JOINT EVENT

26th International Conference on

Advanced Nanotechnology

&

2nd Edition of International Conference on

Materials Technology and Manufacturing Innovations

October 04-05, 2018 Moscow, Russia

Plenary

Day 1

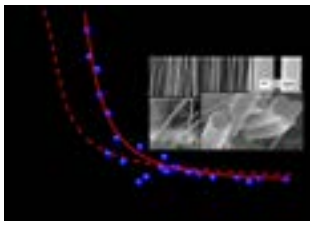
Arkadii Arinstein, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Arkadii Arinstein

Technion–Israel Institute of Technology, Israel

Size-dependent behavior of electrospun polymer nanofibers

Some open problems concerning polymer materials of reduced sizes and dimensions are discussed. The lecture will focus on the mechanical and thermodynamic properties of polymer nanofibers fabricated through electro-spinning which have attracted much attention recently because of their unique features compared to the bulk. More specifically, electrospun polymer nanofibers demonstrate so-called "size-dependent behavior" when thermo-mechanical properties of material start to depend on fiber's diameter, if their diame-ters are small enough. For example, abrupt increase in polymer nanofiber elastic mod-ulus has been observed when diameters drop below a certain value. In addition, temperature dependence of elastic modu-lus is highly influenced by fiber diameter. Also, a shift in the glass transition and melting temperatures is observed. The physical aspects of the problem in question will be discussed. The key point of the proposed speculations is based on con-finement concept: it is assumed that size-dependent behavior is related to confine-ment of non-equilibrium supermolecular microstructure of electrospun polymer nanofibers which is formed during their fabrication.



Recent Publications

1. A Arinstein, M Burman, O Gendel-man and E Zussman (2007) The ef-fect of supermolecular structure on polymer nanofiber elasticity Nature Nanotechnology 2:59-62.
2. A Arinstein (2017) Electrospun Pol-ymer Nanofibers. Pan Stanford Pub-lishing ISBN-9789814745277.

Biography

Arkadii Arinstein has completed his PhD in Theoretical and Mathematical Physics at the Landau Institute for Theoretical Physics-Russian Academy of Sci-ences in 1982. For many years, he worked at Semenov Institute for Chemical Physics of the Russian Academy of Sci-ences where he has completed his DSc in Chemical Physics in 1995. Now, he is the Research-Professor at the Technion−Israel Institute of Technology. His research interests include "Statistical physics of polymers and, non-linear phenomena and kinetic processes in disordered systems". In the last 10 years, his studies are devoted to the physics of electrospun polymer nanofibers.

mearin@technion.ac.il

Elazar Y Gutmanas, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

26th International Conference on **Advanced Nanotechnology**
&
2nd Edition of International Conference on
Materials Technology and Manufacturing Innovations
October 04-05, 2018 Moscow, Russia

Elazar Y Gutmanas

Technion-Israel Institute of Technology, Israel

Biodegradable load-bearing nanocomposites for controlled drug delivery and damaged bone repair

The requirement for new bone to replace or restore the function of damaged or lost bone, including cases of tumor resection, is a major clinical and socioeconomic need. Bone grafting is intended to stimulate bone healing and fill bone defects. Load-bearing ability of grafts is very important to avoid additional surgery, needed if implant fixation and fasteners are used and should be removed. One of the research strategies in last years is development of biodegradable graft substitutes. Biodegradable implantable devices should slowly degrade over time and disappear with ingrown natural bone replacing the synthetic graft. Finally no foreign material is left behind, allowing complete tissue regeneration without the risk of chronic inflammation or long term immune response and stress shielding related bone atrophy. We present a short review on processing and properties, including *in vitro* degradation, of load bearing biodegradable nanocomposites and of macroporous 3D scaffolds for bone ingrowth. Nanostructuring of biodegradable β-TCP-polymer, β-TCP-metal, Fe-Ag and Fe-Fe_2O_3 composites is achieved employing high energy attrition milling of powder blends, followed by high pressure consolidation at ambient temperature and densities close to theoretical retention of nanoscale structure. The strength of developed nanocomposites is significantly higher as compared with micronscale composites of the same or similar composition. The developed nanocomposites supported the attachment the human osteoblast cells and exhibited no signs of cytotoxicity. Interconnected system of nanopores formed during processing of nanocomposites is used for incorporation of drugs, including antibiotics and anticancer drugs and can be used for loading of bioactive molecules enhancing bone ingrowth.

Biography

Elazar Y Gutmanas has completed his PhD at the Institute of Solid State Physics, Academy of Sciences of USSR in 1970. He immigrated from the USSR and joined Technion in 1974. He investigated dislocation mobility and mechanisms of plastic deformation. He developed near-net shape processing method-cold sintering/high pressure consolidation of powders at ambient temperature and together with Prof Irena Gotman; powder immersion reaction assisted coating-PIRAC and reactive forging–processing of dense ceramic matrix composites employing pressure assisted exothermic reactions. Currently cold sintering is used for processing of load-bearing bioresorbable nanocomposites for orthopedic implants.

gutmanas@technion.ac.il

Notes:

Valyaev Alexandr, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Valyaev Alexandr

Nuclear Safety Institute RAS, Russia

Ways to accelerate nanotechnologies implementation in the health care system

Commercialization of nanotechnologies in Russian Health Care System RHCS requires detail analysis of all obstacles. Here we discuss 3 problems: Prof. Ilizarov's apparatus; 'Perftorun', known as 'blue blood' therapy of Russian prof. Beloyartsev; 'Litar' and artificial bone technology of Prof. Krasnov, used to replace bones defects. We look into challenges of Russian nanotechnology clusters and education. Prof. Petrov, coauthor of our communication, has his own rich experience in implementing new nanotechnologies, used to treat injured military personnel in Russian armed conflicts, such as Chechen war. Russian technology innovations require 30 - 40 years for commercialization, 5 - 10 years in USA . Substantial investment capital significant stringent requirements and high chance of technology failure in preclinical or clinical trials hinder this development in developed countries. Stringent regulatory approval state process further increases time and cost its moving to the market. Patent protection is often key strategy to attract multimillion investment required for early stage transition of medical technology into commercial product. Our proposal is to enhance commercial translation of 3 above mentioned organizations. Then enable treatment of severe bone fractures and injuries, where patient's own tissues cannot be employed. These technologies were validated through surgical procedure performed in military. RHCS authorities are evaluated based on how efficiently they conduct certification and regulatory approval of new medical technologies.

Recent Publications

1. A.N. Valyaev, S.V. Kazakov, A.A. H. D. Passell et. al . "Assessments of Risks and Possible Ecological and Economic Damages from Large-Scale Natural and Man-Induced Catastrophes in Ecology-Hazard Regions of Central Asia and the Caucasus." In NATO Science for Peace and Security Series -C: Environmental Security, Proc. of NATO Advanced Research Workshop: "Prevention, Detection and Response to Nuclear and Radiological Threat", May 2-7, 2007 Yerevan, Armenia, Editors: S. Apikyan et. al. Published House: Springer, Netherlands, 2008, pp. 281-299
2. G.M. Aleksanyan, A.N .Valyaev, K I. Pyuskyulyan. "Several approaches to the solution of water contamination problems in transboundary rivers, crossing the territory of Armenia" in NATO Science Series: Proc. of NATO Advanced Research Workshop: "Nuclear Risk in Central Asia", Kazakhstan, Almaty, June 20-22, 2006. Editors: B. Salbu and L. Skipperud, Published House: Springer Science +Business Media B.V. 2008, Netherlands, pp. 201-211.
3. A.N. Valyaev, S.V. Kazakov, A.A. H. D. Passell et. al . "Assessments of Risks and Possible Ecological and Economic Damages from Large-Scale Natural and Man-Induced Catastrophes in Ecology-Hazard Regions of Central Asia and the Caucasus." in NATO Science for Peace and Security Series -C: Environmental Security, Proc. of NATO Advanced Research Workshop: "Nuclear Risk in Central Asia", Kazakhstan, Almaty, June 20-22, 2006. Editors: B. Salbu and L. Skipperud, Published House: Springer Science +Business Media B.V. 2008, Netherlands, pp. 133-149.

Biography

Valyaev Alexander Nikiforovich was born on May 15, 1949. He graduated from the high school in 1966 and began studying at the Tomsk Polytechnic University (THU), Siberian Tomsk city. He graduated TPU with honors in 1972 as an electromechanical engineer. He studied in doctoral studies in the Pedagogical University in Kazakhstan Almaty city. In 1998 he successfully defended the doctoral dissertation “Radiation Induced and Mechanical Effects in Solids as a Result of High Intensity Electron and Ion Beams” Then he continued the work as EKSTU professor. From 2000 till present my family live in Moscow. At first he worked as a leading researcher in the Department of Applied Engineering in “Conversion" plant in Balashikha city, Moscow Region. From 2001 to the present time he is the Leading Researcher, Professor, Doctor of Sciences in the Division of Ecological Safety and Radiation Risk of Nuclear Safety Institute of Russian Academy of Sciences in Moscow.

anvalyaev@mail.ru

Notes:

Kolan Madhav Reddy, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Kolan Madhav Reddy

Shanghai Jiao Tong University, China

Nanoscale deformation characterization of light-weight ceramics

Lightweight ceramics often composes of oxides, nitrides, carbides and borides have recently gained technological importance or even still at the development stage with regard to future applications. Therefore experimental observations of the atomic structure and their deformation mechanisms of lightweight ceramics are of extreme importance in understanding and tailoring the materials properties. In this presentation, author will demonstrate the atomic imaging of boron-rich solids (i.e., B_4C and B_6O) using newly developed annular bright field scanning transmission electron microscopy (ABF-STEM) technique. The atomistic observations upon deformation provide the direct evidence for the intragranular amorphous shear bands in both these brittle ceramics. To reduce the brittleness, nano-crystalline B_4C (n-B_4C) microstructure with a homogenous distribution of nano-sized pores and amorphous carbon at grain boundaries (GBs) was synthesized at relatively low temperatures. Transmission electron microscopy (TEM) of n-B_4C reveals that the unusual nanosize effect arises from the deformation reduced elimination of nano-porosity mediated by grain boundary sliding with the assistance of the soft boundary phases. Finally, our recent observations combined with computer simulations reveals GB sliding leads to the amorphous band formation at pre-distorted icosahedral GB regions with initiation of cavitation within the amorphous bands. These theoretical and experimental results provide an atomistic explanation for the influence of GBs on the deformation behavior of nano-crystalline ceramics. .

Biography

Kolan Madhav Reddy has completed his PhD in Materials Science and Engineering at Tohoku University, Japan and Postdoctoral research at Johns Hopkins University, USA. He is currently an Associate Professor in School of Materials and Engineering at Shanghai Jiao Tong University, China. He has authored and co-authored more than 25 peer-reviewed papers and filed a patent.

kmreddy@sjtu.edu.cn

Notes:

Hemant Parmar, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Hemant Parmar

Ujjain Engineering College, India

Application of artificial neural networks for the prediction of performance of desiccant material for desiccant cooling system

Desiccant cooling system (DCS) is an alternate suitable option against conventional cooling system in humid climates. A typical system combines a dehumidifier that uses dry desiccant wheel with desiccant material, with direct or indirect evaporative systems and a sensible cooling system. DCS is the environmental protection technique for cooling purpose of the building. Desiccant wheel is main key component of the DCS and this wheel has desiccant material. The desiccant materials may be a suitable option for better use of evaporative cooling techniques in warm and humid climate. The dehumidification of air by adsorption is a physical process by desiccant materials that attracts the molecules of water present in air on the adsorbent surface. Desiccant materials attract moisture from the air by creating an area of low vapour pressure at the surface of desiccant. Some common adsorbents used are SiO_2 (Silica gel), LiCl, Al_2O_3 (Activated alumina), LiBr and Zeolite. This system reduces the level of chlorofluorocarbons (CFC) in the environment because it restricts the use of conventional refrigerant. An Artificial Neural Network (ANN) was constructed to predict symptoms of desiccant wheel for any climatic conditions. The symptoms of desiccant wheel were outlet specific humidity and outlet dry bulb temperatures. Feed-forward network was employed with resilient back-propagation (*trainrp*) algorithm used as the training function. The outputs from the network were obtained and validated with the experimental results. Among the constructed networks, the best prediction performance was observed in two-hidden-layered network with minimum error. The modeling of the desiccant wheel was carried out with neural network toolbox of MATLAB® with two inputs (specific humidity and temperature at inlet) and two outputs (specific humidity and temperature at outlet) values. The performance index (Mean square error) for specific humidity and temperature were calculated as 0.00209 and 0.00579 respectively. The proposed model may be used for any climatic conditions to predict the output from the desiccant wheel for the design of the solid desiccant based cooling system in humid climate.

Recent Publications

1. Parmar H., Hindoliya D.A., 2013, "Performance of solid desiccant based evaporating cooling system under the climatic zones of India". International Journal of Low Carbon Technologies, vol.8, pp 52-57.
2. Parmar H., Hindoliya D.A., 2011, "Artificial Neural Network based modeling of Desiccant Wheel". Energy and Buildings, vol.43, pp 3505-3513.
3. Parmar H., Hindoliya D.A., 2011, "Solid Desiccant Cooling System Employed with Ventilation Cycle". Journal of Institution of Engineers (Springer), DOI 10.1007/s40032-012-0038-9.

4. Parmar H., Hindoliya D.A., 2011, "Desiccant Cooling System for Thermal Comfort: A Review". International Journal of Engineering Science and Technology, vol.3, pp 4218-4227.
5. Parmar H., Hindoliya D.A., 2018, "Studies on Job Satisfaction Level Among Employees of Dairy Based Industry". Journal of Industrial Engineering, Accepted, In Press.

Biography

Hemant Parmar has expertise in the field of Desiccant Material and Desiccant Cooling System for thermal comfort. He is also an expert in the field of Energy and Environment. He has published many research papers in different areas. His work on the Desiccant Cooling System creates new pathways for protection of the environment to reduce CFC level.

hemant_parmar1@rediffmail.com

Notes:

Shlomo Berger, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Shlomo Berger

Technion-Israel Institute of Technology, Israel

Developement of dielectric nano-crystal structures for highly sensitive piezoelectric detectors

Nanocrystals made of nonlinear dielectric materials were grown inside alumina nano pores. The nano crystals are characterized by a low dielectric permittivity (such as sodium nitrite, glycine, alanine and lithium sulphate) required for a high detection sensitivity of a small applied mechanical pressure (lower than 1 Pa). The crystals were grown inside alumina nano pores arranged in a highly dense array (1011 pores/cm2) oriented in vertical to the aluminum substrate plane. The pores have a major role in the nucleation and growth of the nano crystals with preferred crystallographic orientations along the longitudinal axis of the pores. The preferred crystallographic orientation of the nano crystals can be controlled and changed by the growth process parameters. The surface morphology, microstructure and composition of the crystals were characterized. The piezoelectric response of the nanocrystals inside the pores was measured at an applied mechanical pressure range of 0.1-100 Pa. The mechanism of nucleation and growth of the nano crystals inside the alumina pores will be discussed. A correlation between the crystallographic orientation of the crystals and their piezoelectric sensitivity will be presented.

Biography

Shlomo Berger has completed his PhD from the Technion Institute of Technology, Israel. He completed one year of a Postdoctoral degree at Harvard University, USA. Since then, he is a Faculty Member in the Faculty of Materials Science and Engineering, Technion, Israel. He has been studying dielectric nano crystals over the past 15 years focusing on pyroelectric and piezoelectric properties of non-linear dielectric nano crystals. His research group developed a unique process of growing low - k nano crystals with preferred crystallographic orientations leading to a highly sensitive detection of heat and mechanical pressure. He presented his research work in many invited talks and reviewed scientific papers.

berger@tx.technion.ac.il

Notes:

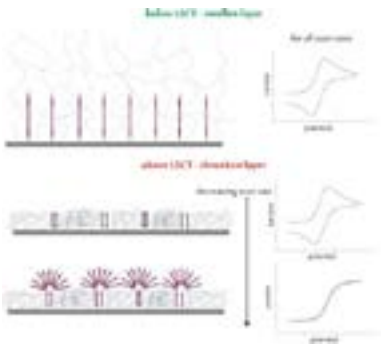
Zbigniew Jan Stojek, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Zbigniew Jan Stojek

University of Warsaw, Poland

Modification of electrodes with a thin film of environmentally sensitive gel to get micro and nano electrode-array behavior

Polymer layers were frequently deposited on electrode surfaces to achieve their desired electrochemical and physicochemical properties. A new trend appeared recently. It is the formation of the so-called intelligent interfaces. They can be obtained by the deposition of a thin layer, on the electrode surface, of a hydrogel that is environmentally-sensitive. This procedure was used to build and develop sensors, biosensors, fuel cells, switchable ON-OFF electrodes, and memimpedance systems. It is well known that in a non-conductive, porous layer that is deposited on the electrode surface, the transport of an electroactive molecule to that surface proceeds rather through the gel channels. In parallel, it was reported; that in the case of non-electro active layers it was possible to obtain very different voltammetric responses. The type of response depended on the structure of the layer and the rate of the potential sweep. In this work, we report the results obtained with electrodes modified with a very thin layer of environmentally sensitive hydrogel. Two methods were used in the preparation of the layers: electrochemically induced polymerization and self-assembling of nano/microgel spheres. The main component of the gels was poly (N-isopropylacrylamide). In the second method, the crosslinkers containing the –S-S- groups were added to the initial mixture of the monomers. Both: swollen or shrunken states of the hydrogel layers were employed in the investigation of the transport of an external redox probe. Depending on the scan rate and the state of the film the voltammetric behavior resembled that of a set of nano/micro-electrodes or that of linear diffusion.



Recent Publications

1. Katz E (2016) Modified Electrodes and Electrochemical Systems Switchable by Temperature Changes. Electroanalysis 28:1916-29.
2. Kaniewska K, Karbarz M, Stojek Z (2015) Electrochemical attachment of thermo- and pH-sensitive interpenetrating-polymers-network hydrogel to conducting surface. Electrochimica Acta 179:372-8.
3. Karbarz M, Mackiewicz M, Kaniewska K, Marcisz K, Stojek Z (2017) Recent developments in design and functionalization of micro- andnanostructural environmentally-sensitive hydrogels based onN-isopropylacrylamide. Applied Materials Today 9:516-32.
4. Menshykau D, Compton RG (2009) Electrodes modified with electroinactive layers: distinguishing through-film transport from pinhole (pore) diffusion. Langmuir 25:2519-29.

