As absorber coatings, magnetron sputtered chromium-based coatings and industrially electroplated black chromium coatings, were studied. The sputtered absorbers were a 3-layer stack of CrOx/Cr/CrOx with layer thicknesses of 0.05/0.03/0.05 µm, respectively. The electroplated black chromium coating had a thickness of 0.2 µm. Copper was used as a substrate for all of the absorbers studied.

The degradation of the absorber surfaces and influence of diffusion barriers were analysed by optical measurements (solar absorptance with a UV/Vis/NIR spectrophotometer and thermal emittance with a FTIR spectrophotometer), microstructural analyses were performed using a field-emission scanning electron microscope (FESEM). The absorbers were aged by means of heat treatments in a circulating air furnace at 200, 300, 400 and 500°C for two hours. The experimental analyses were performed before and after the ageing studies.

The results showed that without a barrier coating copper substrate atoms can diffuse into the absorber coating and through the coating to the surface of the coating and form CuO islands on the surface. These phenomena degraded optical selectivity of the absorber surface. The diffusion can be prevented or retarded with a diffusion barrier layer between the Cu substrate and the absorber coating. The 3-µm-thick Ni barrier prevented Cu diffusion and retained optical selectivity up to 500°C for two hours and the 0.5-µm-thick Al layer up to 400°C.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Surface Engineering
Authors: Kotilainen, M., Vuoristo, P.
Number of pages: 11
Pages: 481-491
Publication date: 2015

Host publication information
Title of host publication: Surface Modification Technologies XXVIII: Tampere University of Technology Tampere, Finland June 16-18, 2014
ISBN (Print): 978-81-926196-1-3
Keywords: Thermal ageing, Thin films, Absorber coating, Aluminium barrier, Copper substrate, Diffusion barrier, Magnetron sputtering, Stability
Research output: Scientific - peer-review › Conference contribution

Influence of the Spray Gun Type on Microstructure and Properties of HVAF Sprayed Fe-Based Corrosion Resistant Coatings
The aim of this study is to evaluate the microstructural details and corrosion properties of novel Fe-based coatings prepared using two different generations of HVAF spray guns. These two generations of HVAF guns are Activated Combustion HVAF (AC-HVAF, 2nd generation) M2 gun and Supersonic Air Fuel HVAF (SAF, 3rd generation) M3 gun. Structural details were analysed using x-ray diffractometry and field-emission scanning electron microscope. Higher denseness with homogeneous microstructure was achieved for Fe-based coating deposited by the M3 process. Such coatings exhibit higher particle deformation and lower oxide content compared to coatings manufactured with M2 gun. Corrosion properties were studied by open-cell potential measurements and electrochemical impedance spectroscopy. The lower porosity and higher interlamellar cohesion of coating manufactured with M3 gun prevent the electrolyte from penetrating through the coating and arriving to the substrate, enhancing the overall corrosion resistance. This can be explained by the improved microstructures and coating performance.
**In situ hybridization of pulp fibres using Mg-Al layered double hydroxides**

Inorganic Mg2+ and Al3+ containing layered double hydroxide (LDH) particles were synthesised in situ from aqueous solution onto chemical pulp fibres of pine (Pinus sylvestris). High super saturated (hss) solution with sodium carbonate produced LDH particles with an average diameter of 100–200 nm. Nano-size (70 nm) LDH particles were found from fibers external surface and, to a lesser degree, from the S2 cell wall after synthesis via low super saturated (lss) route. The synthesis via slow urea hydrolysis (Uhyd) yielded micron and clay sized LDH (2–5 µm) and enabled efficient fiber densification via mineralization of S2 fiber wall layer as indicated by TEM and compliance analysis. The Uhyd method decreased fiber compliance up to 50%. Reduction in the polymerization degree of cellulose was observed with capillary viscometry. Thermogravimetric analysis showed that the hybridization with LDH reduced the exothermic heat, indicating, that this material can be incorporated in flame retardant applications. Fiber charge was assessed by adsorption experiments with methylene blue (MB) and metanil yellow (MY). Synthesis via lss route retained most of the fibres original charge and provided the highest capacity (10 µmol/g) for anionic MY, indicating cationic character of hybrid fibers. Our results suggested that mineralized fibers can be potentially used in advanced applications such as biocomposites and adsorbent materials.
Layered Double Hydroxide (LDH)-Based Rubber Nanocomposites

Local cleaning method for micron-sized particle contamination in thin film processing

Manufacturing of Calibration Samples for Barkhausen Noise Measurements with Temperature Controlled Laser Processing
MBE GROWN GaInNAsSb MULTIJUNCTION SOLAR CELLS: PATH TOWARDS 50% EFFICIENCY

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Aho, A. J., Polojärvi, V. V., Aho, T. A., Raappana, M. J. S., Tukiainen, A. K., Guina, M. D.
Publication date: 2015

Host publication information
Title of host publication: 18th European Molecular Beam Epitaxy Workshop. Canazei, Italy
ASJC Scopus subject areas: Energy(all)
Links:

Bibliographical note
xpresentation
Research output: Professional › Conference contribution

Mechanical performance and CO2 uptake of ion-exchanged zeolite A structured by freeze-casting
Zeolite 4A has been freeze-cast into highly porous monoliths with a cylindrical shape. The brittle monoliths, with lamellar or columnar pores and wall thicknesses between 8 and 35μm, show a compressive mechanical response along the main pore axis that could be modeled by a buckling behavior. The failure strength is proportional to the density and the amount of transverse bridging across lamella, which was shown to be related to the pore cross-sectional aspect ratio. Monoliths with highly anisotropic pores with a cross-sectional aspect ratio higher than 3 yielded sequentially from the top surface, whereas monoliths with a pore aspect ratio lower than 3 were found to delaminate into longitudinal splinters. The freeze-cast monoliths show a sharp gas breakthrough front with a 1:9 mixture of CO2:N2, indicating rapid uptake kinetics of the lamellar structures.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Ceramic materials, Department of Signal Processing, Engineering materials science and solutions (EMASS), Workshop for Research in Artistic Technologies, RATS, Stockholm University, Sweden, Luleå University of Technology, Department of Materials and Environmental Chemistry, Berzelii Center EXSELENT on Porous Materials, Division of Materials Science
Authors: Ojuva, A., Järveläinen, M., Bauer, M., Keskinen, L., Valkonen, M., Akhtar, F., Levänen, E., Bergström, L.
Number of pages: 12
Pages: 2607-2618
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of the European Ceramic Society
Volume: 35
Issue number: 9
ISSN (Print): 0955-2219
Ratings:
Scopus rating (2016): CiteScore 3.25 SJR 1.135 SNIP 1.776
Micro- and nano-scale defect detection, cleaning and repair techniques to improve the quality of nanoscale barrier coatings

General information
State: Published
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging
Authors: Lahti, J.
Publication date: 2015
Peer-reviewed: Unknown

Bibliographical note
posterc
Research output: Scientific › Paper, poster or abstract

Micro- and nano-scale defect detection, cleaning and repair techniques to improve the quality of nanoscale barrier coatings

General information
State: Published
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging
Authors: Lahti, J.
Publication date: 2015
Peer-reviewed: Unknown
Research output: Scientific › Paper, poster or abstract

Micro- and nano-scale defect detection, cleaning and repair techniques to improve the quality of nanoscale barrier coatings
Micro- and nano-scale defect detection, cleaning and repair techniques to improve the quality of nanoscale barrier coatings

Microstructural analysis of high-pressure cold-sprayed Ni, NiCu and NiCu + Al2O3 coatings

Cold spraying has shown its potential to produce metallic and composite coatings with high quality and performance. For instance, the impermeability of the coatings is the criterion for the corrosion resistance and thus, fully dense coatings can act as real corrosion barrier coatings. Our previous study has demonstrated the good corrosion properties of high-pressure cold-sprayed (HPCS) Ni and NiCu coatings whereas the present study focuses on the analysis of structural characteristics behind the dense coatings. Microstructures of as-sprayed and heat-treated HPCS Ni, Ni20Cu and Ni20Cu+Al2O3 coatings have been evaluated with FESEM from top-view direction. This revealed clearly particle deformation and particle boundaries whereas particle bonding was evaluated with cavitation-erosion test. Density was proven with Corrodkote test and impermeable HPCS NiCu+Al2O3 coating structures were achieved. Furthermore, cavitation-erosion resistance of NiCu coating was improved by heat treatment.
Modelling of Material Properties Using Frequency Domain Information from Barkhausen Noise Signal

Frequency spectrum, bispectrum and bicoherence which are computed from Barkhausen noise (BN) signal are used to model material properties. The use of frequency domain information can be a significant addition to the more common time domain data analysis of the BN signals. The frequency spectrum shows the magnitude of the spectral components present in the signal. These components can also have interaction which is revealed only by the higher-order spectra. Third order spectrum can be used to detect the quadratic phase coupling phenomenon, which is a result of nonlinearity in the signal. In this study, a special attention is paid on the segment biphase to distinguish the quadratic phase coupling from constant non-zero biphase. Partial least squares regression models are made to model the surface hardness and residual stress properties from a set of carburizing case-hardened steel samples.
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.

Muraglitazar-Eluting Bioabsorbable Vascular Stent Inhibits Neointimal Hyperplasia in Porcine Iliac Arteries

Purpose To evaluate the biocompatibility of a new muraglitazar-eluting poly-lactide copolymer stent and investigate its ability to prevent the formation of intimal hyperplasia.

Materials and Methods Ten self-expandable muraglitazar-eluting poly-96l/4d-lactic acid (PLA96) stents and 10 self-expandable control PLA96 stents were implanted into porcine common iliac arteries. After 28 days follow-up, all stent-implanted iliac arteries were harvested and prepared for quantitative histomorphometric analysis.
Results Angiographic analysis revealed that one control PLA96 stent had occluded and one had migrated. Histomorphometric analysis demonstrated that, with the control PLA96 stent, the luminal diameter and area were decreased versus the muraglitazar-eluting PLA96 stents (means ± standard error of the mean, 3.58 mm ± 0.34 vs 4.16 mm ± 0.14 and 9.83 mm² ± 2.41 vs 13.75 mm² ± 0.93, respectively). The control PLA96 stent induced more intimal hyperplasia than the bioactive muraglitazar-eluting PLA96 stent (557 μm ± 122 vs 361 μm ± 32). Vascular injury scores demonstrated only mild vascular trauma for both stents (muraglitazar-eluting, 0.68 ± 0.07; control, 0.75 ± 0.08). Inflammation scores also showed mild inflammation for both stents (muraglitazar-eluting, 1.05 ± 0.17; control, 1.23 ± 0.19).

Conclusions This new muraglitazar-eluting PLA96 stent was shown to be biocompatible with a tendency for better patency and less intimal hyperplasia compared with the control PLA96 stents.
New alternative route for the preparation of phosphate glasses with persistent luminescence properties

In this paper, we investigate a new alternative route for the preparation of phosphate glasses with persistent luminescence properties. Phosphate glasses within the P2O5-Na2O-CaO and P2O5-Na2O-SrO systems were prepared by a standard melting process in air by adding Sr4Al14O25:Eu2+,Dy3+ microparticles in the glass batch before melting. We found that all the investigated glasses show persistent luminescence. It is clearly shown that conventional melting in air of Sr4Al14O25:Eu2+,Dy3+ microparticles in phosphate glass batch can be a new technique to prepare phosphate glasses with persistent luminescence properties.
New routes from cellulose to textile fiber and ready products

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Fibre Materials, Aalto University, VTT Tech Res Ctr Finland, VTT Technical Research Center Finland
Authors: Nousiainen, P., Rissanen, M., Michud, A., Sixta, H., Hummel, M., Setälä, H.
Publication date: 2015

Host publication information
Title of host publication: Proceedings of 15th AUTEX World Textile Conference, June 10-12, 2015, Bucharest, Romania
ISBN (Print): 9786066852760
Research output: Scientific - peer-review › Conference contribution

Optical properties and thermionic emission in solar cells with InAs quantum dots embedded within GaNAs and GaInNAs
The optical properties of p-i-n solar cells comprised of InAs quantum dots embedded within GaNAs and GaInNAs quantum wells are reported. Strain compensating and mediating GaNAs and GaInNAs layers shift the photoluminescence emission as well as absorption edge of the quantum dots to longer wavelengths. GaNAs and GaInNAs quantum wells contribute also to extending the absorption edge. In addition, the use of GaNAs and GaInNAs layers enhances the thermal escape of electrons from QDs by introducing steps for electrons to the GaAs conduction band.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Augmented Human Activities (AHA), Frontier Photonics, Faculty of Exact Sciences and Engineering, Hyperion University
Authors: Polojärvi, V., Pavelescu, E., Schramm, A., Tukiainen, A., Aho, A., Puustinen, J., Guina, M.
Number of pages: 4
Pages: 122-125
Publication date: 2015
Peer-reviewed: Yes
Early online date: 19 Jun 2015

Publication information
Journal: Scripta Materialia
Volume: 108
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
ASJC Scopus subject areas: Materials Science(all), Condensed Matter Physics
Keywords: Quantum dot, Quantum well, Solar cell, Strain engineering, Thermal escape
DOIs:
Pigment-Cellulose Nanofibril Composite and Its Application as a Separator-Substrate in Printed Supercapacitors

Pigment-cellulose nanofibril (PCN) composites were manufactured in a pilot line and used as a separator-substrate in printed graphene and carbon nanotube supercapacitors. The composites consisted typically of 80% pigment and 20% cellulose nanofibrils (CNF). This composition makes them a cost-effective alternative as a substrate for printed electronics at high temperatures that only very special plastic films can nowadays stand. The properties of these substrates can be varied within a relatively large range by the selection of raw materials and their relative proportions. A semi-industrial scale pilot line was successfully used to produce smooth, flexible, and nanoporous composites, and their performance was tested in a double functional separator-substrate element in supercapacitors. The nanostructural carbon films printed on the composite worked simultaneously as high surface area active electrodes and current collectors. Low-cost supercapacitors made from environmentally friendly materials have significant potential for use in flexible, wearable, and disposable low-end products.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Department of Automation Science and Engineering, Augmented Human Activities (AHA), VTT
Authors: Torvinen, K., Lehtimäki, S., Keränen, J. T., Sievänen, J., Vartiainen, J., Hellén, E., Lupo, D., Tuukkanen, S.
Number of pages: 8
Pages: 1040-1047
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Electronic Materials Letters
Volume: 11
Issue number: 6
ISSN (Print): 1738-8090
Ratings:
Scopus rating (2016): CiteScore 1.58 SJR 0.519 SNIP 0.872
Scopus rating (2015): SJR 0.609 SNIP 1.106 CiteScore 1.94
Scopus rating (2014): SJR 0.694 SNIP 1.328 CiteScore 2.02
Scopus rating (2013): SJR 1.235 SNIP 2.54 CiteScore 3.39
Scopus rating (2012): SJR 0.602 SNIP 1.012 CiteScore 1.72
Scopus rating (2011): SJR 0.529 SNIP 0.992 CiteScore 1.3
Scopus rating (2010): SJR 0.461 SNIP 0.799
Scopus rating (2009): SJR 0.494 SNIP 0.513
Original language: English
Keywords: cellulose nanofibrils (CNF), graphene, carbon nanotubes, supercapacitors, separator, substrate
Electronic versions:
Torvinen_2015_EML_pre-print
DOIs: 10.1007/s13391-015-5195-6

Bibliographical note
Versio ja lupa ok 12.1.2016 /KK
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 μm 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 μm. 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
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: Ultrafast and intense lasers, Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics, Ulyanovsk State University, Fiber Optics Research Center, Russian Academy of Sciences
Authors: 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
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: Scientific - peer-review › Conference contribution

Processing and characterization of novel borophosphate glasses and fibers for medical applications

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Authors: Massera, J., Shpotyuk, Y., Sabatier, F., Jouan, T., Boussard-Plédel, C., Railand, C., Bureau, B., Petit, L., Boetti, N., Milanese, D., Hupa, L.
Pages: 52-60
Publication date: 2015
Peer-reviewed: Yes

Publication information
Quantum dot semiconductor disk laser at 1.3 μm

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Frontier Photonics, Ioffe Institute, Polytekhchineshaya str. 26, Saint-Petersburg 194021, Saint-Petersburg Polytechnical University, Saint-Petersburg 195251
Number of pages: 4
Pages: 3400-3403
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Optics Letters
Volume: 40
Issue number: 14
ISSN (Print): 0146-9592
Ratings:
Scopus rating (2016): CiteScore 2.02 SJR 0.692 SNIP 1.163
Scopus rating (2015): SJR 0.684 SNIP 1.083 CiteScore 1.85
Scopus rating (2014): SJR 0.803 SNIP 1.194 CiteScore 1.87
Scopus rating (2013): SJR 0.822 SNIP 1.19 CiteScore 1.79
Scopus rating (2012): SJR 0.758 SNIP 1.124 CiteScore 1.64
Scopus rating (2011): SJR 0.836 SNIP 1.272 CiteScore 1.7
Scopus rating (2010): SJR 0.911 SNIP 1.128
Scopus rating (2009): SJR 0.924 SNIP 0.993
Scopus rating (2008): SJR 0.957 SNIP 1.2
Scopus rating (2007): SJR 0.95 SNIP 1.082
Scopus rating (2006): SJR 0.887 SNIP 1.158
Scopus rating (2005): SJR 0.986 SNIP 1.149
Scopus rating (2004): SJR 0.992 SNIP 1.216
Scopus rating (2003): SJR 1.362 SNIP 1.308
Scopus rating (2002): SJR 0.861 SNIP 1.051
Scopus rating (2001): SJR 1.099 SNIP 1.09
Scopus rating (2000): SJR 0.948 SNIP 1.074
Scopus rating (1999): SJR 1.068 SNIP 0.966
Original language: English
DOIs:
10.1016/j.jnoncrysol.2015.05.028
Research output: Scientific - peer-review › Article
Recent progress in wafer-fused VECSELs emitting in the 1310 nm waveband

Over the last years we have continuously improved the performance of 1300 nm band VECSELs with wafer fused gain mirrors in the intra-cavity diamond and the flip-chip heat dissipation configurations. In this work we present recent results for gain mirrors that implement both heat-dissipation schemes applied to the same fused gain mirror structure. We demonstrate record high output powers of 7.1 W in the intra-cavity diamond heat-spreader configuration and 6.5 W in the flip-chip heat dissipation scheme. These improvements are achieved due to optimization of the wafer fused gain mirror structure based on AlGaInAs/InP-active region fused to AlAs-GaAs distributed Bragg reflector (DBR) and application of efficient methods of bonding semiconductor gain mirror chips to diamond heatspreaders.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Frontier Photonics, École Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland
Authors: Sirbu, A., Rantamäki, A., Iakolev, V., Mereuta, A., Caliman, A., Volet, N., Lyytikäinen, J., Okhotnikov, O., Kapon, E.
Number of pages: 7
Publication date: 2015

Host publication information
Place of publication: BELLINGHAM
Publisher: SPIE
Editor: Guina, M.

Publication series
Name: Proceedings of SPIE
Publisher: SPIE-INT SOC OPTICAL ENGINEERING
Volume: 9349
ISSN (Print): 0277-786X
Keywords: Wafer-fused vertical-external-cavity surface-emitting lasers (VECSELs), wafer-fused gain mirrors, optically pumped VECSELs, photonics technology, SEMICONDUCTOR DISK LASER
DOIs: 10.1117/12.2079752
Source: WOS
Source-ID: 000353134900006
Research output: Scientific - peer-review > Conference contribution

Research on icing behavior and ice adhesion testing of icephobic surfaces

Surface engineering shows potential to provide sustainable approach to icing problems. Currently several passive anti-ice mechanisms adoptable to coatings are known but further research is required to proceed for practical applications. Icing wind tunnel and centrifugal ice adhesion test equipment enable the evaluation and development of anti-ice and icephobic coatings for e.g., wind turbine applications but also other growing players in arctic environment e.g. oil, extractive and logistic industries. This research is focused on the evaluation of icing properties of various surfaces.

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Roll-to-roll coating by liquid flame spray nanoparticle deposition
Nanostructured coatings have been prepared on a flexible, moving paperboard using deposition of ca. 10-50-nm-sized titanium dioxide and silicon dioxide nanoparticles generated by a liquid flame spray process, directly above the paperboard, to achieve improved functional properties for the material. With moderately high production rate (~ g/min), the method is applicable for thin aerosol coating of large area surfaces. LFS-made nanocoating can be synthesized e.g. on paper, board or polymer film in roll-to-roll process. The degree of particle agglomeration is governed by both physicochemical properties of the particle material and residence time in aerosol phase prior to deposition. By adjusting the speed of the substrate, even heat sensitive materials can be coated. In this study, nanoparticles were deposited directly on a moving paperboard with line speeds 50-300 m/min. Functional properties of the nanocoating can be varied by changing nanoparticle material; e.g. TiO2 and SiO2 are used for changing the surface wetting properties. If the liquid precursors are dissolved in one solution, synthesis of multi component nanoparticle coatings is possible in a one phase process. Here, we present analysis of the properties of LFS-fabricated nanocoatings on paperboard. The thermophoretic flux of nanoparticles is estimated to be very high from the hot flame onto the cold substrate. A highly hydrophobic coating was obtained by a mass loading in the order of 50-100 mg/m<sup>2</sup> of titanium dioxide on the paperboard.
Te-doping of self-catalyzed GaAs nanowires

Tellurium (Te)-doping of self-catalyzed GaAs nanowires (NWs) grown by molecular beam epitaxy is reported. The effect of Te-doping on the morphological and crystal structure of the NWs is investigated by scanning electron microscopy (SEM) and high-resolution transmission electron microscopy (TEM). The study reveals that the lateral growth rate increases and axial growth rate decreases with increasing Te doping level. The changes in the NW morphology can be reverted to some extent by changing the growth temperature. At high doping levels, formation of twinning superlattice is observed alongside the {111}-facetted sidewalls. Finally, the incorporation of Te is confirmed by Raman spectroscopy.
Temperature coefficients for GaInP/GaAs/GaInNAsSb solar cells

We report the temperature coefficients for MBE-grown GaInP/GaAs/GaInNAsSb multijunction solar cells and the corresponding single junction sub-cells. Temperature-dependent current-voltage measurements were carried out using a solar simulator equipped with a 1000W Xenon lamp and a three-band AM1.5D simulator. The triple-junction cell exhibited an efficiency of 31% at AM1.5G illumination and an efficiency of 37-39% at 70x real sun concentration. The external quantum efficiency was also measured at different temperatures. The temperature coefficients up to 80°C, for the open circuit voltage, the short circuit current density, and the conversion efficiency were determined to be -7.5mV/°C, 0.040mA/cm²/°C, and -0.09%/°C, respectively.
The deformation, strain hardening, and wear behavior of chromium-alloyed hadfield steel in abrasive and impact conditions

The alloying of Hadfield steels aims at enhanced mechanical properties and improvements in the wear resistance. In this work, the impact and abrasive properties of a chromium-alloyed high-manganese Hadfield steel were experimentally studied using a wide variety of testing techniques and characterization methods. In addition, an in-service sample was characterized to identify the wear and hardening mechanisms in a real application (jaw crusher). The dynamic mechanical behavior of the steel was determined using the Hopkinson split bar technique. The abrasion properties were studied with three-body abrasion tests using several different natural abrasives. The effects of existing plastic strain and normal loading on the surface hardening and wear rate were further investigated with scratch testing. High-velocity impact testing was performed to evaluate the effect of pre-strain on the impact wear behavior of the material. It was shown that the dynamic loading affects both the yield behavior and the strain hardening rate of the studied steel. The connection between pre-
strain, hardness, and wear rate in abrasion was established. In impact conditions, plastic straining of the surface layer first has a positive effect on the wear resistance, but when strain hardening reached the observed ductility limit, it showed an adverse effect on the material's performance. The addition of chromium and an increase in the manganese content from the nominal ASTM Hadfield composition provided some improvements in the strength, ductility, and surface hardening of the studied steel.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Computational Science X (CompX), Engineering materials science and solutions (EMASS), VTT Technical Research Centre of Finland
Authors: Lindroos, M., Apostol, M., Heino, V., Valtonen, K., Laukkanen, A., Holmberg, K., Kuokkala, V. T.
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Tribology Letters
Volume: 57
Issue number: 3
Article number: 24
ISSN (Print): 1023-8883
Ratings:
Scopus rating (2016): SJR 1.016 SNIP 1.278 CiteScore 2.04
Scopus rating (2015): SJR 1.03 SNIP 1.202 CiteScore 1.96
Scopus rating (2014): SJR 1.306 SNIP 1.639 CiteScore 2.21
Scopus rating (2013): SJR 1.404 SNIP 1.727 CiteScore 2.53
Scopus rating (2012): SJR 1.33 SNIP 1.569 CiteScore 1.95
Scopus rating (2011): SJR 1.199 SNIP 1.581 CiteScore 1.74
Scopus rating (2010): SJR 1.139 SNIP 1.389
Scopus rating (2009): SJR 0.982 SNIP 1.348
Scopus rating (2008): SJR 1.218 SNIP 1.248
Scopus rating (2007): SJR 1.228 SNIP 1.353
Scopus rating (2006): SJR 1.019 SNIP 1.135
Scopus rating (2005): SJR 0.941 SNIP 1.253
Scopus rating (2004): SJR 1.098 SNIP 1.287
Scopus rating (2003): SJR 1.093 SNIP 1.44
Scopus rating (2002): SJR 0.874 SNIP 0.983
Scopus rating (2001): SJR 0.993 SNIP 1.173
Scopus rating (2000): SJR 0.87 SNIP 0.945
Scopus rating (1999): SJR 1.101 SNIP 0.915
Original language: English
ASJC Scopus subject areas: Mechanical Engineering, Mechanics of Materials, Surfaces, Coatings and Films, Surfaces and Interfaces
Keywords: Abrasive wear, Hadfield manganese steel, High strain rate, Impact wear, Plasticity, Work hardening
Electronic versions:
The deformation, strain hardening and wear behavior of chromium alloyed Hadfield steel in abrasive and impact conditions
DOIs:
10.1007/s11249-015-0477-6
Links:
http://urn.fi/URN:NBN:fi:ttly-201603223737
Source: Scopus
Source-ID: 84921751364
Research output: Scientific - peer-review › Article

The effect of coupling agents on silicate-based nanofillers/carbon black dual filler systems on the properties of a natural rubber/butadiene rubber compound

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
The effect of physical adhesion promotion treatments on interfacial adhesion in cellulose-epoxy composite

**General information**

State: Published

Ministry of Education publication type: D3 Professional conference proceedings

Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Research group: Paper Converting and Packaging


Number of pages: 10

Publication date: 2015

**Host publication information**

Title of host publication: Proceedings of the 20th International Conference on Composite Materials

Links:

http://iccm20.org/fullpapers/file?f=WM39KAy5r2

**Bibliographical note**

ISBN- tai ISSN-numeroa kysytty, ei löydy

Research output: Professional › Conference contribution
The effect of the outermost fibre layers on solubility of dissolving grade pulp

Dissolving pulps are used to manufacture various cellulose derived products through cellulose dissolution. Solubility of cellulose pulp has been claimed to be strongly dependent on the porosity development, the degree of polymerisation and the pulp viscosity. The removal of external cell walls has been proposed to have a key role in the pulp solubility. In this paper, the effect of the outermost surface layers on the solubility of a dissolving grade pulp was studied. Furthermore the effect of mechanical peeling and combined mechanical and enzymatic treatment on pulp solubility was compared. Based on the results combined mechanical and enzymatic treatment efficiently opens up the fibre structure and has a clear positive effect on the solubility of dissolving pulp. It seems that long fibre fraction is less accessible to solvent chemicals than the other pulp fractions. Mechanical peeling of outer fibre layers does not improve fibre dissolution to NaOH/ZnO. Thus, it seems that peeling alone is not a sufficient pre-treatment prior to dissolution. The results also revealed that the peeling treatment does not enhance the effects of enzymes as the studied mechanical treatment does.
Thermal cycling reliability of Sn-Zn lead-free solders in sensor application

There is a demand for low melting temperature solder in some applications (e.g., sensor attachment) where the components being soldered are temperature-sensitive. However, the same solder needs to meet the life cycle reliability requirements for the entire product. Among low temperature lead-free solders, eutectic Sn-9%Zn (wt.%) lead-free solder offers good mechanical reliability and low melting temperature. However, the presence of Zn makes it susceptible to oxidation especially at elevated temperatures. In this paper, the reliability of sensor attachments using Sn-9%Zn solder and capillary underfills was studied under thermal shock. Three different underfill materials were used with two of them containing fillers. The thermal shock test results showed that the underfills substantially improved the lifetime of the solder joints, and the underfills with fillers provided the best mechanical support to the solder joints. The reliability of the Sn-9%Zn solder joints with underfills was found to be comparable to that of the Sn-Pb-2%Ag solder joints. Failure analysis revealed that a uniform distribution of the underfill was critical to achieve a reliable sensor attachment.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electrical Engineering, Research area: Reliability, University of Maryland, USA
Authors: Mostofizadeh, M., Das, D., Pecht, M., Frisk, L.
Number of pages: 7
Pages: 1240 - 1246
Publication date: 2015

Host publication information
Title of host publication: ECTC 2015, Electronic Components and Technology Conference, May 26-29, 2015, San Diego, USA
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 9781479986095
DOI's: 10.1109/ECTC.2015.7159755
Research output: Scientific - peer-review » Conference contribution

Thermal Management in Long-Wavelength Flip-Chip Semiconductor Disk Lasers

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Research group: Laboratory for Future Electronics, Department of Electronics and Communications Engineering, Research group: Surface Science, Frontier Photonics
Authors: Rantamäki, A., Saarinen, E. J., Lyytikäinen, J., Heikkinen, J., Kontio, J. M., Lahtonen, K., Valden, M., Okhotnikov, O.
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: IEEE Journal of Selected Topics in Quantum Electronics
Volume: 21
Issue number: 6
Article number: 1501507
ISSN (Print): 1077-260X
Ratings:
Scopus rating (2016): CiteScore 2.96 SJR 1.139 SNIP 1.322
Scopus rating (2015): SJR 1.449 SNIP 1.393 CiteScore 3.03
Scopus rating (2014): SJR 1.889 SNIP 2.072 CiteScore 3.49
Scopus rating (2013): SJR 2.258 SNIP 2.38 CiteScore 4.55
Scopus rating (2012): SJR 2.742 SNIP 2.661 CiteScore 4.35
Scopus rating (2011): SJR 2.367 SNIP 2.845 CiteScore 3.87
Scopus rating (2010): SJR 2.217 SNIP 2.599
Scopus rating (2009): SJR 2.964 SNIP 2.869
Scopus rating (2008): SJR 2.476 SNIP 2.433
Scopus rating (2007): SJR 2.428 SNIP 1.746
Scopus rating (2006): SJR 2.131 SNIP 2.383
Scopus rating (2005): SJR 2.93 SNIP 2.594
Scopus rating (2004): SJR 2.827 SNIP 2.62
Scopus rating (2003): SJR 3.121 SNIP 3.103
Scopus rating (2002): SJR 2.664 SNIP 2.508
Scopus rating (2001): SJR 2.25 SNIP 1.926
Scopus rating (2000): SJR 2.37 SNIP 1.335
Scopus rating (1999): SJR 3.466 SNIP 1.611
Original language: English
DOIs:
10.1109/JSTQE.2015.2420599

Bibliographical note
ORG=orc,0.5
ORG=elt,0.5
Research output: Scientific - peer-review › Article

Thermomechanical properties of overmold epoxies in MEMS packaging

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Electrical Engineering, Research area: Reliability
Authors: Fard Sanei, M. A., Kiilunen, J., Pippola, J., Lahokallio, S., Frisk, L.
Number of pages: 5
Pages: 175-179
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the IMAPS Nordic Annual Conference, June 8-9, 2015, Helsingør, Denmark
Publisher: IMAPS Nordic
ISBN (Print): 9781510808133

Towards high power flip-chip long-wavelength semiconductor disk lasers

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Research group: Surface Science, Frontier Photonics
Authors: Rantamäki, A., Saarinen, E., Lytyikäinen, J., Heikkinen, J., Lahtonen, K., Valden, M., Okhotnikov, O.
Publication date: 2015

Host publication information
Title of host publication: Proceedings of SPIE
Volume: 9349
Publisher: SPIE
ISBN (Electronic): 9781628414394
DOIs:
10.1117/12.2076795

Ultra barrier protection for paper packaging using atomic layer deposition

General information
State: Published
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging
Authors: Lahti, J.
Publication date: 2015

Publication information
Year: 2015
VECSELs: Innovative light sources for PDT
Photodynamic therapy (PDT) with porphyrins and red light (610–630 nm) is finding increasing clinical application for both the eradication of relatively small tumors and the palliation of inoperable or obstructive tumors. PDT also shows some promise for the sterilization of the tumor bed after surgical removal of neoplastic masses. Optically pumped vertical external-cavity surface-emitting lasers (VECSELs) appear to be a very innovative and efficient technology in this specific wavelength range. Furthermore, VECSELs are power scalable and wavelength tunable, and are an appealing light source for PDT.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Kantola, E. L., Leinonen, T. P., Penttinen, J., Korpijärvi, V., Mordon, S. R., Guina, M.
Publication date: 2015

Host publication information
Title of host publication: 2015 conference of International Photodynamic association, 22.-26.5.2015, Rio de Janeiro, Brazil
Publication series
Name: Photodiagnosis and Photodynamic Therapy
Publisher: Elsevier
Volume: 12
No.: 3
ISSN (Electronic): 1572-1000
DOIs:
doi:10.1016/j.pdpdt.2015.07.084

Bibliographical note
Research output: Scientific - peer-review › Conference contribution

Wear behavior and work hardening of high strength steels in high stress abrasion
High strength steels (HSS) used in highly abrasive environments, such as in mining and crushing, must endure high stress abrasion. To properly understand the wear behavior of materials under such circumstances, the connection between surface loading, work hardening, and material removal has first to be determined. In this study, wear resistant steels with initial hardness ranging from 400 to 750 HV were investigated in single-grit abrasion. In the cyclic abrasion experiments, the abrasion resistance of the steels was improved noticeably from the initial state due to surface hardening. However, the highest surface hardening rate did not result in the highest wear resistance. Moreover, when the surface loading was sufficiently increased, the transition to a high wear rate mechanism was observed.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Computational Science X (CompX), Engineering materials science and solutions (EMASS)
Authors: Lindroos, M., Valtonen, K., Kemppainen, A., Laukkanen, A., Holmberg, K., Kuokkala, V.
Number of pages: 9
Pages: 32-40
Publication date: 2015
Peer-reviewed: Yes

Publication Information
Journal: Wear
Volume: 322-323
ISSN (Print): 0043-1648
Ratings:
Scopus rating (2016): CiteScore 3 SJR 1.558 SNIP 2.071
Scopus rating (2015): SJR 1.527 SNIP 2.017 CiteScore 2.73
Scopus rating (2014): SJR 1.715 SNIP 2.38 CiteScore 2.46
Scopus rating (2013): SJR 1.319 SNIP 2.416 CiteScore 2.37
Scopus rating (2012): SJR 1.36 SNIP 2.178 CiteScore 1.85
Scopus rating (2011): SJR 1.547 SNIP 2.865 CiteScore 2.43
Wood compression model for radial compression of earlywood and latewood

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Authors: Moilanen, C., Björkqvist, T., Saarenrinne, P.
Number of pages: 6
Pages: 261-266
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the XII Finnish Mechanics Days
Publisher: Rakenteiden Mekaniikan Seura ry
ISBN (Print): 978-952-93-5608-9
Links:

Bibliographical note
ORG=mei,0.5
ORG=ase,0.5
Research output: Scientific › Conference contribution

X-ray Diffraction based Residual Stress Profiling of Heat Affected Surface Layer in Flame Cut Heavy Steels

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Materials Characterization, Research group: Metals Technology
Authors: Saarinen, T., Jokiaho, T., Santa-aho, S., Vippola, M., Peura, P.
Number of pages: 13
Pages: 595-607
Yellow-orange-red VECSELs: Emergence of a compact and versatile laser platform for medical applications: ePoster

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Guina, M., Kantola, E. L., Leinonen, T. P., Penttinen, J., Mordon, S. R.
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the Twenty Eighth International Conference on Surface Modification Technologies
Publisher: Valardocs
Edition: 1st edition
ISBN (Print): 978-81-926196-1-3
Research output: Scientific - peer-review › Conference contribution

Yellow-orange semiconductor disk lasers for medical applications

General information
State: Unpublished
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Research group: Ultrafast and intense lasers
Publication date: 2015

Host publication information
Title of host publication: 2015 annual conference of the American Society for Laser Medicine & Surgery, Florida, USA.

Bibliographical note
xposter
Research output: Scientific - peer-review › Conference contribution

Älytekstiilien standardisointityö jo hyvässä vauhdissa

Standardisointityössä Euroopassa valmistaudutaan uusien älykkäiden tekstiilituotteiden ja tekstiiliyärjestelmiä koskien markkinoille tulemiseen. Älykkäiden tekstiilien työryhmän WG31 työ on julkaistiin ensimmäinen tekninen raportti ”CEN/TR 16298 Tekstiilit ja tekstiiliyöt. Älytekstiilit. Määritelmät, soveltaminen ja standardisointitarpeet” marraskuussa 2011.

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science, Research group: Fibre Materials
Authors: Varheenmaa, M.
Number of pages: 1
Pages: 14-14
Publication date: 2015
Peer-reviewed: Unknown

Publication information
Journal: Tekstiililehti
Issue number: 4
ISSN (Print): 0040-2370
Original language: Finnish
Nanofabrication and Adsorption Studies of Organic Molecules on Metal and Metal Alloy Surfaces as Templates for Biofunctional Applications

The nanofabrication of organic layers on metal and metal alloy surfaces was studied in this thesis by employing photoelectron spectroscopy (PES) as the main analysis method. The motivation for this research is to introduce new properties to metal and metal alloy surfaces via self-assembly driven adsorption processes of organic molecules. Trimesic acid (TMA) and glycine adsorption on single crystal Cu(100) surface was investigated with PES and scanning tunnelling microscopy (STM). TMA on Cu(100) exhibits coverage dependent surface phases with drastic changes in the molecular orientation. The mobile TMA molecules at low coverage transform into Cu atom coordinated TMA networks and finally into carboxyl (COOH) functionalized, densely packed TMA monolayers. This is enabled due to three equivalent COOH groups symmetrically around a rigid benzene ring. Homo- and heterochiral surface phases of achiral glycine on Cu(100) were observed, and a new structural model for glycine bonding on Cu(100) based on STM and density functional theory calculations is presented. The coadsorption of aminopropyl trimethoxysilane (APS) and mercaptopropyl trimethoxysilane (MPS) on stainless steel was studied with an aim to incorporate MPS in APS matrix with tuneable distribution. In addition to the determination of elemental and chemical states at the surface, PES data was also used to determine the surface morphology by employing inelastic electron energy-loss background analysis. Synchrotron radiation mediated PES enabled the study of the in-depth distribution of the chemical states in non-destructive manner. The functionality of the APS/MPS overlayers on stainless steel was studied with chemical derivatization. The studies of TMA and glycine on Cu(100) provide important knowledge of the adsorption behaviour of small molecules on surfaces, which is crucial for understanding the adsorption phenomena of larger molecules, such as proteins on more complex substrates. The fabricated surface structures may also be applicable to molecular electronics or catalytic surfaces. The bifunctional APS/MPS nanomolecular layer on stainless steel works as a template, to which biomolecules can be covalently coupled with tuneable distribution. Hence, the stainless steel surface can be biofunctionalized for a range of applications, depending on the properties of the biomolecules.
Versatile erosion wear testing with the high speed slurry-pot

The high speed slurry-pot tester was developed for application oriented erosion wear testing of materials used in mineral handling and processing. It enables tests in demanding high stress abrasive and erosive environments simulating wear, for example in slurry pumps, tanks and pipes, mineral crushing and grinding, loader buckets, dredging, and drilling. The key design features of the test method are the possibility to use up to 10 millimeter sized particles and sample speeds up to 20 m/s in conditions ranging from wet slurry environments to dry sand or gravel.

The tester has been used to test many different material types, including conventional steels, surface treated steels, cast irons, thick and thin coatings, ceramics, hybrid materials, polymers and elastomers. With the high speed slurry-pot tester, samples of various types and sizes can be tested.

In the FIMECC BSA/P2/SP3 project, the focus is in the testing of materials intended for demanding wear related applications. Moreover, the test system is further developed for various wear conditions, including slurry-erosion, grinding
Polymer Hybrid Thin-Film Composites with Tailored Permeability and Anti-Fouling Performance

Composites and hybrid materials are new material combinations which can provide added value for existing products or create novel multifunctional properties. This thesis aimed at fabricating and modifying thin-film composites (TFC) by using various coating technologies. Moreover, the target was to tailor the permeability or to create anti-fouling performance. Inorganic, inorganic-organic and organic coating layers were made by atmospheric plasma deposition (APD), sol-gel (SG), atomic-layer-deposition (ALD) or polyvinyl alcohol (PVA) dispersion coating methods. Coatings were deposited using either roll-to-roll or batch process. APD method was used to create an inorganic silicon oxide (SiOx) coating layer on a low-density polyethylene (LDPE) coated board. In addition, atmospheric plasma was used for pre-treatment of LPDE surface prior SG coatings. The SiOx coatings did not show a significant improvement in barrier performance using the specific roll-to-roll process. Therefore, SG coating method was studied instead in order to form a barrier layer on LDPE-board by using the roll-to-roll process. SG coatings reduced the surface roughness and made the polymer surfaces either hydrophilic or hydrophobic. In addition, the coating chemistry had an effect on the oxygen and grease barrier performances. The highly cross-linked SG coating gave a better oxygen barrier performance, while the other SG coating revealed an enhancement in the grease barrier. Plasma activation of the LDPE surface enhanced the wettability and adhesion of SG coatings. In addition, SG coating was applied on a polylactic acid (PLA) coated board. The SG coating created favourable, smooth and hydrophilic primer layer on PLA-board, which was further coated with an inorganic aluminium oxide (Al2O3) skin layer by using ALD. The particular TFC structure based on ALD and SG coatings gave a slightly better barrier performance compared to a plain ALD coating. PVA and ALD based antifouling coatings increased the hydrophilicity and surface polarity of the polyamide (PA) TFC membranes. All the coated membranes indicated an enhancement in bacteria-repellence. Indeed, the improvement in the bacterial anti-adhesion performance of coated membranes was due to an increase in surface polarity. The biocide-modified PVA coatings enhanced further the anti-fouling performance due to their antimicrobial activity. As expected, in comparison to the uncoated membrane, the PVA-coated membranes tend to increase the salt rejection and to reduce the water and salt permeability. However, the biocide-modified PVA coatings decreased the water permeability and showed also a minor decline on the salt rejection. The ALD coatings increased the water and salt permeability and furthermore, reduced the salt rejection.
Effects of composition and microstructure on the abrasive wear performance of quenched wear resistant steels

Wear resistant steels are commonly categorized by their hardness, and in the case of quenched wear resistant steels, their Brinell hardness grades are widely considered almost as standards. In this study, the abrasive wear performance of 15 commercially available 400 HB grade quenched wear resistant steels from all over the world were tested with granite gravel in high stress conditions. The aim was to evaluate the real wear performance of nominally similar steels. Also properties such as hardness, hardness profiles, microstructures and chemical compositions of the steels were studied and reasons for the differences in their wear performance further discussed. In terms of mass loss, over 50% differences were recorded in the abrasive wear performance of the studied steels. Variations in the chemical compositions were linked to the auto-tempered microstructures of the steels, and the microstructural characteristics were further linked to their ultimate wear behavior. © 2014 Elsevier B.V.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Tampere University of Technology, Metso Minerals, Inc.
Number of pages: 8
Pages: 225-232
Publication date: 15 Sep 2014
Peer-reviewed: Yes

Publication information
Journal: Wear
Volume: 317
Issue number: 1-2
ISSN (Print): 0043-1648
Ratings:
Scopus rating (2016): CiteScore 3 SJR 1.558 SNIP 2.071
Scopus rating (2015): SJR 1.527 SNIP 2.017 CiteScore 2.73
Scopus rating (2014): SJR 1.715 SNIP 2.38 CiteScore 2.46
Scopus rating (2013): SJR 1.319 SNIP 2.416 CiteScore 2.37
Scopus rating (2012): SJR 1.36 SNIP 2.178 CiteScore 1.85
Scopus rating (2011): SJR 1.547 SNIP 2.865 CiteScore 2.43
Scopus rating (2010): SJR 1.509 SNIP 2.153
Scopus rating (2009): SJR 1.684 SNIP 2.07
Scopus rating (2008): SJR 1.597 SNIP 1.863
Scopus rating (2007): SJR 1.286 SNIP 1.889
Scopus rating (2006): SJR 1.435 SNIP 2.036
Scopus rating (2005): SJR 1.473 SNIP 2.007
Scopus rating (2004): SJR 1.335 SNIP 1.965
Scopus rating (2003): SJR 1.104 SNIP 1.788
Scopus rating (2002): SJR 0.958 SNIP 1.365
Scopus rating (2001): SJR 0.937 SNIP 1.47
Scopus rating (2000): SJR 1.069 SNIP 1.149
Scopus rating (1999): SJR 0.848 SNIP 1.338
Original language: English
ASJC Scopus subject areas: Condensed Matter Physics, Surfaces and Interfaces, Materials Chemistry, Surfaces, Coatings and Films, Mechanics of Materials
In this study, we have developed a chip-surface stimulus electrode array for fully-implantable subretinal prosthesis chip. To realize visual restoration with high resolution, stimulus electrodes should be miniaturized and arrayed with high density. When we miniaturize them, however, their electrochemical impedances become higher and their amount of charge injection becomes smaller. Additionally, as the number of electrodes increases, it becomes difficult to make electrical connection to each pixel of the retinal prosthesis chip and each electrode by electrical wiring. To overcome these problems, we have developed the stimulus electrodes that have low electrochemical impedances and large charge injection capacities, and established a fabrication process of chip-surface stimulus electrode array. We fabricated the stimulus electrodes made of extremely porous platinum which had large-surface-area compared with conventional Pt. We also fabricated the chip-surface stimulus electrodes array on the subretinal prosthesis chip which surface was rough and covered with insulator film.
Development of Si neural probe module with adjustable gain amplifier for neuronal signal recording

In recent years, lots of research on biomedical technologies directly using bio-signals such as BMI (Brain Machine Interface) have been performed intensively. Among bio-signals, ECoG (Electrocorticogram), LFP (Local Field Potential), and AP (Action Potential) are usually recorded especially for diagnosis, treatment, and prevention of brain diseases. These bio-signals have different amplitudes and frequency bandwidths, and the signal intensities vary accordingly with recording electrode conditions and individual variation. Therefore, a multiple bio-signals recording system having adjustable gain and bandwidth is strongly required. In this study, we designed the adjustable gain amplifier appropriate for the system, and fabricated the module composed of the amplifier and a Si neural probe for the multiple bio-signal recording in the deep brain. Additionally, we verified fundamental functions of the module by in vitro experiments.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Research group: Computational Biophysics and Imaging Group, BioMediTech, Integrated Technologies for Tissue Engineering Research (ITTE), Graduate School of Engineering, Electrical and Electronics Engineering Department, Department of Bioengineering and Robotics, Tohoku University, Nagasaki Institute of Applied Science
Authors: Tani, T., Naganuma, H., Harashima, T., Iwagami, T., Kino, H., Kiyoyama, K., Kellomäki, M., Hyttinen, J., Tanaka, T.
Pages: O-377-O-378
Publication date: 17 Aug 2014
Peer-reviewed: Yes

Publication information
Journal: Transactions of Japanese Society for Medical and Biological Engineering
Volume: 52
ISSN (Print): 1347-443X
Scopus rating:
Scopus rating (2016): SJR 0.101 SNIP 0.024 CiteScore 0.03
Scopus rating (2015): SJR 0.1 SNIP 0 CiteScore 0
Scopus rating (2014): SJR 0.124 SNIP 0.013 CiteScore 0.01
Scopus rating (2013): SJR 0.103 SNIP 0.393 CiteScore 0.1
Scopus rating (2012): SJR 0.105 SNIP 0.149 CiteScore 0.11
Scopus rating (2011): SJR 0.104 SNIP 0.198 CiteScore 0.13
Scopus rating (2010): SJR 0.103 SNIP 0.193
Scopus rating (2006): SJR 0.101 SNIP 0.043
Scopus rating (2005): SJR 0.106 SNIP 0.126
Scopus rating (2004): SJR 0.103 SNIP 0.487
Scopus rating (2003): SJR 0.111 SNIP 0.167
Scopus rating (2002): SJR 0.112 SNIP 0.052
Scopus rating (2001): SJR 0.106 SNIP 0.283
Scopus rating (2000): SJR 0.122 SNIP 0.194
Scopus rating (1999): SJR 0.106 SNIP 0.075
Original language: English
ASJC Scopus subject areas: Biomedical Engineering
Keywords: Adjustable gain amplifier, Multiple bio-signal recording, Si neural probe
DOIs:
10.11239/jsmbe.52.O-253
Source: Scopus
Source-ID: 84939439184
Research output: Scientific - peer-review › Article
University-Industry Co-operation Using a Practice-based Innovation Tool: Case Advisory Professorship Programme in Materials Technology

In the thesis, the usability and effectiveness of a practice-based innovation tool for university–industry co-operation, the advisory professorship model, is evaluated. The research material was collected by applying the tool with a materials technological emphasis in the regional co-operation network in 2008–2012. The inputs, functions, and internal dynamics of the innovation environment, as well as the results and effects of innovation activities in the materials technology advisory professorship programme (MTAP) network, are analysed qualitatively using a conceptual framework for the evaluation of regional innovative capability and the Network-Based Innovative Capability (NBIC) matrix. In the network of the MTAP programme, new practice-based innovation processes, concentrated in practice-based problems and development targets in companies, products, operational environment, or markets were created. The role of the university was especially in producing information in the front-end phases of innovation processes, related mostly to properties and processing knowledge of materials, the feasibility of development ideas, and searching for new R&D opportunities. The nature of university-based research inputs was typically fast and short-term. Some innovation processes ended up as new products or product improvements. New knowledge, information, and knowledge networks were created. The advisory professorship model can be considered a useful practice-based innovation tool for regional university–industry cooperation with some limitations. In the thesis, the materials technology-related regional resources, infrastructure, and needs from both private and public sectors are also studied and levels of regional availability, access, and delivery options for materials technological research are analyzed in the Lahti region. Based on this information, it is suggested how the knowledge, network, and innovation system related to materials technology should be developed further by public policies and strategies in the region.

General information
State: Published
Ministry of Education publication type: G4 Doctoral dissertation (monograph)
Organisations: Department of Materials Science
Authors: Eerola, S.
Number of pages: 208
Publication date: 6 Jun 2014

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

Publication series
Name: Tampere University of Technology. Publication
Publisher: Tampere University of Technology
No.: 1216
ISSN (Print): 1459-2045
Electronic versions:
  eerola.pdf

Bibliographical note
Awarding institution: Tampere University of Technology
Source: researchoutputwizard
Source-ID: 274
Research output: Monograph › Doctoral Thesis

Switchable water absorption of paper via liquid flame spray nanoparticle coating
Surface wetting/anti-wetting and liquid absorption are relevant properties of many porous solids including paper and other cellulose-based materials. Here we demonstrate how surface wetting by water and water absorption of commercially available Kraft paper can be altered by thin nanoparticle coatings fabricated by liquid flame spray in facile and continuous one-step process. Surface wettability and absorption properties of paper increased with silica and decreased with titania (TiO2) nanoparticle coatings. Moreover, the water-repellent (superhydrophobic) TiO2 nanoparticle coated paper could be switched to superhydrophilic and water absorbing by ultraviolet illumination. The experiments revealed that although surface wetting and liquid absorption of nanoparticle coated paper are strongly related to each other, they are two distinct phenomena which do not necessarily correlate. We propose wetting regimes on the nanoparticle coated paper samples on the basis of the experimental observations.

General information
State: Published
Textile-Based Sensors and Smart Clothing System for Respiratory Monitoring

Long-term respiratory monitoring provides valuable information for diagnostic and clinical treatment. Traditional measures of respiration require a mouthpiece or a mask, neither of which can be used as ubiquitous healthcare equipment. Using a smart clothing system seems to be a better alternative. Researchers in the field of smart textiles have focused on the development of health-related products since the 1990s, and textile-based sensors used for respiratory measurements have been discussed in several projects. Although the soft and flexible characteristics of textile-based sensors make them attractive, the flexibility of the materials also affects the signal quality. In a laboratory situation, where each sensor is tested as a single element, this is not as critical as in a user situation, where the sensor is integrated into the clothing and worn by different users engaging in different activities. The principal objective of this thesis was to explore the possibility of performing reliable respiratory monitoring using a clothing platform. The research began by investigating the possible methods and materials that can be used to produce textile-based sensors for respiratory monitoring applications. The aim was to determine the most suitable method for integrating the sensing function into the clothing system. Study results have shown that sensors made with a conductive coating demonstrated superior performance in terms of sensitivity, stability, and reliability. Therefore, five prototype systems based on conductive coating technique were developed. Sensor placement, signal collection techniques, and the clothing system configuration were the main concerns, while issues related to the sensor wearability, maintenance, and aesthetic appearance, as well as the environment and health, were
also discussed. Knitting was found to be the most economical method for producing the textile-based sensors; however, sensors made of knit fabric do not perform as well as the coated ones. Therefore, elastic-conductive hybrid yarns have been created to improve the electro-mechanical properties of knitted-based sensors, and eventually, a prototype with two sensors and a built-in data-bus was made by fully-fashion knitting technique. Two smart clothing system prototypes, based on conductive coating technique, were tested systematically by ten subjects. The first prototype consisted of one sensing element, and the results show that the smart clothing system could successfully monitor the subjects’ breathing patterns during sitting, standing, and different forms of running. The system has also proven to be useful in the observation of sleep apnea disorder symptoms. The second prototype consisted of two sensing elements. Apart from all the characteristics of the first prototype system, a system with two sensing elements can be used to determine the relationship between the rib cage and abdomen compartments, which provides information for certain diseases, e.g., cardiac arrhythmias. The second smart clothing system prototype was compared with a conventional respiratory belt for validation. Signals from the clothing system and the respiratory belt were collected simultaneously with a self-designed LabVIEW program, and further processed with MATLAB. Quantitative analyses were conducted based upon different comparison techniques, such as Pearson’s correlation, ANOVA and Fast Fourier Transform analysis. The results demonstrate that the smart clothing system can provide reliable respiratory measurements, with signals of comparable quality to the conventional respiratory belt. In addition, the wearability and user acceptance were studied by means of a survey. The survey results indicate that users were more comfortable with the smart clothing system and that most believe that using a smart clothing system will improve both health condition and quality of life.

A 1.33 μm picosecond pulse generator based on semiconductor disk mode-locked laser and bismuth fiber amplifier

We demonstrate that a combination of ultrafast wafer bonded semiconductor disk laser and a bismuth-doped fiber amplifier provides an attractive design for high power 1.33 μm tandem hybrid systems. Over 0.5 W of average output power was achieved at a repetition rate of 827 MHz that corresponds to a pulse energy of 0.62 nJ. (C) 2014 Optical Society of America
Characterisation of Novel Corrosion Resistant Stainless Steel/Rubber/Composite Hybrid Structures

Last decade has shown an increasing interest in hybrid materials and structures. With hybrids there is not only potential to create high strength low weight structures, but also to tailor the properties of the final product in a way that is unattainable by any single material alone. Simpler manufacturing process, increased functional integration, improved sound and vibration damping properties, enhanced crack propagation resistance and protection against collapse in a crash are just some examples of possible advantages of hybrid materials. However, before implementation in industrial application, adequate adhesion between the material components of a hybrid must be ensured. Also, from industrial point of view the required manufacturing method should not increase substantially the costs of the product. Although many established adhesion procedures exist, there is still lack of functioning joining methods for certain material combinations. Especially, the adhesive joining of polymeric materials to stainless steel is demanding, as the conventional methods require laborious manufacturing steps. In this study, the possibility to bond stainless steel to fibre reinforced epoxy composite with an ethylene propylene diene terpolymer (EPDM) based rubber is studied. Two different rubber compounds are used to create stainless steel/rubber/composite hybrids and a mild steel/rubber/composite structure is used as a reference. Both geometry-dependent peel tests together with environmental testing and geometry-independent single cantilever beam test are used to study the adhesion of the structure's interfaces. Scanning electron microscopy and transmission electron microscopy are used to characterise the nature of the interfaces of the hybrids. In addition, the effect of the rubber on the energy absorption properties of the hybrid structure was of interest. This was studied by non-destructive vibration damping test and by high velocity impact test. In these tests, both sample geometry (rubber thickness) and test parameters were varied to investigate their effect on the hybrid's behaviour. It was found that the studied method to bond stainless steel and epoxy composite by EPDM rubber enables the use of a simple manufacturing process and it furthermore results in well-
bonded hybrid structure. The stainless steel/composite bond strength is defined by the cohesive strength of the rubber and the bond maintains its strength in harsh environments. This enables the evaluation of the stainless steel/composite bond's strength by using the rubber's bulk properties instead of the substrate/rubber interfacial properties, which are difficult to define in a reliable manner. The stainless steel/rubber/composite structure has significantly better vibration damping properties than an all-metal structure. In addition, the rubber improves significantly the damage tolerance of the structure when compared to a corresponding structure which has been conventionally bonded. Thus, the approach of joining stainless steel to fibre reinforced epoxy composite with rubber has potential for industrial applications and the hybrid structure would offer a lighter and better damping solution when compared to all-metallic ones.

### General information

State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Materials Science
Authors: Sarlin, E.
Number of pages: 71
Publication date: 16 May 2014

### Publication information

Place of publication: Tampere
Publisher: Tampere University of Technology
Original language: English

### Publication series

Name: Tampere University of Technology. Publication
Publisher: Tampere University of Technology
Volume: 1208
ISSN (Print): 1459-2045
Electronic versions: sarlin.pdf

### Bibliographical note

Awarding institution: Tampere University of Technology
Source: researchoutputwizard
Source-ID: 1467
Research output: Collection of articles › Doctoral Thesis

### 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 mA/cm² in respect to effective area illuminated. These measurements have been performed under real sun AM1.5 (~1000 W/m²) illumination. © 2014 Elsevier B.V.

### General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics, Department of Physics and Astronomy, University of Turku, Turun Yliopisto/Turun Biomateriaalikeskus
Authors: 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
Process for producing microfibrillated cellulose

A process for treating cellulosic fibers comprises mechanically pre-treating the fibers followed by treating the fibers with an enzyme and thereafter mixing the fibers with a solution comprising an alkali metal hydroxide followed by mechanically treating the fibers to form microfibrillated cellulose. In this way it is possible to produce microfibrillated cellulose (MFC) in an improved and energy efficient way.
Site-Controlled Epitaxy and Fundamental Properties of InAs Quantum Dot Chains

Self-assembled InAs/GaAs quantum dots (QD) are artificial atoms which exhibit extremely high optical and structural quality and enable tailoring of the quantum confinement by adjusting their size, shape, and chemical composition. However, a disadvantage of the self-assembled formation process is that the QDs are randomly located on the GaAs surface. The ability to determine the positions of the QDs at the moment of nucleation, i.e. site-controlled growth, is essential for the new generation of photonic applications including single- and entangled-photon sources and nanophotonic integrated circuits. The purpose of this thesis is to introduce a new nanomaterial system composed of site-controlled InAs quantum dot chains (QDC) grown by molecular beam epitaxy in nanoimprint lithography prepared grooves. A thorough investigation of the structural and optical properties of QDCs is also presented. The thesis demonstrates that, regardless of the inherent anisotropy of the GaAs(100) surface, QDCs having similar density, size, and emission energy can be grown simultaneously on nanopatterns with different orientations by carefully selecting the growth parameters. However, the in-plane optical polarization of the spontaneous emission from the QDCs depends on their orientation. In more general perspective, this thesis reveals that the nanopattern on which the site-controlled QDs are grown has a strong influence on their morphological properties, including shape, size, strain profile, and composition profile. These properties are strongly cross-correlated and they all influence the electronic and optical characteristics of the QDs. For example, the growth of QDs in the grooves increases their oscillator strength for the vertically polarized spontaneous emission, which is the polarization component that can be coupled to surface plasmons in a metal film. This polarization property accompanied by the possibility of deterministic lateral positioning makes the site-controlled QDCs potential building blocks for plasmonic and nanophotonic waveguides.

1.33 um MOPA system based on ultrafast semiconductor disk laser and bismuth fiber amplifier

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre
Authors: Heikkinen, J., Gumenyuk, R., Rantamäki, A., Leinonen, T., Melkumov, M., Dianov, E. M., Okhotnikov, O. G.
Number of pages: 1
Pages: 32-32
Publication date: 2014

Host publication information
Title of host publication: Optics and Photonics Days 2014, OPD2014 Proceedings, 20-22 May, 2014, Turku, Finland
1.55 µm GaInNAsSb/GaAs ridge waveguide lasers and semiconductor optical amplifiers for photonic integrated circuits

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Korpijärvi, V., Giannoulis, G., Mäkelä, J., Viheriälä, J., Iliadis, N., Avramopoulos, H., Laakso, A., Guina, M.
Number of pages: 2
Pages: 151-152
Publication date: 2014

Host publication information
Title of host publication: IEEE 24th International Semiconductor Laser Conference, ISLC 2014, 7-10 September, 2014, Mallorca, Spain
Publisher: IEEE
ISBN (Print): 978-1-4799-5721-7

Publication series
Name: IEEE International Semiconductor Laser Conference
DOIs: 10.1109/ISLC.2014.208

Bibliographical note
Contribution: organisation=orc,FACT1=1
Portfolio EDEND: 2014-12-30
Publisher name: IEEE
Source: researchoutputwizard
Source-ID: 769
Research output: Scientific - peer-review » Conference contribution

50-ps Passively Mode-Locked Red Praseodymium Laser

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Gaponenko, M., Metz, P. W., Härkönen, A., Heuer, A., Leinonen, T., Guina, M., Südmeyer, T., Huber, G., Kränkel, C.
Number of pages: 3
Pages: 1-3
Publication date: 2014

Host publication information
Title of host publication: International conference on advanced solid-state lasers, ASSL 2014, 16-21 November, 2014, Shanghai, China
Publisher: Optical Society of America
ISBN (Print): 978-1-55752-822-3

Publication series
Name: International conference on advanced solid-state lasers
DOIs: 10.1364/ASSL.2014.ATh2A.35

Bibliographical note
55 um GaInNAsSb/GaAs ridge waveguide lasers and semiconductor optical amplifiers

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre
Authors: Mäkelä, J., Korpijärvi, V., Viheriälä, J., Giannoulis, G., Iliadis, N., Avramopoulos, H., Guina, M.
Number of pages: 1
Pages: 66-66
Publication date: 2014

Host publication information
Title of host publication: Optics and Photonics Days 2014, OPD2014 Proceedings, 20-22 May, 2014, Turku, Finland
Publisher: Finnish Optical Society
ISBN (Print): 978-952-12-3055-4

Publication series
Name: Optics and Photonics Days

Bibliographical note
Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-10-24<br/>Publisher name: Finnish Optical Society
Source: researchoutputwizard
Source-ID: 999
Research output: Scientific › Conference contribution

8 Erityisalueita. 8.1. Tiivistimet

General information
State: Published
Ministry of Education publication type: B2 Part of a book or another research book
Organisations: Department of Materials Science
Authors: Miettinen, J.
Number of pages: 14
Pages: 405-417
Publication date: 2014

Host publication information
Title of host publication: Koneenosien suunnittelu
Place of publication: Helsinki
Publisher: Sanoma Pro Oy

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-12-02<br/>Source: researchoutputwizard
Source-ID: 1078
Research output: Scientific › Chapter

8 Erityisalueita, 8.5 Mekatroniikka

General information
State: Published
Ministry of Education publication type: B2 Part of a book or another research book
Organisations: Department of Materials Science
Authors: Miettinen, J.
Number of pages: 8
Abrasion and compression resistance of liquid-flame-spray-deposited functional nanoparticle coatings on paper

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging, Department of Physics, Research area: Aerosol Physics, Research group: Aerosol Synthesis, Engineering materials science and solutions (EMASS), Abo Akad Univ, Abo Akademi University, Dept Phys, Paper and Fibre Research Institute (PFI), SP Technical Research Institute of Sweden
Authors: Stepień, M., Chinga-Carrasco, G., Saarinen, J. J., Teisala, H., Tuominen, M., Haapanen, J., Kuusipalo, J., Mäkelä, J. M., Toivakka, M.
Number of pages: 15
Pages: 68-82
Publication date: 2014

Host publication information
Title of host publication: 13th TAPPI Advanced Coating Fundamentals Symposium 2014
Publisher: TAPPI Press
ISBN (Print): 9781510801295
ASJC Scopus subject areas: Materials Chemistry, Electrical and Electronic Engineering
Links:
http://www.scopus.com/inward/record.url?scp=84942588921&partnerID=8YFLogxK (Link to publication in Scopus)

Bibliographical note
ORG=mol,0.5
ORG=fys,0.5
Source: Scopus
Source-ID: 84942588921
Research output: Scientific - peer-review » Conference contribution

Abrasion, Erosion and Cavitation Erosion Wear Properties of Thermally Sprayed Alumina Based Coatings

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science
Authors: Matikainen, V., Niemi, K., Koivuluoto, H., Vuoristo, P.
Number of pages: 19
Pages: 18-36
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Coatings
Volume: 4
Issue number: 1
ISSN (Print): 2079-6412
Absorption recovery dynamics in 2 um GaSb-based SESAMs

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Paajaste, J., Suomalainen, S., Härkönen, A., Griebner, U., Steinmeyer, G., Guina, M.
Number of pages: 6
Pages: 1-6
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 47
Issue number: 6
Article number: 065102
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
Scopus rating (2011): SJR 1.257 SNIP 1.399 CiteScore 2.36
Scopus rating (2010): SJR 1.291 SNIP 1.288
Scopus rating (2009): SJR 1.283 SNIP 1.337
Scopus rating (2008): SJR 1.446 SNIP 1.563
Scopus rating (2007): SJR 1.385 SNIP 1.633
Scopus rating (2005): SJR 1.203 SNIP 1.466
Scopus rating (2004): SJR 1.123 SNIP 1.442
Scopus rating (2003): SJR 0.9 SNIP 1.2
Scopus rating (2002): SJR 0.99 SNIP 1.221
Scopus rating (2001): SJR 0.901 SNIP 1.205
Scopus rating (2000): SJR 0.79 SNIP 1.133
Scopus rating (1999): SJR 0.925 SNIP 1.249
Original language: English
DOIs:
10.1088/0022-3727/47/6/065102

Abstracts of the 28th International Conference on Surface Modification Technologies, SMT28, Tampere University of Technology, Tampere, Finland, June 16-18, 2014
General information
State: Published
Ministry of Education publication type: C2 Edited books
Organisations: Department of Materials Science
Number of pages: 150
Publication date: 2014

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

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-11-28
Source: researchoutputwizard
Source-ID: 1780
Research output: Scientific - peer-review › Anthology

Adjustable wetting of Liquid Flame Spray (LFS) TiO2-nanoparticle coated board: Batch-type versus roll-to-roll Stimulation methods

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Department of Physics, Engineering materials science and solutions (EMASS)
Authors: Tuominen, M., Teisala, H., Haapanen, J., Aromaa, M., Mäkelä, J. M., Stepien, M., Saarinen, J. J., Toivakka, M., Kuusipalo, J.
Number of pages: 9
Pages: 271-279
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 29
Issue number: 2
ISSN (Print): 0283-2631
Ratings:
Scopus rating (2016): CiteScore 1.2 SJR 0.385 SNIP 0.652
Scopus rating (2015): SJR 0.375 SNIP 0.787 CiteScore 0.91
Scopus rating (2014): SJR 0.444 SNIP 0.823 CiteScore 0.99
Scopus rating (2013): SJR 0.389 SNIP 0.684 CiteScore 0.71
Scopus rating (2012): SJR 0.628 SNIP 1.281 CiteScore 1.13
Scopus rating (2011): SJR 0.582 SNIP 0.902 CiteScore 0.78
Scopus rating (2010): SJR 0.658 SNIP 0.764
Scopus rating (2009): SJR 1.167 SNIP 0.984
Scopus rating (2008): SJR 0.928 SNIP 0.857
Scopus rating (2007): SJR 2.018 SNIP 1.035
Scopus rating (2006): SJR 1.002 SNIP 0.951
Scopus rating (2005): SJR 1.181 SNIP 0.997
Scopus rating (2004): SJR 2.08 SNIP 1.354
Scopus rating (2003): SJR 2.952 SNIP 1.129
Scopus rating (2002): SJR 1.836 SNIP 1.145
Scopus rating (2001): SJR 1.12 SNIP 1.147
Scopus rating (2000): SJR 1.086 SNIP 1.154
Scopus rating (1999): SJR 1.086 SNIP 1.001
Original language: English
DOIs:
Analytic modeling of temperature dependence of 2D carrier mobility in as-grown and annealed GaInNAs/GaAs quantum well structures

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Donmez, O., Sarcan, F., Lisesivdin, S., Vaughan, M., Erol, A., Gunes, M., Arikan, M., Puustinen, J., Guina, M.
Number of pages: 13
Pages: 1-13
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Semiconductor Science and Technology
Volume: 29
Article number: 125009
ISSN (Print): 0268-1242
Ratings:
Scopus rating (2016): SJR 0.632 SNIP 0.866 CiteScore 1.75
Scopus rating (2015): SJR 0.675 SNIP 0.977 CiteScore 1.73
Scopus rating (2014): SJR 0.991 SNIP 1.088 CiteScore 1.72
Scopus rating (2013): SJR 1.173 SNIP 1.133 CiteScore 1.53
Scopus rating (2012): SJR 1.051 SNIP 0.982 CiteScore 1.42
Scopus rating (2011): SJR 1.01 SNIP 1.08 CiteScore 1.66
Scopus rating (2010): SJR 0.82 SNIP 0.88
Scopus rating (2009): SJR 0.886 SNIP 0.914
Scopus rating (2008): SJR 1.298 SNIP 1.291
Scopus rating (2007): SJR 1.252 SNIP 1.161
Scopus rating (2006): SJR 1.193 SNIP 1.095
Scopus rating (2005): SJR 1.216 SNIP 1.133
Scopus rating (2004): SJR 1.42 SNIP 1.142
Scopus rating (2003): SJR 1.235 SNIP 0.981
Scopus rating (2002): SJR 0.996 SNIP 0.925
Scopus rating (2001): SJR 0.962 SNIP 0.845
Scopus rating (2000): SJR 1.193 SNIP 0.811
Scopus rating (1999): SJR 1.193 SNIP 0.874
Original language: English
DOIs:
10.1088/0268-1242/29/12/125009

Bibliographical note
Contribution: organisation=orc,FACT1=1
Portfolio EDEND: 2014-11-21
Publisher name: Institute of Physics Publishing
Source: researchoutputwizard
Source-ID: 264
Research output: Scientific - peer-review › Article

A new Generation Sweating Thermal Manikin for the Evaluation of the Thermoregulation Properties of Protective Clothing

General information
Antibacterial properties and chemical stability of superhydrophobic silver-containing surface produced by sol-gel route

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Heinonen, S., Huttunen-Saarivirta, E., Nikkanen, J., Raulio, M., Priha, O., Laakso, J., Strogårds, E., Levänen, E.
Number of pages: 13
Pages: 149-161
Publication date: 2014
Peer-reviewed: Yes

Publication Information
Journal: Colloids and Surfaces A: Physicochemical and Engineering Aspects
Volume: 453
ISSN (Print): 0927-7757
Ratings:
Scopus rating (2016): SJR 0.797 SNIP 1.104 CiteScore 2.93
Scopus rating (2015): SJR 0.803 SNIP 1.116 CiteScore 2.83
Scopus rating (2014): SJR 0.843 SNIP 1.252 CiteScore 2.81
Scopus rating (2013): SJR 0.811 SNIP 1.255 CiteScore 2.6
Scopus rating (2012): SJR 0.841 SNIP 1.189 CiteScore 2.34
Scopus rating (2011): SJR 0.812 SNIP 1.183 CiteScore 2.43
Scopus rating (2010): SJR 0.872 SNIP 1.115
Scopus rating (2009): SJR 0.848 SNIP 1.059
Scopus rating (2008): SJR 0.886 SNIP 1.041
Scopus rating (2007): SJR 0.795 SNIP 0.978
Scopus rating (2006): SJR 0.822 SNIP 1.091
Scopus rating (2005): SJR 0.813 SNIP 1.004
Scopus rating (2004): SJR 0.844 SNIP 1.106
Scopus rating (2003): SJR 0.824 SNIP 1.033
Scopus rating (2002): SJR 0.763 SNIP 0.945
Scopus rating (2001): SJR 0.825 SNIP 0.971
Scopus rating (2000): SJR 0.69 SNIP 0.782
Scopus rating (1999): SJR 0.621 SNIP 0.82
Original language: English
DOIs:
10.1016/j.colsurfa.2014.04.037
Apparent Fracture Toughness Versus Micro-Scale Fracture Toughness of Interfaces-The Challenge of Critical Values

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Engineering materials science and solutions (EMASS), Department of Materials Science, Research group: Plastics and Elastomer Technology, Aalto University
Authors: Kanerva, M., Jokinen, J., Sarlin, E., Saarela, O.
Pages: 173-188
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Materials Performance and Characterization
Volume: 3
Issue number: 3
ISSN (Print): 2165-3992
Ratings:
Scopus rating (2016): SJR 0.205 SNIP 0.323 CiteScore 0.42
Scopus rating (2015): SNIP 0.296 SJR 0.145 CiteScore 0.24
Scopus rating (2014): SNIP 0.35 SJR 0.132
Scopus rating (2013): SNIP 0.111 SJR 0.104
Original language: English
DOIs:
10.1520/MPC20130068

Application of DIC technique for studies of Kuru Granite rock under static and dynamic loading

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science
Authors: Fourmeau, M., Gomon, D., Vacher, R., Hokka, M., Kane, A., Kuokkala, V.
Number of pages: 7
Pages: 691-697
Publication date: 2014

Host publication information
Title of host publication: 20th European Conference on Fracture (ECF20), Fracture at all scales, 30th June - 4th July, 2014, Trondheim
Publication series
Name: Procedia Materials Science
Volume: 3
ISSN (Print): 2211-8128
DOIs:
10.1016/j.mspro.2014.06.114
Applications of supercritical carbon dioxide in materials processing and synthesis

General information
State: Published
Ministry of Education publication type: A2 Review article in a scientific journal
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Zhang, X., Heinonen, S., Levänen, E.
Number of pages: 17
Pages: 1-16
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: RSC Advances
Issue number: xx
ISSN (Print): 2046-2069
Ratings:
Scopus rating (2016): CiteScore 3.06 SJR 0.875 SNIP 0.743
Scopus rating (2015): SJR 0.959 SNIP 0.837 CiteScore 3.42
Scopus rating (2014): SJR 1.114 SNIP 0.965 CiteScore 3.87
Scopus rating (2013): SJR 1.117 SNIP 0.903 CiteScore 3.74
Scopus rating (2012): SJR 0.863 SNIP 0.603 CiteScore 2.4
Original language: English
DOIs:
10.1039/C4RA10662H

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-11-27<br/>Publisher name: The Royal Society of Chemistry
Source: researchoutputwizard
Source-ID: 1845
Research output: Scientific - peer-review › Review Article

Askeleen edellä - puettavan teknologian markkinat kasvussa

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science
Authors: Rantasalo, S.
Number of pages: 1
Pages: 10-10
Publication date: 2014
Peer-reviewed: Unknown

Publication information
Journal: Tekstiliilehti
Issue number: 2
ISSN (Print): 0040-2370
Original language: Finnish

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-05-27<br/>Publisher name: Suomen Tekstiiliteknillinen liitto ry
Source: researchoutputwizard
Source-ID: 1355
Research output: Professional › Article

Atomistic investigation on the structure-property relationship during thermal spray nanoparticle impact

General information
Barkhausen noise-magnetizing voltage sweep measurement in evaluation of residual stress in hardened components

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Santa-aho, S., Sorsa, A., Hakanen, M., Leiviskä, K., Vippola, M., Lepistö, T.
Number of pages: 6
Pages: 1-6
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Measurement Science and Technology
Volume: 25
Issue number: 8
ISSN (Print): 0957-0203
Ratings:
Scopus rating (2016): CiteScore 1.75 SJR 0.668 SNIP 1.173
Scopus rating (2015): SJR 0.687 SNIP 1.303 CiteScore 1.71
Scopus rating (2014): SJR 0.657 SNIP 1.319 CiteScore 1.58
Scopus rating (2013): SJR 0.555 SNIP 1.244 CiteScore 1.53
Scopus rating (2012): SJR 0.716 SNIP 1.529 CiteScore 1.65
Scopus rating (2011): SJR 0.844 SNIP 1.703 CiteScore 1.77
Scopus rating (2010): SJR 0.679 SNIP 1.462
Scopus rating (2009): SJR 0.919 SNIP 1.573
Scopus rating (2008): SJR 0.881 SNIP 1.494
Scopus rating (2007): SJR 0.823 SNIP 1.492
Scopus rating (2006): SJR 0.744 SNIP 1.58
Scopus rating (2005): SJR 0.82 SNIP 1.584
Scopus rating (2004): SJR 0.828 SNIP 1.64
Scopus rating (2003): SJR 0.666 SNIP 1.199
Scopus rating (2002): SJR 0.589 SNIP 1.2
Scopus rating (2001): SJR 0.616 SNIP 1.548
Scopus rating (2000): SJR 0.79 SNIP 1.204
Scopus rating (1999): SJR 1.484 SNIP 0.905
Original language: English
DOIs:
10.1088/0957-0233/25/8/085602

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-09-29<br/>Publisher name: IOP Publishing
Source: researchoutputwizard
Source-ID: 1451
Research output: Scientific - peer-review › Article

Behaviour of ferritic-martensitic steel and aluminium base coatings under demanding elevated temperature conditions

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Huttunen-Saarivirta, E., Metsäjoki, J., Kuokkala, V.
Number of pages: 8
Pages: 57-64
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Tribology: Materials, Surfaces and Interfaces
Volume: 8
Issue number: 2
ISSN (Print): 1751-5831
Ratings:
Scopus rating (2016): SJR 0.297 SNIP 0.464 CiteScore 0.64
Scopus rating (2015): SJR 0.305 SNIP 0.476 CiteScore 0.51
Scopus rating (2014): SJR 0.362 SNIP 0.38 CiteScore 0.36
Scopus rating (2013): SJR 0.247 SNIP 0.312 CiteScore 0.32
Scopus rating (2012): SJR 0.333 SNIP 0.376 CiteScore 0.27
Scopus rating (2011): SJR 0.276 SNIP 0.363 CiteScore 0.3
Scopus rating (2010): SJR 0.353 SNIP 0.261
Scopus rating (2009): SJR 0.155 SNIP 0.114
Scopus rating (2008): SJR 0.122 SNIP 0
Original language: English
DOIs:
10.1179/1751584X13Y.0000000055

Bibliographical note
Biofunctional hybrid materials: bimolecular organosilane monolayers on FeCr alloys

General information
State: Published
Ministry of Education publication type: A1 Journal article-reviewed
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
Publication information
Journal: Nanotechnology
Volume: 25
Issue number: 43
Article number: 435603
ISSN (Print): 0957-4484
Ratings:
Scopus rating (2016): CiteScore 2.87 SJR 1.096 SNIP 0.814
Scopus rating (2015): SJR 1.18 SNIP 0.966 CiteScore 3.07
Scopus rating (2014): SJR 1.465 SNIP 1.258 CiteScore 3.09
Scopus rating (2013): SJR 1.585 SNIP 1.244 CiteScore 2.74
Scopus rating (2012): SJR 1.846 SNIP 1.306 CiteScore 3.34
Scopus rating (2011): SJR 1.892 SNIP 1.461 CiteScore 3.86
Scopus rating (2010): SJR 1.844 SNIP 1.259
Scopus rating (2009): SJR 1.819 SNIP 1.28
Scopus rating (2008): SJR 1.875 SNIP 1.333
Scopus rating (2007): SJR 1.91 SNIP 1.36
Scopus rating (2006): SJR 1.934 SNIP 1.378
Scopus rating (2005): SJR 1.925 SNIP 1.445
Scopus rating (2004): SJR 1.849 SNIP 1.477
Scopus rating (2003): SJR 1.427 SNIP 1.371
Scopus rating (2002): SJR 0.962 SNIP 0.993
Scopus rating (2001): SJR 0.901 SNIP 0.94
Scopus rating (2000): SJR 0.881 SNIP 0.891
Scopus rating (1999): SJR 1.131 SNIP 0.953
Original language: English
DOIs:
10.1088/0957-4484/25/43/435603

Bibliographical note
Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-10-17<br/>Publisher name: Institute of Physics
Ministry of Education publication type: D4 Published development or research report or study

Biorefinery products. Initial process piloting and material prototype production in the case of barriers, 3D-mouldable packaging and filters

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Case-Depth Verification of Hardened Samples with Barkhausen Noise Sweeps

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Santa-aho, S., Vippola, M., Lepistö, T., Sorsa, A., Leiviskä, K., Hakanen, M.
Number of pages: 8
Pages: 1307-1314
Publication date: 2014

Host publication information
Publisher: American Institute of Physics
ISBN (Print): 978-073541211-8

Publication series
Name: AIP Conference Proceedings
Publisher: American Institute of Physics
Volume: 1581
ISSN (Print): 0094-243X
ISSN (Electronic): 1551-7616
DOIs:
10.1063/1.4864972

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-08-30
Source: researchoutputwizard
Source-ID: 1452
Research output: Scientific › Conference contribution

Cavity-enhanced single photon emission from site-controlled In(Ga)As quantum dots fabricated using nanoimprint lithography

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Augmented Human Activities (AHA), Frontier Photonics
Authors: Tommila, J., Belykh, V., Hakkarainen, T. V., Heinonen, E., Sibeldin, N., Schramm, A., Guina, M.
Number of pages: 4
Pages: 1-4
Publication date: 2014
Peer-reviewed: Yes
Characterisation of novel corrosion resistant stainless steel/rubber/composite hybrid structures

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Department of Electrical Engineering, Research area: Reliability, Research group: Materials Characterization
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the SAMPE Europe 9th International Technical Conference & Forum

Bibliographical note
ORG=mol,0.8
ORG=dee,0.2
Research output: Professional › Conference contribution

Comparison of Chondroitin Sulfate and Hyaluronic Acid Doped Conductive Polypyrrole Films for Adipose Stem Cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Computational multiscale modelling concept and supporting experimental testing procedures for material wear behaviour under severe environments

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Materials Science
Number of pages: 4
Pages: 1-4
Publication date: 2014

Host publication information
Title of host publication: The 16th Nordic Symposium on Tribology - NORDTRIP 2014, 10th - 13th June, Aarhus, Denmark
Publisher: Danish technological institute
ISBN (Print): 978-87-92765-26-0

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-12-17
Source: researchoutputwizard
Source-ID: 894
Research output: Scientific › Conference contribution

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
Control of emitted light polarization in a 1310nm dilute nitride spin-vertical cavity surface emitting laser subject to circularly polarized optical injection

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Alharti, A., Hurtado, A., Al Seyab, R., Korpijärvi, V., Guina, M., Henning, I., Adams, M.
Number of pages: 5
Pages: 1-5
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: APPLIED PHYSICS LETTERS
Volume: 105
Issue number: 18
Article number: 181106
ISSN (Print): 0003-6951
Ratings:
Scopus rating (2016): CiteScore 2.67 SJR 1.132 SNIP 0.996
Scopus rating (2015): SJR 1.085 SNIP 0.983 CiteScore 2.47
Scopus rating (2014): SJR 1.799 SNIP 1.462 CiteScore 3.25
Scopus rating (2013): SJR 2.149 SNIP 1.652 CiteScore 3.77
Scopus rating (2012): SJR 2.554 SNIP 1.754 CiteScore 3.76
Scopus rating (2011): SJR 2.805 SNIP 1.94 CiteScore 4.04
Scopus rating (2010): SJR 2.926 SNIP 1.789
Scopus rating (2009): SJR 2.857 SNIP 1.848
Scopus rating (2008): SJR 2.934 SNIP 1.83
Scopus rating (2007): SJR 3.039 SNIP 1.913
Scopus rating (2006): SJR 3.457 SNIP 2.288
Scopus rating (2005): SJR 3.709 SNIP 2.382
Scopus rating (2004): SJR 3.904 SNIP 2.38
Scopus rating (2003): SJR 3.765 SNIP 2.27
Scopus rating (2002): SJR 3.917 SNIP 2.365
Scopus rating (2001): SJR 4.111 SNIP 2.212
Scopus rating (2000): SJR 4.277 SNIP 2.013
Scopus rating (1999): SJR 4.35 SNIP 2.11
Original language: English
DOIs:
10.1063/1.4901192

Bibliographical note
Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-11-11<br/>Publisher name: American Institute of Physics AIP
Source: researchoutputwizard
Source-ID: 88
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
Publisher: European Environment Agency
ISBN (Print): 3-936338-34-5

Publication series
Name: European photovoltaic solar energy conference
Links:
Degradation mechanisms of bioresorbable polyesters. Part 1. Effects of random scission, end scission and autocatalysis

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Gleadall, A., Pan, J., Kruft, M., Kellomäki, M.
Number of pages: 10
Pages: 2223-2232
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Acta Biomaterialia
Volume: 10
Issue number: 5
ISSN (Print): 1742-7061
Ratings:
Scopus rating (2016): CiteScore 6.66 SJR 1.789 SNIP 1.921
Scopus rating (2015): SJR 1.997 SNIP 1.99 CiteScore 6.58
Scopus rating (2014): SJR 1.814 SNIP 2.324 CiteScore 6.53
Scopus rating (2013): SJR 1.963 SNIP 2.269 CiteScore 6.41
Scopus rating (2012): SJR 1.904 SNIP 2.125 CiteScore 5.51
Scopus rating (2011): SJR 1.808 SNIP 1.91 CiteScore 5.15
Scopus rating (2010): SJR 1.794 SNIP 1.964
Scopus rating (2009): SJR 1.399 SNIP 1.662
Scopus rating (2008): SJR 1.404 SNIP 1.981
Scopus rating (2007): SJR 1.199 SNIP 1.493
Scopus rating (2006): SJR 0.837 SNIP 1.131
Original language: English
DOIs:
10.1016/j.actbio.2013.12.039

Degradation mechanisms of bioresorbable polyesters. Part 2. Effects of initial molecular weight and residual monomer

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Gleadall, A., Pan, J., Kruft, M., Kellomäki, M.
Number of pages: 8
Pages: 2233-2240
Publication date: 2014
Peer-reviewed: Yes

Publication information
Design driven world of cellulose-from bulk to luxury?
Tekes—the Finnish Funding Agency for Innovation has granted funding 4.5 million funding for a project targeting on new approaches for use of wood-based cellulose. Project “Design Driven Value Chains in The World of Cellulose” (DWoC) launched by VTT Technical Research Centre of Finland, Aalto University and Tampere University of Technology integrates design and design processes into the strategic development of businesses operating in the field. The aim is to create a business ecosystem to serve both existing industry and a new, growing cellulose-based industry, and to brand Finland as a producer of refined, cellulose-based products. This manuscript summarises the future visions and background aspects and facts that have led to the initiation of the project. The presentation based on the manuscript also presents some of the first demonstrator processes and products developed during the first operational year of the project. These demonstrators include: Fibre yarn process that produces yarn from cellulose pulp fibres without traditional spinning process using novel wet extrusion technique (figure on right). Foam forming method for manufacturing well-formed foamed stuctures for new product applications 3D-printing technology enabling customisable on demand production of fibre structures and components using modified cellulosic raw materials.
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

Dilute Nitride Space Solar Cells: Towards 4 Junctions

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

Host publication information
Title of host publication: 10th European Space Power Conference ESPC 2014, 13-17 April, 2014, Noordwijkerhout, the Netherlands
Publisher: European Space Agency
ISBN (Print): 978-92-9221-283-4

Publication series
Name: European Space Agency - Special Publication (ESA - SP)
Volume: 719
ISSN (Print): 1609-042X

Bibliographical note
ESA SP-719<br/>Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-09-18<br/>Publisher name: European Space Agency
Source: researchoutputwizard
Source-ID: 60
Research output: Scientific - peer-review › Conference contribution

Direct laser writing of microstructures for the growth guidance of human pluripotent stem cell derived neuronal cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Turunen, S., Käpylä, E., Lähteenmäki, M., Ylä-Outinen, L., Narkilahti, S., Kellomäki, M.
Number of pages: 8
Direct laser writing of synthetic poly(amo-no acid) hydrogels and poly(ethylene glycol) diacrylates by two-photon polymerization

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Käpylä, E., Sedlack, T., Aydogan, D. B., Viltanen, J., Rypacek, F., Kellomäki, M.
Number of pages: 10
Pages: 280-289
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Materials Science and Engineering C: Materials for Biological Applications
Volume: 43
ISSN (Print): 0928-4931
Ratings:
Scopus rating (2016): CiteScore 3.78 SJR 0.857 SNIP 1.176
Scopus rating (2015): SJR 1.312 SNIP 1.084 CiteScore 3.13
Scopus rating (2014): SJR 0.716 SNIP 1.196 CiteScore 2.88
Dynamics of time-resolved photoluminescence in GaInNAs and GaNAsSb solar cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Department of Chemistry and Bioengineering, Research group: Supramolecular photochemistry, Frontier Photonics
Authors: Gubanov, A., Polojärvi, V., Aho, A., Tukiainen, A., Tkachenko, N. V., Guina, M.
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Nanoscale Research Letters
Volume: 9
Article number: 80
ISSN (Print): 1931-7573
Ratings:
Scopus rating (2016): SJR 0.589 SNIP 0.746 CiteScore 2.15
Scopus rating (2015): SJR 0.538 SNIP 0.653 CiteScore 1.69
Scopus rating (2014): SJR 0.748 SNIP 1.019 CiteScore 2.15
Scopus rating (2013): SJR 0.79 SNIP 0.967 CiteScore 2.23
Scopus rating (2012): SJR 1.049 SNIP 1.073 CiteScore 2.58
Scopus rating (2011): SJR 1.04 SNIP 1.124 CiteScore 2.88
Scopus rating (2010): SJR 1.062 SNIP 1.007
Scopus rating (2009): SJR 1.063 SNIP 1.01
Scopus rating (2008): SJR 0.828 SNIP 0.632
Scopus rating (2007): SJR 1.458 SNIP 0.71
Original language: English
DOIs:

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-08-30
Publisher name: Elsevier S.A.
Source: researchoutputwizard
Source-ID: 658
Research output: Scientific - peer-review > Article

Bibliographical note
Contribution: organisation=orc,FACT1=0.7
Contribution: organisation=keb,FACT2=0.3
Portfolio EDEND: 2014-04-29
Publisher name: SpringerOpen
Effect of abrasive properties on the high-stress three-body abrasion of steels and hard metals

Especially in tunneling, the abrasiveness of rock is an important property, which can easily be determined by several methods developed for the purpose. With this in mind, it is rather surprising that the effects of different rock types on the wear mechanisms of engineering materials have not been too widely studied. In this paper, high stress three-body abrasive tests were conducted with four different abrasives with a relatively large (2-10 mm) particle size. As test materials, three different steels and three hard metals were used. The tests clearly showed that material type has an influence on how different abrasive and material properties affect the abrasive wear mechanisms and severity. For example with hard metals, the most important property of the abrasives is their crushability, as only small abrasive particles are able to properly attack the binder phase and cause high wear rates. On the other hand, it seems that the abrasiveness of rock is not the dominating property determining the severity of wear in the current test conditions for any of the tested materials. In fact, with steels no single abrasive property could be shown to clearly govern the abrasive wear processes. In any case, when using the determined abrasiveness values in wear estimations, the contact conditions in the method used for determining the abrasiveness values should be as similar as possible with the end application.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Ratia, V., Heino, V., Valtonen, K., Vippola, M., Kemppainen, A., Siitonen, P., Kuokkala, V.
Number of pages: 16
Pages: 3-18
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Tribologia - Finnish Journal of Tribology
Volume: 32
Issue number: 1
ISSN (Print): 0780-2285
Ratings:
Scopus rating (2016): CiteScore 0.24 SJR 0.141 SNIP 0.076
Scopus rating (2015): SJR 0.101 SNIP 0
Scopus rating (2014): SJR 0.316 SNIP 0.126
Scopus rating (2013): SJR 0.118 SNIP 0.019
Scopus rating (2012): SJR 0.24 SNIP 0.312
Scopus rating (2011): SJR 0.237 SNIP 0.103
Scopus rating (2010): SJR 0.125 SNIP 0.055
Scopus rating (2009): SJR 0.459 SNIP 0.37
Scopus rating (2008): SJR 0.13 SNIP 0.228
Scopus rating (2007): SJR 0.126 SNIP 0.186
Scopus rating (2006): SJR 0.159 SNIP 0.438
Scopus rating (2005): SJR 0.181 SNIP 0.429
Scopus rating (2004): SJR 0.104 SNIP 0.479
Scopus rating (2003): SJR 0.227 SNIP 0.277
Scopus rating (2002): SJR 0.101 SNIP 0
Scopus rating (2001): SJR 0.221 SNIP 0
Scopus rating (2000): SJR 0.238
Scopus rating (1999): SJR 0.119
Original language: English
Electronic versions:
Ratia_Tribologia_2014
Links:
https://journal.fi/tribologia/issue/view/3255

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-12-01<br/>Publisher name: Suomen Tribologia-yhdistys
Effect of quartzite and granite in wear surfaces on dry sliding

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Engineering materials science and solutions (EMASS)
Authors: Heino, V., Valtonen, K., Kuokkala, V.
Number of pages: 5
Pages: 85-89
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Tribology: Materials, Surfaces and Interfaces
Volume: 8
Issue number: 2
ISSN (Print): 1751-5831
Ratings:
Scopus rating (2016): SJR 0.297 SNIP 0.464 CiteScore 0.64
Scopus rating (2015): SJR 0.305 SNIP 0.476 CiteScore 0.51
Scopus rating (2014): SJR 0.362 SNIP 0.38 CiteScore 0.36
Scopus rating (2013): SJR 0.247 SNIP 0.312 CiteScore 0.32
Scopus rating (2012): SJR 0.333 SNIP 0.376 CiteScore 0.27
Scopus rating (2011): SJR 0.276 SNIP 0.363 CiteScore 0.3
Scopus rating (2010): SJR 0.353 SNIP 0.261
Scopus rating (2009): SJR 0.155 SNIP 0.114
Scopus rating (2008): SJR 0.122 SNIP 0
Original language: English
DOIs:
10.1179/1751584X14Y.0000000065

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-11-28<br/>Publisher name: Maney Publishing; Institute of Materials, Minerals and Mining
Source: researchoutputwizard
Source-ID: 442
Research output: Scientific - peer-review › Article

Effect of test parameters on large particle high speed slurry erosion testing

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Number of pages: 7
Pages: 98-104
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Tribology: Materials, Surfaces and Interfaces
Volume: 8
Issue number: 2
ISSN (Print): 1751-5831
Ratings:
Scopus rating (2016): SJR 0.297 SNIP 0.464 CiteScore 0.64
Effect of viscose fabric modification on the mechanical and water absorption properties of composites prepared through vacuum infusion

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science
Authors: Rajan, R., Riihivuori, J., Rainasalo, E., Skrifvars, M., Järvelä, P.
Number of pages: 15
Pages: 1-15
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Reinforced Plastics and Composites
ISSN (Print): 0731-6844
Ratings:
Scopus rating (2016): SJR 0.418 SNIP 0.648 CiteScore 1.24
Scopus rating (2015): SJR 0.489 SNIP 0.846 CiteScore 1.32
Scopus rating (2014): SJR 0.686 SNIP 1.021 CiteScore 1.58
Scopus rating (2013): SJR 0.6 SNIP 1.027 CiteScore 1.35
Scopus rating (2012): SJR 0.53 SNIP 0.872 CiteScore 1
Scopus rating (2011): SJR 0.415 SNIP 0.768 CiteScore 0.86
Scopus rating (2010): SJR 0.421 SNIP 0.91
Scopus rating (2009): SJR 0.508 SNIP 0.857
Scopus rating (2008): SJR 0.477 SNIP 0.724
Scopus rating (2007): SJR 0.358 SNIP 0.765
Scopus rating (2006): SJR 0.328 SNIP 0.682
Scopus rating (2005): SJR 0.312 SNIP 0.601
Scopus rating (2004): SJR 0.363 SNIP 0.658
Scopus rating (2003): SJR 0.344 SNIP 0.479
Scopus rating (2002): SJR 0.585 SNIP 0.637
Scopus rating (2001): SJR 0.575 SNIP 0.785
Scopus rating (2000): SJR 0.653 SNIP 0.773
Scopus rating (1999): SJR 0.548 SNIP 0.777
Original language: English
DOIs:
Effects of cyclic pre-straining on mechanical properties of an austenitic microalloyed high-Mn twinning-induced plasticity steel

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Engineering materials science and solutions (EMASS)
Authors: Hamada, A., Järvenpää, A., Honkanen, M., Jaskari, M., Porter, D., Karjalainen, L.
Number of pages: 6
Pages: 47-52
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Procedia Engineering
Issue number: 74
ISSN (Print): 1877-7058
Ratings:
Scopus rating (2016): CiteScore 0.74 SJR 0.282 SNIP 0.697
Scopus rating (2015): SJR 0.238 SNIP 0.568 CiteScore 0.56
Scopus rating (2014): SJR 0.275 SNIP 0.679 CiteScore 0.53
Scopus rating (2013): SJR 0.217 SNIP 0.464 CiteScore 0.4
Scopus rating (2012): SJR 0.191 SNIP 0.396 CiteScore 0.28
Scopus rating (2011): SJR 0.237 SNIP 0.586 CiteScore 0.45
Scopus rating (2010): SJR 0.219 SNIP 0.434
Original language: English
DOIs:
10.1016/j.proeng.2014.06.222

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-08-13<br/>Publisher name: Sage
Source: researchoutputwizard
Source-ID: 1337
Research output: Scientific - peer-review › Article

Erosion wear of glass fibre reinforced vinylester

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Materials Characterization
Authors: Suihkonen, R., Perolainen, J., Lindgren, M., Valtonen, K., Ojala, N., Vuorinen, J.
Number of pages: 6
Pages: 1-6
Publication date: 2014

Host publication information
Title of host publication: The 16th Nordic Symposium on Tribology - NORDTRIB 2014, 10th - 13th June, Aarhus, Denmark
Publisher: Danish technological institute
ISBN (Print): 978-87-92765-26-0

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-11-02
Evaluation of thermal Comfort Properties of Prototype Uniforms for Rescue Team Workers

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science
Authors: Varheenmaa, M.
Number of pages: 6
Pages: 1-6
Publication date: 2014

Host publication information
Title of host publication: Ambience14&10i3m, Tampere Hall, Tampere, Finland 7-9 September 2014
Editor: Varheenmaa, M.

Publication series
Name: Proceedings of Ambience, Scientific Conference for Smart Textiles
No.: 1
ISSN (Print): 2342-4540

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-09-23
Source: researchoutputwizard
Source-ID: 1704
Research output: Scientific - peer-review › Conference contribution

Evidence for an In Situ Developed Polymer Phase in Ionic Elastomers

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Number of pages: 15
Pages: 3436-3450
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Macromolecules
Volume: 47
Issue number: 10
ISSN (Print): 0024-9297
Ratings:
Scopus rating (2016): SJR 2.557 SNIP 1.507 CiteScore 5.76
Scopus rating (2015): SJR 2.407 SNIP 1.638 CiteScore 5.82
Scopus rating (2014): SJR 2.534 SNIP 1.721 CiteScore 5.83
Scopus rating (2013): SJR 2.576 SNIP 1.754 CiteScore 6.09
Scopus rating (2012): SJR 2.779 SNIP 1.58 CiteScore 5.35
Scopus rating (2011): SJR 2.556 SNIP 1.593 CiteScore 5.15
Scopus rating (2010): SJR 2.51 SNIP 1.51
Scopus rating (2009): SJR 2.962 SNIP 1.533
Scopus rating (2008): SJR 2.819 SNIP 1.54
Scopus rating (2007): SJR 3.102 SNIP 1.613
Scopus rating (2006): SJR 2.987 SNIP 1.714
Scopus rating (2005): SJR 2.579 SNIP 1.654
Scopus rating (2004): SJR 2.606 SNIP 1.691
Extruded polymer films for optimal enzyme-catalyzed oxygen scavenging

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Johansson, K., Kotkamo, S., Rotabakk, T. B., Johansson, C., Kuusipalo, J., Jönsson, L. J., Jörnström, L.
Number of pages: 9
Pages: 1-8
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Chemical Engineering Science
Volume: 108
ISSN (Print): 0009-2509
Ratings:
Scopus rating (2016): CiteScore 3.05 SJR 1.037 SNIP 1.442
Scopus rating (2015): SJR 1.038 SNIP 1.606 CiteScore 2.96
Scopus rating (2014): SJR 1.115 SNIP 1.642 CiteScore 2.81
Scopus rating (2013): SJR 1.157 SNIP 1.866 CiteScore 2.95
Scopus rating (2012): SJR 1.189 SNIP 1.847 CiteScore 2.77
Scopus rating (2011): SJR 1.205 SNIP 1.685 CiteScore 2.8
Scopus rating (2010): SJR 1.319 SNIP 1.708
Scopus rating (2009): SJR 1.293 SNIP 1.759
Scopus rating (2008): SJR 1.299 SNIP 1.6
Scopus rating (2007): SJR 1.347 SNIP 1.523
Scopus rating (2006): SJR 1.308 SNIP 1.553
Scopus rating (2005): SJR 1.445 SNIP 1.801
Scopus rating (2004): SJR 1.301 SNIP 1.858
Scopus rating (2003): SJR 1.7 SNIP 1.676
Scopus rating (2002): SJR 1.675 SNIP 1.279
Scopus rating (2001): SJR 1.706 SNIP 1.734
Scopus rating (2000): SJR 1.313 SNIP 1.307
Scopus rating (1999): SJR 1.214 SNIP 1.539
Original language: English
DOIs: 10.1016/j.ces.2013.12.035

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-06-26<br/>Publisher name: American Chemical Society
Source: researchoutputwizard
Source-ID: 150
Research output: Scientific - peer-review › Article
Fatigue behavior of laser clad round steel bars
Laser cladding is an overlay welding method to manufacture high performance, fusion bonded metal, and metal matrix composite coatings on metallic substrates with low dilution. Owing to steep thermal gradients, rapid solidification, and possible mismatch in coefficients of thermal expansion between the coating and the substrate, laser cladding induces large tensile residual stresses in coating layer, potentially affecting the service life of clad component under external load-induced stresses. In this study, four-point bending and torsion fatigue tests were conducted on relatively large round laser clad steel bars to determine the effect of laser cladding on fatigue strength. Quenched and tempered 42CrMo4 steel clad with Inconel 625 and S355 structural steel clad with Stellite 21 were subjected to various stress levels for relatively large number of cycles with and without postweld heat treatment (PWHT). The results indicated that Stellite 21 decreased the fatigue life of S355 at all the applied loads, whereas Inconel 625 increased the fatigue life of 42CrMo4 at high loads but decreased at low loads. Applied PWHT did not show any positive influence on fatigue life.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mechanical Engineering and Industrial Systems, Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Tuominen, J., Nääki, J., Poutala, J., Miettinen, J., Peltola, T., Vuoristo, P., Rasehorn, I., Alam, M., Kaplan, A.
Number of pages: 10
Pages: 1-10
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Laser Applications
Article number: 012006
ISSN (Print): 1042-346X
Ratings:
Scopus rating (2016): SJR 0.648 SNIP 1.097 CiteScore 1.56
Scopus rating (2015): SJR 0.489 SNIP 1.143 CiteScore 1.71
Scopus rating (2014): SJR 0.7 SNIP 1.298 CiteScore 1.69
Scopus rating (2013): SJR 0.672 SNIP 0.964 CiteScore 1.32
Scopus rating (2012): SJR 0.245 SNIP 0.685 CiteScore 0.49
Scopus rating (2011): SJR 0.321 SNIP 0.801 CiteScore 0.74
Scopus rating (2010): SJR 0.422 SNIP 0.852
Scopus rating (2009): SJR 0.576 SNIP 1.069
Scopus rating (2008): SJR 0.378 SNIP 0.73
Scopus rating (2007): SJR 0.498 SNIP 1.099
Scopus rating (2006): SJR 0.537 SNIP 1.053
Scopus rating (2005): SJR 0.406 SNIP 0.917
Scopus rating (2004): SJR 0.524 SNIP 1.018
Scopus rating (2003): SJR 0.52 SNIP 0.95
Scopus rating (2002): SJR 0.526 SNIP 1.525
Scopus rating (2001): SJR 0.68 SNIP 1.762
Scopus rating (2000): SJR 0.874 SNIP 1.327
Scopus rating (1999): SJR 0.396 SNIP 1.211
Original language: English
DOIs:
10.2351/1.4903351

Bibliographical note
Published online 03 joulukuu 2014 ; (J.Laser Appl. 27, 012006 (2015))<br/>Contribution: organisation=mol,FACT1=0.75<br/>Contribution: organisation=mei,FACT2=0.25<br/>Portfolio EDEND: 2014-12-30<br/>Publisher name: American Institute of Physics; Laser Institute of America
Source: researchoutputwizard
Source-ID: 1650
Research output: Scientific - peer-review › Article
Flexor tendon healing within the tendon sheath using bioabsorbable poly-l/d-lactide 96/4 suture. A histological in vivo study with rabbits

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Viinikainen, A., Göransson, H., Taskinen, H., Röyttä, M., Kellomäki, M., Törmälä, P., Rokkanen, P.
Number of pages: 7
Pages: 1319-1325
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Materials Science: Materials in Medicine
Volume: 25
Issue number: 5
ISSN (Print): 0957-4530
Ratings:
Scopus rating (2016): SJR 0.533 SNIP 0.739 CiteScore 2.02
Scopus rating (2015): SJR 0.738 SNIP 0.952 CiteScore 2.46
Scopus rating (2014): SJR 0.739 SNIP 1.348 CiteScore 2.52
Scopus rating (2013): SJR 0.825 SNIP 1.349 CiteScore 3.02
Scopus rating (2012): SJR 0.861 SNIP 1.305 CiteScore 2.68
Scopus rating (2011): SJR 1.006 SNIP 1.228 CiteScore 2.8
Scopus rating (2010): SJR 0.949 SNIP 1.06
Scopus rating (2009): SJR 0.817 SNIP 0.996
Scopus rating (2008): SJR 0.686 SNIP 0.997
Scopus rating (2007): SJR 0.803 SNIP 0.979
Scopus rating (2006): SJR 0.724 SNIP 1.034
Scopus rating (2005): SJR 0.548 SNIP 1.046
Scopus rating (2004): SJR 0.465 SNIP 0.955
Scopus rating (2003): SJR 1.109 SNIP 0.808
Scopus rating (2002): SJR 0.923 SNIP 1.072
Scopus rating (2001): SJR 0.755 SNIP 1.378
Scopus rating (2000): SJR 0.707 SNIP 1.048
Scopus rating (1999): SJR 0.66 SNIP 1.078
Original language: English
DOIs: 10.1007/s10856-014-5160-1

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-04-30
Publisher name: Springer New York
Source: researchoutputwizard
Source-ID: 1734
Research output: Scientific - peer-review › Article

Formation and phase transformation of Bi-containing QD-like clusters in annealed GaAsBi

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Wu, M., Luna, E., Puustinen, J., Guina, M., Trampert, A.
Number of pages: 10
Pages: 1-10
Publication date: 2014
Peer-reviewed: Yes

Publication information
Fretting corrosion: Analysis of the failure mechanism for low voltage drives applications

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering
Authors: Mengotti, E., Duarte, L., Pippola, J., Frisk, L.
Number of pages: 6
Pages: 2109-2114
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Microelectronics Reliability
Volume: 54
Issue number: 9-10
ISSN (Print): 0026-2714
Ratings:
Scopus rating (2016): CiteScore 1.57 SJR 0.47 SNIP 0.976
Scopus rating (2015): SJR 0.618 SNIP 1.193 CiteScore 1.81
Scopus rating (2014): SJR 0.601 SNIP 1.432 CiteScore 1.9
Scopus rating (2013): SJR 0.594 SNIP 1.264 CiteScore 1.55
Scopus rating (2012): SJR 0.586 SNIP 1.414 CiteScore 1.6
Scopus rating (2011): SJR 0.621 SNIP 1.382 CiteScore 1.63
Garment fit by Numbers: Statistical Identification of a Garment’s Misfit

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science
Authors: Hernandez, N., Mattila, H., Berglin, L.
Number of pages: 6
Pages: 1-6
Publication date: 2014

Host publication information
Title of host publication: Ambience14&10i3m, Tampere Hall, Tampere, Finland 7-9 September 2014
Place of publication: Tampere
Publisher: Tampere University of Technology
Editor: Varheenmaa, M.

Publication series
Name: Proceedings of Ambience, Scientific Conference for Smart Textiles
Publisher: Tampere University of Technology
No.: 1
ISSN (Print): 2342-4540

GaSb-based SESAM Mode-Locked Tm,Ho:KLW Laser at 2060 nm

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Frontier Photonics
Number of pages: 3
Pages: 1-3
Green (In,Ga,Al)P-GaP light-emitting diodes grown on high-index GaAs surfaces

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Ledentsov, N., Shchukin, V., Lyytikäinen, J., Okhotnikov, O., Shemyakov, Y., Payusov, A., Gordeev, N., Maximov, M., Schlichting, S., Nippert, F., Hoffmann, A.
Number of pages: 5
Pages: 1-5
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: APPLIED PHYSICS LETTERS
Volume: 105
Issue number: 18
Article number: 181902
ISSN (Print): 0003-6951
Ratings:
Scopus rating (2016): CiteScore 2.67 SJR 1.132 SNIP 0.996
Scopus rating (2015): SJR 1.085 SNIP 0.983 CiteScore 2.47
Scopus rating (2014): SJR 1.799 SNIP 1.462 CiteScore 3.25
Scopus rating (2013): SJR 2.149 SNIP 1.652 CiteScore 3.77
Scopus rating (2012): SJR 2.554 SNIP 1.754 CiteScore 3.76
Scopus rating (2011): SJR 2.805 SNIP 1.94 CiteScore 4.04
Scopus rating (2010): SJR 2.926 SNIP 1.789
Scopus rating (2009): SJR 2.857 SNIP 1.848
Scopus rating (2008): SJR 2.934 SNIP 1.83
Scopus rating (2007): SJR 3.039 SNIP 1.913
Scopus rating (2006): SJR 3.457 SNIP 2.288
Scopus rating (2005): SJR 3.709 SNIP 2.382
Scopus rating (2004): SJR 3.904 SNIP 2.38
Scopus rating (2003): SJR 3.765 SNIP 2.27
Scopus rating (2002): SJR 3.917 SNIP 2.365
Scopus rating (2001): SJR 4.111 SNIP 2.212
Scopus rating (2000): SJR 4.277 SNIP 2.013
Scopus rating (1999): SJR 4.35 SNIP 2.11
Original language: English
DOIs:
10.1063/1.4900938
Hard nanodiamonds in soft rubbers: Past, present and future - A review

General information
State: Published
Ministry of Education publication type: A2 Review article in a scientific journal
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Shakun, A., Vuorinen, J., Hoikkanen, M., Poikelispää, M., Das, A.
Number of pages: 11
Pages: 49-69
Publication date: 2014
Peer-reviewed: Yes

Publication Information
Journal: Composites part a: applied science and manufacturing
Issue number: 6
ISSN (Print): 1359-835X
Ratings:
Scopus rating (2016): CiteScore 4.82 SJR 1.402 SNIP 2.053
Scopus rating (2015): SJR 1.53 SNIP 2.18 CiteScore 4.09
Scopus rating (2014): SJR 1.67 SNIP 2.538 CiteScore 4.08
Scopus rating (2013): SJR 1.59 SNIP 2.828 CiteScore 3.92
Scopus rating (2012): SJR 1.559 SNIP 2.706 CiteScore 3.36
Scopus rating (2011): SJR 1.443 SNIP 2.499 CiteScore 3.23
Scopus rating (2010): SJR 1.553 SNIP 2.241
Scopus rating (2009): SJR 1.536 SNIP 1.976
Scopus rating (2008): SJR 1.388 SNIP 1.853
Scopus rating (2007): SJR 1.222 SNIP 2.188
Scopus rating (2006): SJR 1.208 SNIP 2.268
Scopus rating (2005): SJR 1.109 SNIP 2.103
Scopus rating (2004): SJR 1.159 SNIP 1.671
Scopus rating (2003): SJR 1.132 SNIP 1.411
Scopus rating (2002): SJR 1.308 SNIP 1.512
Scopus rating (2001): SJR 1.426 SNIP 1.33
Scopus rating (2000): SJR 1.273 SNIP 1.298
Scopus rating (1999): SJR 0.824 SNIP 1.104
Original language: English
DOIs:
10.1016/j.compositesa.2014.04.014

High-accuracy method for sample positioning in tightly focused nonlinear reflectivity measurement systems for semiconductor saturable absorber mirrors

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre
Authors: Orsila, L., Hyyti, J., Härkönen, A., Steinmeyer, G., Guina, M.
High Alpha - Termisesti ruiskutetut kromioksidi- ja piikarbidiseosteiset alumiinioksidipinnoitteet. Loppuraportti

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Organisations: Department of Materials Science, Research group: Ceramic materials, Research group: Surface Engineering
Authors: Hyväriinen, L., Hakalahti, J., Niemi, K., Vuoristo, P.
Number of pages: 56
Publication date: 2014

Publication information
Place of publication: Tampere
Publisher: Tampereen teknillinen yliopisto. Materiaaliopin laitos
Original language: Finnish
Electronic versions:
high_alpha_termisesti_ruiskutetut_alumiinipinnoitteet.pdf
Links:

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>&nbsp;Portfolio EDEND: 2015-02-27<br/>&nbsp;Publisher name: Finnish Optical Society
Source: researchoutputwizard
Source-ID: 533
Research output: Professional › Commissioned report

High-efficiency 20 W yellow VECSEL

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Kantola, E., Leinonen, T., Ranta, S., Tavast, M., Guina, M.
Number of pages: 9
Pages: 6372-6380
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Optics Express
Volume: 22
Issue number: 6
ISSN (Print): 1094-4087
Ratings:
Scopus rating (2016): CiteScore 3.48 SJR 1.487 SNIP 1.589
High-efficiency tunable yellow-orange VECSEL with an output power of 20 W

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Kantola, E., Leinonen, T., Ranta, S., Tavast, M., Guina, M.
Number of pages: 7
Pages: 1-7
Publication date: 2014

Host publication information
Publisher: SPIE
Article number: 89660D
ISBN (Print): 978-0-8194-9879-3

Publication series
Name: SPIE conference proceedings
Volume: 8966
ISSN (Print): 0277-786X
ISSN (Electronic): 1996-756X
DOIs:
10.1117/12.2037676

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: 653
Research output: Scientific - peer-review › Conference contribution
High gain 1.3-μm GaInNAs SOA with fast gain dynamics and enhanced temperature stability

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Fitsios, D., Giannoulis, G., Iliadis, N., Korpijärvi, V., Viheriälä, J., Laakso, A., Dris, S., Spyropoulou, M., Avramopoulos, H., Kanellos, G., Pleros, N., Guina, M.
Number of pages: 6
Pages: 1-6
Publication date: 2014

Host publication information
Publisher: SPIE
ISBN (Print): 978-0-8194-9895-3

Publication series
Name: SPIE conference proceedings
Volume: 8982
ISSN (Print): 0277-786X
ISSN (Electronic): 1996-756X
DOIs:
10.1117/12.2037904

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: 305
Research output: Scientific - peer-review › Conference contribution

High performance wafer-fused semiconductor disk lasers emitting in the 1300 nm waveband

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Number of pages: 6
Pages: 29398-29403
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Optics Express
Volume: 22
Issue number: 24
ISSN (Print): 1094-4087
Ratings:
Scopus rating (2016): CiteScore 3.48 SJR 1.487 SNIP 1.589
Scopus rating (2015): SJR 1.976 SNIP 1.755 CiteScore 3.78
Scopus rating (2014): SJR 2.349 SNIP 2.166 CiteScore 4.18
Scopus rating (2013): SJR 2.358 SNIP 2.226 CiteScore 4.38
Scopus rating (2012): SJR 2.587 SNIP 2.145 CiteScore 3.85
Scopus rating (2011): SJR 2.579 SNIP 2.606 CiteScore 4.04
Scopus rating (2010): SJR 2.943 SNIP 2.466
Scopus rating (2009): SJR 3.092 SNIP 2.669
Scopus rating (2008): SJR 3.195 SNIP 2.393
Scopus rating (2007): SJR 3.27 SNIP 2.032
Scopus rating (2006): SJR 3.233 SNIP 2.326
Scopus rating (2005): SJR 3.334 SNIP 2.379
Scopus rating (2004): SJR 2.833 SNIP 2.499
Scopus rating (2003): SJR 2.688 SNIP 2.193
Scopus rating (2002): SJR 1.547 SNIP 1.673
Scopus rating (2001): SJR 1.442 SNIP 1.39
Scopus rating (2000): SJR 1.246 SNIP 0.714
Scopus rating (1999): SJR 1.381 SNIP 0.838
Original language: English
DOIs:
10.1364/OE.22.029398

**Bibliographical note**
Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-12-16<br/>Publisher name: Optical Society of America
Source: researchoutputwizard
Source-ID: 1520
Research output: Scientific - peer-review › Article

**High power cavity-adjusted semiconductor disc lasers emitting in the 1310 nm waveband**

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Frontier Photonics
Authors: Sirbu, A., Rantamäki, A., Iakovlev, V., Mereuta, A., Lyytikäinen, J., Caliman, A., Okhotnikov, O., Kapon, E.
Number of pages: 2
Publication date: 2014

**Host publication information**
Title of host publication: ISLC 2014, IEEE 24th International Semiconductor Laser Conference, 7 - 10 September, 2014, Mallorca, Spain
Publisher: IEEE
ISBN (Print): 978-1-4799-5721-7

**Publication series**
Name: IEEE International Semiconductor Laser Conference
DOIs:
10.1109/ISLC.2014.231

**Bibliographical note**
Oral WA6<br/>Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-09-24<br/>Publisher name: IEEE
Source: researchoutputwizard
Source-ID: 1519
Research output: Scientific - peer-review › Conference contribution

**High-power flip-chip semiconductor disk laser in the 1.3. um wavelength band**

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Rantamäki, A., Sirbu, A., Saarinen, E. J., Lyytikäinen, J., Mereuta, A., Iakovlev, V., Kapon, E., Okhotnikov, O. G.
Number of pages: 4
Pages: 4855-4858
Publication date: 2014
Peer-reviewed: Yes

**Publication information**
Journal: Optics Letters
Volume: 39
High power semiconductor disk laser with a semiconductor-dielectric-metal compound mirror

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Research group: Surface Science, Frontier Photonics
Authors: Rantamäki, A., Saarinen, E. J., Lyytikäinen, J., Lahtonen, K., Valden, M., Okhotnikov, O. G.
Number of pages: 4
Pages: 1-4
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: APPLIED PHYSICS LETTERS
Volume: 104
Issue number: 10
Article number: 101110
ISSN (Print): 0003-6951
Ratings:
Scopus rating (2016): CiteScore 2.67 SJR 1.132 SNIP 0.996
Scopus rating (2015): SJR 1.085 SNIP 0.983 CiteScore 2.47
Scopus rating (2014): SJR 1.799 SNIP 1.462 CiteScore 3.25
Scopus rating (2013): SJR 2.149 SNIP 1.652 CiteScore 3.77
Scopus rating (2012): SJR 2.554 SNIP 1.754 CiteScore 3.76
Scopus rating (2011): SJR 2.805 SNIP 1.94 CiteScore 4.04
Scopus rating (2010): SJR 2.926 SNIP 1.789
Scopus rating (2009): SJR 2.857 SNIP 1.848
Scopus rating (2008): SJR 2.934 SNIP 1.83
Scopus rating (2007): SJR 3.039 SNIP 1.913
Scopus rating (2006): SJR 3.457 SNIP 2.288
Scopus rating (2005): SJR 3.709 SNIP 2.382
Scopus rating (2004): SJR 3.904 SNIP 2.38
Scopus rating (2003): SJR 3.765 SNIP 2.27
Scopus rating (2002): SJR 3.917 SNIP 2.365
Scopus rating (2001): SJR 4.111 SNIP 2.212
Scopus rating (2000): SJR 4.277 SNIP 2.013
Scopus rating (1999): SJR 4.35 SNIP 2.11
Original language: English
DOIs:
10.1063/1.4868535

**Bibliographical note**

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

Source: researchoutputwizard

Source-ID: 1349

Research output: Scientific - peer-review › Article

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**High Power Wafer-Fused Flip Chip Semiconductor Disk Laser at 1.27 μm**

**General information**

State: Published

Ministry of Education publication type: A4 Article in a conference publication

Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, École Polytechnique Fédérale de Lausanne, Laboratory of Physics of Nanostructures, CH-1015 Lausanne, Switzerland

Authors: Rantamäki, A., Sirbu, A., Saarinen, E., Lyytikäinen, J., Iakolev, V., Kapon, E., Okhotnikov, O.

Publication date: 2014

**Host publication information**

Title of host publication: 6th EPS-QEOD Euro photon Conference, 24-29 August, 2014, Neuchâtel, Switzerland.

Conference Digest : Europhysics Conference Abstract Volume 38 E

ISBN (Print): 2-914771-89-4

Research output: Scientific - peer-review › Conference contribution

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**High-speed Sliding Friction of Laser-textured Silicon Nitride in Water against Rubber**

The effects of a specific laser patterning on friction of silicon nitride bulk ceramic in water against rubber were investigated. A dimple-like patterning was applied to the surfaces of silicon nitride bulk ceramic blocks with pulsed laser drilling. Friction measurements were conducted with a special device designed for high-velocity sliding wear and friction testing of hard materials in wet conditions. Sliding velocities in the water-lubricated test ranged from 3.3 to 33 m/s and the load was 80 N. Anomalies in friction behaviour were observed in 8.3 and 16.7 m/s, which can only partially be explained with test equipment characteristics.

**General information**

State: Published

Ministry of Education publication type: A4 Article in a conference publication

Organisations: Department of Materials Science, Research group: Ceramic materials, Department of Mechanical Engineering and Industrial Systems, Research group: Laser, Research area: Manufacturing and Automation

Authors: Ismailov, A., Kumpulainen, T., Vihinen, J., Levänen, E.

Number of pages: 7

Pages: 267-273

Publication date: 2014

**Host publication information**

Title of host publication: Proceedings of the Twenty Eighth International Conference on Surface Modification Technologies

ISBN (Print): 978-81-926196-1-3

Keywords: Friction, Silicon Nitride, Sliding, Wear, Laser

Electronic versions:

high_speed_sliding_friction
High temperature reliability of electrically conductive adhesive attached temperature sensors on flexible polyimide substrates

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering
Authors: Lahokallio, S., Kilunen, J., Frisk, L.
Number of pages: 6
Pages: 2017-2022
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Microelectronics Reliability
Volume: 54
Issue number: 9-10
ISSN (Print): 0026-2714
Ratings:
Scopus rating (2016): CiteScore 1.57 SJR 0.47 SNIP 0.976
Scopus rating (2015): SJR 0.618 SNIP 1.193 CiteScore 1.81
Scopus rating (2014): SJR 0.601 SNIP 1.432 CiteScore 1.9
Scopus rating (2013): SJR 0.594 SNIP 1.264 CiteScore 1.55
Scopus rating (2012): SJR 0.586 SNIP 1.414 CiteScore 1.6
Scopus rating (2011): SJR 0.621 SNIP 1.382 CiteScore 1.63
Scopus rating (2010): SJR 0.602 SNIP 1.114
Scopus rating (2009): SJR 0.736 SNIP 1.176
Scopus rating (2008): SJR 0.932 SNIP 1.235
Scopus rating (2007): SJR 0.743 SNIP 1.228
Scopus rating (2006): SJR 0.716 SNIP 1.153
Scopus rating (2005): SJR 0.514 SNIP 1.009
Scopus rating (2004): SJR 0.537 SNIP 0.823
Scopus rating (2003): SJR 0.472 SNIP 0.786
Scopus rating (2002): SJR 0.592 SNIP 0.756
Scopus rating (2001): SJR 0.411 SNIP 0.694
Scopus rating (2000): SJR 0.349 SNIP 0.382
Scopus rating (1999): SJR 0.22 SNIP 0.562
Original language: English
DOIs:
10.1016/j.microrel.2014.07.095

Bibliographical note
Contribution: organisation=dee,FACT1=1<br/>Portfolio EDEND: 2014-11-30<br/>Publisher name: Pergamon Press
Source: researchoutputwizard
Source-ID: 859
Research output: Scientific - peer-review » Article

Improving the extensibility, wet web and dry strength of paper by addition of agar

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science
Authors: Vishtal, A., Retulainen, E.
Number of pages: 10
Pages: 434-443
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 29
Issue number: 3
ISSN (Print): 0283-2631

Ratings:
Scopus rating (2016): CiteScore 1.2 SJR 0.385 SNIP 0.652
Scopus rating (2015): SJR 0.375 SNIP 0.787 CiteScore 0.91
Scopus rating (2014): SJR 0.444 SNIP 0.823 CiteScore 0.99
Scopus rating (2013): SJR 0.389 SNIP 0.684 CiteScore 0.71
Scopus rating (2012): SJR 0.628 SNIP 1.281 CiteScore 1.13
Scopus rating (2011): SJR 0.582 SNIP 0.902 CiteScore 0.78
Scopus rating (2010): SJR 0.658 SNIP 0.764
Scopus rating (2009): SJR 1.167 SNIP 0.984
Scopus rating (2008): SJR 0.928 SNIP 0.857
Scopus rating (2007): SJR 2.018 SNIP 1.035
Scopus rating (2006): SJR 1.002 SNIP 0.951
Scopus rating (2005): SJR 1.181 SNIP 0.997
Scopus rating (2004): SJR 2.08 SNIP 1.354
Scopus rating (2003): SJR 2.952 SNIP 1.129
Scopus rating (2002): SJR 1.836 SNIP 1.145
Scopus rating (2001): SJR 1.12 SNIP 1.147
Scopus rating (2000): SJR 1.086 SNIP 1.154
Scopus rating (1999): SJR 1.086 SNIP 1.001

Original language: English

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2015-01-22
Source: researchoutputwizard
Source-ID: 1759
Research output: Scientific - peer-review › Article

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

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Aho, A., Korpijärvi, V., Tukiainen, A., Puustinen, J., Guina, M.
Number of pages: 6
Pages: 1-6
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Applied Physics
Volume: 116
Article number: 213101
ISSN (Print): 0021-8979
Ratings:
Scopus rating (2016): CiteScore 1.72 SJR 0.632 SNIP 0.815
Scopus rating (2015): SJR 0.618 SNIP 0.84 CiteScore 1.57
Scopus rating (2014): SJR 1.005 SNIP 1.18 CiteScore 2.04
Influence of powder composition and manufacturing method on electrical and chromium barrier properties of atmospheric plasma sprayed spinel coatings prepared from MnCo2O4 and Mn2CoO4 + Co powders on Crofer 22 APU interconnectors

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Optoelectronics Research Centre, Engineering materials science and solutions (EMASS), Frontier Photonics
Number of pages: 12
Pages: 17246-17257
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 39
Issue number: 30
ISSN (Print): 0360-3199
Ratings:
Scopus rating (2016): CiteScore 3.74 SJR 1.142 SNIP 1.286
Scopus rating (2015): SJR 1.294 SNIP 1.319 CiteScore 3.46
Scopus rating (2014): SJR 1.212 SNIP 1.494 CiteScore 3.54
Scopus rating (2013): SJR 1.278 SNIP 1.467 CiteScore 3.38
Scopus rating (2012): SJR 1.515 SNIP 1.729 CiteScore 3.96
Scopus rating (2011): SJR 1.456 SNIP 1.837 CiteScore 4.42
Scopus rating (2010): SJR 1.589 SNIP 1.871
Scopus rating (2009): SJR 1.333 SNIP 1.885
Scopus rating (2008): SJR 1.401 SNIP 2.096
Scopus rating (2007): SJR 1.279 SNIP 2.201
Scopus rating (2006): SJR 1.073 SNIP 2.161
Scopus rating (2005): SJR 1.107 SNIP 1.787
Influence of substrate contamination, web handling, and pretreatments on the barrier performance of aluminum oxide atomic layer-deposited BOPP film

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Lahtinen, K., Lahti, J., Johansson, P., Seppänen, T., Cameron, D. C.
Number of pages: 10
Pages: 1-10
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Coatings Technology and Research
Volume: 11
Issue number: 3
ISSN (Print): 1547-0091
Ratings:
Scopus rating (2016): SJR 0.409 SNIP 0.614 CiteScore 1.44
Scopus rating (2015): SJR 0.421 SNIP 0.83 CiteScore 1.45
Scopus rating (2014): SJR 0.51 SNIP 1.062 CiteScore 1.5
Scopus rating (2013): SJR 0.534 SNIP 1.077 CiteScore 1.46
Scopus rating (2012): SJR 0.572 SNIP 1.364 CiteScore 1.39
Scopus rating (2011): SJR 0.517 SNIP 1.007 CiteScore 1.24
Scopus rating (2010): SJR 0.571 SNIP 0.968
Scopus rating (2009): SJR 0.396 SNIP 0.683
Scopus rating (2008): SJR 0.249 SNIP 0.502
Scopus rating (2007): SJR 0.432 SNIP 0.472
Scopus rating (2006): SJR 0.606 SNIP 1.016
Scopus rating (2005): SJR 0.219 SNIP 0.201
Original language: English
DOIs:
10.1007/s11998-014-9584-9

Bibliographical note
online first
Contribution: organisation=mol,FACT1=1
Portfolio EDEND: 2014-05-27
Publisher name: Springer
Research output: Scientific - peer-review › Article

Influence of surface hydroxylation on the oxidation of FeCr in O2 and air
Influence of the powder morphology and plasma play process parameters on the structure and properties of Al2O3 based plasma sprayed coatings

Influence of the spray gun type on microstructure and properties of HVAF sprayed Fe-based corrosion resistant coatings
In vitro bioluminescence used as a method for real-time inhibition zone testing for antibiotic-releasing composites

Aims: This study describes the potential of real-time bioluminescence imaging in evaluating the antibiotic efficiency of two cylinder-shaped bioabsorbable antibiotic-releasing composites by in vitro inhibition zone tests. The bacterial infections of bone tissue can cause extensive hard and soft tissue damage and decrease the efficiency of oral antibiotic therapy due to the poor blood circulation in the infected area. To overcome this problem, new, locally antibiotic-releasing biodegradable composites have been developed. Study Design & Methodology: The two composites evaluated in this study were composed of poly(L-lactide-co-ε-caprolactone) matrix, β-tricalcium phosphate ceramic and either ciprofloxacin or rifampicin antibiotic. The composites were tested with genetically modified model pathogens of osteomyelitis (Pseudomonas aeruginosa and Staphylococcus epidermidis) in vitro in inhibition zone tests using a method of real-time bioluminescence. Results: The first signs of the effect of the released ciprofloxacin or rifampicin became visible after four hours of incubation and were seen as changed bioluminescence around the composite pellet on a culture dish. Both of the composite types showed excellent effects against the sensor bacteria within the diffusion area. Bioluminescence measurements suggested that no survivor bacteria capable of evolving resistant strains were left inside the inhibition zones. The S. epidermidis bacterial strain was an inhibition sensor and P. aeruginosa was a stress sensor. Conclusion: These results highlight the potential of the composite materials capable against the pathogens of osteomyelitis. The approach allows continuous visual inspection of the efficacy of the antibiotics against the bacteria.
Kilpailukykyä pk-sektorin yrityksille; Tietoisku

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science
Authors: Järvelä, P.
Number of pages: 2
Pages: 26-27
Publication date: 2014
Peer-reviewed: Unknown

Publication information
Journal: Muovi - Plast
Issue number: 2
ISSN (Print): 0788-8430
Original language: Finnish

Bibliographical note
Contribution: organisation=mol,FACT1=1
Portfolio EDEND: 2014-06-26
Publisher name: Muoviyhdistys
Source: researchoutputwizard
Source-ID: 579
Research output: Professional › Article

Köyhänävustusta design-pakkaukseksi. Äitiyspakkauksen sukupuu

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science
Authors: Mustonen, M.
Number of pages: 1
Pages: 18-18
Publication date: 2014
Peer-reviewed: Unknown

Publication information
Journal: Tekstiililehti
Volume: 77
Issue number: 1
ISSN (Print): 0040-2370
Original language: Finnish

Bibliographical note
Contribution: organisation=mol,FACT1=1
Portfolio EDEND: 2014-12-01
Publisher name: Suomen tekstiiliteknillinen liitto
Source: researchoutputwizard
Source-ID: 1113
Research output: Professional › Article

Life Cycle Assessment on Personal Protective Equipments

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science
Authors: Fatarella, E., Parisi, L., Varheenmaa, M., Talvenmaa, P., Pavlidou, S.
Number of pages: 8
Pages: 1-8
Publication date: 2014

Host publication information
Title of host publication: Ambience14&10i3, Tampere Hall, Tampere, Finland 7-9 September 2014
Magnetotransport study on as-grown and annealed n- and p-type modulation-doped GaInNAs/GaAs strained quantum well structures

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Dönmez, Ö., Sarcan, F., Erol, A., Gunes, M., Cetin Arikan, M., Puustinen, J., Guina, M.
Number of pages: 6
Pages: 1-6
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Nanoscale Research Letters
Volume: 9
Article number: 141
ISSN (Print): 1931-7573
Ratings:
Scopus rating (2016): SJR 0.589 SNIP 0.746 CiteScore 2.15
Scopus rating (2015): SJR 0.538 SNIP 0.653 CiteScore 1.69
Scopus rating (2014): SJR 0.748 SNIP 1.019 CiteScore 2.15
Scopus rating (2013): SJR 0.79 SNIP 0.967 CiteScore 2.23
Scopus rating (2012): SJR 1.049 SNIP 1.073 CiteScore 2.58
Scopus rating (2011): SJR 1.04 SNIP 1.124 CiteScore 2.88
Scopus rating (2010): SJR 1.062 SNIP 1.007
Scopus rating (2009): SJR 1.063 SNIP 1.01
Scopus rating (2008): SJR 0.828 SNIP 0.632
Scopus rating (2007): SJR 1.458 SNIP 0.71
Original language: English
DOIs:

Mapping of stress raising in laser clad components depending on geometry and defects

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Mechanical Engineering and Industrial Systems, Department of Materials Science
Metallographic Studies of Electron Beam Welded Copper Plates: EBSD Studies of the Cross-Sections and Determination of EBSD Reference Curves by EB-Welded Tensile Test Samples

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Organisations: Department of Materials Science
Authors: Karhula, T.
Number of pages: 241
Publication date: 2014

Publication information
Place of publication: Olkiluoto
Publisher: Posiva
Original language: English

Publication series
Name: Posiva Working Report
Publisher: Posiva
No.: 2013-14
Electronic versions:
Posiva_WR2013_14_Karhula_EBSD
Links:

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-05-27
Source: researchoutputwizard
Source-ID: 662
Research output: Professional › Commissioned report

Microstructural Characteristics and Tribological Behavior of HVOF-Sprayed Novel Fe-Based Alloy Coating

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science
Authors: Milanti, A., Koivuluoto, H., Vuoristo, P., Bozelli, G., Bozza, F., Lusvarghi, L.
Number of pages: 23
Pages: 98-120
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Coatings
Volume: 4
Issue number: 1
ISSN (Print): 2079-6412
Original language: English
DOIs:
10.3390/coatings4010098

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-06-26<br/>Publisher name: MDPI
Source: researchoutputwizard
Source-ID: 1085
Research output: Scientific - peer-review › Article
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., Polojärvi, 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

Multifunctional superhydrophobic nanoparticle coatings for cellulose-based substrates by liquid flame spray

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science
Authors: Teisala, H.
Number of pages: 1
Pages: 59
Publication date: 2014
Peer-reviewed: Unknown

Publication information
Journal: Materia
Issue number: 1
ISSN (Print): 1459-9694
Original language: Finnish
Links:
http://www.vuorimiesyhdistys.fi/sites/default/files/materia/pdf/Materia%201-2014_0.pdf

Bibliographical note
Contribution: organisation=mol,FACT1=1
Portfolio EDEND: 2014-09-05
Publisher name: Vuorimiesyhdistys
Source: researchoutputwizard
Source-ID: 1608
Research output: Professional Article
Negative and positive magnetoresistance in GaInNAs/GaAs modulation-doped quantum well structures

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Nutku, F., Donmez, O., Sarcan, F., Erol, A., Puustinen, J., Arikan, M., Guina, M.
Number of pages: 7
Pages: 1-7
Publication date: 2014
Peer-reviewed: Yes

Publication information
ISSN (Print): 0947-8396
Ratings:
Scopus rating (2016): CiteScore 1.52
Scopus rating (2015): CiteScore 1.38
Scopus rating (2014): CiteScore 1.74
Scopus rating (2013): CiteScore 1.75
Scopus rating (2012): CiteScore 1.71
Scopus rating (2011): CiteScore 1.77
Original language: English
DOIs:
10.1007/s00339-014-8852-y

Bibliographical note
Online First. Accepted: 27 October 2014. Published: 30 October 2014.
Contribution: organisation=orc,FACT1=1
Portfolio EDEND: 2014-11-21
Publisher name: Springer
Source-ID: 1167
Research output: Scientific - peer-review Article

Novel Regenerated Cellulose Fibers with High Water Absorption Properties

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science
Authors: Kamppuri, T., Vehviläinen, M., Grönqvist, S., Rissanen, M.
Number of pages: 5
Pages: 1-5
Publication date: 2014

Host publication information
Title of host publication: Ambience 14 & 10i3m, Tampere Hall, Tampere, Finland 7-9 September 2014
Place of publication: Tampere
Publisher: Tampere University of Technology
Editor: Varheenmaa, M.
Observation of atomic ordering of triple-period-A and -B type in GaAsBi

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Wu, M., Luna, E., Puustinen, J., Guina, M., Trampert, A.
Number of pages: 4
Pages: 1-4
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: APPLIED PHYSICS LETTERS
Volume: 105
Article number: 041602
ISSN (Print): 0003-6951
Ratings:
Scopus rating (2016): CiteScore 2.67 SJR 1.132 SNIP 0.996
Scopus rating (2015): SJR 1.085 SNIP 0.983 CiteScore 2.47
Scopus rating (2014): SJR 1.799 SNIP 1.462 CiteScore 3.25
Scopus rating (2013): SJR 2.149 SNIP 1.652 CiteScore 3.77
Scopus rating (2012): SJR 2.554 SNIP 1.754 CiteScore 3.76
Scopus rating (2011): SJR 2.805 SNIP 1.94 CiteScore 4.04
Scopus rating (2010): SJR 2.926 SNIP 1.789
Scopus rating (2009): SJR 2.857 SNIP 1.848
Scopus rating (2008): SJR 2.934 SNIP 1.83
Scopus rating (2007): SJR 3.039 SNIP 1.913
Scopus rating (2006): SJR 3.457 SNIP 2.288
Scopus rating (2005): SJR 3.709 SNIP 2.382
Scopus rating (2004): SJR 3.904 SNIP 2.38
Scopus rating (2003): SJR 3.765 SNIP 2.27
Scopus rating (2002): SJR 3.917 SNIP 2.365
Scopus rating (2001): SJR 4.111 SNIP 2.212
Scopus rating (2000): SJR 4.277 SNIP 2.013
Scopus rating (1999): SJR 4.35 SNIP 2.11
Original language: English
DOI: 10.1063/1.4891854

Optical gain in 1.3 μm electrically-driven dilute nitride VCSOA
Optically Pumped Edge-Emitting GaAs-Based Laser With Direct Orange Emission

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Toikkanen, L., Härkönen, A., Lyytikäinen, J., Leinonen, T., Laakso, A., Tukiainen, A., Viheriälä, J., Bister, M., Guina, M.
Number of pages: 3
Pages: 384-386
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Photonics Technology Letters
Volume: 26
Issue number: 4
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
Optical projection tomography as a tool for 3D imaging of hydrogels

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 7
Pages: 3443-3449
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Biomedical Optics Express
Volume: 5
Issue number: 10
ISSN (Print): 2156-7085
Ratings:
Scopus rating (2016): CiteScore 3.8 SJR 1.315 SNIP 1.526
Scopus rating (2015): SJR 1.432 SNIP 1.647 CiteScore 4.07
Scopus rating (2014): SJR 1.754 SNIP 1.798 CiteScore 3.86
Scopus rating (2013): SJR 1.549 SNIP 1.827 CiteScore 3.98
Scopus rating (2012): SJR 1.301 SNIP 1.662 CiteScore 2.85
Scopus rating (2011): SJR 0.846 SNIP 1.757
Original language: English
DOIs:
10.1364/BOE.5.003443

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-09-10
Publisher name: Optical Society of America
Source: researchoutputwizard
Source-ID: 298
Research output: Scientific - peer-review » Article
Optical projection tomography can be used to investigate spatial distribution of chondrocytes in three-dimensional biomaterial scaffolds for cartilage tissue engineering.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Järvinen, E., Muhonen, V., Haaparanta, A., Kellomäki, M., Kiviranta, I.
Number of pages: 5
Pages: 1549-1553
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Bio-Medical Materials and Engineering
Volume: 24
Issue number: 3
ISSN (Print): 0959-2989
Ratings:
Scopus rating (2016): SJR 0.254 SNIP 0.415 CiteScore 0.81
Scopus rating (2015): SJR 0.334 SNIP 0.754 CiteScore 0.99
Scopus rating (2014): SJR 0.284 SNIP 0.486 CiteScore 0.94
Scopus rating (2013): SJR 0.349 SNIP 0.55 CiteScore 0.98
Scopus rating (2012): SJR 0.434 SNIP 0.73 CiteScore 1.4
Scopus rating (2011): SJR 0.424 SNIP 0.584 CiteScore 1.31
Scopus rating (2010): SJR 0.403 SNIP 0.328
Scopus rating (2009): SJR 0.367 SNIP 0.434
Scopus rating (2008): SJR 0.428 SNIP 0.543
Scopus rating (2007): SJR 0.544 SNIP 0.534
Scopus rating (2006): SJR 0.405 SNIP 0.581
Scopus rating (2005): SJR 0.295 SNIP 0.511
Scopus rating (2004): SJR 0.354 SNIP 0.831
Scopus rating (2003): SJR 0.392 SNIP 0.523
Scopus rating (2002): SJR 0.461 SNIP 0.69
Scopus rating (2001): SJR 0.373 SNIP 0.623
Scopus rating (2000): SJR 0.215 SNIP 0.32
Scopus rating (1999): SJR 0.426 SNIP 0.661
Original language: English
DOIs:
10.3233/BME-140959

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-06-30
Publisher name: IOS Press
Source: researchoutputwizard
Source-ID: 589
Research output: Scientific - peer-review Article

Ormocomp-Modified Glass Increases Collagen Binding and Promotes the Adherence and Maturation of Human Embryonic Stem Cell-Derived Retinal Pigment Epithelial Cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Optoelectronics Research Centre, Research group: Surface Science, Frontier Photonics, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Käpylä, E., Sorkio, A., Teymouri, S., Lahtonen, K., Vuori, L., Valden, M., Skottman, H., Kellomäki, M., Juutil-Uusitalo, K.
Number of pages: 11
**Publication information**

Journal: Langmuir
ISSN (Print): 0743-7463
Ratings:

Scopus rating (2016): CiteScore 3.99 SJR 1.55 SNIP 1.188
Scopus rating (2015): SJR 1.686 SNIP 1.308 CiteScore 4.33
Scopus rating (2014): SJR 1.816 SNIP 1.391 CiteScore 4.59
Scopus rating (2013): SJR 1.895 SNIP 1.356 CiteScore 4.55
Scopus rating (2012): SJR 2.177 SNIP 1.382 CiteScore 4.37
Scopus rating (2011): SJR 2.051 SNIP 1.357 CiteScore 4.42
Scopus rating (2010): SJR 2.148 SNIP 1.4
Scopus rating (2009): SJR 2.156 SNIP 1.351
Scopus rating (2008): SJR 2.383 SNIP 1.34
Scopus rating (2007): SJR 2.449 SNIP 1.434
Scopus rating (2006): SJR 2.375 SNIP 1.428
Scopus rating (2005): SJR 2.157 SNIP 1.463
Scopus rating (2004): SJR 1.963 SNIP 1.458
Scopus rating (2003): SJR 1.953 SNIP 1.4
Scopus rating (2002): SJR 2.011 SNIP 1.489
Scopus rating (2001): SJR 2.01 SNIP 1.382
Scopus rating (2000): SJR 2.039 SNIP 1.479
Scopus rating (1999): SJR 1.719 SNIP 1.496

Original language: English
DOIs:
10.1021/la5023642

**Bibliographical note**

Contribution: organisation=elt,FACT1=0.7<br/>Contribution: organisation=orc,FACT2=0.3<br/>Portfolio EDEND: 2014-11-30<br/>Publisher name: American Chemical Society
Source: researchoutputwizard
Source-ID: 659
Research output: Scientific - peer-review › Article

**Paper-based microfluidics: Fabrication technique and dynamics of capillary driven surface flow**

**General information**

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Department of Physics, Engineering materials science and solutions (EMASS)
Authors: Songok, J., Tuominen, M., Teisala, H., Haapanen, J., Mäkelä, J. M., Kuusipalo, J., Toivakka, M.
Number of pages: 7
Pages: 20060-20066
Publication date: 2014
Peer-reviewed: Yes

**Publication information**

Journal: ACS Applied Materials and Interfaces
Volume: 6
Issue number: 22
ISSN (Print): 1944-8244
Ratings:

Scopus rating (2016): CiteScore 7.6 SJR 2.524 SNIP 1.528
Scopus rating (2015): SJR 2.299 SNIP 1.568 CiteScore 7.38
Scopus rating (2014): SJR 2.126 SNIP 1.64 CiteScore 6.88
Scopus rating (2013): SJR 1.979 SNIP 1.543 CiteScore 6.05
Performance assessment of multijunction solar cells incorporating GaInNAsSb

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Aho, A., Tukiainen, A., Polojärvi, V., Guina, M.
Number of pages: 7
Pages: 1-7
Publication date: 2014
Peer-reviewed: Yes

**Publication information**
Journal: Nanoscale Research Letters
Volume: 9
Article number: 61
ISSN (Print): 1931-7573
Ratings:
Scopus rating (2016): SJR 0.589 SNIP 0.746 CiteScore 2.15
Scopus rating (2015): SJR 0.538 SNIP 0.653 CiteScore 1.69
Scopus rating (2014): SJR 0.748 SNIP 1.019 CiteScore 2.15
Scopus rating (2013): SJR 0.79 SNIP 0.967 CiteScore 2.23
Scopus rating (2012): SJR 1.049 SNIP 1.073 CiteScore 2.58
Scopus rating (2011): SJR 1.04 SNIP 1.124 CiteScore 2.88
Scopus rating (2010): SJR 1.062 SNIP 1.007
Scopus rating (2009): SJR 1.063 SNIP 1.01
Scopus rating (2008): SJR 0.828 SNIP 0.632
Scopus rating (2007): SJR 1.458 SNIP 0.71
Original language: English
DOIs:

**Bibliographical note**
Contribution: organisation=orc,FACT1=1
Portfolio EDEND: 2014-02-15
Publisher name: SpringerOpen
Source: researchoutputwizard
Source-ID: 61
Research output: Scientific - peer-review › Article

Performance of Electrically Conductive Adhesive Attached Sensors in High Temperature Cycling

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electrical Engineering
Authors: Lahokallio, S., Frisk, L.
Number of pages: 6
Pages: 698-703
Performance of passive RFID tags in a high temperature cycling test

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electrical Engineering
Authors: Lahokallio, S., Kiilunen, J., Frisk, L.
Number of pages: 5
Pages: 1-5
Publication date: 2014

Host publication information
Title of host publication: ESTC 2014, 5th Electronics System-Integration Technology Conference, September 16-18, 2014, Helsinki, Finland
Place of publication: Piscataway, NJ
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-4026-4
DOIs: 10.1109/ESTC.2014.6962848

Bibliographical note
Contribution: organisation=dee,FACT1=1<br/>Portfolio EDEND: 2014-11-30
Source: researchoutputwizard
Source-ID: 860
Research output: Scientific - peer-review › Conference contribution

Physicochemical characterization of segmented polyurethanes prepared with glutamine or ascorbic acid as chain extenders and their hydroxyapatite composites

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Cetina-Diaz, S., Chan-Chan, L., Vargas-Coronado, R., Cervantes-Uc, J., Quintana-Owen, P., Paakinaho, K., Kellomäki, M., Di Silvio, L., Deb, S., Cauich-Rodriguez, J.
Number of pages: 11
Pages: 1966-1976
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Materials Chemistry B
Volume: 2
Issue number: 14
ISSN (Print): 2050-750X
Ratings:
Polarization switching and bistability in a 1300 nm spin-VCSEL Subject to Circularly Polarized Optical Injection

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Alharti, A., Hurtado, A., Korpipäri, V., Guina, M., Henning, I., Adams, M.
Number of pages: 2
Pages: 95-96
Publication date: 2014

Host publication information
Title of host publication: IEEE Photonics Conference, IPC 2014, 12 - 16 October, 2014, San Diego, California, USA
Publisher: IEEE
ISBN (Print): 978-1-4577-1504-4

Publication series
Name: IEEE Photonics Conference
DOIs:
10.1109/IPCon.2014.6995228
Links:
http://www.ipc-ieee.org/

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-04-29<br/>Publisher name: RSC Publications
Source: researchoutputwizard
Source-ID: 213
Research output: Scientific - peer-review › Article

Post-mortem evaluation of oxidized atmospheric plasma sprayed Mn-Co-Fe oxide spinel coatings on SOFC interconnectors

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Number of pages: 11
Pages: 17284-17294
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 39
Issue number: 30
ISSN (Print): 0360-3199
Ratings:
Scopus rating (2016): CiteScore 3.74 SJR 1.142 SNIP 1.286
Preparation of Cu2O Superhydrophobic Film with Hierarchical Structure via the Facile Route

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science
Authors: Pei, M., Wang, B., Tang, Y., Zhang, X., Yan, H., Zhang, X.
Number of pages: 4
Pages: 315-318
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Asian Journal of Chemistry
Volume: 26
Issue number: 2
ISSN (Print): 0970-7077
Ratings:
Scopus rating (2016): SJR 0.151 SNIP 0.154 CiteScore 0.2
Scopus rating (2015): SJR 0.149 SNIP 0.154 CiteScore 0.19
Scopus rating (2014): SJR 0.153 SNIP 0.208 CiteScore 0.23
Scopus rating (2013): SJR 0.181 SNIP 0.412 CiteScore 0.37
Scopus rating (2012): SJR 0.17 SNIP 0.247 CiteScore 0.28
Scopus rating (2011): SJR 0.175 SNIP 0.291 CiteScore 0.29
Scopus rating (2010): SJR 0.171 SNIP 0.264
Scopus rating (2009): SJR 0.182 SNIP 0.283
Scopus rating (2008): SJR 0.206 SNIP 0.426
Scopus rating (2007): SJR 0.202 SNIP 0.49
Scopus rating (2006): SJR 0.164 SNIP 0.356
Scopus rating (2005): SJR 0.193 SNIP 0.378
Scopus rating (2004): SJR 0.241 SNIP 0.508
Properties and microstructure of HVOF thermally sprayed carbide based coatings

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Iosif, H., Utu, I., Serban, V., Vuoristo, P., Niemi, K., Koivuluoto, H.
Number of pages: 6
Pages: 261-266
Publication date: 2014

Host publication information
Title of host publication: 5th International Conference on Advanced Materials and Structures, AMS 2013; Timisoara; Romania; 24 October 2013 through 25 October 2013
Publisher: Scitec Publications Ltd.
ISBN (Print): 978-303835212-9

Publication series
Name: Solid State Phenomena
Volume: 216
Properties of GaAsBi with Bi-rich clusters

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre
Authors: Puustinen, J., Wu, M., Luna, E., Hilska, J., Guina, M.
Number of pages: 1
Pages: 58-58
Publication date: 2014

Host publication information
Title of host publication: Optics and Photonics Days 2014, OPD2014 Proceedings, 20-22 May, 2014, Turku, Finland
Publisher: Finnish Optical Society
ISBN (Print): 978-952-12-3055-4

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2015-01-22<br/>Publisher name: Scitec Publications Ltd.
Source: researchoutputwizard
Source-ID: 539
Research output: Scientific › peer-review › Conference contribution

Properties of WC-FeCrAl coatings manufactured by different high velocity thermal spray processes

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Bolelli, G., Hulka, I., Koivuluoto, H., Lusvarghi, L., Milanti, A., Niemi, K., Vuoristo, P.
Number of pages: 16
Pages: 74-89
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Surface and Coatings Technology
Volume: 247
ISSN (Print): 0257-8972
Ratings:
Scopus rating (2016): CiteScore 2.56 SJR 0.874 SNIP 1.359
Scopus rating (2015): SJR 0.871 SNIP 1.415 CiteScore 2.46
Scopus rating (2014): SJR 0.998 SNIP 1.681 CiteScore 2.44
Scopus rating (2013): SJR 1.057 SNIP 1.859 CiteScore 2.58
Scopus rating (2012): SJR 1.049 SNIP 1.658 CiteScore 2.2
Scopus rating (2011): SJR 1.053 SNIP 1.851 CiteScore 2.38
Scopus rating (2010): SJR 1.155 SNIP 1.66
Scopus rating (2009): SJR 1.449 SNIP 1.526
Scopus rating (2008): SJR 1.479 SNIP 1.564

Bibliographical note
Contribution: organisation=orc,FACT1=1<br/>Portfolio EDEND: 2014-10-24<br/>Publisher name: Finnish Optical Society
Source: researchoutputwizard
Source-ID: 1315
Research output: Scientific › Conference contribution
Protective coatings of electronics under harsh thermal shock

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering
Authors: Pippola, J., Marttila, T., Frisk, L.
Number of pages: 5
Pages: 2048-2052
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Microelectronics Reliability
Volume: 54
Issue number: 9-10
ISSN (Print): 0026-2714
Ratings:
Scopus rating (2016): CiteScore 1.57 SJR 0.47 SNIP 0.976
Scopus rating (2015): SJR 0.618 SNIP 1.193 CiteScore 1.81
Scopus rating (2014): SJR 0.601 SNIP 1.432 CiteScore 1.9
Scopus rating (2013): SJR 0.594 SNIP 1.264 CiteScore 1.55
Scopus rating (2012): SJR 0.586 SNIP 1.414 CiteScore 1.6
Scopus rating (2011): SJR 0.621 SNIP 1.382 CiteScore 1.63
Scopus rating (2010): SJR 0.602 SNIP 1.114
Scopus rating (2009): SJR 0.736 SNIP 1.176
Scopus rating (2008): SJR 0.932 SNIP 1.235
Scopus rating (2007): SJR 0.743 SNIP 1.228
Scopus rating (2006): SJR 0.716 SNIP 1.153
Scopus rating (2005): SJR 0.514 SNIP 1.009
Scopus rating (2004): SJR 0.537 SNIP 0.823
Scopus rating (2003): SJR 0.472 SNIP 0.786
Scopus rating (2002): SJR 0.592 SNIP 0.756
Scopus rating (2001): SJR 0.411 SNIP 0.694
Scopus rating (2000): SJR 0.349 SNIP 0.382
Scopus rating (1999): SJR 0.22 SNIP 0.562
Original language: English
DOIs: 10.1016/j.surfcoat.2014.03.021

10.1016/j.microrel.2014.07.106
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-μm-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.

Reliability of adhesive joined thinned chips on flexible substrates under humid conditions

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering
Authors: Frisk, L., Saarinen-Pulli, K.
Number of pages: 6
Pages: 2058-2063
Review of railway track applications of Barkhausen noise and other magnetic testing methods

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Civil Engineering, Department of Materials Science, Engineering materials science and solutions (EMASS), Life Cycle Effectiveness of the Built Environment (LCE@BE)
Authors: Santa-aho, S., Sorsa, A., Nurmikolu, A., Vippola, M.
Number of pages: 7
Pages: 657-663
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Insight
Volume: 56
Issue number: 12
ISSN (Print): 1354-2575
Ratings:
Scopus rating (2016): SJR 0.362 SNIP 0.584 CiteScore 0.65
Scopus rating (2015): SJR 0.3 SNIP 0.666 CiteScore 0.58
Scopus rating (2014): SJR 0.402 SNIP 0.629 CiteScore 0.53
Scopus rating (2013): SJR 0.44 SNIP 0.87 CiteScore 0.6
Scopus rating (2012): SJR 0.37 SNIP 0.675 CiteScore 0.42
Scopus rating (2011): SJR 0.349 SNIP 0.748 CiteScore 0.44
Scopus rating (2010): SJR 0.417 SNIP 0.882
Scopus rating (2009): SJR 0.39 SNIP 0.8
Scopus rating (2008): SJR 0.382 SNIP 0.752
Scopus rating (2007): SJR 0.413 SNIP 0.787
Scopus rating (2006): SJR 0.48 SNIP 0.692
Scopus rating (2005): SJR 0.414 SNIP 0.865
Scopus rating (2004): SJR 0.387 SNIP 0.843
Scopus rating (2003): SJR 0.462 SNIP 0.778
Scopus rating (2002): SJR 0.271 SNIP 0.915
Scopus rating (2001): SJR 0.306 SNIP 0.579
Scopus rating (2000): SJR 0.211 SNIP 0.463
Scopus rating (1999): SJR 0.243 SNIP 0.54
Original language: English
DOIs:
10.1784/insi.2014.56.12.657

Review on Liquid Flame Spray in paper converting: Multifunctional superhydrophobic nanoparticle coatings
Wettability of a solid surface by a liquid plays an important role in several phenomena and applications, for example in adhesion, printing, and coating. Especially, wetting of rough surfaces has attracted a considerable scientific interest in recent decades. Superhydrophobic surfaces, which possess extraordinary water repellency properties due to their low surface energy chemistry and specific nano- and microscale roughness, are of particular interest due to the great variety
of potential applications ranging from self-cleaning surfaces to microfluidic devices. Here we examine functional superhydrophobic and superhydrophilic nanoparticle coatings fabricated by liquid flame spray (LFS) on cellulose-based substrate materials. The article is a review of earlier papers with some new results and conclusions added. LFS has proved itself straightforward and versatile one-step method to fabricate broad range of functional nanoparticle coatings on various substrate materials in an atmospheric roll-to-roll process. It has established itself among the most potential candidates for large-scale production of superhydrophobic coatings on affordable cellulose-based substrates.

General information
State: Published
Ministry of Education publication type: A2 Review article in a scientific journal
Organisations: Department of Materials Science, Department of Physics, Research area: Aerosol Physics, Research group: Aerosol Synthesis, Engineering materials science and solutions (EMASS)
Authors: Teisala, H., Tuominen, M., Haapanen, J., Aromaa, M., Stepień, M., Mäkelä, J. M., Saarinen, J. J., Toivakka, M., Kuusipalo, J.
Number of pages: 13
Pages: 747-759
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 29
Issue number: 4
ISSN (Print): 0283-2631
Ratings:
Scopus rating (2016): CiteScore 1.2 SJR 0.385 SNIP 0.652
Scopus rating (2015): SJR 0.375 SNIP 0.787 CiteScore 0.91
Scopus rating (2014): SJR 0.444 SNIP 0.823 CiteScore 0.99
Scopus rating (2013): SJR 0.389 SNIP 0.684 CiteScore 0.71
Scopus rating (2012): SJR 0.628 SNIP 1.281 CiteScore 1.13
Scopus rating (2011): SJR 0.582 SNIP 0.902 CiteScore 0.78
Scopus rating (2010): SJR 0.658 SNIP 0.764
Scopus rating (2009): SJR 1.167 SNIP 0.984
Scopus rating (2008): SJR 0.928 SNIP 0.857
Scopus rating (2007): SJR 2.018 SNIP 1.035
Scopus rating (2006): SJR 1.002 SNIP 0.951
Scopus rating (2005): SJR 1.181 SNIP 0.997
Scopus rating (2004): SJR 2.08 SNIP 1.354
Scopus rating (2003): SJR 2.952 SNIP 1.129
Scopus rating (2002): SJR 1.836 SNIP 1.145
Scopus rating (2001): SJR 1.12 SNIP 1.147
Scopus rating (2000): SJR 1.086 SNIP 1.154
Scopus rating (1999): SJR 1.086 SNIP 1.001
Original language: English
Keywords: Cellulose, Functional coating, Liquid flame spray, Nanoparticle coating, Review, Superhydrophobic
DOI:s:
10.3183/NPPRJ-2014-29-04-p747-759
Links:
http://www.scopus.com/inward/record.url?eid=2-s2.0-84914820253&partnerID=tZOtx3y1

Bibliographical note
Contribution: organisation=mol,FACT1=0.5<br/>
Contribution: organisation=fys,FACT2=0.5<br/>
Portfolio EDEND: 2014-12-30<br/>
Publisher name: Svenska Pappers- och Cellulosaingenioersfoereningen
Source: researchoutputwizard
Source-ID: 1611
Research output: Scientific - peer-review › Review Article
Sedimentation stability and rheological properties of ionic liquid-based bidisperse magnetorheological fluids

The sedimentation stability and rheological properties of ionic liquid-based magnetorheological fluids comprising a mixture of micron- and nano-sized particles were experimentally studied. Three different fluids with the same total particle concentration of 15 vol% were prepared for testing: one containing only microparticles and two others in which 5 or 10 wt% of the microparticles were replaced by nanoparticles. The nanoparticles were surface stabilized against oxidation. For comparison purposes, silicon oil-based magnetorheological fluids with similar solid fractions were also prepared and tested. The results indicate that, with ionic liquid as a carrier fluid, the addition of nanoparticles at 10 wt% reduces the sedimentation rate almost by an order of magnitude from that without nanoparticles, while the reduction in the dynamic yield stress is only marginal. The ionic liquid-based fluids also had a better dispersion of particles.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mechanical Engineering and Industrial Systems, Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Jönkkäri, I., Isakov, M., Syrjälä, S.
Number of pages: 10
Pages: 2256-2265
Publication date: 2014
Selective morphologies of MgO via nanoconfinement on y-Al2O3 and reduced graphite oxide (rGO): improved CO2 capture capacity at elevated temperatures

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Zhang, X., Qui, K., Levänen, E., Guo, X. Z.
Number of pages: 7
Pages: 8825-8831
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: CrystEngComm
Issue number: 16
ISSN (Print): 1466-8033
Ratings:
Scopus rating (2016): SJR 1.043 SNIP 0.904 CiteScore 3.37
Scopus rating (2015): SJR 1.063 SNIP 0.999 CiteScore 3.83
Scopus rating (2014): SJR 1.131 SNIP 1.11 CiteScore 3.97
Scopus rating (2013): SJR 1.079 SNIP 1.11 CiteScore 3.81
Scopus rating (2012): SJR 1.253 SNIP 1.142 CiteScore 3.83
Semiconductor disk lasers for precision spectroscopic applications

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre
Authors: Leinonen, T., Chen, M., Alford, W. J., Shirakawa, A., Fetzer, G. J., Sandolphon, A., Tavast, M., Ranta, S., Guina, M.
Number of pages: 1
Pages: 30-30
Publication date: 2014

Host publication information
Title of host publication: Optics and Photonics Days 2014, OPD2014 Proceedings, 20-22 May, 2014, Turku, Finland
Publisher: Finnish Optical Society
ISBN (Print): 978-952-12-3055-4

Publication series
Name: Optics and Photonics Days

Bibliographical note
Invited talk<br>Contribution: organisation=orc,FACT1=1<br>Portfolio EDEND: 2014-10-24<br>Publisher name: Finnish Optical Society
Source: researchoutputwizard
Source-ID: 914
Research output: Scientific › Conference contribution

Semiconductor disk laser with a semiconductor dielectric-metal mirror

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Research group: Surface Science, Frontier Photonics
Authors: Rantamäki, A., Saarinen, E. J., Lyytikäinen, J., Lahtonen, K., Valden, M., Okhotnikov, O. G.
Number of pages: 1
Pages: 1-1
Publication date: 2014
Sequential stress combinations in product level reliability testing of industrial electronics

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electrical Engineering
Authors: Pippola, J., Marttila, T., Frisk, L.
Number of pages: 5
Pages: 738-742
Publication date: 2014

Host publication information
Title of host publication: The 16th Electronics Packaging Technology Conference, EPTC 2014, 3-5 December 2014, Marina Bay Sands, Singapore
Place of publication: Piscataway, NJ
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-6994-4
Links:
http://www.eptc-ieee.net/

Bibliographical note
Contribution: organisation=dee,FACT1=1<br/>Portfolio EDEND: 2014-12-30
Source: researchoutputwizard
Source-ID: 1277
Research output: Scientific - peer-review › Conference contribution

SESAM Mode-Locked Red Praseodymium Laser

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Frontier Photonics
Authors: Gaponenko, M., Metz, P., Härkönen, A., Heuer, A., Leinonen, T., Guina, M., Südmeyer, T., Huber, G., Kränkel, C.
Number of pages: 3
Pages: 6939-6941
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Optics Letters
Volume: 39
Issue number: 24
ISSN (Print): 0146-9592
Ratings:
Scopus rating (2016): CiteScore 3.54 SJR 1.864 SNIP 1.658
Silane-modified substratum improves cell attachment of human embryonic stem cell-derived retinal pigment epithelial cells

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Optoelectronics Research Centre, Research group: Surface Science, Univ Tampere, University of Tampere, BioMediTech, BMT FM5, BioMediTech
Authors: Juuti-Uusitalo, K., Sorkio, A. E., Käpylä, E. M. K., Teymouri, S., Lahtonen, K. T., Vuori, A. M., Valden, M. O., Skottman, H., Kellomäki, M. A. E.
Pages: 3996
Publication date: 2014

Host publication information
Title of host publication: Investigative Ophthalmology & Visual Science
Volume: 55
Publisher: Association for Research in Vision and Ophthalmology
Edition: 13
Article number: 3996 - D0055
ISBN (Print): 0146-0404
ISBN (Electronic): 1552-5783
Links: http://iovs.arvojournals.org/article.aspx?articleid=2269472&resultClick=1

Bibliographical note
xabstract
Research output: Scientific › Conference contribution

Single-frequency 1178 nm SDL/Yb-PBGF MOPA with an output power of 31 W

General information
State: Published
Single site-controlled quantum dot in micropillar cavity

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Optoelectronics Research Centre
Authors: Hakkarainen, T. V., Tommila, J., Belykh, V., Heinonen, E., Schramm, A., Guina, M.
Number of pages: 1
Pages: 17-17
Publication date: 2014

Host publication information
Title of host publication: Optics and Photonics Days 2014, OPD2014 Proceedings, 20-22 May, 2014, Turku, Finland
Publisher: Finnish Optical Society
ISBN (Print): 978-952-12-3055-4

Publication series
Name: Optics and Photonics Days

Bibliographical note
Oral, Session 3, Integrated optics
Contribution: organisation=orc,FACT1=1
Portfolio EDEND: 2014-10-24
Publisher name: Finnish Optical Society
Source-ID: 393
Research output: Scientific - peer-review » Conference contribution

Sliding Wear of Quartzite and Granite Surfaces

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science
Authors: Heino, V., Valtonen, K., Kuokkala, V.
Number of pages: 6
Publication date: 2014
Slurry pot investigation of the influence of erodent characteristics on the erosion resistance of austenitic and duplex stainless steel grades

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science
Authors: Lindgren, M., Perolainen, J.
Number of pages: 11
Pages: 38-48
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Wear
Issue number: 319
ISSN (Print): 0043-1648
Ratings:
Scopus rating (2016): CiteScore 3 SJR 1.558 SNIP 2.071
Scopus rating (2015): SJR 1.527 SNIP 2.017 CiteScore 2.73
Scopus rating (2014): SJR 1.715 SNIP 2.38 CiteScore 2.46
Scopus rating (2013): SJR 1.319 SNIP 2.416 CiteScore 2.37
Scopus rating (2012): SJR 1.36 SNIP 2.178 CiteScore 1.85
Scopus rating (2011): SJR 1.547 SNIP 2.865 CiteScore 2.43
Scopus rating (2010): SJR 1.509 SNIP 2.153
Scopus rating (2009): SJR 1.684 SNIP 2.07
Scopus rating (2008): SJR 1.597 SNIP 1.863
Scopus rating (2007): SJR 1.286 SNIP 1.889
Scopus rating (2006): SJR 1.435 SNIP 2.036
Scopus rating (2005): SJR 1.473 SNIP 2.007
Scopus rating (2004): SJR 1.335 SNIP 1.965
Scopus rating (2003): SJR 1.104 SNIP 1.788
Scopus rating (2002): SJR 0.958 SNIP 1.365
Scopus rating (2001): SJR 0.937 SNIP 1.47
Scopus rating (2000): SJR 1.069 SNIP 1.149
Scopus rating (1999): SJR 0.848 SNIP 1.338
Original language: English
DOI: 10.1016/j.wear.2014.07.006

Bibliographical note
Contribution: organisation=mol,FACT1=1<br/>Portfolio EDEND: 2014-10-30
Publisher name: Elsevier
Source: researchoutputwizard
Source-ID: 949
Research output: Scientific - peer-review › Article

Stakeholders’ perspectives Shok’n’ Roll - from Science to Solutions