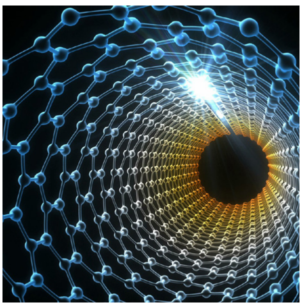
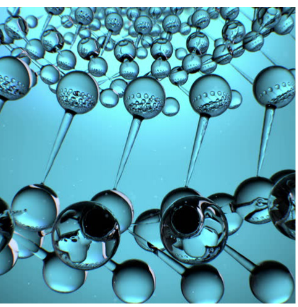
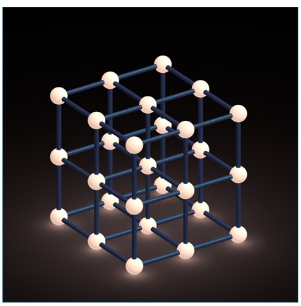
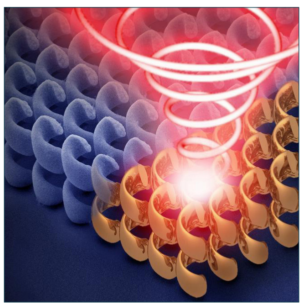
Scientific Tracks & Sessions
May 16, 2019

Nanomaterials 2019
Nanoscience 2019









Joint Event on

2nd International Conference on

Nanomaterials and Nanotechnology

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22nd International Conference on

Advanced Nanoscience and Nanotechnology

May 16-17, 2019 | Prague, Czech Republic

Mater Sci Nanotechnol, Volume 3

Silicon nanofabrication and carbon-based nanotechnology

Kaitlyn Parsons and **Joseph W Lyding**
University of Illinois, USA

Scanning tunneling microscopy (STM) offers the unique opportunity to push the limits of nanotechnology by means of atomic precision control of individual atoms. Hydrogen resist lithography is an example of how the Lyding group at the University of Illinois at Urbana-Champaign has demonstrated the potential to push the atomic limit in silicon. In addition to opening new directions in silicon-based molecular nano technology, this work also led to the fortuitous result that deuterium can be used to dramatically retard hot-electron degradation effects in today's CMOS technology. Continued CMOS scaling has necessitated the search for new materials that address the limits of silicon technology. Carbon-based nanotechnology, in the form of carbon nanotubes (CNTs), graphene and atomically precise graphene nanoribbons (GNRs), has emerged as a promising area for post-silicon device applications. One of the major challenges in studying these carbon structures is a clean transfer method onto semiconductor substrates. The Lyding group developed the unprecedented clean deposition method of nonvolatile nanostructures onto clean surfaces known as dry contact transfer (DCT). In this method, nanomaterials are applied to an applicator and then carefully stamped onto the substrate in ultra-high vacuum (UHV). The success of this DCT method along with STM and scanning tunneling spectroscopy (STS) has revealed characteristics of nanostructures including orientation-dependent effects in single-walled carbon nanotubes, zigzag edge states in the electronic structure of graphene and atomic precision control of atomically precise GNRs. Nanometallization using STM addresses how these carbon nanostructures can then be fabricated in devices. This presentation provides compelling evidence of atomic precision using carbon nanostructures and offers future direction in order to continue advancing the limits of nanotechnology.

Speaker Biography

Kaitlyn Parsons is a senior PhD candidate in electrical and computer engineering at the University of Illinois at Urbana-Champaign conducting research in Professor Joseph W Lyding's group. Her research is on scanning tunneling microscopy and spectroscopy of wet chemically synthesized graphene nanoribbons. She has presented at numerous conferences on her research including at the American Physical Society conference in Boston, Massachusetts and at the Materials Research Society conference in Phoenix, Arizona. She holds a Master of Science in electrical and computer engineering from the University of Illinois at Urbana-Champaign and two Bachelor of Science degrees in engineering physics and applied mathematics from the University of Colorado, Boulder.

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Notes:

Nano-scaled fillers (nanotubes, nanosheets): Do they toughness brittle matrices?

Ivo Dlouhy, Petr Tatarko, Luca Bertolla and **Zdenek Chlup**
Brno and Brno University of Technology, Czech Republic

Carbon nanotubes (CNTs) have been shown having excellent potential as reinforcements in a wide range of composite systems, thanks to their exceptional intrinsic mechanical and other functional properties. There has been growing interest in using CNTs in ceramic and/or glass matrices as toughening filler, in the last decade. Also, graphene nanosheets (GNSs) and graphene oxide nanosheets (GONSs) have attracted attention thanks to their unique combination of mechanical, thermal and electrical properties. Graphene thus appears to be an ideal second phase filler in order to modify properties of ceramics. Analogous effects have been newly obtained with boron nitride nanotubes (BNNTs) and nanosheets (BNNSs).

The aim of this contribution is to provide a snapshot of the current state of the art on the real effect of nanoscale fillers incorporated into glass/ceramic matrices on their composite fracture resistance.

For CNTs in silica matrix the fracture toughness KIC increased linearly to 100-120% relative to silica monoliths up to high CNT content (15 wt.%). There was an improvement of 35% in KIC of silica with addition of 2.5% GNSs and GONSs. Toughening mechanisms including GONSs necking, pull-out, crack bridging, crack deflection and crack branching were evidenced for silica matrix composites. Similar effects have been proven in alumina composites, e.g. when incorporating 0.8 vol. % of GNS the improvement of the KIC was more than 40%. BNNT, cylindrical and bamboo-like, incorporated into nanostructured tetragonal zirconia stabilized with 3 mol.% yttria contributed to significant increase of KIC, 2.5 wt. % addition produced 100% increase in KIC compared to the monolithic zirconia. Exploitation of BNNSs in borosilicate glass matrix resulted in about 45% KIC increase.

The main effect of nanoscale filler has to be seen not only in producing synergy of several toughening mechanisms active during crack initiation/propagation but also in affecting microstructures formation during sintering.

Speaker Biography

Ivo Dlouhý has been affiliated with Institute of Physics of Materials, Czech Academy of Sciences, Brno, as a head of Brittle Fracture Group. He is employed at Brno University of Technology, Institute of Materials Science and Engineering, as professor and institute director. He graduated at Faculty of Metallurgy and Materials, TU Ostrava in 1979. His got his PhD degree from Institute of Physics of Materials, Czech Academy of Sciences, in 1984. Since 1992, he is active as senior scientist at the Department of Mechanical Properties. Since 2008, he is the professor of materials strength, experimental fracture mechanics and mechanical testing of materials at Faculty of Mechanical Engineering, Brno University of Technology. Except for research reports, author 210 papers registered by Web of Science, h-index 19. He is the member of editorial boards of journals Engineering Fracture Mechanics, International Journal of Applied Ceramic Technology and Metal Physics and Advanced Technologies.

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Smart nanocomposites based on thermally reversible networks

Francesco Picchioni
University of Groningen, The Netherlands

The use of nano-fillers in thermally reversible networks constitute and easy as well as extremely attractive route to smart nanocomposites. In particular, the Diels Alder reaction between furan and maleimide derivatives has been extensively reported for the preparation of nanocomposite materials that exhibits heat or electricity induced self-healing, shape memory and possibility for cradle-to-cradle recycling. The covalent nature of the Diels-Alder adducts ensures relatively high glass transition temperatures, while its reversible character provides the necessary dynamic character that ensures the possibility for self-healing and shape memory effects. In the present work, we will start by briefly illustrating the wide variety of substrates suitable for modification with Diels-Alder active groups and their self-healing behavior. Against this backdrop, the special case of nanocomposites will be illustrated as paradigmatic example for the possible use of this interaction also between a polymeric matrix and a filler. In particular, the use of carbon nanotubes as filler paves the way towards shape memory materials as well as electricity-induced self-healing.

Speaker Biography

Francesco Picchioni obtained his PhD (2000) in Polymer Chemistry at the University of Pisa (Italy) on a project dealing with thermoplastic rubbers. After 3 years postdoc at the Technical University of Eindhoven (on a project about “solid state modification of polypropylene”), he joined in 2003 the University of Groningen first as assistant professor and then associate (2007). Since 2013. He is full professor in Chemical Product Engineering. He is (co)author of about 90 papers in peer-reviewed journals and 4 patents.

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Photo-thermal directed assembly

Hagay Shpaisman, Ehud Greenberg and **Nina Armon**
Bar-Ilan University, Israel

Micro-patterning of various materials was recently developed based on the laser-induced microbubble technique (LIMBT). LIMBT relies on the formation of a microbubble due to laser heating of a dispersion of nanoparticles (NPs) that absorb the laser light. Natural and Marangoni convection currents carry the NPs to the bubble/substrate interface where some of them are pinned. Moving the substrate relative to the laser beam results in deposition of NPs along a predetermined path. Unfortunately, for many materials this deposition is non-continuous. We have recently found that controlling the construction and destruction of the microbubble through modulation of the laser enables the formation of continuous patterns by preventing the microbubble from getting pinned to the deposited material. Furthermore, we show that microstructure formation from an ion solution could be explained by a similar mechanism. Photo-thermal reduction of the ion solution leads to formation of NPs. These NPs are then pinned to the bubble/substrate interface. This innovative approach can be applicable for producing thin conductive patterns and allow fabrication of microelectronic devices and sensors.

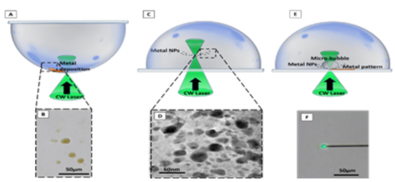

Illustration of deposition processes for different laser focus positions:(A) at the interface between the solution droplet and air,(B) inside the solution and (C) at the substrate/solution interface. The inset in each figure shows the deposits (bright-field microscopy image for A,C and TEM for B)

Speaker Biography

Hagay Shpaisman is currently working as a principal investigator in Bar-Ilan University, Israel. In 2013, he serves as a senior lecturer (eq. to assistant professor) at Department of Chemistry & Institute for Nanotechnology and Advanced Materials (BINA), Bar-Ilan University, Israel. Between 2010 – 2013, post-doctoral fellow with Prof. David Grier at NYU, USA and obtained his PhD under the supervision of Prof. David Cahen during 2010 from the Weizmann Institute of Science, Israel. They are fascinated by scientific questions that are at the interface between chemistry, physics and material science. They develop novel methods for bottom-up directed assembly by utilizing optical and acoustic fields. These fields dictate the spatial distribution of materials, their mesoscopic structure and could allow formation of new hybrid materials. A key feature of this approach is its modularity, as it could be implemented on various material systems. Due to the flexibility in material choice, this innovative approach will open the door to new ways to act upon materials, with envisioned applications for electronics, photonics and drug delivery systems.

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Mater Sci Nanotechnol, Volume 3

Overview of commercial nanomaterial products and the common thread of compatibility

David Strawser
Technical Developments, Israel

Consumer Product Indexes (CPI) that relate to products incorporating at least one nanomaterial have been developed by several countries including the United States, Japan and Germany. From these indexes we find about 2000 consumer products listed from 32 countries. These products can be grouped into five major categories based on composition: metals, carbonaceous, silicon, other, not revealed. The "not revealed" category comprises nearly 50% of the products, metals about 35%, and carbonaceous, silicon and other all garner about 5% each. The types of organizations that are conducting research and/or commercialization of nanomaterials can be grouped into 5 major categories: industry, non-governmental, research center, governmental and university. Although we might expect industry to perceive lucrative advantages from developing and promoting nano-based products, it is interesting to see that they are found to be at the bottom of the list, garnering a mere 4%, whereas university involvement is 12 times greater at 50%. Combined government and university involvement amount to 75%. A major challenge in all areas of product development is compatibility between components and with the end use environments. Developing products that incorporate nanomaterials presents an even greater challenge in compatibility issues due to either the high reactivity brought about by the high surface area of nanomaterials, or by almost complete incompatibility with nearly all other substances. As we strive to produce more commercial products based on nanomaterials, perhaps we should be questioning why industry involvement is drastically lower than either academic or government entities, and if a model can be found that enables a more efficient route form lab to commercial products.

Speaker Biography

David Strawser brings to the conference a wealth of chemical and technology experience in a wide variety of industries and academic settings that include nanomaterials, pharmaceutical and health care, conductive polymers, electronics, waste water treatment and detergents. In addition, to research projects with nanomaterials, he has both worked with and headed teams that have taken materials from the laboratory R&D stage through commercial production. His unusual ability to understand technology and applications in unrelated fields has been demonstrated in patents, commercial products and processes. He currently focuses on the challenges of developing methods to functionalize nanomaterials in order to tune compatibility with other materials in order to maximize the contribution that the nanomaterials make to the formulation properties.

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Notes:

Nanotech in modern vaccines

Fabio Vengoechea[1] and **Josefa Bernad-Bernad**[2]

[1]Laboratorio Avimex SA de CV, Mexico

[2]National Autonomus University of Mexico, Mexico

Avian influenza (AI), caused by the avian influenza virus type "A", is a disease that can affect poultry for human consumption and some strains can cause high mortality rates (33-100 %). In Mexico, a pandemic was registered in 2009 due to the influenza virus AH1N1. The existing vaccines (W/O and O/W) for AI are administered repeatedly generating deposits, fibrosis, stress, pain, among others, which leads to lower production, lower weight and economic losses for the producer, as well as price increase for the market. These may contain some adjuvants that cause inflammation at the site of application and are associated with symptoms of apathy, lethargy and temporary lameness. In recent years, modified-release nanotechnology systems have become an area of global interest. A promising option is the so-called "sensitive stimulus" polymers, which change their structure and functions in response to external stimuli, with which they are intended to reduce the side effects associated with multidose therapies, so at Laboratorio Avimex we are exploring this field to generate safe and effective vaccines, which are projected into the future, which is a great contribution to animal and human health.

Speaker Biography

Fabio Vengoechea is a Colombian researcher whom graduated from the undergraduate program in Chemistry from the Quindio's University (Colombia, 2008). He has completed his PhD from Autonomous University of the State of Morelos (Mexico, 2013). He has explored the synthesis of nano and biomaterials with biocompatible catalyst organometallic systems. He has experience in microstructural biopolymers and design of nanopolymers, by methods such as GPC, homonuclear decoupling NMR, TEM and SEM. He has postdoctoral studies at the Institute of Chemistry of National Autonomus University of Mexico, where he was working in synthesis of palladium organometallic catalyst for the production of molecules with broad structural diversity with UGI reactions. Currently, he is coordinator of Laboratory of Nanotechnology at Laboratorios Avimex, where he is working in the development of modified-release vaccines and antibiotics. He has published 8 papers in reputed journals. He likes to combine science and sports, since he has competed as high performance triathlete in regional teams in Colombia and Mexico.

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A novelty in the current CVD techniques: Plasma radicals assisted polymerization via chemical vapour

Bianca Rita Pistillo, Kevin Menguelti and **Damien Lenoble**
Luxembourg Institute of Science and Technology, Luxembourg

The terrific grown in the last forty years of chemical vapor deposition (CVD) allowed this fabrication process to become as a fundamental element in many industrial products, such as semiconductors, optoelectronics, optics and many others. Despite this strong advance, the technology still faces many challenges and new techniques are developing all around to world. Plasma Radicals Assisted Polymerization via Chemical Vapour Deposition (PRAP-CVD) has been developed at Luxembourg Institute of Science and Technology as an efficient alternative to conventional vapor-based processes of conductive thin films. In PRAP-CVD, oxidative radicals are generated by a remote plasma chamber from a selected initiator and precursor is injected directly in the process chamber. The process is based on the concomitant but physically separated injection of low-energy oxidative radical initiators and vaporized precursor species into the reactor where temperature and pressure are finely controlled. A few advantages of making the process completely dry includes the possibility of processing solvent-sensitive substrates such as paper, overcoming the effects of rinsing on the underlying films in the case of multilayer structures. Moreover, PRAP-CVD allows the deposition of highly conformal coatings, which accurately follows the geometry of the underlying substrate independently from its nature. Poly (3, 4-ethylenedioxythiophene has been chosen as a case study to demonstrate the effectiveness of this technique. In this work, the properties of PRAP-CVD PEDOT films and its applications will be presented.

Speaker Biography

Bianca Rita Pistillo is currently a research and technology associate at Luxembourg Institute of Science and Technology in Luxembourg. She earned her PhD in Chemistry of Innovative Materials at University of Bari (Italy) in 2009. After completing her PhD, she accepted a position as researcher at University of Aldo Moro (Italy), where she worked for 3 years. During that time, she increased her expertise on chemical/morphological surface nanomodification by Chemical Vapour Depositions. In 2012, she accepted to move to LIST jointing the nanomaterials and nanotechnology unit, where she has started to develop a novel technique named Plasma Radicals Assisted Polymerization – CVD, demonstrating as an efficient alternative to conventional vapour based processes. PRAP-CVD is also characterized by a quite unique degree of conformality of deposited films on 3D complex substrates. In 2017, she was awarded the IAAM Scientist Medal by the International Association of Advanced Materials, recognizing her contribution to nanomaterials field.

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Mater Sci Nanotechnol, Volume 3

Bioinspired micro/nanostructured surfaces with wettability from design to functions

Yongmei Zheng
Beihang University, China

Biological surfaces provide endless inspiration for design and fabrication of smart materials. It has recently been revealed to have become a hot research area in materials and science world. Inspired by the roles of micro- and nanostructures in the water collecting ability of spider silk, a series of bioinspired gradient fibers has been designed by integrating fabrication methods and technologies such as fluid-coating, electrospinning-electrospraying, and web-assembly, etc., where the “spindle-knot/joint” structures with multiple gradients (e.g., roughness, curvature, etc.) can be realized to achieve functions of droplet transport, fog-harvesting, etc. In addition, the integrative conical spine materials with gradient micro- and nanostructures can be fabricated to achieve the ability of droplet transport in efficiency. Otherwise, the functional surfaces with micro- and nanostructures are developed to achieve the effect of water repellency by methods combining machining, electrospinning, soft lithography, and nanotechnology. These micro- and nanostructure surfaces with wettability exhibit robust transport and controlling of microdroplets, which would be promising applications.

Speaker Biography

Yongmei Zheng completed her PhD and currently working as a professor at Beihang University. His research interests are focused on bioinspired surfaces with gradient micro- and nanostructures to control dynamic wettability and develop the surfaces with characteristics of water repellency or fog-harvesting, tiny droplet transport, and so on. She has publications more than 100 SCI papers included in Nature, Adv. Mater., etc., with 12 cover stories and a book “bioinspired wettability surfaces: Development in micro- and nanostructures”. Her work was highlight as scientist on News of Royal Society of Chemistry, Chemistry World in 2014. She is a member of Chinese Composite Materials Society (CSCM), International Society of Bionic Engineering (ISBE). She wins an ISBE outstanding contribution award in 2016 by ISBE.

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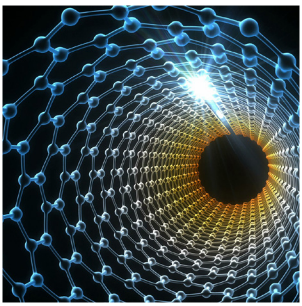

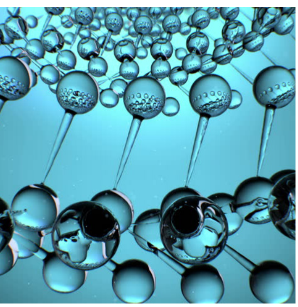

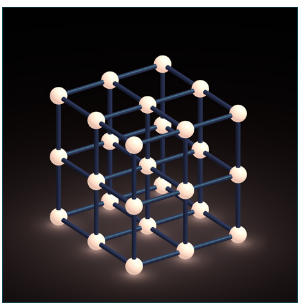

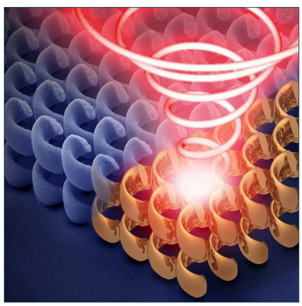

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Computing thermo-elasticity of crystalline systems from quasi-static and quasi-harmonic approximations

Maurizio Destefanis
University of Turin, Italy

An effective algorithm for the quasi-harmonic calculation of anisotropic thermo-elasticity of materials is discussed and implemented into the CRYSTAL program for quantum-mechanical simulations of extended systems. The directional elastic response of solid compounds is expressed in terms of the fourth-order *stiffness tensor*: Its components - namely, the elastic constants – define the stress-strain linear relationships.

One of the main challenges to state-of-the-art methodologies is that of reliably and efficiently accounting for thermal effects on solid compounds. The simplest way to accomplish this is by means of standard harmonic lattice dynamics; however, when anharmonic thermal effects are totally neglected, the volume and elastic response do not exhibit any dependence on the temperature. An easy way to overcome these limitations is offered by the so-called *quasi-harmonic approximation*: It explicitly introduces the volume into the expression of the phonon frequencies, which are still computed at the harmonic level but at several volumes. The Helmholtz free energy is then expressed as function of both volume and temperature (and not just of temperature as it would be at the harmonic level), thus allowing the thermal expansion of the system to be determined. Then, the thermo-elastic constants of the compound are given by the second-order derivatives of the Helmholtz free energy with respect to strain – normalized by the volume at that temperature. A simpler approach is also presented: inside the *quasi-static approximation*, the thermal dependence of elastic constants is assumed to be due only to the thermal expansion of the system – the derivatives are performed on the static energy, which does not include any thermal contribution. This algorithm has then been applied to the forsterite mineral and the results are discussed: It shows great accuracy with experimental data (especially with the trends) and good coherency among different DFT functionals.

Speaker Biography

Maurizio Destefanis obtained his BSc and MSc in Chemistry at University of Turin, Italy. During the degree program, his interests were focused on the interface between chemistry and computer science, since he developed software for chemistry during both his theses projects and research activity in computational chemistry. He specialized into algorithm development (mainly through the Fortran programming language – imperative and static) and application design (mainly through the Ruby programming language – object-oriented and dynamic). Currently, he is working in the Information Technology field for the company Accenture as a backend Java developer. In 2011, he was also awarded by the Italian Chemical Society with the bronze medal at the Italian Chemistry Olympiads competition.

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Mater Sci Nanotechnol, Volume 3

Graphdiyne: From foundation to application

Yuliang Li
Chinese Academy of Sciences, China

As a new all-carbon material, 2D graphdiyne has attracted more and more attention due to its preparation under low-temperature. Graphdiyne, consisting of layers containing sp and sp^2 carbons, was proposed as one of the synthetically approachable carbon allotropes. In graphdiyne, each benzene ring is connected to six adjacent benzene rings through two carbon–carbon triple bonds, resulting in a flat porous structure exhibiting high chemical stability and electrical conductivity. Graphdiyne families have attracted great attention of many structural, theoretical and synthetic scientists, due to their promising electronic, optical and mechanical properties. The physical properties of graphdiyne have also been systemically investigated and the applications of graphdiyne in the fields of energy, optoelectronics and catalysis have been achieved.

Speaker Biography

Yuliang Li is currently working as a professor at the Institute of Chemistry, Chinese Academy of Sciences. He worked as a visiting scholar and visiting professor at the Lab of Organic Chemistry at University of Amsterdam in Netherlands, the Radiation Lab at University of Notre Dame and the Department of Chemistry at the University of Hong Kong. He has published more than 600 peer reviewed scientific articles and invited reviews. His research interests lie in the fields on design and synthesis of functional molecules, self-assembly methodologies of low dimension and large size molecular aggregations structures, chemistry of carbon and rich carbon, with particular focus on the design and synthesis of photo-, electro-active molecular heterojunction materials and nanoscale and nano-structural materials.

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Mater Sci Nanotechnol, Volume 3

Ring models of nanomaterials

Pavel Osmera senior[1], **Daniel Zuth**[1], **Anna Kucerova**[1], **Pavel Osmera junior**[2], **Tomas Marada**[1] and **Ladislav Dobrovsky**[1]
[1]Brno University of Technology, Czech Republic
[2]Masaryk Memorial Cancer Institute, Czech Republic

The classical approach in particle physics is based on the fact that the electron has some parameters like charge, mass, etc. but does not have a structure. In our calculations, the electron is assumed as structured particle having magnetic properties. VFRT (Vortex Fractal Ring Theory) uses the electron, proton and neutron as a particle with a toroidal (ring) shape, which is formed by fractal substructures connected to each other by vortex electromagnetic fields. The atomic nucleus can be built from the ring protons and neutrons. Combining knowledge of physical chemistry, evolutionary optimization, 3D graphic, programming in Python, and mathematics makes it possible to create programs for designing new nanostructure models. The first testing proposal for the nanostructure prediction program is limited to carbon structures. The aim was to verify whether the proposed program is capable of generating known carbon nanostructures, such as graphene. The following versions of the program will no longer have this limitation.

Ring models can be used for explanation of vitalized water. There are currently two opposing views on vitalized water. Some authors consider everything around vitalized water as a pseudo-science. On the contrary there are good and positive insight. Water vortex and magnetic field of permanent magnets changes some of the water properties. Vitalized water can be created by different water vitalizers. Next aim of the article is to describe 8 ways how we can obtain vitalized water, measure the physical properties of vitalized water (diamagnetism, wettability, surface tension and conductivity) and compare the efficiency of these 8 ways. There are 8 types water vitalizers: 1) a connector with a hole for 2 PET bottles, 2) a connector with magnets added, 3) a magnetic vortex vitalizer for water tap, 4) a vitalizer for a bathtub in the bathroom, 5) vitalizer with a motor and magnetic stirrer, 6) vitalizer with balls, 7) vitalizer for watering gardens and removing settled minerals in heating pipes and regulating heads, 8) vitalizer with shungite. There is big difference in water's magnetic properties.

Speaker Biography

Pavel Osmera received the MS degree in Electrical Engineering from Brno University of Technology Institute of Automation in 1969. During 1983-2018, he worked in Faculty of Mechanical Engineering, Institute Automation and Computer Science. His research is oriented to evolutionary optimization and physical chemistry. He was the founder and the organizer of the MENDEL International Conference on Soft Computing in 1995. From 1994 to 2000, he was director of the Institute: Automation and Computer Science, faculty of Mechanical Engineering in Brno. Now, he is currently working as professor in Brno University of Technology, Czech Republic.

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Mater Sci Nanotechnol, Volume 3

Bandgap tunability in one dimensional system

Rakesh Kumar, Payal Wadhwa, Shailesh Kumar, T J Dhilip Kumar and **Alok Shukla**
Indian Institute of Technology Ropar, India

For optoelectronic applications of low dimensional materials, a direct bandgap is required; but for optoelectronic applications of the same material in different wavelength range, bandgap tunability is required. Even though tunability of bandgap in direct bandgap materials carries huge potential for optoelectronic applications like LEDs and solar cells, an exhaustive formulation for bandgap tuning is unavailable. In this article, we report broad theoretical investigations using periodic potential profiles for direct bandgap one-dimensional isomeric systems having the same functional groups. We derived all possible correlations between bandgaps of one-dimensional isomeric systems using two parameters, width and depth of the deepest potential well at global minimum. The derived correlations are verified for known synthetic as well as natural polymers (biological and organic) and also for other one-dimensional direct bandgap systems. We have demonstrated bandgap tuning simply by modifying the potential profile on changing the position of the functional group in a periodic supercell. This insight would greatly help experimentalists in designing new isomeric systems of different bandgap values from a direct bandgap polymer or a one-dimensional inorganic system for its optoelectronic applications.

Speaker Biography

Rakesh Kumar is an assistant professor in the department of Physics at IIT Ropar, India. In 2006, he received his PhD degree from Indian Institute of Technology Bombay, where he worked on superconductivity and magnetism. Thereafter, he joined Tata Institute of Fundamental Research, Mumbai as a visiting fellow, where he continued his research work on magnetic materials. In 2007, he moved to University of Peirre and Marie Curie, Paris, France to work on graphene and other two-dimensional layered materials like InSe, $NbSe_2$, BSCCO superconductors and Bismuth. He worked on fabrication as well as electrical characterization of Field Effect Transistors (FETs). His current research interests focused on theoretical and experimental investigations of low dimensional materials and the involved Physics towards its electronic applications.

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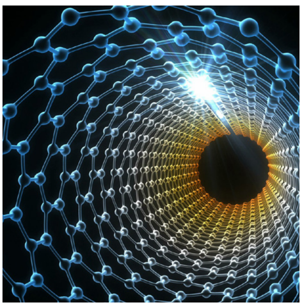

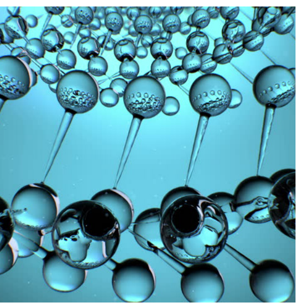

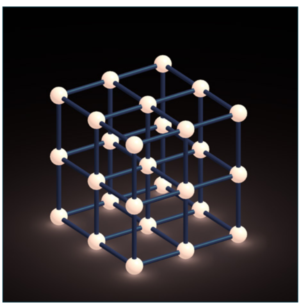

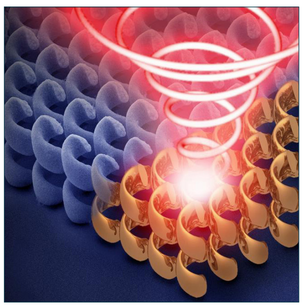

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Investigating the role of gold nanoparticle shape and size in their toxicities to fungi with a novel synthesis method

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With the flourishing development of nanotechnology, abundant amount of nanomaterials have been manufactured and applied in all sorts of areas in everyday life. Among which, gold nanoparticles (GNPs) possesses a certain proportion and very important status due to their fascinating properties like quantum size effects and wide applications in the fields of surface enhanced Raman scattering (SERS), chemical and biological sensing, biomedicine and so on. With such high usage in daily and industrial life, the release of GNPs into the environment is increasing in great quantities. Thus, attentions have been drawn to the effects of GNPs to the environment, especially the effects on living organisms, and ultimately the effects on human bodies and health. Unfortunately, the characteristics of the toxicology of GNPs on living organisms are still not fully understood up till now.

In our study, a novel synthesis method of shape and size controllable GNPs has been developed. And with such method, gold nanoflowers sized from as small as less than 1nm to ~60nm; along with mixtures of gold nanospheres and gold nanoplates from ~5nm to large aggregates of ~400nm has been synthesized to investigate the relationship of GNPs' toxicities with their size and shape. Fungi has been chosen for toxicity assessment due to their important role as decomposers in the ecosystem, which enables fungi to directly interact with the ecosystem and control its health condition. In our study, *Aspergillus niger, Mucor hiemalis, and Penicillium chrysogenum* were selected and exposed to the GNPs with designed size and shape and incubated for 48 hours before survival rates were examined and compared. Our results indicated that fungi species caused the largest variety of the tolerance to GNPs. Meanwhile, larger and non-spherical GNPs held higher toxicities.

Speaker Biography

Kangze Liu is currently a PhD student in Technological University Dublin, Ireland. She graduated from the Department of Hydraulic Engineering in Tsinghua University, China in 2015 and got BE in hydraulic engineering. Her current research focuses on the novel synthesis methods, characteristics and applications of gold nanoparticles. Her research topics include but not limited to: Establishment and evaluation of nanotest as a detection method of human fungal infections; evaluation of cold atmospheric plasma (CAP) for brain cancer treatment; establishment of a bottom-up in situ synthesis method of GNPs using phosphates and evaluation of its toxicity; establishment and evaluation of digital nanotest as a smart microbial detection system for water monitoring. Up till now, she has 3 papers published in international peer-reviewed journals, and 1 published book chapter. She is also a reviewer and has reviewed 8 papers for journals on MDPI.

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