Biography

Zbigniew Jan Stojek is a chemistry professor at Faculty of Chemistry, University of Warsaw. He is an expert in application of functionalized microgels in the drug delivery systems and in construction of sensors and biosensors. He is also active in developing new methodologies in electrochemistry and electroanalysis.

stojek@chem.uw.edu.pl

Notes:

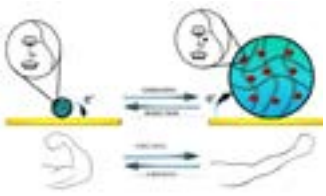
Marcin Karbarz, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Marcin Karbarz

University of Warsaw, Poland

Controlling microgel size by electrochemically induced volume phase transition

Microgels are polymer hydrogels or macromolecules that form, in a micro scale, three-dimensional networks filled with a solvent. Microgels are characterized by low viscosity and very high surface area, but the most intriguing property of these materials is their ability to change substantially their volume. This phenomenon is called the volume phase transition and is observed as the response of a polymer network to an external stimulus, such as change in temperature, pH, ionic strength and magnetic/electric field. In microgels, the change in volume is great and it is much quicker compared to regular-size hydrogels. These properties are useful in such potential applications as controlled drug delivery systems; catalysis and sensors. We have successfully synthesized a novel microgel the volume of which could be changed by using an electrochemical trigger. At appropriate potential and at human-body temperature the volume change was unusually high by more than one order of magnitude. The starting material was a thermoresponsive microgel built from N-isopropylacrylamide, sodium acrylate and N, N'-bisacryloylcystine as the cross linker. The gel has been modified with aminoferrocene through amid-bond formation. The influence of oxidation state of the ferrocene groups in the micro-gel on volume phase transition temperature was determined. The -S-S- groups from the N, N'-bisacryloylcystine linker were employed in the chemisorption of the microgels on the Au electrode surface and the formation of gel monolayers. It appeared that the microgel layers could be either in the shrunken or the swollen state depending on the oxidation number of the iron atoms in the ferrocene groups. The oxidation number could be changed electrochemically and the shrunken-swollen transformation could be repeated reversibly many times. The properties of the obtained materials were examined with dynamic light scattering technique, UV-V is spectroscopy, SEM and TEM microscopies and cyclic voltammetry.



Recent Publications

1. Karbarz M, Mackiewicz M, Kaniewska K, Marcisz K, Stojek Z (2017) Recent developments in design and functionalization of micro- and nanostructural environmentally-sensitive hydrogels based on N-isopropylacrylamide. Applied Materials Today 9:516-532.

2. Marcisz K, Romanski J, Stojek Z, Karbarz M (2017) Environmentally sensitive hydrogel functionalized with electroactive and complexing-iron(III) catechol groups. Journal of Polymer Science, Part A: Polymer Chemistry 55:3236-3242.
3. Mackiewicz M, Marcisz K, Strawski M, Romanski J, Stojek Z, Karbarz M (2018) Modification of gold electrode with a monolayer of self-assembled microgels. Electrochimica Acta 268:531-538.
4. Mackiewicz M, Kaniewska K, Romanski J, Augustin E, Stojek Z, Karbarz M (2015) Stable and degradable microgels linked with cystine for storing and environmentally triggered release of drugs. Journal of Materials Chemistry B 3:7262-7270.
5. Mackiewicz M, Stojek Z, Karbarz M (2017) Unusual swelling behavior of core-shell microgels built from polymers exhibiting lower critical solubility temperature. European Polymer Journal 95: 314-322.

Biography

Marcin Karbarz's scientific interest has focused on the obtaining new, advanced gel materials with the desired properties. The research is focused on functionalization of gels to get their needed properties. Among those properties are the gel abilities to undergo a volume phase transition under specified conditions, become electro-active and electro-sensitive, undergo reversible changes in their properties upon phase transition, bind/sorb certain individuals and release them in controlled manner, become sensitive to other / new environmental factors, self-heal and self-assembly.

karbarz@chem.uw.edu.pl

Notes:

Arabadzhi Vladimir Vsevolodovich, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Arabadzhi Vladimir Vsevolodovich

Institute of Applied Physics (RAS), Russia

Radio-absorbing parametric material

For parameters that are constant in time, no structure of the absorbing coating (material) can simultaneously satisfy the following four conditions: (a) effective absorption, (b) a spatial ultra-wide absorption band (i.e. the absorption efficiency is independent of the spatial frequency or angle of arrival this wave), (c) a temporary ultra-wide absorption band (i.e. the absorption efficiency does not depend on the time frequency of the incident wave), (d) the small thickness of the absorbing coating compared to the length of the absorbed wave. The microstructure of the parametric coating (material) considered in the presentation allows to simultaneously (jointly) satisfy the conditions (a)-(d) on the basis of the use of elements (optoelectronic switches, optic fibers) of high resolution in space and time. The presentation is considered with a structure (geometrically resembling a foam), consisting of a set of three-dimensional cells, separated from each other by thin walls of controlled transparency. The wall of controlled transparency is a metal grid, where linear elements are electrically connected with each other by optoelectronic switches. Each switch is controlled by pulses of laser through optic fibers. The conducting state of the switches corresponds to opaque state of walls, and the non-conducting state of switches corresponds to the transparent state of the walls. Control of walls transparency presents the alternation in time (during the control period, which is much less than minimum period of the wave to be absorbed) of relatively short time intervals of opacity and relatively long time intervals of transparency. The current distribution of the incident wave field, instantly pierced by the emerging opaque walls, becomes the initial condition for oscillations inside the cell (virtual resonator) and has time to become sufficiently small, since the minimum natural frequency is very great and defined by very small geometric dimensions of each cell.

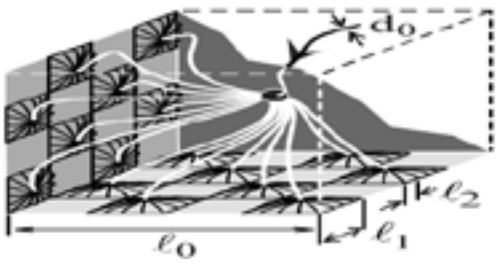


Figure: One cell of parametric material: optic fibers supplies laser pulses of light to optoelectronic switches

Recent Publications

1. Vladimir V Arabadzhi (2017) Cyclical wave bolt for electromagnetic waves. IJEAS 4(11):137-143.
2. V V Arabadzhi (2005) Nonreflecting Switching Microstructure. Journal of Communications Technology and Electronics 50(5):561-573.

3. V V Arabadzhi (2001) Absorption of Long Waves by nonresonant parametic microstructures. Radiophysics and Quantum Electronics 44(3):249-261.
4. Vladimir V Arabadzhi (2011) Solutions to Problems of Controlling Long Waves with the Help of Micro-Structure Tools, ISBN: 9781608052752, ID: 825415521, e-book Bentham Science Publishers.
5. V V Arabadzhi (2017) Cyclical Wave Bolt for Sound Waves in a Gas Stream // Adv. Sci. Technol. Eng. Syst. J. 2(6):272-274.

Biography

Arabadzhi Vladimir Vsevolodovich is a physicist at Institute of Applied Physics (RAS), Russia. He completed his PhD in 1994 at the field of Radio physics. His achievements are inventions in active wave control. His area of interests is wave thrust, reducing of acoustical and radio visibility of physical bodies.

v.v.arabadzhi@appl.sci-nnov.ru

Notes:

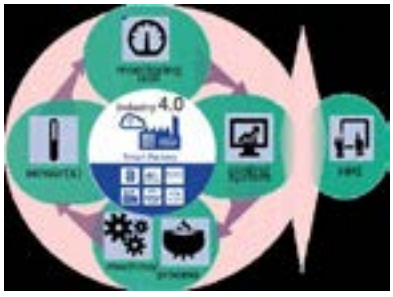
Sergey A Shevchik, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Sergey A Shevchik

Swiss Federal Laboratories for Material Science and Technology, Switzerland

Machine learning: A new paradigm for process monitoring in industry 4.0

Industry 4.0 is a new concept that incorporates multiple cutting edge technologies into a single environment and promises fast, high quality and cheap manufacturing capabilities. In this philosophy the human participation in routine tasks of the manufacturing process is minimized, or even excluded, and the process monitoring and decision making is delegated to machines. From this perspective the recent advances in machine learning (ML) are materializing the ideas of Industry 4.0 and give the directions for the further developments. The present work is an Industry 4.0 approach that employs the latest advances in ML creating monitoring systems for several industrial processes. In particular, the quality monitoring for laser welding, additive manufacturing, fracture mechanics and friction of mechanical parts is presented. Our technique relies on the measurements of the versatile physical parameters of the real processes that are unified in a single parameter space within ML framework. This information further is processed to obtain higher context information. This implies the search of the unique signatures of the momentary, quality-critical events that are extracted by the algorithms from a continuous signals flow. This approach, combined with the high sensitive detectors, allowed observing separate groups of the momentary events with a time resolution within (10-500) millisecond range thus discovering a promising precision of such systems in the future. The realization of this approach for real-time monitoring was investigated as well and the feasibility of this on the example of the laser welding was shown.



Biography

Shevchik S got his background in laser physics and bio photonics and later enriched it participating in a number of projects in machine learning and artificial intelligence. This dual expertise allowed creating a number of unique techniques, in which the artificial intelligence is employed to understand the physics of a number of industrial processes and to go beyond the human possibilities in process monitoring.

sergey.shevchik@empa.ch

Yinfeng Li, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Yinfeng Li

Shanghai Jiao Tong University, China

Mechanical properties and behaviors of low dimensional materials

With the rise of nanotechnology and the advances in interdisciplinary research, low dimensional materials (LDM) such as graphene have received intense global interest due to their unique physical and chemical properties over traditional materials. This talk is aimed to summarize our recent studies on the mechanical properties and behavior of LDM, including nanoparticles, graphene allotropies and two dimensional heterostructures, characterized using molecular dynamic simulations combining first principle calculation as well as theoretical analysis. Atomistic models of monolayer and multilayer graphene structures are constructed for the effect of surface functionalization (hydrogenation) as well as hybridization (with Boron Nitride) on the in-plane strength as well as thermal conductivity. Disclination theory is applied innovatively to the planar heterostructure with hybrid grains of graphene and hexagonal boron nitride for the key factors affecting the overall strength. Graphene multilayers with ordered interlayer characteristics are further constructed and analyzed. The coarse-grained MD simulations are performed to analyze the dynamic penetration process of LDM across a cell membrane. The evolutions of free energy as LDM piercing through the cell membrane are calculated by the innovative application of thermodynamic integration in nano-biological systems. The physical mechanisms of surface functionalization, stiffness and topological shapes on the penetrability of LDM are revealed by analyzing the change of penetration barrier and mode, and bioimaging experiments are carried out for verifications. Investigations about the principles and mechanisms of the mechanical properties and behavior of LDM are critical to its functional design and biological control.

Biography

Yinfeng Li received his Ph.D. degree from Shanghai Jiao Tong University in 2014, and now serves as an associate professor there. He has focused on the understanding of basic principles that control mechanical properties and behaviors of materials in both micro- and nano-scale. He has published 32 SCI indexed papers in high impact journals with more than 550 citations, including PNAS, JMPS, Carbon, Nanoscale, Acta Mater, etc. He has been selected in Shanghai Chenguang talent project and awarded the prestigious 'IAAM Scientist Medal' by International Association of Advanced Materials for notable and outstanding research in his field.

liyinfeng@sjtu.edu.cn

Notes:

Jason Zhang, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Jason Zhang
University of Ottawa, Canada

Bismuth-based new photocatalysts and associated photoreactors

Bismuth-based semiconductors are promising materials as visible light responsive photocatalysts due to their suitable band gaps, well-dispersed valence bands, commercial availabilities at reasonable costs, and the possibility of preparing them under mild conditions. Recent work on the preparation, characterization and activity testing of Bismuth-based photo active nanomaterials as well as associated photo reactor designs are introduced herein. In order to enhance the photocatalytic activities of the new materials, different precursors, additives, preparation procedures and process parameters, and surface treatments were tried to obtain binary and ternary heterostructures, with different doping, surface modification, nano-particle size and morphology. Application potentials of selected highly-active new catalysts were evaluated by examining the kinetics of photocatalytic degradations in compatible reactor designs. Suggestions were made for further work in the area.

Biography

Jason Zhang has completed his post-secondary education in Chemical Engineering at Hebei University of Technology, Tianjin University, and University of Waterloo respectively. He works at the University of Ottawa as a Full Professor and Vice-Dean of Engineering. He is currently on academic leave at Hebei University of Technology. He has published over 70 papers in SCI-indexed journals since 2013 and he also serves as an Editorial Board Member in *Chinese Journal of Chemical Engineering* and *Biotechnology Advances*.

zzhang@uOttawa.ca

Notes:

JOINT EVENT

26th International Conference on

Advanced Nanotechnology

&

2nd Edition of International Conference on

Materials Technology and Manufacturing Innovations

October 04-05, 2018 Moscow, Russia

Plenary

Day 2

Dondi dall'Orologio Giovanni, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Dondi dall'Orologio Giovanni

University of Bologna, Italy

Optical properties of nanocomposites

In traditional composites, micron sized particles or agglomerates typically cause significant light scattering, hampering natural restorations; in nanocomposites the particle dimensions are small enough to produce highly translucent fillings. Color, spectral reflectance (R%), scattering (S), absorption (K), translucency parameters (TP), transmittance (T%) were calculated for translucent (Trans), enamel (E), dentin (D) shades of a nanocomposite. The relative spectral radiance of each sample was measured against white and black ceramic tile backgrounds using a spectroradiometer. Specimens were measured inside a color-assessment cabinet under constant D65 CIE standard illumination; illuminating/measuring configuration corresponded to CIE d/0°. Color coordinates in CIELAB color space: L^*, a^*, b^* and the attributes of the color C^* (chroma) and h° (hue angle) were calculated from the spectral reflectance data. S and K coefficients from Kubelka-Munk theory were calculated algebraically from the spectral reflectance data of each specimen. TP values were determined by calculating the color difference in CIELAB color space between readings against black and white backgrounds for the same specimen. Statistical analysis was performed using a one-way analysis of variance (ANOVA) and Tukey's multiple comparison tests with Bonferroni correction. Tran's shades showed the lowest mean R%, S and K values and the highest mean TP and T% in comparison with E and D shades. Nanofillers enable an improvement in the material's esthetic and optical properties. There is a significant increase for precision of shade characters with higher translucency, thus providing excellent finish and gloss retention to the restoration.

Biography

Dondi dall'Orologio Giovanni, a doctor in Medicine at the University of Bologna in 1969, achieved the post graduated title of specialist in dentistry. He was appointed as an Assistant Professor in 1973 and became an Associate Professor in 1983. He is the Head of the Division of Conservative Dentistry from 1973 to 2014 and Director of the Master's program in Clinical Dentistry with Advanced Technology from 2003 to 2014. He experimented with new technology with a spectrophotometer; this led to the development of a new machine for reading the color of composite restorations *in vivo*. He has published more than 75 papers in reputed international journals.

giovanni.dondi@unibo.it

Notes:

Anna Antsiferova, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

26th International Conference on **Advanced Nanotechnology**
&
2nd Edition of International Conference on
Materials Technology and Manufacturing Innovations
October 04-05, 2018 Moscow, Russia

Anna Antsiferova

National Research Center 'Kurchatov Institute', Russia

Accumulation of silver nanoparticles in mammalian brain and effects on cognitive functions

A silver has been known as an antiseptic agent from the ancient times. Nowadays due to the development of the nano technologies, silver is mostly used in nanoform and is applied in food and light industries, medicine and pharmaceutics. The most ambiguous area of its application is the alternative medicine, where nanosilver is recommended for daily use in order to treat bacterial and viral diseases and to strengthen the immunity. However, the supposed doses are quite high and the periods of the administration are quite long. The objective of the research was to identify negative effects caused by nano silver treatment on cognitive, behavioral and physiological functions of mammals as well as to measure the amount of silver in the brain and their parts. Colloidal solution of PVP coated silver performed by the food supplement Argovit C manufactured in Russia was used as silver nanoparticles. Due to Dynamic Light Scattering (DLS) and TEM the mean size of the nanoparticles was 34±4 nm. C57BL/6 mice were used as a mammal model. The mice have been daily exposed to the nano particles during 30, 60, 120 and 180 days in the amount of 50 μg per day. Mice were tested in several behavioral and cognitive mazes and in Pheno Master to check their physiological functions. After that mice were decapitated and their brain and the parts were investigated by neutron activation analysis to measure the amount of silver in them. It can be concluded that accumulation of nanosilver in mammalian brain leads to cognitive and behavioral impairments.

Biography

Anna Antsiferova has completed her Graduation from the Physical Faculty of Lomonosov Moscow State University in 2011. She has recieved her PhD degree in Physics and Math at the National Research Center Kurchatov Institute in 2016. She is a Head of the Laboratory of Nanosafety of the National Research Center Kurchatov Institute; Deputy Dean and an Assocciate Professor in the Department of Nano, Bio, Informational, Cognitive and Socio-humanitarian Technologies -Moscow Institute of Physics and Technology. She has published 18 papers in reputed journals, two books and given more than 30 talks on the international conferences.

antsiferova_aa@nrcki.ru

Notes:

Monica Julieth Valencia Botero, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Monica Julieth Valencia Botero

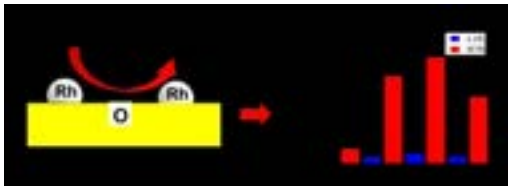
Vaasa Energy Business Innovation Centre, Finland

Transient CO_2 methanation over Rh/CeO_2-ZrO_2 catalysts

Statement of the Problem: The CO_2 valorization is one of the main research priorities worldwide. However, the CO_2 is a thermodynamically stable molecule that requires high-selectivity materials to react. Ceria-based catalysts have proved to be a suitable option for converting CO_2 into methane, especially the Rh/CeO_2. After applying a pretreatment of High Temperature Reduction (HTR) with pure H_2 to $1\%Rh/CeO_2$ materials, higher amounts of methane are produced during the transient state. That activity enhancement has been supposed to occur due to the additional oxygen vacancies (active sites) created after the HTR. The purpose of this study was to get new insights about the role of oxygen vacancies on the CO_2 activation, by testing materials with improved oxygen storage capacities.

Methodology & Theoretical Orientation: Polycristaline CeO_2, CeO_2-ZrO_2 and ZrO_2 supports were synthesized by precipitation/co-precipitation method. 1% Rh was then loaded by incipient wetness impregnation. The samples were characterized by means of BET surface, XRD, TPR and TGA. The produced methane after both low and high temperature reduction was followed during 1 hour.

Findings: As the introduction of zirconium into the ceria lattice enhances the reduction degree of the materials, higher quantities of methane during the transient state are produced. Therefore, a relationship between the reduction degree of the CeO_2-containing materials and the CO_2 conversion was found. However, the additional oxygen vacancies formed during the treatment are not stable at reaction conditions. Further research is needed in order to understand the mechanism for which those high-activity sites could be kept.



Recent Publications

1. Westermann A, Azambre B, Bacariza M C, Graça I, Ribeiro M F, Lopes J M and Henriques C (2017) The promoting effect of Ce in the CO_2 methanation performances on NiUSY zeolite: A FTIR in situ/operando study. Catalysis Today 283:74-81.
2. Karelovic A and Ruiz P (2013) Mechanistic study of low temperature CO_2 methanation over Rh/TiO_2 catalysts. Journal of Catalysis 301:141-153.

3. Tada S, Shimizu T, Kamayama H, Haneda T and Kikuchi R (2012) Ni/CeO_2 catalysts with high CO_2 methanation activity and high CH_4 selective at low temperatures. International Journal of Hydrogen Energy 37(7):5527-5531.
4. Novák É, Fodor K, Szailer T, Oszkó A and Erdöhelyi A (2002) CO2 hydrogenation on Th/TO2 previously reduced at different temperatures. Topics in Catalysis 20(1-4):107-117.
5. de Leitenburg C, Trovarelli A and Kašpar J (1997) A temperature-programmed and transient kinetic study of CO2 activation and methanation over CeO2-supported noble metals. Journal of Catalysis 166(1):98-107.

Biography

Monica Julieth Valencia Botero is a Project Researcher at the Vaasa Energy Business Innovation Centre (VEBIC) in the domain of the assessment of the energy systems, especially bioenergy and renewable energy. She has experience in several aspect of the energy business including technologies, environmental assessment, material science and biofuels and bioenergy. She has completed her Bachelor's degree in Chemical Engineering and MSc in Engineering-Chemical Engineering at Universidad Nacional de Colombia- Manizales, Colombia and PhD in Environmental and Energy Engineering Sciences at the University of Udine, Italy.

monica.valencia.botero@uwasa.fi

Notes:

Rodney Marcelo do Nascimento, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Rodney Marcelo do Nascimento

São Carlos Institute of Physics - University of São Paulo, Brazil

Growing of apatite particles on surfaces of natural rubbers and their effects on blood wettability

This work addresses a study of the interaction between hybrid Natural Rubber (NR) surfaces and a Simulated Body Fluid (SBF) aiming to access desirable properties to exploit the applications as bioactive coatings. The surfaces were physico chemically modified during 30 days in contact with SBF. The formation of calcium phosphate particles on NR coatings occurs due to the electrostatic interaction between negatively charged layer along the NR surface (– 57 mV) and Ca^{2+} thus inducing the nucleation of Ca based salts, especially with phosphate ions (PO_4^{3-}). The apatite then grew spontaneously accompanied by consuming the calcium and phosphate ions. Various ions (e.g., Ca^{2+}, $CaOH^{+}$, PO_4^{3-}, HPO_4^{2-} and CaH_2PO^{4+}) on the surfaces can enable the adsorption ability of the protein and some chemicals in the human blood. The increase of the blood wettability was attested by contact angle and contact radius measurements. On the other hand, the hybrid NR coating exhibited both stability and biodegradability in different levels (time dependence). These features make the material a candidate for tissue engineering, for instance to provide a functionalized surface applicable as an occlusive membrane, bioactive coating and (or associated with) scaffolds.

Biography

Rodney Marcelo do Nascimento has completed his PhD in 2011 from Universidade Estadual Paulista UNESP, Brazil and Postdoctoral studies from Université Claude Bernard Lyon, France in 2015. He has published nine papers as first author in reputed journals and has been serving as a Reviewer Board Member of the *International Journal of Nanomedicine* since 2017. He has received an award in Surface Engineering from the National Institute of Surface Engineering – Conselho Nacional de Desenvolvimento Científico e Tecnológico-CNPq, Brazil, 2013. Currently, he works in the development and hybrid materials using natural polymers and bioactive particles for biomedical applications in University of São Paulo.

rodneymn@ifsc.usp.br

Notes:

Hyung-Man Kim, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Hyung-Man Kim

INJE University, South Korea

Electroactive polymers for ocean kinetic energy harvesting

The recent issue of serious global warming has stimulated research on the development of de-carbonized energy harvesting technologies. The ocean has the most valuable natural resources which have resulted in the construction of a wide variety of offshore plants all over the world. Because nearly all offshore plants are stand-alone plants that do not transmit electricity, they must have their own power generators. This paper aims to provide a source of information on ocean kinetic energy harvesting with electroactive polymers from the natural oscillations of ocean waves and currents. Electroactive polymers play an important role due to having electricity generation characteristics that correspond to mechanical stimuli. Among them, dielectric elastomers and piezoelectric materials have shown considerable promise for harvesting energy from environmental sources, such as ocean waves and currents. Ionic polymer metal composites, which are known as ionic electroactive polymers, are emerging materials in energy harvesting applications because of their favorable electromechanical characteristics and their highly compliant nature. Moreover, their intimacy with water enables them to be used in a water environment, which is suitable for ocean energy harvesting. Electroactive harvesting for the ocean kinetic energy has the potential to coexist with marine environments.

Biography

Hyung-Man Kim is currently Chair Professor of Mechanical Engineering at INJE University and the Director of the National Leading Research Laboratory of regenerative fuel cell. His academic career started with a Bachelor's and a Master's degree, both in Mechanical Engineering from Seoul National University, Korea, followed by a Ph.D. degree at the University of Tokyo, Japan, in 1997. Professor Kim is an internationally renowned expert in energy engineering and is distinguished for his seminal contributions in the areas of fuel cells, multi-scale multiphase heat and mass transport with electrochemical reactions, computational modeling, integration and control of regenerative fuel cell with photovoltaic cell, renewable energy of ocean kinetic energy harvester, distributed generation, smart grid, and sustainable energy for global environment. He is an author/co-author of over 100 journal papers. His scientific research has been recognized by many recent awards, including ISE Fellow Award, the INJE Distinguished Scholar Award, and Academic Award for the Fuel Cell Research Achievement. In addition to his scholastic achievements with outstanding research credential, he has also received many teaching excellence awards, including the Award for the student mentoring at Teacher's day and Grand Prize of the Regional Brain-Korea 21 Directors from Ministry of Education and Science, Korea. In the international community, Prof. Kim has served as reviewer and has been a member of the editorial board for more than 20 international journals.

mechkhm@inje.ac.kr

Notes:

António Ribeiro, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

26th International Conference on **Advanced Nanotechnology**
&
2nd Edition of International Conference on
Materials Technology and Manufacturing Innovations
October 04-05, 2018 Moscow, Russia

António Ribeiro

Universidade de Lisboa, Portugal

Electrical properties of conductive polymers under stress

Statement of the Problem: With the growing field of application of composites as replacements for hitherto metallic applications, the need for conductive polymers has increased. In fact, although composites can often replace metals with gains in weight, some applications require electrical conductive properties. Metallic films and grids have been envisaged and sometimes applied, but the high density of metals still imposes a significant increase in weight. The use of electrically conductive polymers might provide an interesting solution, but there is scarce information about the electrical behavior of such polymers when included in structural members. Additive manufacturing is a technology that enables the construction of graded materials. The specimens where built with layers in conductive PLA and regular PLA. The purpose of this study is to describe the tests and results obtained while measuring the electrical conductivity of polymers under stress.

Methodology & Theoretical Orientation: Electrical resistance of specimens was measured under different load conditions. The specimens were obtained by fusion deposition modeling; since this process delivers non-isotropic parts, the influence of manufacture process parameters was also tested. Specimens were tested for uniaxial and bending behavior.

Findings: A database of values of the electrical conductivity of the studied polymers was obtained and the influence of the manufacture parameters on this property was studied.

Recent Publications

1. Leigh Simon J, et al. (2012) A simple, low-cost conductive composite material for 3D printing of electronic sensors. PLOS One 7(11):e49365.
2. Espalin David, et al. (2014) 3D Printing multi-functionality: structures with electronics. International Journal of Advanced Manufacturing Technology 72(5-8):963-978.
3. Czyżewski J, et al. (2009) Rapid prototyping of electrically conductive components using 3D printing technology. Journal of Materials Processing Technology 209(12-13):5281-5285.
4. Panda Biranchi Narayan, et al. (2017) A CAD-based approach for measuring volumetric error in layered manufacturing. Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science. 231(13):2398-2406.
5. Panda Biranchi, et al. (2018) Experimental and numerical modelling of mechanical properties of 3D printed honeycomb structures. Measurement. 116:495-506.

Biography

Antonio Ribeiro is an Assistant Professor in the Mechanical Engineering Department at the Instituto Superior Tecnico, lecturing several courses in the Mechanical Design and Structural Materials Scientific Area. He has completed his PhD in Mechanical Vibrations at the University of Lisbon. His main studies are focused "On holistic approaches to engineering design and additive manufacturing".

relogio.ribeiro@tecnico.ulisboa.pt

Väino Sammelselg, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Väino Sammelselg

University of Tartu, Estonia

Thin and ultrathin protective coatings - unapparent but already in industry

Corrosion costs are still huge, reaching up to 1% from gross national product of many industrial countries. From other side society cannot develop further without considerable saving in energy and materials, and better protecting our environment. Transferring these demands into the coatings world mean that the coatings must be as thin as possible and produced by energy and environment saving technologies. Thin and ultrathin coatings have several naturally positive properties as compared with the traditional, thick protective coatings: better elasticity and optical transparency, smaller residual stresses, etc. But thin coatings must be still well protective, wear resistive, and if needed, paintable and/or biocompatible. For development of thin protective coatings several techniques were used, e.g. atomic layer deposition, ALD, for preparing nanolaminates of metal oxides and electrophoresis for nanographene ultrathin films [1]; also anodizing plus ALD for new thin protective coating applicable for anodizable alloys [2]. In the presentation will be given results of laboratory studies and tests and reviewed first introductions of the methods into industry, and discussed perspectives of further developments.

1. J. Mondal, A. Marques, L. Aarik, J. Kozlova, A. Simões, V. Sammelselg. Corr. Sci. 105 (2016) 161.
2. V. Sammelselg, L. Aarik, M. Merisalu, Method of preparing corrosion resistant coatings, WO 2014102758 A1 20140703. , Publication date: July 3rd 2014; Priority date: Dec. 31st 2012.

Biography

Väino Sammelselg has completed his PhD in 1989 from Institute of Physics of Estonian Academy of Sciences and following years was visiting resercher in several universities of Finland and Sweden. In 2003 was elected inorganic chemistry professor in the Institute of Chemistry of University of Tartu, is serving today also as head of materials science department in the Institute of Physics. His main scientific interests are thin film and coating technology and characterization, corrosion protection and nanotechnology applications. He has published more than 140 papers referred in WOS database, and has h-index 32.

vaino.sammelselg@ut.ee

Notes:

Anna V Bychkova et al., Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

26th International Conference on **Advanced Nanotechnology**
&
2nd Edition of International Conference on
Materials Technology and Manufacturing Innovations
October 04-05, 2018 Moscow, Russia

Anna V Bychkova

N.M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Russia

Stable plasma protein coatings on magnetite nanoparticles for biomedical applications

Mariia V. Lopukhova, Alexander I. Shalupov, Luybov A. Wasserman, Pavel G. Pronkin, Alexander L. Kovarski and **Mark A. Rosenfeld**
N.M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Russia

Proteins are promising materials for creation of coatings on magnetic nanoparticles (MNPs) due to their biocompatibility, prevention of MNPs agglomeration and chemical reactions in biological liquids [1]. Magnetically targeted nanosystems with protein coatings are considered to be applicable in different areas of biology and medicine including theranostics and biosensing techniques. Proteins represent extremely susceptible targets for oxidants. The protection mechanisms in preventing oxidative damages for proteins within cells are mainly related to a large variety of antioxidant enzymatic systems. In contrast, plasma proteins are scarcely protected by these systems but the highly site-specific oxidation was convincingly demonstrated for some proteins, indicating that protein structure could be adapted to oxidation [2]. The mechanism providing plasma protein functioning in the conditions of generating reactive oxygen species (ROS) is a base for to the development of free radical approach to immobilizing of protein on magnetic nanoparticles (MNPs) in dispersions. Adsorption of a group of blood proteins including serum albumin and immunoglobulin G on MNPs and stability of the coatings was studied with the help of dynamic light scattering (DLS), UV/Vis spectrophotometry, differential scanning calorimetry (DSC), spin label technique [3], ferromagnetic resonance (FMR) [4], and the method of spectral-fluorescent probes [5]. The novel approach lead to the formation of stable cross-linked functional coatings on magnetite (Fe_3O_4) MNPs assembled from protein molecules. The free radical linking of thrombin and immunoglobulin G on the surface of nanoparticles has been shown to almost completely keep native properties of the protein molecules as potential therapeutic products and biovectors. The reported study aimed at obtaining multifunctional coating on magnetic nanoparticles was funded by RFBR and Moscow city Government according to the research project № 15-33-70019 «mol_a_mos», and by the Russian Science Foundation project No. 18-73-00350; protein study on the surface of MNPs was funded by RFBR, according to the research project No. 16-34-60244 mol_a_dk; spectral-fluorescent probes applications were developed according to the research RFBR project No. 16-03-00735 a. The research was carried out within the framework of budget financing under the government task (themes 0084-2014-0001, State registration No 01201253311, and 0084-2014-0005, State registration No 01201253307).

Recent Publications

1. Bychkova, A.V.; Sorokina, O.N.; Rosenfeld, M.A.; Kovarski, A.L. Multifunctional biocompatible coatings on magnetic nanoparticles. Russian Chemical Reviews. 2012. Vol. 81 (11). PP. 1026-1050.
2. Rosenfeld, M.A.; Vasilyeva, A.D.; Yurina, L.V.; Bychkova, A.V. Oxidation of proteins: is it a programmed process? Free Radical Research, 2018, Vol. 52, No. 1. PP. 14–38.
3. Sorokina, O.N.; Bychkova, A.V.; Shapiro, A.B.; Kovarskii, A.L.; Tikhonov, A.P. The application of the spin label method for studying the adsorption of macromolecules on magnetic nanoparticles. Russian Journal of Physical

Chemistry B. 2010. V. 4. № 3. PP. 510-514.

4. Bychkova, A.V.; Rosenfeld, M.A.; Leonova, V.B.; Sorokina, O.N.; Lomakin, S.M.; Kovarski, A.L. Free-radical cross-linking of serum albumin molecules on the surface of magnetite nanoparticles in aqueous dispersion. Colloid Journal. 2013. Vol. 75. № 1. PP. 7-13.
5. Bychkova, A.V.; Pronkin, P.G.; Sorokina, O.N.; Tatikolov, A.S.; Rosenfeld, M.A. Study of Protein Coatings Cross-Linked via the Free-Radical Mechanism on Magnetic Nanoparticles by the Method of Spectral and Fluorescent Probes. Colloid Journal. 2014. Vol. 76. No. 4. PP. 387–394.

Biography

Anna V Bychkova has graduated from D. Mendeleyev University of Chemical Technology of Russia in "Materials science and technology of new materials" and completed her PhD in "Physical Chemistry" from N.M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences (Moscow, Russia) where has been working as a reserch scientist since 2006. She has published more than 50 papers in peer-reviewed journals, 7 chapters in books, 1 Russian patent and awarded the scholarship of the President of the Russian Federation for young scientists and graduate students engaged in research and development in priority areas of the Russian economy modernizing (2013-2018).

anna.v.bychkova@gmail.com

Notes:

Igor Solodov, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

26th International Conference on **Advanced Nanotechnology**
&
2nd Edition of International Conference on
Materials Technology and Manufacturing Innovations
October 04-05, 2018 Moscow, Russia

Igor Solodov
University of Stuttgart, Germany

Non-destructive characterization and testing of composite materials by using mechanical resonance of defects

Planar sub-surface defects are characteristic modes of failure that are induced by impacts, fatigue stresses, deviations in production process in a wide class of materials and components, including rolled sheet metals, fibre-reinforced concrete and plastics, and additive manufacturing in 3D printing solutions. To detect these defects, various classical methods of non-destructive testing (NDT) of materials were developed and applied: optical shearography, eddy current, multiple versions of thermography, and ultrasonic techniques. A novel NDT methodology proposed makes use of mechanical resonance of the defect areas. It is based on the effect of local defect resonance (LDR) which develops if the defect is activated by mechanical excitation whose frequency matches to its natural vibration frequency. The latter is based on the fact that inclusion of a defect leads to a local decrease of rigidity for a certain mass of the material that manifests in a particular characteristic frequency of the defect. Under the frequency match condition, the input energy is delivered and trapped selectively in the defect area that increases dramatically its vibration amplitude. The LDR approach thus enhances substantially the sensitivity and efficiency of the classical NDT techniques based on mechanical activation of defects. Besides, the locality of the resonance enables to visualize the defect area and to quantify its size and shape. The case studies to be considered include resonant imaging of various defects in composite materials via laser vibrometry, thermosonics and nonlinear techniques.

Recent Publications

1. Solodov I, Bai J, Bekgulyan S and Busse G (2011) A local defect resonance to enhance acoustic wave-defect interaction in ultrasonic nondestructive testing. Applied Physics Letters. 99:211911.
2. Solodov I, Bai J and Busse G (2013) Resonant ultrasonic spectroscopy of defects: case study of flat-bottomed holes. Journal of Applied Physics. 113:223512.

Biography

Igor Solodov is Guest Professor at Institute of Plastics Technology. His research mainly focuses on Ultrasonic & Nonlinear Mechanics.

igor.solodov@ikt.uni-stuttgart.de

Notes:

Jambiin Oyun, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

26th International Conference on **Advanced Nanotechnology**
&
2nd Edition of International Conference on
Materials Technology and Manufacturing Innovations
October 04-05, 2018 Moscow, Russia

Jambiin Oyun
Ulaanbaatar State University, Mongolia

Sharaviin Munkhjargal
National University of Mongolia

Separation of medical nanopowder from the natural minerals by $ScCO_2$

The traditional methods, we experimented, have unique advantages keeping $ScCO_2$ in the primary material by simple, cost ineffective and high productive way, avoiding necessity of grinding a material to a smaller particles, using chemical salts. It is green, ecologically pure and ready to use for industrial production. In the world practice, in order to derive medical nanopowder $ScCO_2$ is usually added to the target material either in gas or liquid form. In contrast to this, in the Mongolian traditional technology the thermal processing of medical material does not loose CO_2 and keeps it in the target material. By this work, we aimed to prove that our experiment made on the basis of the traditional technology is performed at the current nanotechnological level and to explain it's scientific substantiation by modern scientific expressions. Nano-sized medical raw materials has been derived from the medical quality natural spar ($CaCO_3$) without the use of chemical salt. The theoretical base of the method consists in the transferring and keeping CO_2 to a supercritical state during thermo-chemical processing of the spar at 900-9500C. The ScCO2 has a form of solid solution that holds the properties of both gas and solid. Afterwards, with dissolving it in the cow milk, the solution is equalized by the solvents expansion with the decrease of temperature and creates amorphous crystal nanopowder. The size of the resultant product $C_3H_3CaLuO_6$ was determined both by XRD and TEM analysis as to be 13.51 nm(Lu>13.09 nm).

Biography

Jambiin Oyun is a Professor in Chemical Department of Technology Division at the Ulaanbaatar State University of Mongolia. She has completed her Graduation at Irkutsk State University named A A Zhdanov specializing in chemistry. She has completed her PhD and the thesis is entitled as "Concentration and determination of microquantities rare earth elements from minerals and rocks by polymeric chelating sorbents" and has completed her ScD on the topic "Scientific basis of traditional technology for the treatment of pharmaceutical minerals in Mongolia" at the Mongolian Academy of Sciences and Chemical Science in 2002. She has published 16 monographies, over 30 scientific papers, 213 popular-scientific articles and presented more than 30 reports at the foreign and Mongolian scientific conferences. She has received 10 patents, 9 utility model certificates, fulfilled 4 scientific projects and supervised 7 doctoral and 33 master's works.

Munkhjargal Sharaviin is currently working as a Senior lecturer in the School of Physics at National University of Mongolia, Mongolia.

oyunjambaubsu@gmail.com
munkhjargal@num.edu.mn

Notes:

Haizea Gonazalez Barrio, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Haizea Gonazalez Barrio

University of the Basque Country, Spain

IBR manufacturing by hybrid combination of laser metal deposition and machining processes

The use of additive manufacturing (AM) technologies in aeronautic industries is on increase. An example of this is the fact that most companies in the sector have started to combine additive with machining operations. The laser metal deposition (LMD) process is one of the most used AM methods together with the selective laser melting (SLM) process, but only the first one is currently capable of producing big parts. The LMD technology can work with a wide range of metals; some of them are common within the aeronautic industry, such as Titanium, Inconel 718 and Hastelloy X, among others. This technology implies big challenges due to its complexity; in order to attain good results a high number of process parameters must be controlled, like laser power, gas and powder flux, filling strategies, feed rate, to name just a few. The present research work aims to study the manufacturing and repair of turbine components, such as blisk, by LMD. To that end, a blisk is manufactured by additively building up blades on a core disk substrate. In addition, a monitoring of the temperature of the process and the height of the clad is also realized. Therefore, this work demonstrates the feasibility of manufacturing and repairing high added value parts by 5 axis LMD.

Recent Publications

1. Arrizubieta J I, Martinez S, Lamikiz A, Ukar E, Arntz K and Klocke F (2017) Instantaneous powder flux regulation system for laser metal deposition. Journal of Manufacturing Processes 29:242-251.
2. Arrizubieta J I, Lamikiz A, Klocke F, Martinez S, Arntz K and Ukar E (2017) Evaluation of the relevance of melt pool dynamics in laser material deposition process modeling, International Journal of Heat and Mass Transfer 115:80-91.
3. Calleja A, Tabernero I, Ealo J A, Campa, F J, Lamikiz A and López de Lacalle L N (2014) Feed rate calculation algorithm for the homogeneous material 5 deposition of blisk blades by 5-axis laser cladding. Int. J. Adv. Manufacturing Technology, 74, Issue 9–12, pp 1219–1228
4. Calleja A, Tabernero I, FernándezV A, Celaya A, Lamikiz A and López de Lacalle L N (2014) Improvement of

Strategies and Parameters for Multi-Axis Laser Cladding Operations, Optics and Lasers in Engineering, 56:113-120.

5. Artetxe E, González H, Calleja A, Polvorosa R, Lamikiz A and López de Lacalle L N (2016) Optimized methodology for aircraft engine IBRs five-axis machining. Int. J. Mechatronics and Manufacturing Systems 9(4):385.

Biography

Haizea González is a Mechanical and Manufacturing Engineer and PhD student at the Basque Country University since 2015. She has experience in industrial companies, such as Novalti S A (aerospace manufacturing company). She also has I+D+i experience working as Mechanical Engineering Department Collaborator since 2013. She is specialised in hybrid manufacturing combining laser metal deposition and machining processes. He has a book chapter, 3 indexed articles, and 6 papers in industrial manufacturing magazines, 7 national and international conferences.

Haizea.gonzalez@ehu.eus

Notes:

L N López de Lacalle, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

26th International Conference on **Advanced Nanotechnology**
&
2nd Edition of International Conference on
Materials Technology and Manufacturing Innovations
October 04-05, 2018 Moscow, Russia

L N López de Lacalle

University of the Basque Country, Spain

General methodology for manufacturing complex geometries in turbo-machinery components

Aeronautical industry is on the path to steady growth in the last decades. One of the major focuses for manufacturing is turbo-machinery rotary components, such as impellers or bladed disks. The fabrication of these elements presents many challenges to be faced from the designing conception to the arrival in the market. Among them, it is important to point that they are made of difficult-to-cut super alloys and need to fulfill dimensional requirements. In Figure 1, manufacturing process for complex geometries that require 5-axis simultaneously movements is shown. According to the defined process for complex geometries, an IBR was selected as case of study for applying different steps with the aim of establishing a full methodology to fabricate complex geometries. As workpiece material, Inconel 718 was selected, common material in these applications. The proposed process was divided in the following stages: part design and definition, according to industry requirements; tool definition and tool path generation. CAM software is needed to define 5-axis simultaneous movements. A Calleja, et al. developed a model for tool path programming of these components. Digital twin: Simulation of the full machining processes considering every machine component involved in the process. A digital twin of machining process is developed with the aim of predicting collisions or machine kinematics limitation; post-processing and 5-axis machining. Final part measurements and result analysis Not with-standing, improvement in this area of knowledge leads many research to analyze about alternatives to this traditional methodology with new manufacturing technologies, as electrochemical machining, linear friction welding, laser cladding or a new trend known as super abrasive machining and new ways of lubricooling technologies as CryoMQL.

Recent Publications

1. Artetxe E, González H, Calleja A, Polvorosa R, Lamikiz A and López de Lacalle L N (2016) Optimised methodology for aircraft engine IBRs five-axis machining. Int. J. Mechatronics and Manufacturing Systems 9:4.
2. Calleja A, Alonso M.A, Fernández A, Tabernero I, Ayesta I, Lamikiz A and López de Lacalle L N (2014) Flank milling model for tool path programming of turbine blisks and compressors. Int. J. of Production Research: 3354-3369.
3. Klocke F, Schmitt R, Zeis M, Heidemanns L, Kerkhoff J, Heinen D and Klink A (2015) Technological and economical assessment of alternative process chains for blisk manufacture. Procedia CIRP 35:67-72C.

4. González H, Calleja A, Pereira O, Ortega N, López de Lacalle LN and Barton M (2018) Super abrasive machining of integral rotary components using grinding flank tools. Metals 8:24
5. Pereira O, Martín-Alfonso JE, Rodríguez A, Calleja A, Fernández-Valdivielso A and López de Lacalle LN (2017) Sustainability analysis of lubricant oils for minimum quantity lubrication based on their tribo-rheological performance. Journal of Cleaner Production 164: 1419-1429.

Biography

L N López de Lacalle: University Professor of the Department of Mechanical Engineering at the University of the Basque Country (UPV/EHU) and director of the Aeronautics Advanced Manufacturing Center (CFAA). He is also head of the high-performance manufacturing line. He manages international I+D+i projects with several companies and research centers. Ph.D. for more than 20 years, nowadays his research lines are focused in machining processes for difficult-to-cut materials and green manufacturing. He has 3 books, more than 115 JCR international articles, 60 international conference papers and 5 patents among others. He has H-index of 42.

norberto.lzlacalle@ehu.eus

Notes:

Octavio Manuel Pereira, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Octavio Manuel Pereira

University of the Basque Country, Spain

Cryogenic lubri-coolant machining on difficult-to-cut alloys

Nowadays, environmental consciousness is taking relevance in the society. This situation involves some consequences in the manufacturing processes with the aim of improving this philosophy. In the particular case of machining operations, the target is reducing the use of cutting fluids to assist the process. It has to be taken into account that these cutting fluids are based on mineral oils and consequently, its use is environmentally inefficient. Besides, according to several authors, its use represents between 17% and 30% of the total manufacturing costs. Therefore, looking for other lubricooling alternatives is a big challenge to be faced. Among these alternatives, CryoMQL, which combines CO_2 cryogenic cooling and MQL, is presented as a full solution reaching a balance between environmental and economic issues. In the figure several performances of its use are shown. Furthermore, this lubricooling technique takes relevance during the machining processes of heat-resistant super alloys. The use of these alloys, known also as difficult-to-cut materials, is growing worldwide in aeronautical industry related to turbomachinery components. In particular, Inconel 718 super alloy is one of the most used materials in this sector to manufacture turbofan critical components due to its high hardness combined with a good tensile strength at high temperatures. However, this material presents some challenges during machining processes leading to high cutting forces, low material removal rates, and other problems that may cause premature tool breakage which needs to be avoided. Therefore, in order to improve milling processes in Inconel 718, in this paper is presented a new lubricooling technique of applying CryoMQL in which CO_2 is used as internal tool coolant with the aim of reducing its consumption. The results show that its use improves the current process, not only from an environmental point of view, but also from economic and technical point of view, reaching a technology known as ECO2 milling performance (economy+ecology).

Recent Publications

1. González H, Calleja A, Pereira O, Ortega N, López de Lacalle LN and Barton M (2018) Super abrasive machining of integral rotary components using grinding flank tools. Metals 8:24.
2. Pereira O, Martín-Alfonso J.E., Rodríguez A, Calleja A, Fernández-Valdivielso A and López de Lacalle LN (2017) Sustainability analysis of lubricant oils for minimum quantity lubrication based on their tribo-rheological

performance. J. of Cleaner Production 164:1419-1429.

3. Pereira O, Rodríguez A, Barreiro J, Fernández-Abia AI and López de Lacalle LN (2017) Nozzle design for combined use of MQL and cryogenic gas in machining. Int. J. of Precision Eng. and Manufacturing-Green Technology 4:87-95.
4. Pereira O, Rodríguez A, Fernández-Abia AI, Barreiro J and López de Lacalle LN (2016) Cryogenic and minimum quantity lubrication for an ecoefficiency turning of AISI 304. J. of Cleaner Production 139:440-449.
5. Pereira O, Rodríguez A, Fernández-Valdivielso A, Barreiro J, Fernández-Abia AI and López de Lacalle LN (2015) Cryogenic hardturning of ASP23 steel using carbon dioxide. Procedia Engineering 132:486-491.

Biography

Octavio Pereira Industrial engineering with master in cybernetics. Ph.D. from the University of Leon. Researcher in the Department of Mechanical Engineering at the University of the Basque Country since 2013. He is specialised in green cooling-refrigeration techniques, life cycle assessments in machining operations and hard turning processes. He has a book chapter, 9 JCR (>50% Q1) international article, 24 papers in industrial manufacturing magazines, 18 national and international conferences and 3 patents.

norberto.lzlacalle@ehu.eus

Notes:

Lei Pan, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

26th International Conference on **Advanced Nanotechnology**
&
2nd Edition of International Conference on
Materials Technology and Manufacturing Innovations
October 04-05, 2018 Moscow, Russia

Lei Pan

Harbin Institute of Technology, China

Shadow boxing with laser: Laser damage resistance of three-dimensional photonic crystals

The laser damage behavior of three-dimensional photonic crystals (3D-PCs) with an opal structure is investigated using both experimental and simulation methods. Polystyrene (PS) colloidal crystals films with a reflection peak at 1064 nm are used as the model material. Disordered films (DF) are fabricated with PS microspheres as contrast samples. The laser-induced damage threshold (LIDT) of 3D-PCs is tested, which is as 2.35 times high as the LIDT of DF. All laser damages are derived from defects in 3D-PCs, implying that the LIDT of ideal 3D-PCs will be significantly increased. The simulation results show that the electric field is contained in the pores of 3D-PCs while it is reduced in the PS microspheres, which may decrease the absorption of laser energy by 3D-PCs. In contrast, the electric field distribution is irregular in DF. Enhanced electric field areas are located in both the pores and microspheres of DF. Considering higher electric field intensity causes more energy absorption and higher temperature, the DF has a lower LIDT. The 3D-PCs structure uses ordered vacancy to contain and strike back laser energy and can increase the LIDT without changing the chemical composition of materials.

Biography

Lei Pan is a Research Associate in School of Chemistry and Chemical Engineering at Harbin Institute of Technology. He has completed his BE and ME degrees at Tianjin University and PhD at Harbin Institute of Technology in 2015. His current research interests mainly focus on "Design and fabrication of well-defined nano-structured materials and their applications for optical and thermal field".

panlei@hit.edu.cn

Notes:

JOINT EVENT

26th International Conference on

Advanced Nanotechnology

&

2nd Edition of International Conference on

Materials Technology and Manufacturing Innovations

October 04-05, 2018 Moscow, Russia

Young Researchers Forum

Day 2

Jatoi Abdul Wahab et al., Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-021

AgNP/CE electrospun nanofibers for antibacterial applications

Jatoi Abdul Wahab and **Qing Qing Ni**
Shinshu University, Japan

In the present work, we report our research on cellulose nanofibers decorated with silver nanoparticles by novel methods. Cellulose acetate was used as a precursor for cellulose nanofibers. Cellulose acetate nanofibers were fabricated by electrospinning and then treated with 0.01 M NaOH solution for 30 hours to produce cellulose nanofibers. Synthesis of silver nanoparticles was carried out by three simple methods. $AgNO_3$ was used as precursor for synthesis of silver nanoparticles. Three methods were used for reduction of ionic silver (Ag^+) into AgNPs were heat treatment, N, N-Dimethylformamide induced heat treatment and 3,4-Dihydroxyphenethylamine coating. The samples were characterized by scanning electron microscopy (SEM), X-ray diffraction spectroscopy (XRD), transmission electron microscopy (TEM), Fourrier transform infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS) and Field emission scanning electron microscopy (FESEM). Sizes of the AgNPs were calculated using Debye-Scherrer method and from the TEM images. SEM and FESEM images depicted regular morphology of the nanofibers. Structural modifications of cellulose acetate into cellulose were confirmed by FTIR and XRD analysis. Formation of the metallic silver was confirmed from XRD and XPS data. XRD data revealed FCC crystalline structure of the AgNPs. TEM images show cellulose nanofibers covered with well dispersed AgNPs.

Biography

Jatoi Abdul Wahab is a PhD student in Bioscience and Textile Technology Department at Shinshu Univeristy, Ueda, Japan. He has completed his ME at Mehran-UET, Pakistan and MSc in Textile Engineering (Chemical Engineering Class) at Politecnico di Torino, Italy. He has been engaged in research, teaching and academic activities for over ten years. He has so far published 17 research articles in reputed research journals. He is the author of four workbooks and has presented (both oral and poster presentations) his research in several international conferences as well.

16st104b@shinshu-u.ac.jp

Notes:

Vladislav Gamaleev, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-021

Investigation of Pt-supported nanographene produced by in-liquid plasma for development of polymer electrolyte fuel cells

Vladislav Gamaleev
Meijo University, Japan

Recently, various fuel cells, such as polymer electrolyte fuel cell (PEFC), are attracting a lot of attention owing to small size and at relatively low working temperature (below 80°C), which makes possible usage of PEFCs in automobile and household power generation. However, PEFC has a problem with decrease of output caused by corrosion of amorphous carbon used as a catalytic carrier, which could be solved by use of carbon nanostructures with stronger crystal structure than amorphous carbon. In this work, nano-graphene supported by Pt nanoparticles was synthesized and examined for possible application in development of PEFC with increased durability. Nano-graphene was synthesized by in-liquid plasma generated in ethanol using AC high voltage (~11.7 kV). Amorphous component of synthesized nano-graphene was removed by hydrogen peroxide treatment and removal of amorphous carbon was confirmed by Raman spectroscopy. Platinum (Pt) nanoparticles were prepared on the surface of nano-graphene by the reduction of Pt salt precursors (H2Cl6Pt) in solution. Formation of Pt nanoparticles of diameter in range 2-4 nm was confirmed by transmission electron microscopy and X-ray diffraction measurement of Pt-supported nano-graphenes. Membrane electrode assembly (MEA) was constructed, where Pt-supported nano-graphene was used as the catalytic layer. Power generation characteristic of MEA were evaluated and current density for developed MEA was approximately 240 mA / cm2. From the electrochemical evaluation of Pt-supported nano-graphene, it was found that durability of Pt-supported nano-graphene was about seven times higher than that of carbon black, which looks promising for improvement of durability of PEFC.

Biography

Vladislav Gamaleev has completed his PhD at Kochi University of Technology, Japan. He is a Postdoctoral Researcher at Meijo University. His research interests include "Generation of plasma at atmospheric and high pressure in gas and liquid phase, and plasma diagnostics by optical emission spectroscopy". Currently, he is focusing on the generation of oxygen radicals by atmospheric pressure plasma for biological and agriculture applications. He is a member of Japan Society of Applied Physics (JSAP).

vlad@meijo-u.ac.jp

Notes:

Jie Sun, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-021

Confined chemistry and its application for lithium/sodium ion batteries

Jie Sun
Tianjin University, China

We have studied three kinds of electrode reaction mechanisms for lithium ion batteries: the intercalation reaction mechanism, such as graphite anode and lithium cobalt oxide cathode, which has a stable structure without chemical bond breaking for lithiation, leading to a long cycling life, but its specific capacity is low due to the limited lithium-storage sites; the alloying/conversion reaction mechanism, such as silicon, phosphorus, tin anode, sulfur cathode, which has a high theoretical capacity, but decays rapidly because of its large volume expansion for lithiation; the deposition/growth mechanism, such as lithium metal anode, which tends to form dendrites with no host material, resulting in many problems of the irreversible reaction with electrolyte, poor cycle performance, and short circuit. In summary, the reaction mechanism of the electrode materials determines its intrinsic characteristics and inherent defects, which is difficult to overcome. Aiming at the above problems, we have designed and constructed a series of micro reactors at the molecular scale, so that the alloying or deposition reaction mechanism could be confined in this space and transforms into a similar intercalation reaction mechanism, contributing to improving its structural stability and electrochemical performance.

Biography

Jie Sun has completed her PhD in Chemical Engineering and Technology at Beijing University of Chemical Technology and Postdoctoral studies at Stanford University. She has worked as a Professor of Chemical Engineering and Technology at Tianjin University. She has published more than 30 papers in reputed journals.

jies@tju.edu.cn

Notes:

JOINT EVENT

26th International Conference on

Advanced Nanotechnology

&

2nd Edition of International Conference on

Materials Technology and Manufacturing Innovations

October 04-05, 2018 Moscow, Russia

Video Presentation

Veroniki P Vidali, Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C5-020

Anthracene-based molecular glasses: Design, synthesis and applications in nanolithography and organic electronics overview and perspectives

Veroniki P Vidali
National Centre of Scientific Research "Demokritos", Greece

Anthracene derivatives constitute a promising class of small molecules with many potential applications, in the areas of organic electronics and nanolithography. Indeed, anthracene exhibits attractive properties for incorporation in films used in electronic devices (electronic conductivity, high charge mobility, appropriate ionization potential) and nanolithography applications (high etch resistance). Nevertheless, its high crystallization and sublimation tendencies pose severe challenges in the use of robust solution processes and in the formation of high quality films. Thus, the development of optimized anthracene-based compounds with tunable properties depending on the application is necessary. Towards this direction, developed synthetic routes lead, mainly, to symmetric structures using expensive organometallic reactions. Herein, a design strategy for the synthesis of anthracene-based molecular glasses (MGs), suitable for applications in nanolithography and with perspectives for application in organic photonic devices is presented. Film-forming properties were tuned, by controlling molecular architecture, structure flexibility and incorporation of tetrahedral and planar cores. Cheap, efficient and scalable methods, based mainly on esterification reactions, were applied, leading to the synthesis of a "library" of diverse anthracene-based structures from common intermediates. Many of these molecules were highly soluble, thermally stable and formed amorphous and stable films, introducing a new class of solution-processable anthracene-based MGs with high etch resistance and suitable for positive-tone chemically amplified systems. Moreover, in certain cases, film patterning in EUV, reached dimensions below 30 nm. Recently, selected compounds have been tested as active layers in OLED structures affording very promising results. Additional perspectives of this research will be discussed.

Biography

Veroniki P Vidali is an Organic Chemist. She has completed her PhD at Agricultural University of Athens in 2004. She worked as a Post-Doctoral Fellow at Natural Products and Bioorganic Chemistry Laboratory, Institute of Nanoscience and Nanotechnology at NCSR “Demokritos" from 2004 to 2007 and as Scientific Staff from 2007 to 2017, while since 2017 she has been working as a Research Assistant at NCSR “Demokritos". Her main research interests include “Organic synthesis of bioactive natural products and polyaromatic compounds applied in nanotechnology”. She has co-authored 18 peer-reviewed research articles in international journals and one book-chapter.

v.vidali@inn.demokritos.gr

Notes: