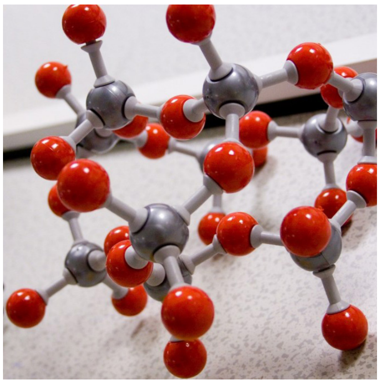
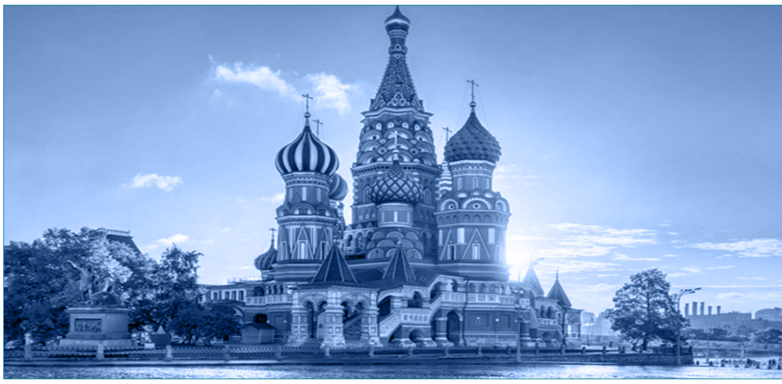
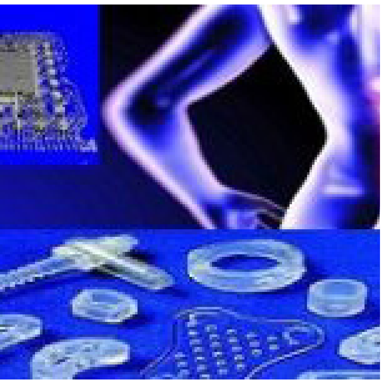
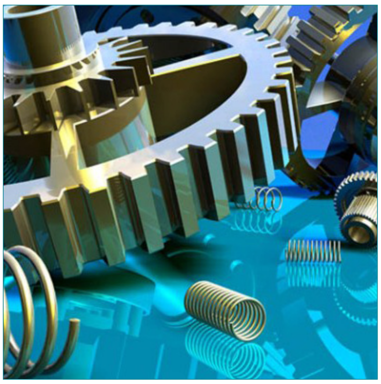
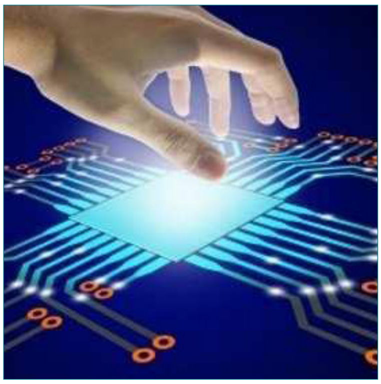
Keynote Forum
July 23, 2018

Material Science 2018

International Conference on

Materials Science and Engineering

July 23-25, 2018 | Moscow, Russia

Sergei Kulkov

Tomsk State University, Russia

Zirconia / Alumina ceramics with cellular structure for Biomedical applications

It has been studied a porous ceramic obtained from nanopowders obtained by plasma spray technique. The porosity of ceramic was 5 - 75 %. The aim of the work is the investigation of densification, structure and mechanical properties of materials based on zirconia-based powders produced by plasma spray synthesis and sintered at different temperatures. It has been shown that structure of the sintered ceramic has a system of cell and rod elements. These structures formed by stacking hollow powder particles. There were three types of pores in ceramics: large cellular hollow spaces, small interparticle pores which are not filled with powder particles and the smallest pores in the shells of cells. The cells generally did not have regular shapes.The size of the interior of the cells many times exceeded the thickness of the walls which was a single-layer packing grains. The increase of the pore space in the ceramics was accompanied by the decrease of the average size of voids inside the cells and the average grain size.The stress-strain diagrams for ceramics with porosity higher than 20 % are non-liner, and sintered ceramic with a high porosity has a very similar behavior as compare with natural bone and can be used as perspective material for bone replacement.

Speaker Biography

Sergei Kulkov received his Ph.D. degree from Tomsk State University in 1981 and doctoral degree in 1990 from Institute of Strength Physics and Material Sciences of Russian Academy of Sciences. From 1981 to till today, he worked firstly as researcher and head of ceramic composites laboratory in ISPMS RAS and from1992 as a professor and from 2000 as head of department in Tomsk State University. His current research interests include synthesis and mechanical properties of MMC and CMC with phase transformations and the development of functional materials for different applications.

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Dao Hua Zhang

Nanyang Technological University, Singapore

Integration of optical metamaterials and semiconductors for enhanced optical sensing

Optical metamaterials have attracted intensive attention in recent years due to their novel properties and high potential for a wide range of applications. Integration of such metamaterials with traditional semiconductors could promote that semiconductor device performance to a high level. In this keynote, I will share with you our recent work on split ring resonators (SRRs) and surface plasmon enhanced photodetection. With the electron-beam-lithography process we developed, we have demonstrated two and three dimensional SRR arrays with controllable magnetic resonances for radiations from long wave infrared to near ultraviolet and investigated their applications for biochemical sensing. By integrating metallic hole array with in AsSb based heterojunction photodiode, we have realized strong enhancement in mid-wave infrared photodetection and made them workable at room temperature. A room temperature detectivity of 8×10^{9} Jones has been demonstrated. We also invented two-terminal millimeter wave photodetectors based on fast transportation of SPP induced non-equilibrium electrons and a noise equivalent power of 1.5×10^{-13} $WHz^{-1/2}$ has been achieved.

Speaker Biography

Dao Hua Zhang received PhD degrees from the University of New South Wales, Australia. He is a professor, Deputy Director of Centre of Excellence for Semiconductor Lighting and Displays, Program Director of Photonic Nano-Structures and Application of Nanyang Technological University, Singapore. He has published over 460 papers in international journals and international conferences, 6 books and proceedings, and 3 book chapters. He also filed 3 patents. He is the editor and guest editor of about 10 international journals, including IEEE Transaction on Nano Technology, Journal of Crystal Growth, and Thin Solid Films. He is in International Advisory Committee of several international conferences and has chaired and co-chaired a number International conferences. He is a fellow of Institute of Physics, UK.

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Sammelselg V

University of Tartu, Estonia

Revolutionary thin protective and functional Nanostructured coatings

In the presentation the results of studies of novel technology, including. low-temperature atomic layer deposition (ALD), nano-characterization, include. high-resolution microscopy and surface spectroscopy, and complex testing, include electrochemical and mechanical methods, for different thin, submicron thick coatings on aluminum and titanium alloys, and stainless steels will be introduced. The component list counts of the hybrid and composite nanostructured coatings, electrodeposited polypyrrole, CVD grown large area graphene or mechanically/ mechanochemically prepared graphene nanoplatelets, anodic oxide layers, ALD prepared inorganic films and their laminates, the latter sealing also deep pores of the anodic layers. Pre-treated surfaces and thin coatings were thoroughly characterized (HR-SEM, -(S)TEM, SPM, XPS, XRF, XRD, XRR, µ-Raman, FTIR) and tested (by chemical-, quick and prolonged electrochemical tests, incl. immersion and salt spray, adhesion-, peeling-, and hardness tests). Biocompatibility of different surface finishing was checked by *in-vitro* cell growth and studies, and the best treatments determined. Also excellent corrosion protection coatings were demonstrated and an industrial introduction is in progress. For energy applications functionalization of surfaces with nanoparticles, incl. non-precious metals prepared by different methods was studied, which results will be introduced in the presentation, also the electrode corrosion protection will be discussed.

Speaker Biography

Sammelselg V has completed his PhD in 1989 at Institute of Physics of Estonian Academy of Sciences. He is head of department of Materials Science and professor of Inorganic Chemistry of the University of Tartu, Estonia. His scientific interests relate to technology and characterization of nanostructured materials, nanofilms and -particles/-platelets. He has over 150 publications and several patents that have been cited over 3000 times, his publication H-index is 31 and he has been serving as a reviewer of many reputed Journals.

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W J Fan

Nanyang Technological University, Singapore

Band structures and optical properties of cubic $CsSnBr_3$ Perovskite Nanoplatelets

Perovskite semiconductors have been received great attention due to their potential application in photonic devices, such as laser, LED, solar cell. The perovskite solar cell conversion efficiency is reported up to about 22%. However, there is few reports on the investigation of the k.p band structure of cubic $CsSnBr_3$ perovskite nanoplatelets. In this work, we extracted the band parameters from the first-principles calculation of the cubic $CsSnBr_3$ perovskite. The Luttinger parameters $\gamma 1$ =10.22, $\gamma 2$ =4.32, and $\gamma 3$=1.73 were obtained. Using the obtained parameters, we developed an 8-band k.p method to calculate the optical absorption spectrum of the cubic $CsSnBr_3$ perovskite nanoplatelet with different layer thickness (4 to 8 MLs). The bulk inversion asymmetry was taken into consideration in our model. The energy splitting was observed at non-zero k point (k=0 is the R point). The exciton effect was included in the absorption spectrum simulation. The TE and TM mode exciton enhanced absorption spectrum of $CsSnBr_3$ NPL at room temperature are simulated and obtained. The results could be useful to understand the perovskite based photonic devices.

Speaker Biography

W J Fan received his degree in electrical engineering from National University of Singapore, in 1997. He is an Associate Professor in Nanyang Technological University. He authored/co-authored over 130 refereed journal papers and over 100 conference presentations including 9 plenary/invited talks. According to SCI (Web of Science), the total external citations > 2100 times, his H-index is 22. He co-authored two book chapters. He was awarded JAP outstanding author in 2013. The granted research funding > S$3.9 M from Moe, Astar, Darpa(USA) and Nsg(Japan) as PI/Co-PI. He graduated > 8 PhD students as Main/Co-supervisor. He is the Founder and Vice President of International Optofluidics Organization since 2016. He served as Chair of Symposium B of the 9th International Conference on Materials for Advanced Technologies, Singapore 2017. He is the main editor of Procedia Engineering - Journal of Elsevier (for ICMAT 2017 Symposium B).

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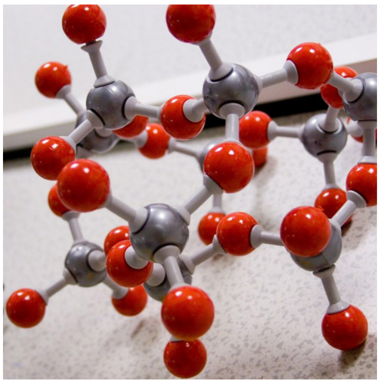
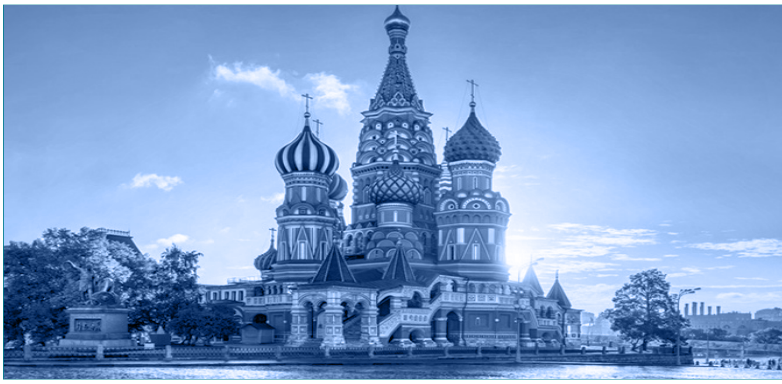
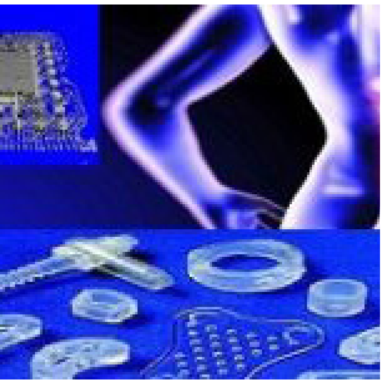
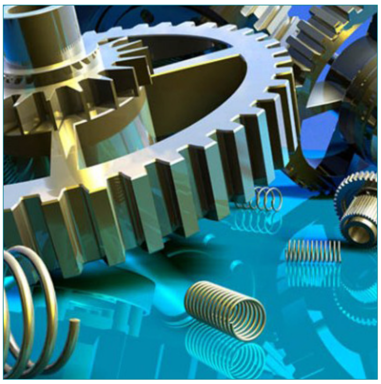
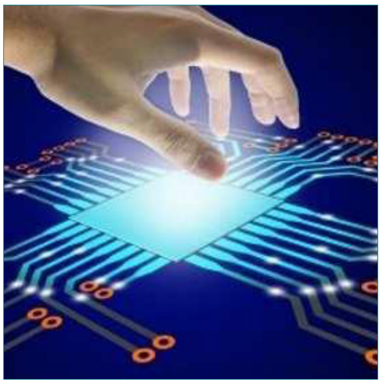
Keynote Forum
July 24, 2018

Material Science 2018

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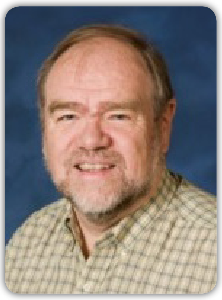

Theo G M van de Ven

McGill University, Canada

A novel aqueous process for the production of functional textile from Cellulose fibers

The biggest issue facing our planet is climate change, caused mainly by emissions generated by combustion of fossil fuels by industry, automobiles and heating of buildings. To mitigate climate change, we should make extensive efforts to find economically sustainable solutions for the use of wood, while at the same time planting more trees than that we cut. At present the large scale uses of wood are: building materials, paper and textile. This study deals with a new way of making functional cellulose fibers, which can be made into filaments, smart textiles, high value cellulose biomaterials, such as superhydrophobic fibers and fibers of high tenacity, as well as high value dyed fibers. In the novel process, kraft fibers are chemically modified in water and made into a dope by dissolving it in an alkaline solution. The dissolved cellulose is regenerated in the acid bath of a spinneret, producing cellulose filaments, which can be further functionalized if desired. Trials on a demonstration spinneret show that such fibers can be spun at industrially speeds and drawing rates. Properties of the novel fibers, such as tenacity, elongation and water take-up are compared to those of rayon and cotton.

Speaker Biography

Theo van de Ven obtained the equivalent of a B.Sc and M.Sc. (in physical and colloid chemistry with a minor in theoretical physics) from the University of Utrecht, Holland, and obtained his PhD from McGill University. After a 2 year postdoc at the University of Sydney, Australia, he returned to McGill, where he is now a Full Professor in the Department of Chemistry, where he holds the Sir William C Macdonald Chair in Chemistry. He is an expert in colloid and surface chemistry, both in fundamental aspects and applied to papermaking and cellulosic materials. He has published over 400 papers in the scientific literature, among which a book ("Colloidal Hydrodynamics", Acad. Press 1989) and several book chapters. He was awarded with ACS Award in Colloid and Surface Science and was elected as Fellow of the Royal Society of Canada.

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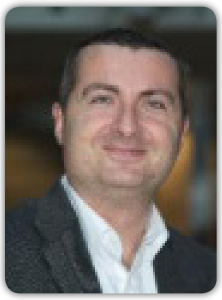

Ennio Capria

European Synchrotron, France

Non-Destructive high resolution 3D imaging for Nanoelectronics

With a density of integration continuously increasing, driven by a need of an always growing power efficiency and performance, 3D integration represent today the most promising strategy to adopt for next generation packaging. Although, various designs are considered, whatever the proposed technology, all of them share the same need to find critical defects (to be correlated with failure events) or to verify the compliance of structural elements in the bulk. X-rays are a powerful tool for this kind of analysis, in particular because they allow a non-destructive approach. 3D characterisation of the device can be obtained, whilst keeping the device functionality, enabling multimodal characterisation and in-situ/in-operando analysis. However, today, the instruments delivering 3D X-ray imaging ("computed tomography") available for conventional laboratory purposes, offer a too poor resolution, compared to the needs of nano-electronics. Thanks to the power of synchrotron radiation, this limit can be now overcome. This talk will illustrate the opportunities offered by synchrotron X-ray 3D imaging operated at the European Synchrotron in Grenoble (France) in collaboration with CEA-LETI. We will describe the unmatched characterisation opportunity offered by the new generation nano-tomography instruments on some standard 3DIC components. This presentation will demonstrate the power of this novel investigation tool, and their importance to boost the packaging innovation. Moreover, we will describe the complementarity between synchrotron X-ray 3D imaging and other traditional nano-characterisation techniques, to offer a multi-modal/multi-scale/multi-technique approach to the future challenges of characterisation in micro and nano-electronics.

Speaker Biography

Ennio Capria is actually Deputy Head of Business Development (Experiment Division) of the European Synchrotron (ESRF). He gained his PhD in Applied Physics at Cranfield University (UK). He then undertook a series of academic and industrial positions in different sectors of nanotechnology. In his research career he has worked on the development of nanobiosensors and on nanocomposites for various applications. In 2011 he joined Elettra where he worked on manufacturing of optoelectronic devices and particularly their characterisation with synchrotron light. Finally, from September 2013 he joined ESRF as the IRT NanoElec Industrial Liaison Engineer, dedicated to the domain of micro-electronics. He has a strong background in the application of a wide range of synchrotron techniques to industrial and applied R&D problems.

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Chodak Ivan

Polymer Institute of the Slovak Academy of Sciences, Slovakia

Effect of Biodegradation on physical properties of PLA- based blends

Biodegradable plastics are the subject of substantial changes of properties due to degradation initiated by enzymes produced by various bacteria. Before obvious changes are observed visually, modification of physical properties is important, occurring in the stage when the material is apparently unchanged. We investigated degradation in compost of virgin polylactic acid (PLA), PLA with a plasticizer triacetin (TAC), and a mixture of PLA / polyhydroxy butyrate (PHB) with TAC. Degradation proceeded at 58ºC up to 16 days and physical properties were measured. The degradation rate varied a little for the three samples. For virgin PLA the degradation test was performed also at 25 and 37ºC. Biodegradation was substantially slower compared to 58ºC, but hardly any difference was observed between 25 and 37ºC. Obviously, the key factor for the degradation rate is glass transition temperature of PLA, being around 55ºC. Physical properties were measured for 8 days (testing specimens keeping their shape intact) or in some cases up to 16 days. At longer periods the materials have been disintegrated to too small fragments to perform any analysis. Complex design of testing methods involved molecular weight and molecular weight distribution made by GPC, supported by measuring measurement of viscosity by rheology. Changes in structure of the materials were determined from changes in Tg and crystallinity determined by DSC. Mechanical properties of samples after certain time of composting were measured and the data were compared with information obtained from dynamic mechanical analysis (DMTA), which provided also exact data on changes in glass transition temperature. From the courses of alterations of various parameters the conclusions have been made regarding the effect of TAC and PHB presence on the biodegradation of PLA, and related changes concerning the structure / mechanical relations.
Acknowledgement: VEGA 2/0019/18, VEGA 1/0570/17, APVV 15-0741

Speaker Biography

Chodak Ivan is a senior scientist at Polymer Institute SAS in Bratislava, Slovakia. His scientific interests cover crosslinking of polyolefins (patented extremely efficient system for polypropylene crosslinking), multiphase systems, i.e. polymer blends and composites with polymeric matrices including nanocomposites and electroconductive composites. Investigation of biodegradable polymers belongs to his most successful topics (patented material based on PHB and PLA with very high toughness, the commercial production is under preparation). He is the author of over 150 scientific publications, 15 patents (4 of them applied in industry). Frequent and long-term cooperation with industry (DSM, BASF, Biomer, National Power, GE Plastics etc.).

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Arbiol J

Catalan Institute of Nanoscience and Nanotechnology, Spain

Free-Standing Nanostructures at atomic scale: From growth mechanisms to local properties

Technology at the nanoscale has become one of the main challenges in science as new physical effects appear and can be modulated at will. Materials for spintronics, electronics, optoelectronics, sensing, energy applications and new generations of functionalized materials are taking advantage of the low dimensionality, improving their properties and opening a new range of applications. As developments in materials science are pushing to the size limits of physics and chemistry, there is a critical need for understanding the origin of these unique physical properties (optical and electronic) and relate them to the changes originated at the atomic scale, eg: linked to changes in (electronic) structure of the material. In the present work, I will show how combining advanced electron microscopy imaging with related spectroscopies in an aberration corrected STEM will allow us to probe the elemental composition and electronic structure simultaneously with the optical properties in unprecedented spatial detail.The talk will focus on several examples in advanced nanomaterials for optical, plasmonic and energy applications. In this way the latest results obtained by my group on direct visualizing and modeling materials at atomic scale will help to understand their growth mechanisms (sometimes complex) and also correlate their physical properties (electronic and photonic) at sub-nanometer with their atomic scale structure. The examples will cover a wide range of nanomaterials: quantum structures self-assembled in a nanowire: quantum wires (1D) and quantum dots (0D) and other complex nanowire-like morphologies for photonic and energy applications (LEDs, lasers, quantum computing, single photon emitters, water splitting cells, batteries), nanomembranes and 2D sheets.

Speaker Biography

Jordi Arbiol graduated in Physics at Universitat de Barcelona (UB) in 1997, where he also obtained his PhD (European Doctorate and PhD Extraordinary Award) in 2001. He was Assistant Professor at UB. From 2009 to 2015 he was ICREA Professor and Group Leader at Institut de Ciència de Materials de Barcelona, ICMAB-CSIC. He is the President of the Spanish Microscopy Society (SME), was the Vice-President from 2013 to 2017. Since 2015 he is ICREA Professor and the leader of the Group of Advanced Electron Nanoscopy at Institut Català de Nanociència i Nanotecnologia (ICN2), CSIC and BIST. He has been awarded with the EU40 Materials Prize 2014 (E-MRS), the 2014 EMS Outstanding Paper Award and listed in the Top 40 under 40 Power List (2014) by The Analytical Scientist. He has over 295 publications that have been cited over 10800 times, and his publication H-index is 57 (WoS), 66 (GoS)

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