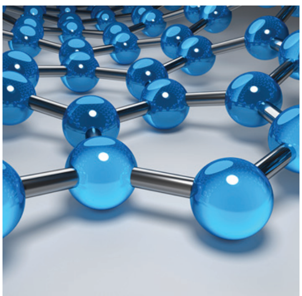
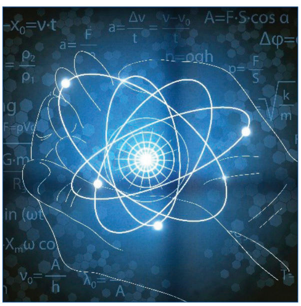
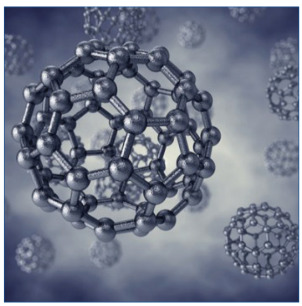
allied academies

Keynote Forum
May 20, 2019

Biomaterials & Materials Physics 2019



2nd International Conference on

Biomaterials and Nanomaterials & Materials Physics and Materials Science

May 20-21, 2019 | Vienna, Austria

Thomas J Webster

Northeastern University, USA

Say goodbye to hospitals and hello to implantable sensors

There is an acute shortage of organs due to disease, trauma, congenital defects, and most importantly, age related maladies. While tissue engineering (and nanotechnology) has made great strides towards improving tissue growth, infection control has been largely forgotten. Critically, therefore, the Centers for Disease Control have predicted more deaths from antibiotic-resistant bacteria than all cancers combined by 2050. Moreover, there has been a lack of translation to real commercial products. This talk will summarize how nanotechnology can be used to increase tissue growth and decrease implant infection without using antibiotics but using sensors (while getting regulatory approval). Our group has shown that nanofeatures, nano-modifications, nanoparticles, and most importantly, nanosensors can reduce bacterial growth without using antibiotics. This talk will summarize techniques and efforts to create nanosensors for a wide range of medical and tissue engineering applications, particularly those that have received FDA approval and are currently being implanted in humans.

Speaker Biography

Thomas J Webster's (H index: 86) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995) and in biomedical engineering from Rensselaer Polytechnic Institute (M.S., 1997; Ph.D., 2000). He has graduated/supervised over 149 visiting faculty, clinical fellows, post-doctoral students, and thesis completing B.S., M.S., and Ph.D. students. He is the founding editor-in-chief of the International Journal of Nanomedicine (pioneering the open-access format). He currently directs or co-directs several centers in the area of biomaterials: The Center for Natural and Tropical Biomaterials (Medellin, Colombia), The Center for Pico and Nanomedicine (Wenzhou China), and The International Materials Research Center (Soochow, China). He regularly appears on NBC, CNN, MSNBC, ABC News, National Geographic, Discovery Channel, and BBC News talking about science and medicine. He has received numerous honors and is current a fellow of AANM, AIMBE, BMES, NAI, and FSBE.

e: th.webster@neu.edu

Notes:

Radenka Maric

University of Connecticut, USA

Novelties in additive manufacturing and bio-printing

Fuel cell electric vehicles (FCEVs) are demonstrating commercial readiness: fully-functional fuel cell/ electric hybrid vehicles with >400 km range and refuel times of <4 minutes have been shown to be feasible. Leading automakers (including Toyota, Daimler, Ford, Honda, Nissan, Hyundai, and GM) have supported, and are continuing to support FCEV development and deployment with billions of dollars of investment spent to date and further significant investment planned. These automakers foresee that FCEVs are a key option in the overall advanced power-train portfolio that will allow them to meet the complete range of customer needs while at the same time complying with environmental, energy efficiency, and regulatory requirements (especially as zero emission vehicles, fuel economy, and greenhouse gas policies are being developed). Some of the technical barriers of polymer electrolyte membrane fuel cell (PEMFC) technology have been clearly identified at a high level. These involve materials cost, performance, reliability, and durability. Currently, electrodes make up almost half of the MEA cost and increases in catalyst efficiency and manufacturing cost reduction in this area are expected to have a large impact on the overall cost. The cost of catalyst ink, even at large volume production of 500,000 units/year, will still represent the highest cost component. However, to be competitive with the internal combustion engine that costs only $25-35/ kW for an entire engine, the cost of the FC stack must be substantially reduced. In order to reduce the cost, we designed low Pt loading catalyst, total loading of 0.15 mg/cm^2, and evaluated the stability and durability of the low Pt loaded nano catalyst. In order to achieve the highest performance and stability with a low Pt loading catalyst, we optimized a gradient structure of the catalyst with optimized, Pt, ionomer and carbon loading.

Speaker Biography

Radenka Maric is the vice president for research at the University of Connecticut. She has been developing nanomaterials and catalysts for fuel cells since 1996. She worked for Japan Fine Ceramic Center, Japan, Engi-Mat, Atlanta, and the National Research Council Canada, Vancouver, before joining the University of Connecticut, Storrs, in 2010. She has published more than 200 papers and is an inventor on eight patents. She is a world-renowned expert in nanomaterials processing for energy applications. A major component of her research has been the development of new manufacturing processes for Solid Oxide Fuel Cell (SOFC) and Proton Exchange Membrane Fuel Cell (PEMFC) components that can potentially lower the cost of materials and processing when compared to traditional fabrication techniques.

e: radenka.maric@uconn.edu

Notes:

Larry D Unsworth

University of Alberta, Canada

Nano-scaffold development for targeting mast cells in human tissue

Mature mast cells reside in connective tissues that largely interface with the external environment, making them crucial sentinel cells that help to direct and control the innate immune response. The rapid degranulation and long-term expression of various proteins that occurs upon mast cell activation provides both a quick and long-term response mechanism. These released mediators are central to protective actions such as wound healing, angiogenesis, and host defense against pathogens and animal venoms. Thus, mast cells are ideal targets for novel immunotherapies. Engineering biomaterials to manipulate the immune response to elicit specific therapeutic outcomes is a burgeoning field of research. In particular, the development of self-assembled peptide systems for directing the action of mast cells within a local tissue environment will be presented, with a special focus upon skin tissue applications. The effect of Nano scaffolds composed of self-assembled peptides was explored using several mast cell types. Initial work focused upon understanding the influence of Nano scaffold structure and chemistry on bone marrow-derived murine mast cell (BMMC) activity: adhesion, degranulation and cytokine release. Results show that BMMCs adhere to the matrix without previous sensitization and can be found within the matrix itself, without exhibiting any signs of activation. This work is considered the first step in quantifying mast cell activity in artificial matrices composed of self-assembling peptides and led to further work looking at IgE independent activation of human mast cells through Mas-related G-protein coupled receptor member X2 (MRGPRX2) receptor. Herein, it was observed that the engineered Nano scaffold matrix could be designed to locally activate tissue-resident mast cells within human tissue samples. This Nano scaffold may provide a new platform to modulate localized mast cell functions thereby facilitating their protective role in the skin.

Speaker Biography

Larry D Unsworth, is a professor in chemical engineering at the University of Alberta. In 2005, he was awarded the international research associate award by NRC-Canada and joined the Massachusetts Institute for Technology USA to work in the area of self-assembled peptides and diffusion in complex media. His PhD was based on the area of engineered surfaces for bio-fouling applications. He has 2 patents and 60+ papers, with a total citation record of 2300: three papers cited 250+ times and another six cited 100+ times, with an h index of 18. His research focus is on development of bio responsive and bioactive, self-assembled peptide constructs.

e: larry.unsworth@ualberta.ca

Notes:

Karl Heinz Gresslehner

University of Applied Sciences Upper Austria, Austria

Thermoelectricity: Principles and applications

Thermoelectricity is the direct conversion of thermal energy into electrical energy (denoted as thermoelectric generator TEG) and vice versa (denoted as thermoelectric cooler TEC). Therefore, thermo electrics is literally associated with thermal and electrical phenomena. The main advantages of TEG's and TEC's are their noiseless operation, no moving parts and no working fluids are necessary.

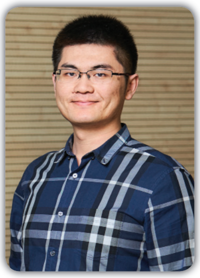
In this presentation we will give an overview of the physical principles of thermoelectricity, the existing state of research and the performance parameters of thermoelectric materials as well as examples of the wide range of applications of thermoelectric modules (e.g. waste heat recovery, generation of electric power in remote area, solar TEG, space flight, medicine, etc.).

Speaker Biography

Karl Heinz Gresslehner completed his PhD in the field of semiconductor physics in 1981 at the Johannes Kepler University, Linz. He is working more than 10 years in the industry and 24 years as a teacher at a school for higher technical education. Since 2016, he is a professor at the University of Applied Sciences in Upper Austria and is the head of the research group thermoelectricity.

e: karl.gresslehner@fh-wels.at

Notes:



Yang Bai

University of Oulu, Finland

A narrow band gap, strong ferroelectric perovskite oxide opening up next-generation opto-ferroelectric and energy harvesting devices

For nearly 40 years, narrow band gap semiconductors and strong ferroelectrics are considered separate material families. Narrow band gap semiconductors are widely used as solar cells and optical sensors. Strong ferroelectric materials have the potential to induce strong piezoelectricity. They are core components for thermal and kinetic sensors, actuators, transducers and energy harvesters. Some simple and pre-mature photoferroelectrics, i.e. ferroelectrics exhibiting photovoltaic effect (e.g. $BaTiO_3$, $BiFeO_3$, $LiNbO_3$ and (Pb, La) (Zr, TiO_3), have been theoretically investigated since the 1970s. However, they either have a wide band gap or a weak ferroelectricity leading to inefficient photovoltaic effects or insensitivity to light/electric/strain excitations, respectively. This issue has then hindered the practical use of these photo-ferroelectrics in potential multi-functional devices.

In this talk, a novel multi-functional perovskite material will be presented, which merges the two fields of narrow band gap semiconductors and strong ferroelectrics for the first time. The composition is a widely used lead-free ferro-/piezoelectric composition, $(K_{0.5}Na_{0.5})$ NbO_3 (KNN), doped by $Ni2^+$ and with oxygen vacancies present in the structure (abbreviated as KNBNNO hereinafter). The KNBNNO is able to exhibit a narrow band gap of 1.6 eV (compared to > 4 eV) whilst maintaining the parental, KNN-level ferroelectric, piezoelectric and pyroelectric properties. Such multi-functional properties enable the KNBNNO to be simultaneously used for visible-range (solar) photovoltaic and ferro-/piezo-/pyroelectric effects. It is the first materials of its kind discovered in history.

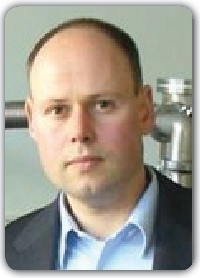
Together with its microstructure and working principles, demonstrations will also be shown in this talk for practical applications of the KNBNNO. These include a single-component, multi-source energy harvester-sensor integration system based on only one material, and an opto-ferroelectric component with interactions between light and domain walls for e.g. light-re-writable data storage distinguishing wavelengths.

Speaker Biography

Yang Bai is a tenure track assistant professor for small-power self-sufficient sensor system in microelectronics research unit, University of Oulu, Finland. He obtained his bachelor's degree in 2011 at Tianjin University, China, and PhD degree in 2015 at University of Birmingham, United Kingdom. In 2016, he was granted a Marie Sklodowska-Curie individual fellowship under European Union's Horizon 2020 research and innovation program. He is also an elected committee member of the IOP (Institute of Physics) energy group, UK. His research interests include multi-functional perovskites, photo-ferroelectrics, ferroelectric and piezoelectric materials and energy harvesting technology.

e: yang.bai@oulu.fi

Notes:



Hinrich Grothe

Vienna University of Technology, Austria

Macromolecular biomaterials causing heterogeneous ice nucleation

Biological materials from plants, bacteria and fungi are dispersed in the environment. This can be whole organisms or just fragments. When these particles get airborne, they are termed bioaerosols and are in the size range between hundred nanometers and a few micrometers. Here we present the particularity that macromolecules from these bioaerosols can be washed of in aqueous solution and that these macromolecules can exist independently from the mother grain, e.g. in water droplets or on the surface of dust particles. In general, ice nucleation of bioaerosols is a topic of growing interest, since their impact on ice cloud formation and thus on radiative forcing, an important parameter in global climate, is not yet fully understood. We have focused on birch trees, which exhibit an elevated ice nucleation activity and we proof the size of these molecules, their stability against oxidation and their chemical origin. Further we find evidence that these macromolecules can be found on the whole surface of many parts of the tree (pollen, leaves, primary and secondary wood) but with different concentrations. An interesting point remains the mechanisms of heterogeneous ice nucleation, in which the biomaterials play a crucial role. Spectroscopy and microscopy have been applied to solve these processes and get a fundamental understanding of how ice nucleation in trees is prevented or triggered, respectively. Obviously, this is a survival mechanism on molecular level.

Speaker Biography

Hinrich Grothe is an associate professor with tenure in the Institute of Materials Chemistry at TU Wien, Austria. He was trained in chemistry at the Leibniz University of Hannover, Germany, where he earned a PhD in low-temperature chemistry. His current research interests involve understanding ice nucleation in clouds triggered by biological particles such as pollen, bacteria, and fungi. He is also interested in aerosol chemistry and cloud glaciation processes. He is an important contributor to the European Geosciences Union (EGU) where he is the science officer of the section Atmospheric Chemistry & Aerosols. Each year, he organizes a session at the EGU General Assembly on atmospheric ice nucleation. He has also organized several workshops for early career professionals about the microphysics of ice clouds. His goal is to find nature's perfect ice nucleus.

e: hinrich.grothe@tuwien.ac.at

Notes:

Andrea Spaggiari

Eugenio Dragoni

University of Modena and Reggio Emilia, Italy

Nickel-Titanium shape memory alloys: Design and development of biomedical devices

Nickel-Titanium shape memory alloys (SMAs) are a smart material with peculiar properties, which are widely exploited in the biomedical field. These materials exhibit two very interesting behavior, the shape memory effect and pseudo-elastic effect, which could be thermally or mechanically triggered. SMAs could undergo very large deformation, even more than 10% and yet recovering the initial shape when the load is removed. They can be deformed and recover the initial shape upon a thermal activation, or they are able to provide a constant force for a given displacement. Their intrinsic hysteretic behavior, along with a quite low elastic modulus, are two elements that makes SMA quite interesting in the prosthetic devices. The excellent corrosion properties, the mechanical strength, the biological and magnetic resonance compatibility, explain the large use of SMA devices in the biomedical field, in particular for mini-invasive techniques. These extraordinary capabilities are due to the microstructural properties of the alloys, which present two stable phases, austenite or martensite, according to the thermomechanical condition applied. Many biomedical devices based on the NiTi SMA are nowadays already on the market in dental, orthopedics, vascular, neurological, and surgical field. However, the smart exploitation of these materials could lead to these results even though these materials presents a high complexity in the design problem, only thanks to a very close collaboration between material scientist, clinicians, engineers and designer. This concurrent engineering approach is needed to overcome several drawbacks such as the thermomechanical fatigue, the temperature sensitivity in order to increase the repeatability of the results. The correct thermomechanical design could be a first step in the exploitation of this very interesting class of materials.

Speaker Biography

Andrea Spaggiari is a 36 years old mechatronics engineer. From 2011 he works as assistant professor at the University of Modena and Reggio Emilia and he is the lecturer of the academic course of “New Materials for Mechatronics Constructions” and of “Integrated 3D Modelling for Mechatronic design” in the master in mechatronic engineering. His current research interests are threefold. First, studying the properties and the mechanical behavior of structural adhesives and their efficient modelling. Second, working on smart materials applications, especially with magneto-rheological fluids and shape memory alloys and his third research covers the multiscale computational simulations of voids and defects in polymeric materials. The research activities led to several industrial projects and to more than 50 papers in international journals.

e: andrea.spaggiari@unimore.it

Notes:

Ernst Gamsjager[1]

Jiri Svoboda[2]

[1]University of Leoben, Austria

[2]Institute of Physics of Materials, Czech Republic

Kinetics of grain arrangements controlled by grain boundary and triple junction migration-experiments and modeling

In several applications functionally oriented materials are exposed to extreme conditions. Large steam turbines are e.g. exposed to high temperatures. The higher the temperature of the hot temperature reservoir, the better is the efficiency factor and the lower is the CO_2 emission caused by the process. Line pipe steels as another example have to withstand high temperatures during welding. It is essential that the microstructures of these materials consist of fine, homogeneously distributed grains. Only then, the materials will have the desired mechanical properties. However, grain growth cannot be completely avoided at elevated temperatures. A possible strategy to retard grain growth to a certain extent is to micro alloy the steels with niobium and titanium. Niobium carbides and titanium nitrides nucleate at the grain boundaries and can effectively pin the grain boundaries. However, this phenomenon is only effective below a certain critical temperature. Normal grain growth is revealed below the critical temperature and abnormal grain growth above this temperature by an in-situ high temperature laser scanning confocal microscope. The kinetics of the motion of triple junctions and of whole grain arrangements is simulated based on the use of local constitutive equations. Not only distinct specific energies and mobilities can be assigned to the grain boundaries, but also finite mobilities can be assigned to the triple junctions. Thereby it is possible to interpret the results of the in-situ experiments in order to better understand the dissipative processes that occur during grain growth at elevated temperatures in micro alloyed steels.

Speaker Biography

Ernst Gamsjager has completed his PhD in 2002 and worked as a post doc with professor Militzer at the University of British Columbia, Canada and professor Fratzl, Max Planck Institute of Biomaterials, Germany. He obtained the Masing Memorial Award of the German Society of Materials Science in 2007. Since 2010, he works as an associate professor at University of Leoben, Austria. He has published around 50 papers in reputed journals, is member of the editorial board of "Metals" and is very active in reviewing manuscripts. He is member of the management committee of the Cost action CA15102 "Solutions for critical raw materials under extreme conditions".

e: ernst.gamsjaeger@unileoben.ac.at

Notes:

Qing Hua Xu

National University of Singapore, Singapore

Multifunctional nanoparticles for simultaneous two-photon imaging and phototherapy

Optical imaging-guided cancer therapy with multi-functional nanoparticles are critical for early detection and treatment of cancers. Two-photon excitation (2PE) based optical imaging and phototherapy have unique advantages such as 3-D selectivity and deep tissue penetration, compared to their one-photon counterparts. Photodynamic therapy (PDT) is noninvasive cancer therapy technique by using combination of light and photosensitizers. Conventional photosensitizers have limited two-photon absorption efficiency and lack of simultaneous imaging capability. Nano-photosensitizers are attractive due to their potential multifunctional capability, which allows integration of efficient Nano-photosensitizers with specific targeting and 2PE fluorescence imaging capabilities to allow imaging-guided PDT with high selectivity. In the last decade, our group have been actively working on development of nanocomposite materials with enhanced two-photon optical properties for biomedical applications. Two different strategies were utilized to develop nanomaterials with enhanced two-photon properties. One method is based on energy transfer from conjugated polymers that have large two-photon absorption cross sections. We have used conjugated polymers as two-photon light harvesting materials to develop various schemes for two-photon sensing, imaging and photodynamic therapy, with efficiency improved by up to 1000 times. The second approach is based on plasmon resonance enhancement. Noble metal nanoparticles are known to display interesting properties of Plasmon resonance, which could be utilized to enhance linear and nonlinear optical properties of nearby chromophores (extrinsic) and metal nanoparticles themselves (intrinsic). We have developed various plasmon engineered nanocomposites with significantly enhanced two-photon optical properties, which can act as highly efficient agents for two-photon excitation based optical imaging guided therapy.

Speaker Biography

Qing Hua Xu has completed his PhD in 2001 from University of California at Berkeley, USA. He is currently an associate professor in department of chemistry, National University of Singapore. He has published over 190 publications that have been cited over 7000 times, and his publication H-index is 49.

e: chmxqh@nus.edu.sg

Sotirios Grammatikos

Norwegian University of Science and Technology, Norway

Solutions and breakthrough technologies to overcome the challenges of polymer composites adoption in construction

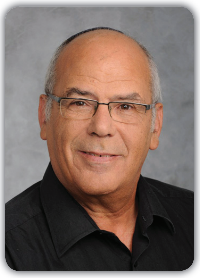
Whilst the design and manufacturing of construction composites has been improved, there are still major issues pertaining to degradation especially in challenging onshore and offshore service conditions. Coupled environmental aging with service-induced degradation lead to significant deterioration during service. Moisture, rain & sand erosion, UV radiation, lightning strikes, impact damage (from bird strikes and hail) as well as thermomechanical fatigue are the major causes of structural degradation. As the effects of the aforementioned conditions (in most cases act in combination) are not always fully understood, unexpected behavior during service often results in structural failures. This undoubtedly reduces the reliability of composites as structural elements making investors and stakeholders reticent in long-term investing in lightweight structures. A complete analysis of the drawbacks of composites that hinder them from being fully adopted by the construction sector will be presented along with the latest technological breakthroughs to overcome such obstacles pertaining to nanotechnology, modelling tools and advanced non-destructive testing.

Speaker Biography

Sotirios Grammatikos is a professor in polymers and composites at NTNU in Norway, director of the ASEM lab and leader of the research group Sustainable Composites. He is also an affiliated professor at Chalmers University of Technology in Sweden. He specializes in the area of product development, characterization, assessment and structural health monitoring of advanced composite materials and structures. His main research interests are smart features of composites, non-destructive evaluation, recycling and durability. Before joining NTNU, he worked at Chalmers, the University of Bath, UK and the University of Ioannina, Greece. He holds a PhD in materials engineering specialized in structural integrity of aerostructures (2009-2013) and has received training in lightweight aerospace composites from the Hellenic Aerospace Industry (HAI). He is author/co-author of approximately 40 publications with 10 h-index. Currently, he supervises 20 graduate and post-graduate students, part of 15 research and innovation projects of which 3 he is coordinator.

e: sotirios.grammatikos@ntnu.no

Notes:



Aharon Gedanken

Bar-Ilan University, Israel

Making the hospital a safer place by the sonochemical coating of all its textiles and medical devices with antibacterial nanoparticles

Sonochemistry is an excellent technique to coat nanomaterials on various substrates, imparting new properties to the substrates. After a short demonstration of coating NPs on ceramics and stainless steel, I'll present the coating of textiles such as polyester, cotton, and nylon. In all cases a homogeneous coating of NPs was achieved. Lately, the FDA shows less enthusiasm towards nano Ag, as a result, we have moved to NPs of ZnO, and CuO as antibacterial agents. They were coated on the above-mentioned fabrics and showed excellent antibacterial properties. The coated textiles were examined for the changes in the mechanical strength of the fabric. A special attention was dedicated to the question whether the NPs are leaching off the fabric when washed repeatedly. The coated ZnO NPs on cotton underwent 65 washing cycles at 75 0 C in water in a Hospital washing machine, no NPs were found in the washing solution and the antibacterial behavior was maintained. Recently, an experiment was conducted at PIGOROV Hospital in Sofia, Bulgaria in which one operation room was equipped with antibacterial textiles, namely, bed sheets, pajamas, pillow cover, and bed cover. 22 Patients in this operation room were probed for bacterial infections. Their infection level was compared with 17 control patient that were using regular textiles. The results are demonstrating that a lower infection level is observed for those patients exposed to the antibacterial textiles. In addition, medical devices were also coated with the same NPs. The following medical devices were coated with metal oxide Nanoparticles and showed very good biocidal properties and inhibition of biofilm formation 1) Urinal Catheters 2) Contact lens 3) Cochlear electrodes, 4) metallic implants, and 5) silicone implants. In my lecture examples of 1) and 2) will be demonstrated. Coating of Catheters with the above-mentioned NPs were performed and the coated catheters were inserted in rabbits. Results showed that the urine of the rabbits was not contaminated with bacteria.

Speaker Biography

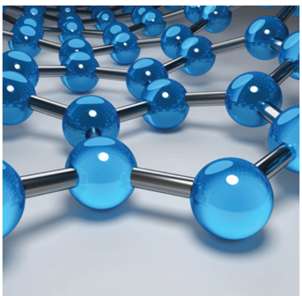
Aharon Gedanken obtained his PhD degree from Tel Aviv University, Israel. After his postdoctoral research at USC in Los Angeles. He got a lecturer position at BIU on Oct 1975. In 1994, he switched his research interest from spectroscopy to nanotechnology. His special synthetic methods of nanomaterials include: Sonochemistry, Microwave Superheating, Sono-electrochemistry, and Reactions under Autogenic Pressure at Elevated Temperatures (RAPET). Since 2004, he is mostly focused on the applications of nanomaterials. He has published 825 peer-reviewed manuscripts in international journals. His H-Index is 90. He was a partner in five EC FP7 projects one of them, SONO, was coordinated by him. This project was announced by the EC as a "Success Story". He was the Israeli representative to the NMP (Nano, Materials, and Processes) committee of EC in FP7. He was awarded the prize of the Israel Vacuum Society in 2009 and the Israel Chemical Society for excellence in Research in Feb 2013.

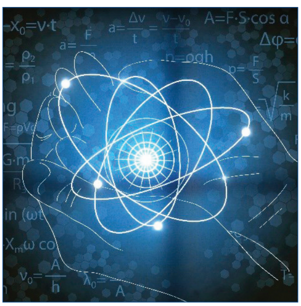
e: gedanken@mail.biu.ac.il

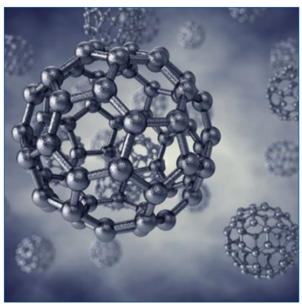
Notes:

Keynote Forum
May 21, 2019

Biomaterials & Materials Physics 2019







2nd International Conference on

Biomaterials and Nanomaterials & Materials Physics and Materials Science

May 20-21, 2019 | Vienna, Austria

2nd International Conference on

Biomaterials and Nanomaterials & Materials Physics and Materials Science

May 20-21, 2019 | Vienna, Austria

Shiva Adireddy

Advano, USA

The scalable silicon solution for Li-ion batteries

Reliable high-energy, rechargeable and portable energy storage systems are essential for the future of smart transportation. The energy density limitation for current state of the art LIB's is one of the issues that needs to be addressed before mass electrification of vehicles can take place. The introduction of Silicon as an anode in rechargeable LIB's can significantly increase their energy density, compared to the state-of-the-art graphite-based anodes. Silicon anodes offer the potential to substantially reduce the mass/volume to stored energy ratio, allowing the battery to be more efficient. However, Silicon anodes exhibit poor capacity retention. This poor capacity retention is attributed to continual SEI growth and volume expansions during the charge discharge process. The silicon nanoparticle material properties are strongly correlated with morphology; crystallinity, particle size, particle size distribution, purity and surface modification which all influence electrochemical behavior. The particle size and surface properties are particularly important parameters for silicon nanoparticles and must be optimized for advanced, next generation, high-performance anodes for LIBs.

Formed in 2014 as a spin-off at Tulane University, Advano is a lithium-ion battery company that is committed to accelerating the renewable energy revolution by enabling access to energy storage systems that store more energy and last longer. Advano's core team of scientists and engineers feature experts in the advanced energy storage space, and industry professionals who are uniquely focused on the commercialization of silicon-enhanced LIBs. Advano tackles silicon's numerous issues using surface functionalization technology. Advano offers a platform to establish a process for cost-effective manufacturing of advanced surface modified silicon nanoparticles with properties that can mitigate the difficulties facing new material for future, high capacity anodes for LIBs. This heavily patented platform technology allows us to controllably alter silicon's properties at its most intimate interfacial dimension—the surface where it meets electrolyte and lithium.

Speaker Biography

Shiva Adireddy is the co-founder and chief technology officer of Advano. As chief technology officer, he continues to shape the company's technical vision and guides product development from concept through manufacturing. He holds a PhD in nanomaterials design and fabrication from the University of New Orleans and an MBA from Tulane University's Freeman School of Business. Over the course of the last 12 years, he has compiled an impressive track record in energy & materials entrepreneurship, manufacturing diverse classes of materials to solve problems in the fields of renewable energy and clean technology. His expertise in both the technical and business aspects of nanotechnology is testified to by his authorship of articles in more than 40 peer-reviewed publications and registration of numerous patents. Prior to founding Advano, he served as research assistant professor in the department of physics and materials engineering at Tulane.

e: shiva.adireddy@advano.io

Notes:

Chin Tarng Lin

National Taiwan University, Taiwan

Verification of the efficacy of targeting peptides linked liposomal nanoparticles for therapy of different cancers

The efficacy of systemic cytotoxic chemotherapy has been widely assessed in patients with advanced hepatocellular carcinoma (HCC). For example, doxorubicin is the most commonly studied chemotherapeutic agent for HCC. However, it has been shown to have a response rate of only 10-20% in clinical trial. In addition, its potential benefit has been reduced by the related adverse effect. So far, the multi kinase inhibitor, sorafenib, is considered to provide survival benefit over supportive care. However, the long-term prognosis of those cancer patients still remains poor. Therefore, in the present experiment, we proposed to use the so-called peptide targeting chemotherapy to overcome the adverse event in the conventional targeted chemotherapy. In order to perform this experiment, we have constructed some specific peptides which can bind specifically to the cancer cells and cancer vascular endothelia by using a phage displayed 12-mer random peptide library. We have obtained 3 different peptides and one control peptide. Each contains 12 amino acids: a. L-peptide: RLLDTNRPLLPY (anti-different cancer cell membrane); b. control peptide: RLLDTNRGGGGG; c. SP-94-peptide: SFSHHTPILP (anti-NPC tumor cell and hepatoma cell membranes) and d. PC5-52-peptide: SVSVGMKPSPRP (anti-tumor endothelia). Those L-peptide (L-P), SP-peptide (SP-P), PC5-52-peptide and a control peptide (C-P) were linked to liposomal iron oxide nanoparticles; and to liposomal doxorubicin (L-D). Using peptide linked liposomal iron oxide, we can localize the peptide targeted tumor cells and tumor endothelia, and then we used those peptides linked liposomal doxorubicin to treat SCID mice bearing different cancer xenografts. Our results showed that when L-P-L-D containing 2mg/kg of SCID mouse body weight was used to treat xenografts bearing SCID mice, the tumor could be well controlled, and no specific adverse event was seen. However, when the control peptide was used to replace the specific peptide, the xenograft size was decreased, but the visceral organs revealed marked apoptotic change. In conclusion, the specific peptides linked liposomal doxorubicin nanoparticles can be used for treatment of SCID mice bearing cancer xenografts with minimal adverse event, especially in the SCID mice species (NGS), which show a remarkable tumor suppression.

Speaker Biography

Chin Tarng Lin was a pathology professor and is an emeritus professor right now at the College of Medicine, National Taiwan University. He has published more than 92 papers and obtained 12 patents and has been invited to give the scientific seminar over 75 times. He has established 10 nasopharyngeal carcinoma cell lines (NPC-TW01to10) and five endometrioid cancer cell lines (OV-TW59-P0 to-P4) in his laboratory. He and his colleague have identified 3 specific peptides to localize their targeted proteins, to identify the cancer xenograft by MRI and to perform peptide-targeted chemotherapy for different cancers with minimal adverse event.

e: ctl@ntu.edu.tw

Notes:

Ferruccio Bottoni

Christian Novotny

USound GmbH, Austria

How piezo MEMS innovate the audio and acoustic industry

The development of MEMS loudspeakers can be compared to the development of the LED technology, and will have similar effects on the audio industry as LED had and still has on the video industry.

In general, MEMS loudspeakers offer several advantages:

- Seamless integration with electronic PCB, indeed the speaker itself is built on a PCB substrate. Single or multiple speakers can be easily integrated on the same substrate together with other electronic components.
- Taking advantage of this seam less integration, USound is able to provide a smart audio module with analog and digital interface. This dramatically shortens the design process of audio products, allowing the customer to easily tune the audio response based on the specific application needs.
- Lower power consumption. The MEMS speaker, due to its own intrinsic high impedance demand lower driving current.

MEMS speakers are a new technology and their full potential has yet to be revealed, but already now, this technology provides unique features and compelling advantages compared to conventional speakers. In fast evolving audio market, early adopters of MEMS technology can provide unbeatable advantages to their end users.

Speaker Biography

Ferruccio Bottoni has almost 20 years of experience in semiconductor and MEMS industry. He started in 1995 at STMicroelectronics working on the flash memories. Subsequently he joined Robert Bosch GmbH in 1999 were he contributed to the ramp-up of MEMS in the automotive markets. He finally joined Sensor Dynamics in 2009 as VP operations and he has retained this position until 2013. During his career, he has held several positions as quality and reliability engineer, process manufacturing manager, technical purchasing manager and VP operations.

e: ferruccio.bottoni@usound.com

Notes:

Sou Ryuzaki

Kyushu University, Japan

Nanopore devices for nano-biomedical

Rapid structural analysis methods for biomolecules and biomaterials consisting of single or several molecules in solution represent innovative technologies to reveal their functions because the functions strongly depend on their own structures. However, there presently exist no rapid structural analysis methods for single nanomaterials suspended in liquid environment. Nanopore sensors have been widely used to investigate the volume of particles and molecules passing through the pore by probing temporal changes in the ionic current pulses. These pulse sensors have been developed for not only size but also shape of analyte during recent years. Smaller aspect ratio defined as the ratio of the depth to the diameter and a high-speed current detection system provide greater spatial resolution, i.e. tomograms of a material passing through a nanopore. Here we will report the development of low-aspect-ratio nanopores with a spatial resolution of ca.35.5 nm and the 10 MHz-current-amplifier, resulting in realization of ultrafast time resolutions of 1.0 μs for the tomography analysis of a material passing through a nanopore. Combining state-of-the-art technologies with Multiphysics simulation methods to translate ionic current data into tomograms of nanomaterials passing through a nanopore, we have achieved rapid structural analysis of single and dabble polystyrene (Pst) beads, and bionanomaterials such as E-colis in aqueous solutions [1]. In addition, we will also report plasmonic nanopore devices, which enable us to detect Surface-enhanced Raman Spectrum of a material inside a nanopore. The nanopore devices will be innovative technologies for the fields of Nano biodevices and structural biology.

Speaker Biography

Sou Ryuzaki is currently an assistant professor of Institute for Materials Chemistry and Engineering (IMCE) at Kyushu University. He graduated with his PhD from department of nuclear engineering at Tokyo Institute of Technology in March 2010. After receiving his PhD, he worked for Nano-Science Center of University of Copenhagen as a postdoctoral research fellow (2010–2011), and he was an assistant professor of Institute of Scientific and Industrial Research (ISIR) at Osaka University (2012–2014). He is engaged in researches related to fundamental materials physics (nanocarbons), plasmonics (plasmonic lasers), organic devices (photovoltaic cells), and nano biodevices (nanopore devices).

e: ryuzaki@ms.ifoc.kyushu-u.ac.jp

Notes:

Xiaodong Peng

Yan Yang, Tiancai Xu *and* ***Junwei Liu***

Chongqing University, China

Investigation on microstructure and properties of Mg-Li-Al alloys

Mg-Li based alloys are the lightest metallic structural materials and have been attracted more and more attentions in the field of aerospace, spaceflight and automobile industry. The Mg-Li-Al alloys are prepared, and the duplex phases of α-Mg of hcp crystal structure and β-Li of bcc crystal structure are obtained. The influences of different alloying elements such as Sr, Zn, and Y on the microstructure and mechanical properties of Mg-Li-Al alloys are investigated. The effect of extrusion process on the microstructure and mechanical properties is also studied, the deformation behavior and dynamic recrystallization mechanism during the hot extrusion process is discussed.

Speaker Biography

Xiaodong Peng graduated from the department of mechanical engineering in Chongqing University, China and received his PhD in materials science and engineering from Case Western Reserve University, USA. He is the professor of Chongqing University, China, and has served as the associate director of National Engineering Research Center for Magnesium Alloys and associate editor of the Journal of Magnesium and Alloys. He has about 200 publications and over 20 patents.

e: pxd@cqu.edu.cn

Notes:

Silvia Todros

University of Padova, Italy

Biocompatibility of synthetic surgical meshes for abdominal wall repair: An integrated experimental-computational approach

Synthetic meshes are frequently adopted for surgical repair of abdominal hernia. Their role should be to strengthen impaired muscles, but without reducing physiological abdominal compliance. Even if mesh surgical procedures are well consolidated, recurrence rate is moderate and adverse effects, including infections, pain and discomfort, are still present. Synthetic meshes are available on the market with different materials and structural characteristics, which affect the interaction with surrounding biological tissues and the consequent biocompatibility of the implant. The research activity presented in this work is aimed at providing experimental and computational tools to support the choice of suitable prostheses for hernia repair, according to patient-specific clinical conditions and, in general, to optimize mesh design for abdominal wall repair. In detail, the proposed research moves from the study of mesh materials and structural properties for a compatibility evaluation, providing criteria to the design of prostheses. For this purpose, physicochemical characterization of polymers used in the manufacturing and mesh morphological analysis are carried out. Mechanical tests are performed, according to suitable protocols selected to mimic in vivo loading conditions. Synthetic meshes follow a non-linear stress-strain behavior, with mechanical characteristics showing different levels of anisotropy, according to the type of mesh. The mechanical response of surgical meshes is described through appropriate constitutive models and parameters, for the implementation in the framework of in silico models. Different numerical models of abdominal wall are developed, including passive and active mechanical properties of abdominal tissues and taking into account different levels of intra-abdominal pressure, corresponding to different motor tasks. Hernia occurrence and surgical repair via synthetic meshes can be simulated. Numerical analyses are carried out to evaluate the biomechanical performance of surgical meshes and their interaction with biological tissues.

Speaker Biography

Silvia Todros is assistant professor in industrial bioengineering at University of Padova, Italy. She received M.Sc. in materials science from the University of Padova in 2005 and PhD in materials engineering at the University of Brescia in 2010. She has been visiting researcher at Cranfield University (Bedford, UK) in smart materials laboratory. Her research activity is mainly aimed at the evaluation of the functional response of biomedical devices and prostheses based on polymeric material, through the characterization of their physicochemical and mechanical properties. She is the author of more than thirty papers in scientific international journals.

e: silvia.todros@unipd.it

Notes:

Sivashankar Krishnamoorthy

Luxembourg Institute of Science and Technology, Luxembourg

Overcoming roadblocks toward reliable and scalable production of nanostructures engineered to the molecular level

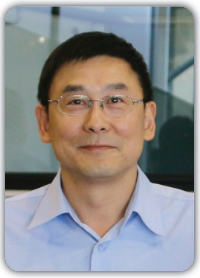
Emerging applications within different industrial sectors including automobile, energy, space and medicine place significant demands on performance of materials used. Precise control over structure and functionality of materials offer significant opportunity to meet such demands provided they can also be produced at high volumes with assured quality and reasonable costs. I will share promising approaches that we have seen over years, to produce diverse material nanoarrays, and functional colloids with geometry and surface functionality engineered down to molecular level. Outcomes that successfully bridge trade-off between spatial resolutions, quality and throughput would be presented, with specific emphasis on medical sector, while carrying wider applicability to range of other sectors.

Speaker Biography

Sivashankar Krishnamoorthy is a group leader for the Materials Research and Technology department at Luxembourg Institute of Science and Technology (LIST). His professional experience spans over 15 years of experience in nanotechnologies and materials science, working at research and technology organizations in Switzerland, Japan, Singapore and Luxembourg. His current research projects focus on investigating structure, property and function down to molecular level, functional micro/nanoscale devices and interfaces, nano plasmonic devices, and application to bio-interfaces. He is actively involved in organizational and strategic efforts on personnel management, acquisition and management of competitive grants, review of competitive grants of different funding agencies, and organization of international conferences.

e: sivashankar.krishnamoorthy@list.lu

Notes:



Yuncang Li

RMIT University, Australia

Biocompatible magnesium alloys for biodegradable implant materials

Magnesium (Mg) based alloys have been extensively considered for their use as biodegradable implant materials. However, controlling their corrosion rate in the physiological environment of the human body is still a significant challenge. One of the most effective approaches to address this challenge is to strategically design new Mg alloys with enhanced corrosion resistance, biocompatibility, and mechanical properties. Our research has developed new series of Mg-zirconium (Zr)-strontium (Sr)-rare earth element (REE) alloys for biodegradable implant applications. Research results indicate that Sr and Zr additions can refine the grain size and enhance the corrosion and biological behaviors of the Mg alloys. Furthermore, the addition of holmium (Ho) and dysprosium (Dy) to Mg-Zr-Sr alloys resulted in enhanced mechanical strength and decreased degradation rate. In addition, less than 5 wt.% Ho and Dy additions to Mg-Zr-Sr alloys led to enhancement of cell adhesion and proliferation of osteoblast cells on the Mg-Zr-Sr-Ho/Dy alloys.

Speaker Biography

Yuncang Li obtained his PhD in materials science engineering from Deakin University in 2004 and then took up a research position in biomaterials engineering at Deakin University until the end of 2014. He joined RMIT University in 2015. He was awarded an Australian Research Council (ARC) Future Fellowship and won several national competitive grants including ARC and Australian National Health and Medical Research Council projects. His research focuses on developing metallic biomaterials for medical applications. He has expertise in microstructure-mechanical property relationships, corrosion, and biocompatibility, surface modification, nanostructured metals and alloys, and metal foams. His research has led to 184 peer-reviewed original publications, with an H index of 31 and over 3180 citations (Google Scholar).

e: yuncang.li@rmit.edu.au

Notes:

Rossana Mara da Silva Moreira Thire

University of Rio de Janeiro, Brazil

Towards new strategies for development of bone tissue engineering composite scaffolds

3D printing techniques become attractive to produce scaffolds for bone tissue engineering (BTE) with high complexity, anisotropy and reproducibility, different shapes and geometries etc. Poly(3-hydroxybutyrate) (PHB) is a microbial and biodegradable polyester, which has been studied as raw material to produce scaffolds for BTE. PHB is biocompatible and has no toxicity to several mammalian cells lines. Addition of a calcium phosphate phase into PHB materials should potentially have the dual effect of improving both the bioactivity and mechanical properties. The aim of this work was to evaluate a join strategy to develop a scaffold for BTE applications: one related to raw materials and other related to manufacturing technique. PHB/beta-tricalcium phosphate (b-TCP) composite scaffolds were directly fabricated by 3D mini-screw extrusion printing. This 3D printing technique uses a simple device, which allows the direct use of a powder mix, without the need for prior preparation of solution or filaments. Compositions containing 0-30 wt.% of b-TCP were used. Scaffolds with physical integrity, internal pore structure of 0º/90º pattern and compressive modulus like that of human trabecular bone were produced. No cytotoxicity was observed for any scaffold. In vitro release of cytokines and growth factors was monitored for 24 h. Higher concentration of growth factors released was observed for composite scaffolds. A release of pro- and anti-inflammatory cytokines was also detected. The use of scaffolds in critical-size bone defects did not alter any thermal sensitivity and motor performance of male Wister rats. Physical and biological tests results showed that PHB scaffolds containing 20 wt.% of b-TCP has greater potential for bone tissue engineering application than those of pure PHB. Moreover, the employed 3D printing technique opens up the opportunity for the use of a wider range of materials and thus, is a viable alternative manufacturing process for composite scaffold materials.

Speaker Biography

Rossana Mara da Silva Moreira Thire received her D.Sc. degree in materials and metallurgical engineering (2003) from Federal University of Rio de Janeiro (UFRJ), Brazil. She is currently a full-time professor at Program of Metallurgical and Materials Engineering (PEMM), UFRJ, Brazil, conducting teaching activities to graduate and undergraduate students and developing researches focused on polymers for biomedical and technological applications. Her main research interests are polymeric and composite biomaterials for bone and skin tissue engineering, drug-loaded biomaterials, additive manufacturing, electrospinning and biodegradable plastics. She is the head of Biomaterial area of PEMM/COPPE/UFRJ, leader of the "Technology in Biomaterials" Research Group, board member of Latin American Society of Biomaterials and Artificial Organs (SLABO) and a member of the Brazilian Committee for Special Study of Additive Manufacturing (ABNT/CEE-261) related to ISO/TC 261Technical Committee. Her work has been recognized with two important Brazilian sponsorships: CNPq Researcher of Productivity and FAPERJ Scientist of our State.

e: rossana@metalmat.ufrj.br

Notes:

Agnieszka Kyziol

Jagiellonian University, Poland

Novelties in bactericidal nanocomposites based on biopolymers and metal nanoparticles

The need for low-cost, scalable, and dispersion-processable nanomaterials is a leading motivation for extensive research in the field of nanocomposite synthesis. Nowadays, nanomaterials based on biopolymers and metal nanoparticles have attracted considerable attention not only in medicine but as well in many other fields such as catalysis, optoelectronics, information storage, environmental technology, engineering, etc. Furthermore, the use of Ag, Au and Cu nanoparticles (NPs) is a cause of intensive recent research due to excellent properties of these metals (e.g. good thermal and electrical conductivity, which might be used in electronics, or optical properties, which might be exploited in catalysis, diagnostics, sensing, and therapeutic applications). What is noteworthy, since multidrug-resistant microorganisms are a major problem for current medicine, nanoscale materials bring also new possibilities in the development of effective antimicrobial systems. Herein, the synthesis of materials based on Ag, Au, Cu NPs and chitosan with the careful analysis in terms of physicochemical properties and biological activity in vitro will be presented. In detail, the chemical structure, size, and morphology of metal NPs in the chitosan matrix have been studied by scanning electron microscopy (SEM), scanning transmission electron microscopy with energy-dispersive X-ray analysis (STEM-EDX) and powder X-ray diffraction (XRD). The surface oxidation state of the metallic nanoparticles and elemental analysis by depth profiling have also been evaluated by X-ray photoelectron spectroscopy (XPS). FTIR measurements were carried out to identify possible interactions between metal nanoparticles and chitosan molecules. Antibacterial activity was evaluated according to the European Norm ASTM E2180-07 for polymeric materials, against selected, resistant Gram-(+) and (-) bacterial strains (S. aureus and P aeruginosa, respectively). The cytotoxicity of the selected nanocomposites was also evaluated using two human cell lines: A549 (human lung adenocarcinoma epithelial cell line) and HaCaT (an immortal human keratinocyte). In view of the potential biomedical application, the most promising materials in form of colloids, films, and coatings will be pointed out.

Speaker Biography

Agnieszka Kyziol has completed her PhD at the age of 29 years from Jagiellonian University, Kraków, Poland. She is the assistant professor in Coordination and Bioinorganic Physiochemistry Group at faculty of chemistry of Jagiellonian University. She has over 60 publications that have been cited over 800 times, and her publication H-index is 15 and has been serving as an editorial board member of reputed Journals.

e: kyziol@chemia.uj.edu.pl

Notes:

Danny Baranes

Ariel University, Israel

Nickel-Coralline biomaterials for repair of brain damage

Biomaterials can provide supportive microenvironment for cell growth and exciting opportunities for tissue regeneration. We found that biomaterials derived from the calcium carbonate skeleton of corals in the crystalline form of aragonite are protective and nurturing scaffolds for nervous tissue growth and survival in vitro. Moreover, implantation of coral skeleton into brain wounds generated following traumatic brain injury in mice causes tissue restoration and functional recovery. Implanted mice showed elevated level of glial fibrillary acidic protein and nestin, markers of nervous tissue generation, as well as reduced anxiety, elevated learning capacity and improved recovery from motor impairment, compared to injured but not implanted mice. These results place coralline scaffolds as a potential new mean to repair damage in the central nervous system.

Speaker Biography

Danny Baranes has established his experience in neuroscience in the lab of the Nobel laureate Dr. Eric Kandel at Columbia University, New York and moved on to study tissue engineering of the central nervous system. He publishes in leading international scientific journals and conferences. He is associate professor and head of the department of molecular biology at Ariel University, Israel.

e: dannyb@ariel.ac.il

Notes: