MindAuthors

INNOVATING MINDS FOR EXCELLENCE

6th World Congress on

Materials Science Engineering

September 18-19, 2023

Rome, Italy

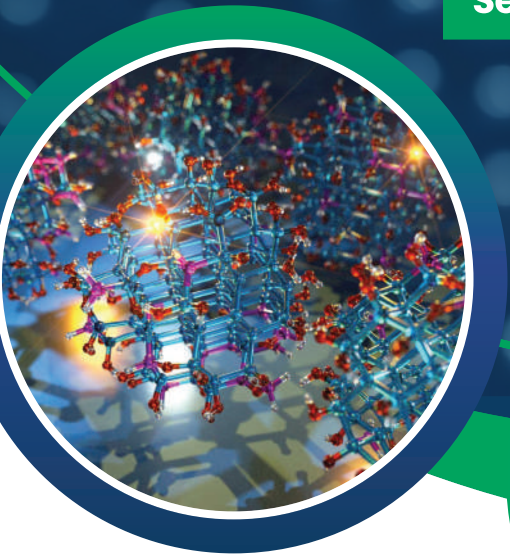
MATERIALS INFO 2023

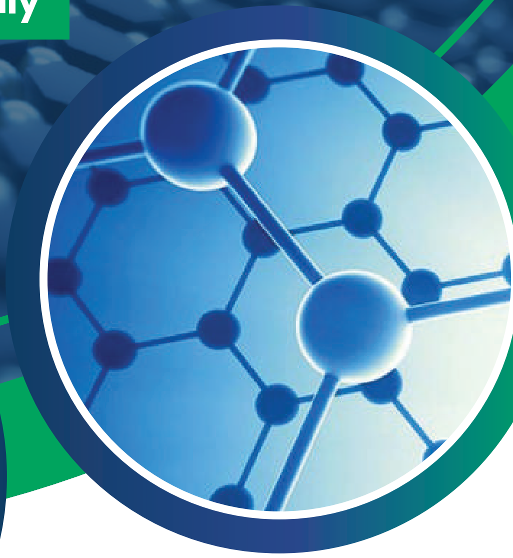
https://materialsconferences.mindauthors.com/

6th World Congress on

Materials Science and Engineering

September 18-19, 2023 | Rome, Italy





Theme: "Materials Innovation and Impact"

Keynote Forum

DAY 1

(Room-1)

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Substrate-Dependent Tribo-Chemical Reactions of Ti_3C_2Tx Nano-Sheets

A. Rota[1,2]

[1]Università di Modena e Reggio Emilia, Italy
[2]CNR Nano – Istituto di Nanoscienze, Italy;

Among 2D materials, Ti3C2Tx nano-sheets represent a promising lubricant material for mechanical applications, due to their hardness, high melting point, good corrosion resistance, together with good tribological properties related to the easy-shear among parallel layers [1,2]. This compound belongs to MXene family, an emerging class of materials obtained by removing the A-phase from the corresponding MAX phase. The present work highlight the importance of the chemical affinity of this solid lubricant with the selected mating materials of the tribological system. A Ti3C2Tx ethanol suspension (1wt.-%) was drop-casted on Fe and Cu substrates, and the tribological properties were studied by means of ball-on-disc tests, using a AISI-440C ball as counterbody. In both cases, the nano-sheets reduces friction, keeping the COF stable well after the evaporation of ethanol. However, in the case of Cu, the low friction state is 35-fold higher than in the case of Fe. In the case of Fe, the formation of oxides on both the substrate and the counterbody leads to the progressive failure of the lubricant. Differently, in the case of Cu, sliding induces the formation of a Ti3C2-based tribolayer on the substrate and on the counterbody, characterized by very low friction even in dry conditions. On the basis of these results, Ti3C2Tx nano-sheets becomes a good candidate for the formulation of new additives for lubrication purposes. Further, this work aims at boosting theoretical and experimental studies on MXenes tribo-chemical processes.

1. M. Naguib, M. et al., Adv. Mater. 23, 4248–4253, 2011.
2. B. C. Wyatt, et al., Ad. Mater., 33, 17, 2007973, 2021.

Biography

Alberto Rota is Professor at the Department of Physics, Informatics and Mathematics of the University of Modena and Reggio Emilia, Italy. He started his carrier in Surface Science, on the chemical, structural and morphological characterizations of nano-structures. He then moved to the Tribology field, splitting his activity in basic and applied research. His main research interests are on surface patterning at the multiscale, and on 2D and solid lubricant materials (graphene, DLC, MoS2, Ag, MXene). He has published more than 40 peer-reviewed journal publications and he gave more than 20 speeches in international conferences. He is member of the Editorial Board of Industrial Lubrication and Tribology journal, and Review Editor for Frontiers in Chemistry.

rotal@unimore.it

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Towards porous SiC(O)@Cu ceramics from functionalised kraft pulp paper and preceramic precursors

Romain Lucas

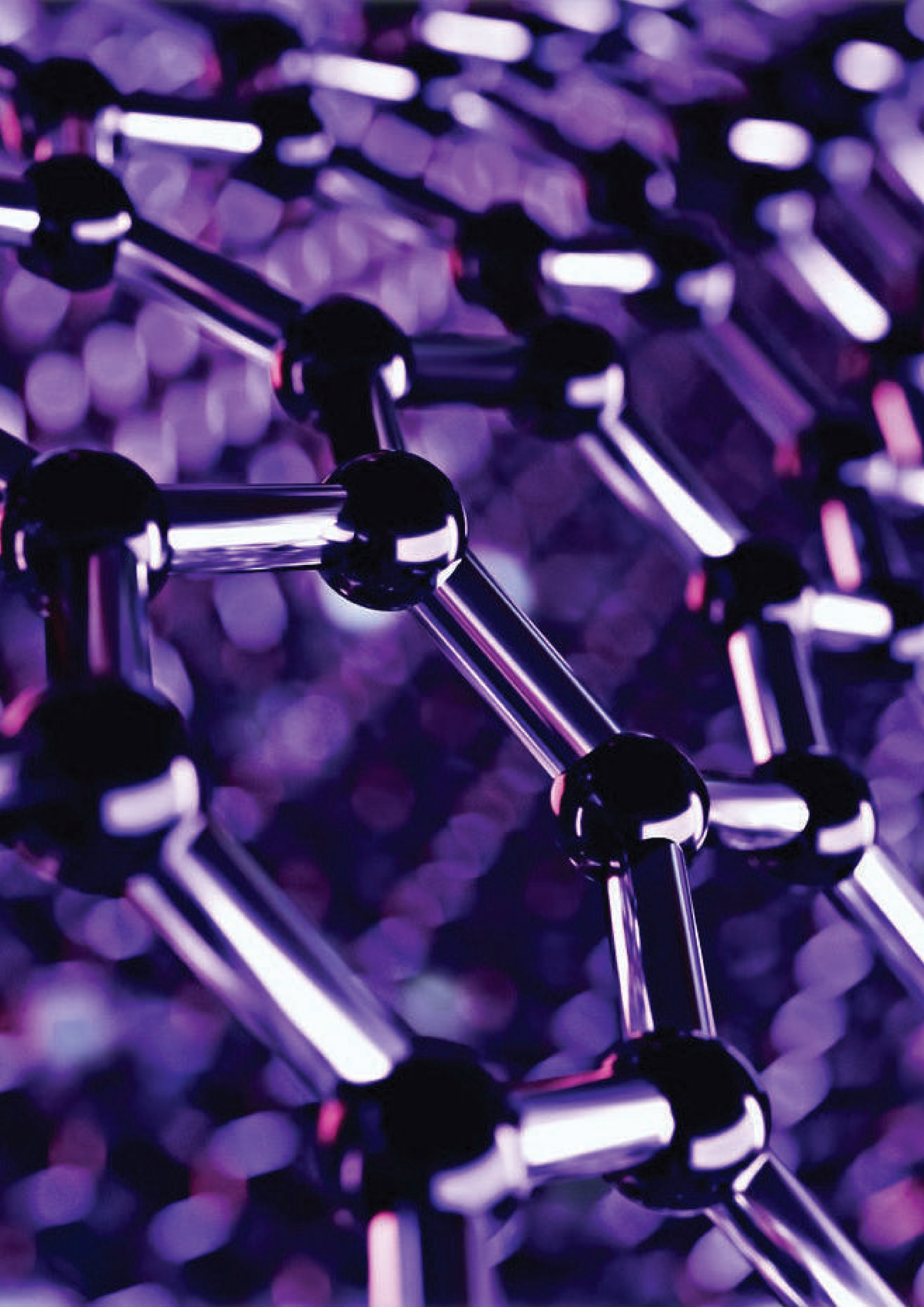
Université de Limoges, IRCER-CNRS, UMR 7315, Centre Européen de la Céramique (CEC), 12 rue Atlantis, F-87068 Limoges Cedex, France

Based on a previous work carried out on lignocellulosic fibre templates, porous silicon carbide (SiC) materials were designed using preceramic precursors with kraft pulp papers (KPP) as starting materials. In this way, different functionalised KPP were impregnated by selected organometallic precursors. The pyrolysed materials were characterised at different stages, by using thermogravimetric analysis coupled with mass spectrometry (TGA-MS), scanning electron microscopy (SEM), and X□ray diffraction (XRD). Various architectured SiC(O) ceramics were successfully obtained with adjustable porosities, depending on the nature of the initial template. The key role of the previous functionalisation of papers was highlighted in terms of interactions at the interface between the polymer and the fibrous lignocellulosic sheets. Moreover, the incorporation of copper in the preceramic papers was also investigated. Depending on the functionalisation of the materials, different phases and coating/dispersion were obtained, with potential applications in the field of catalysis.

Biography

Dr. Romain Lucas obtained his PhD in Organic Chemistry from the University of Limoges (France) in 2009. He subsequently spent a year as a research and teaching assistant at the Institute of Research on Ceramics (IRCER) and at the IUT of Limoges, before being appointed as a Lecturer in 2010. His current research interests, in the group "Ceramics under environmental stresses", focus on the syntheses and rheology of original preceramic polymers, including a core-shell approach, the role of the interfaces between ceramic and organic materials, and the 'green' fabrication of new composites and catalysts using cellulose-based bioresources. He is the author and co-author of 52 publications, 61 oral presentations, with 15 invited talks.

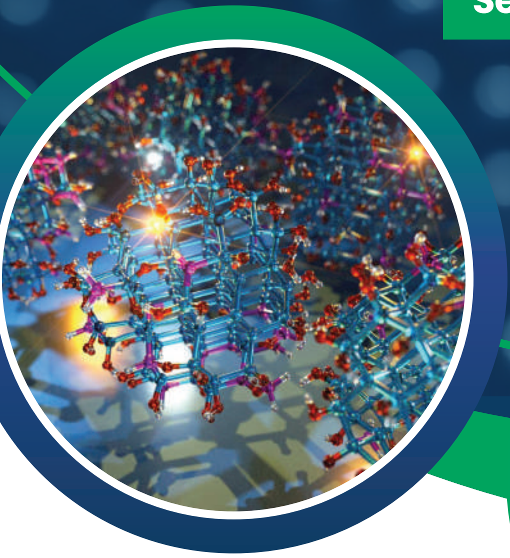
romain.lucas@unilim.fr

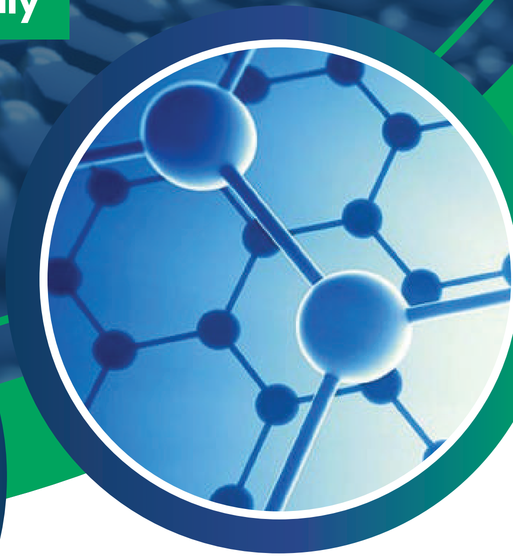


6th World Congress on

Materials Science and Engineering

September 18-19, 2023 | Rome, Italy





Theme: "Materials Innovation and Impact"

Invited Speaker Presentations

DAY 1

(Room-1)

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Electronic band structures of semiconductor superlattices with realistic and arbitrary potentials

Roger Yu

New York Institute of Technology, USA

The application of electronic band structure based on engineered quantum wells have flourished in the past few decades. Many more electronics and optical electronics at nano-scale have pushed the technological frontier to a new level. Our interest is the better understanding of electronic band structure of quantum well systems with realistic potentials which goes beyond the traditional ones which satisfies the periodical conditions. We have adapted a method of solving the Schrodinger's equations with the potentials consists of a finite number of spikes. These spikes can have same or random spacing, their heights can also be made arbitrarily. Our focus is to make our models as close as possible to the multi-layered quantum superlattices gowned in the labs. In our specific numerical studies, we have utilized the sine wave expansion method in discretizing the Schrodinger equation, which has proven to be highly reliable and adaptable in solving quantum well eigen value problems1.

The calculated results of the systems such as statistics of the eigen values, the density of states, wave functions of localized modes, etc. have revealed a number of exciting aspects of the quantum well systems. At the conference we would also discuss the transition of band structures of a crystal to amorphous

1. Zhiming Huang, Roger Yu, Chunping, Tie Lin, Zhanhong Zhang, and Junhao Chu. Phys. Rev. B 65 205312.

Biography

Professor of physics, Dean Emeritus of College of Arts and Sciences, New York Institute of Technology.

ryu@nyit.edu

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

High-performance metal 3d electrodes by 3D printing for water spitting

Jun Ding

Department of Materials Science & Engineering, National University of Singapore

Among many hydrogen generation techniques, the green manufacturing technique – alkaline electrohydrolysis process has received a great attention because of its great potential for hydrogen generation by economic and efficient way. In order to achieve high-performance alkaline electrolysis system, both electrodes (HER and OER) are key components for research and development. Recently, economic materials based on 3d transition metals have been developed for high-performance electrode, such as Fe-Ni for OER and Mo-Ni for HER. Porous structures (such as Ni foam) have shown promising results as electrodes particularly low overpotential for high current density. 3D printing is an alternative way in fabrication of porous 3D structures. Our research work has shown that enhancement of current density at a relatively low voltage can be obtained through a suitable design of 3D structures by 3D printing. More recently, we have optimized composition for Fe-Ni and Mo-Ni for OER and HER electrode, respectively. A combination of a nanoporosity (through sintering) and microporosity (3D printing) can lead in low overpotential for high-current density with an excellent operation stability. In addition, we have demonstrated that absorption of atmospheric water can be used for water splitting, so that the operation of hydrogen generation can be realized without use of clean water.

Biography

Dr Jun Ding obtained his PhD degree in physics from University of Bochum (Germany) in 1990. After his research work as research fellow/senior research fellow at University of Western Australia, he joined National University of Singapore (NUS) in 1997. Now, he is working as Professor as Department of Materials Science & Engineering (NUS). He has published > 500 journal papers with total citations> 30,000 with H-index = 96 (Google Scholar, May 2023).

msedingj@nus.edu.sg

Mind Authors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

New approach using the B-Spline method to solve the nonlinear conduction problems with radiation-conduction-convection boundary conditions using the Kirchhoff transformation

Fouad Erchiqui* and **Zouheir Annasabi**
Engineering School, University of Québec in Abitibi-Témiscamingue
Rouyn-Noranda, J9X5E4,Canada

For non-linear problems, the solution of the heat equation in terms of the Kirchhoff transformation, θ(T), is very limited. This restriction is due to the practical disadvantage of the inverse temperature shift from the Kirchhoff transform T(θ). To get around the difficulties associated with the representation of θ(T) and its inverse T (θ) for solids with strongly non-linear conductivities, a strategy based on a reverse engineering method is considered. It consists in identifying the number of knots and their respective locations on the curve T(θ) at the most efficient computational cost. To obtain the location of the knots, the curve is fitted by B-spline functions and the data is partitioned by an application of the bisectional method with a predetermined error. These knots are further optimized using the non-linear least squares method. The proposed approach can be combined with a numerical method such as the FEM, BEM, and FEV to provide the non-linear solution of the heat equation in terms of θ. However, in this work we have limited ourselves to the FEM. The validation of the proposed approach is achieved through several cases ranging from constant to strongly non-linear thermal conductivities with or without convection. The validation of the proposed approach is performed through several cases of nonlinear boundary conditions (conduction, convection, radiation). As an application, the finite element method is applied to several engineering cases (heating of a copper block, response of an aluminum reactor composed of annular cylinders with cooling tubes and exposed to thermal radiation, etc.).

Biography

Dr Fouad Erchiqui has been a full professor at UQAT's School of Engineering since 2000. He obtained his degree in physics at UQAC and a Ph.D. in mechanical engineering at Université Laval (1996). From 1996 to 2000, he acquired industrial experience in plastics processing at the Industrial Materials Institute (IMI) of the National Research Council of Canada (NRC). His main areas of research are development and characterization of composites and nanocomposites based on thermoplastics and plant reinforcements and multi-physical modeling. His research has generated more than 100 impacted journal articles, 9 book chapters and more than 150 presentations. He has been involved in several modeling technology development activities for NRC and its transfer to industrial partners.

fouad.erchiqui@uqat.ca

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

RF Plasma: From R&D to Commercial Applications

George Paskalov
Plasma Microsystem, Los Angeles, USA

Over the past decades RF plasma technology has been used in many areas, such as material science, electronics, basic physics, etc. Typically, the RF plasma system includes power supply (RF generator and matching network), plasma torch and reactor. Depending on the applications two different RF plasma sources are used: inductive and capacitive. Most thermal plasma processes are based on inductively coupled plasma (ICP), which generates equilibrium plasma in the temperature range of 8000 to 12000 K. The advantages of ICP torches are well known and described elsewhere. Non-equilibrium plasma is mostly used in the semiconductor industry and for some special applications, such as plasma synthesis of fine powder and bio-material surface treatment. We will focus on the present situation in this field by discussing the commercial and R&D efforts related to RF plasma technology for material processing.

Biography

Expertise in plasma technology and applications in material processing, hazardous waste treatment, ore processing, water plasma processing, plasma spray processing, material characterization, statistical design and analyses of experiments. Expertise in the application of low temperature (vacuum) gas discharge plasma for modification of surface properties of various materials (etching, sputtering, and PCVD). Engineering and project management skill in various aspects of research, development, and implementation of new technological processes (thermo-dynamic and macro-kinetics analyses, experiment planning, heat and mass transfer investigation). Expertise in the design and construction of RF and Arc plasma torches and reactors; plasma spray processing; metallic and ceramic sprayed coatings; pulse modulated thermal plasma; electro-dynamic analyses of physical processes, experimentation and plasma process scale-up.

george.paskal44@gmail.com

Theme: "Materials Innovation and Impact"

6th World Congress on

Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Proposed Revolutionary Fuel Materials to Retrofit Light Water Reactors

Raul B. Rebak

General Electric Research, Schenectady NY USA

It is now understood that electricity produced from nuclear reactors is an important component on the decarbonization effort to minimize climate change. To make light water reactors (LWR) safer and more competitive to operate the international nuclear materials community has been evaluating a series of materials called accident tolerant fuels (ATF). These materials can be broadly arranged in three families; (1) coated zirconium-based alloys, (2) monolithic iron-chromium-aluminum alloys and (3) silicon carbide composites. These newer proposed materials may include metals and ceramics and since none of them have ever been used in LWR environments they need to be characterized in the entire fuel cycle from industrial scale fuel bundle manufacturing to final disposal of the used fuel. This presentation will cover the benefits and detriments of each of the family of materials.

Biography

Raul B. Rebak is a Principal Corrosion Engineer working at the GE Research in Schenectady, NY since October 2007. Previously, he was employed at the University of California Lawrence Livermore National Laboratory where he was the lead for materials corrosion testing for the Yucca Mountain Project. Raul has more than 30 years' experience in Corrosion Science and Corrosion Engineering both from the academic and the industrial fields. His extensive research background in nuclear materials, includes power generation and nuclear waste disposition. Raul is also involved in other areas of materials degradation such as oil & gas, healthcare, aerospace, transportation, and energy storage. Raul has a Ph. D. in Materials Science and Corrosion from The Ohio State University (USA). Raul is a Fellow of both NACE International, The Corrosion Society and a Fellow of ASM International.

rebak@ge.com

Mind Authors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Forward Osmosis Desalination Using Pectin-Coated Magnetic Nanoparticles as a Draw Solution

Amr Tayel[1], **Peter Nasr**[2] and **Hani Sewilam**[2,3]

[1]The American University in Cairo (AUC), Egypt

[2]Center for Applied Research on the Environment and Sustainability (CARES), Egypt

[3]RWTH Aachen University, Germany

The potential use of pectin-coated magnetic Fe_3O_4 nanoparticles as a draw solution in forward osmosis (FO) water desalination was investigated. The coated nanoparticles were chosen for their enhanced water flux and facile recovery via magnetic separation. The study focused on the effect of the pectin coating and the operating conditions on FO performance. The fabricated nanoparticles were found to have a magnetite Fe_3O_4 crystal phase, spherical and rod-like shapes, and superparamagnetic properties, making them easily recoverable using a simple magnet. The effect of increasing water salinity on the feed side was studied, resulting in a water flux decrease of 14%, 58%, and 76% for NaCl solutions of 0.25, 0.50, and 1.00 g%, respectively. The study also investigated the effect of the pectin coating at concentrations of 0.5 and 1.0 g% on pure water flux. Results showed a significant effect of the coating, with a water flux of 2.6 LMH obtained against a 55000 ppm NaCl solution as feed, demonstrating the potential use of magnetic nanoparticles as draw solution for brine management. Salt rejection exceeded 95% in all experiments, showing the superiority of magnetic nanoparticles as a draw solution, and providing new insights into the direct use of FO for desalination applications. While a full economic analysis of the use of magnetic nanoparticles as a draw solution for FO processes is still needed, this study provides a foundation for future research.

Biography

Amr Tayel is currently an assistant chemistry professor, a PhD candidate at AUC, Egypt, and a member of the Royal Society of Chemistry (MRSC). Formerly, Amr was a research associate at the Center for Applied Research on the Environment and Sustainability (CARES) at AUC, Egypt and a visiting research scholar at the São Paulo University, Brazil. Amr's research interests are rooted in solving challenging environmental problems using novel nanocomposite materials and membranes.

amrtayel@aucegypt.edu

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

ZnO-based composite nanostructures as promising materials for efficient UV light emitters

Małgorzata Norek[1*], Maksymilian Włodarski[1], Michał Nowak[1], Piotr Nyga[1], Sylwia Gierałtowska[2] and **Wojciech Zaleszczyk[2]**

[1]Military University of Technology, Poland
[2]Institute of Physics PAS, Poland

ZnO-based composite nanostructures offer an unique way to enhance the UV light emitted from the semiconductor. In the presentation, the impact of Au and Ag plasmonic nanoparticles (NPs) on the luminescent performance of the ZnO nanotube arrays (NTs) will be demonstrated. A specific role of surface defects in ZnO, the size and the distance between the NPs, and the strength of plasmonic coupling, in the processes occurring at the ZnO/metal interfaces will be shown. The enhancement of UV emission was observed only in the ZnO/Ag system which occurs most probably via the coupling between the defect-related (DL) excitonic recombination and the localized surface plasmon (LSP) resonance frequency, involving both energy and charge transfer between the metal and the semiconductor. However, the DL-LSP coupling is not sufficient for the enhancement to occur. The metal size and spacing must be properly tuned to obtain larger scattering over the absorption contribution to the overall extinction cross-section. Under these conditions being fulfilled, the UV light can be further improved by efficient transport of electrons from the defect levels in ZnO. Moreover, luminescent properties of ZnO/TiO_2, ZnO/HfO_2 and ZnO/ZrO_2 core/shell hybrid nanotubes (NTs) with the shell thickness varying between 9 and 40 nm will be presented. The hybrid nano-ceramics demonstrated distinct differences in their luminescence performance. The highest UV/VIS ratio and the longest fluorescence lifetime were observed for the ZnO/TiO_2 NTs. The behavior was ascribed to resonance energy/charge transfer between TiO_2 and ZnO owing to the similar position of conduction and valence band edges, and comparable bandgap energies (Eg) which allowed for a simultaneous excitation of electron-hole pairs in both semiconductors.

The research was financed by National Science Centre, Poland (UMO-2020/37/B/ST5/01674).

Biography

Małgorzata Norek has been working at the Military University of Technology, Warsaw (Poland), first as an Assistant Professor (2009-2018), and later as an Associate Professor (2018-present). In the years 2003-2005 she worked in the Institute of Physics, Polish Academy of Science (PAS) in Warsaw. She obtained twice EC Marie Curie Fellowship: at the University of Florence (2004), where she investigated symmetry of triplet states of monoazaphenanthrenes by Optically Detected Magnetic Resonance, and at the Delft University of Technology (2005-2008), where she worked on preparation and evaluation of Lanthanide (III) containing contrast agents for medical diagnosis and therapy. She got PhD at the Delft University of Technology in 2008. Currently, her scientific interests are focused on the synthesis and characterization of anodic aluminum oxide (AAO), fabrication and characterization of AAO-based photonic structures, templated synthesis of ordered nanostructures (e.g. SnO2, ZnO), investigation of optical properties of selected semiconductor nanostructures.

malgorzata.norek@wat.edu.pl

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

High strength characteristics of pure metals elaborated by Spark Plasma Sintering

Hervé Couque[1] and **Frédéric Bernard**[2]

[1]Nexter Munitions, 18 route de Guerry, 18000 Bourges, France

[2]Laboratoire Interdisciplinaire Carnot de Bourgogne - UMR 6303 CNRS/ Université Bourgogne Franche-Comté, BP 47870, 21078 Dijon, France

One of the advantages of powder metallurgy is to generate isotropic metals over a wide range of mechanical strength. To generate high strength, it is not necessary to use conventional process such as swaging or rolling, known to provide non-isotropic mechanical properties. Instead, high strength is reached by using mechanically activated powders along with a rapid sintering process such as Spark Plasma Sintering (SPS). The SPS permit to limit the grain growth and, consequently, maintaining the crystallite size obtained during the ball milling process, therefore providing the required microstructural conditions to reach high strength [1-3].

Large-sized samples made of pure metals such as copper, nickel, and molybdenum allowing tensile testing characterization were studied [1-3]. The influence the sintering temperature and the uniaxial stress applied during SPS cycles on the mechanical properties of pure nickel is provided using tungsten carbide and graphite tools [1]. The influence of milling on the mechanical properties of pure nickel, molybdenum and copper is also reported [1-3].

1. "Influence of oxygen induced during high-energy ball milling process on the mechanical properties of sintered nickel by SPS", A. Bolsonella, F. Naimi, O. Heintz, T. Tricone,H. Couque and F. Bernard, Journal of Alloys and Compounds, JALCOM-157869, 2020.
2. "Influence of carbon diffusion and the oxygen presence on the microstructure of molybdenum powders densified par SPS", M. Moser, S. Lorand, F. Bussière, F.Demoisson, H. Couque and F. Bernard, Metals, 10, 948, 2020.
3. "Influence of strain rate on the mechanical response of nanostructured coppers elaborated by SPD and SPS", H. Couque, Y. Khoptiar, F. Bernard, I. Gutman, F. Bussiere, F. Naimi, R. Boulanger and F. Barthélémy, DYMAT 2021. EPJ Web of Conferences 250, 03014, 2021.

Biography

M. Couque's expertise is in the area of high strain rate mechanical properties and dynamic fracture mechanics. He has more than 40 years of experience in mechanical characterization of metallic, polymeric, ceramic and composite materials. He has developed new experimental techniques presenting unique capabilities to characterize dynamic toughness and adiabatic shear banding characteristics. He is author and co-author of 92 papers. He is in charge of research projects concerning new generations of materials for ammunition and the development of material laws for dynamically loaded structures. He has been co-advisor of 6 Ph.D students. He teachs Solids Mechanics and Fracture Mechanics to 1st year student of the Institut National des Sciences Appliquées Centre Val de Loire since 1999. Since 1996, he is a member of the board of the European association for the promotion of dynamic behaviour studies and applications DYMAT. President from 2009 to 2012. Vive-president editions 2012 - present.

h.couque@nexter-group.fr

Mind Authors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Enlarging the Nanoworld: conductive 3D scaffolds for Neural and Cardiac Prosthesis

Núria Alegret[1,2,3*], Bahaa Daou[1,2], Nerea Pascual[1,2], Luisa Mestroni[3], Jesús Ruiz-Cabello[1], Pedro Ramos-Cabrer[1], Sonia Alonso[2], David Mecerreyes[3] and **Maurizio Prato[1]**

[1]CIC biomaGUNE, Spain
[2]IIS Biodonostia, Spain
[3]Cardiovascular Institute, University of Colorado Denver, USA
[3]POLYMAT - University of the Basque Country UPV/EHU, Spain

Electrically active tissues, such as the heart and neurons and nerves from the central nervous system, have little intrinsic repair ability. Injuries or degenerative diseases affecting these systems, e.g., spinal cord injury or myocardium diseases, are among the highest disease burdens worldwide. As result, the damaged systems loose functionality, leading to motion restrictions in the case of spinal cord injury or reduction of strength for contraction in myocardium diseases, and thus increasing the probability of premature of even sudden death. Permanent implantable 3D constructs able to restore the lost conductivity would be an ultimate solution for the functional recovery of damaged electroactive tissues.

In that line, we have produced smart biohybrid hydrogels and porous scaffolds integrating carbon nanotubes (CNTs), one of the most promising materials to interface with electrically active tissues.[1] The morphology, shape and porosity are critical parameters, and electrical conductivity are important asset when dealing cell regeneration and/or tissue recovery. Therefore, we have developed several methodologies to produce a large variety of CNT-integrating 3D scaffolds with different mechanical and electrical properties. [2] Furthermore, 3D cellular organization was demonstrated to be able to induce cellular network outputs very similar to real in vivo tissue.[3] We have proven our devices to be highly biocompatible, boosting and reinforcing neuronal and cardiac cell signals when compared to control or other CNT-free materials, and efficiently propagate the electrical signal in vitro. Finally, we have implanted the scaffolds onto mice hearts and sciatic nerves to prove their accommodation and biocompatibility in vivo, thus showing great potential to the treatment of both cardiomyopathies and nerve regeneration.

1. a) Usmani, S. et al. (2016). Sci. Adv., 2: e1600087 b) Fabbro, A. et al. (2012). ACS Nano, 6: 2041
2. a) Dominguez-Alfaro et al. (2020), ACS Appl. Mater. Inter. b) Alegret et al. (2017), ACS Appl. Mater. Inter.
3. a) Alegret et al. (2022), Cell Biol. Toxicol. b) Dominguez-Alfaro et al. (2019), ACS Bimater. Sci. Eng.

Biography

Dr. Núria Alegret is a multidisciplinary scientist specialized in carbon nanoscience for tissue engineering. In her PhD (obtained in 2014) she combined computational and experimental work to elucidate the reactivity of fullerenes nanomaterials. In 2015, she joined Prof. Prato's group as a post-doctoral researcher first at the Univeristy of Trieste (Italy) and later to CIC BiomaGune (Spain). In 2018 she was awarded a Global Marie Curie Fellowship between Polymat with Prof. Mecerreyes) and the Cardiology Department of the University of Colorado Denver (USA) with Prof. Mestroni, to further expand her knowledge in a biological laboratory. In 2021 she re-joined Prof. Prato's group at CIC BiomaGUNE as a senior postdoc. The core of her research is a chemical synthetic effort to prepare revolutionary bio-hybrid 3D constructs composed of carbon nanotubes (CNTs) for nerve and in cardiac tissue engineering and their application both in vitro and in vivo.

nalegret@cicbiomagune.es

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Effects of work hardening gradients in incoherent metal-to-metal composites

Janusz Majta[1*] and **Bartłomiej Pabich**[2]

[1,2]AGH University of Science and Technology, Poland

The paper presents the result of rheological studies of multilayer systems, in which the phenomena occurring at the interface of the bcc and hcp phases were subjected to a detailed analysis. The multilayered systems were based on microalloyed steel, strengthened by rheological inhomogeneity resulting from the presence of incoherent particles of Ti or Mg hcp phases. The influence of the scale of the microstructure was considered in terms of the following factors: i) the level of strengthening attained by refinement of the structures of the matrix (grains, pearlite clusters) and second phase (particles of fragmented layers of Ti or Mg, produced by compression test and deep wire drawing (DWD) ii) the introduction of new deformation mechanisms due to presence of incoherent second phase particles in micro-meso scale, iii) changes in competitive processes such as fracture or recovery events which relate to structural refinement of multilayered, inhomogeneous metal-to-metal composites. Micromechanical models are outlined, use of which can rationalize the behavior of investigated materials by including both static and dynamic length scales and considering the interaction of the phases. The main cognitive effects of the present study were achieved thanks to the combination of modern research techniques, theoretical analysis and multi-scale computer modeling of the development of microstructures of the studied multilayer systems. The obtained results showed that the essence of the impact towards the strengthening of the tested multi-layer system is the degree of dispersion and the morphology of the low-ductile Ti or Mg phases.

Biography

Janusz Majta is a professor of Metals Engineering and Industrial Computer Science at the AGH University of Science and Technology Krakow, Poland. He received his Ph.D. in materials science from the AGH in 1990. He was a Postdoctoral Fellow at the University of Waterloo, Canada (1993-94). He was also a visiting staff member at Los Alamos National Laboratory, NM, USA (1998-99 and 2002-03, 2009). His research interest is related to the modeling and theoretical analysis of metal forming and microstructure evolution. Current research interests include all aspects of multiscale modelling, SPD processes, ultrafine-grained, nanostructured, multilayered materials and metal-to-metal composites, especially strengthened by dispersed particles. The aim is the physically-based design of structural materials with superior properties.

janusz.majta@gmail.com

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Challenges to convert HIPS from EEE waste into new electrical appliances

Fabienne Samyn*, **Oxana Giraudeau**, **Sophie Vanhille**, **Olivier Gabut** and **Sophie Duquesne**

Univ. Lille, CNRS, INRAE, Centrale Lille,
UMR 8207 - UMET - Unité Matériaux et Transformations, F - 59000 Lille, France

---

Recycling is essential to reducing plastic pollution. Regulations, as well as voluntary initiatives, are the driving forces behind its implementation. Targets have even been set to increase the recycled content of new products. However, the use of recycled plastics in the production of new products poses challenges. These include the capture and sorting of plastic waste, the possibility of ensuring consistent quality in recycled products, the presence of pollutants, inherited substances and the impact of the first life on the properties of polymers. This presentation consequently aims to highlight these difficulties through a case study: the valorization of recycled HIPS (rHIPS) from WEEE waste to design new products for electrical applications. The first part will show that brominated or phosphorous flame-retardant additives used in virgin HIPS are not suitable for rHIPS. Various characterizations were then carried out to determine whether there were any differences between HIPS and rHIPS and whether these varied according to the origin of the waste, from a qualitative and quantitative point of view. SEM was used to compare the size and size distribution of elastomer nodules (polybutadiene dispersed in PS to form HIPS). DSC, TGA, GC-MS and X-ray fluorescence were used to analyze the additives and pollutants present in rHIPS. GPC was used to characterize PS chain size in all systems. Various pollutants and additives were identified in these grades such as plasticizers, titanium dioxide, and others. Their impact on the FR performances has been studied using model materials prepared from virgin HIPS to which a known amount of pollutants had been added.

Biography

Fabienne Samyn got her PhD in 2007 at the University of Lille. She worked as postdoctoral fellow for one year at ICL-IP/ Institute Polytechnic of New York (NY, USA) and then for two years in the laboratory UMET-ISP in Lille. Since 2011, she joined the Ecole Nationale Supérieure de Chimie de Lille (now Centrale Lille Institute) as assistant professor. She works since 2004 in the field of reaction and resistance to fire. Her activities are focused on the development of fireproofing solutions, their characterization, the understanding of their mechanisms of actions as well as the design of laboratory scale tests for the evaluation of materials in realistic fire scenarios. She has been involved in collaborative European (ERC), national and regional research programs as well as industrial contracts. She has supervised PhD students (10) and is co-author of 44 scientific papers.

fabienne.samyn@live.fr

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Eco-efficient, bio-based and smart self-stratifying coatings

Maude Jimenez[1,2], Charlotte Lemesle[4], Hugo Ferreira[1], Mathilde Casetta[1], Fabienne Samyn[1], Camille Biget[1], Adrien Lebeau[1], Severine Bellayer[1], Sophie Duquesne[1], Anne-Sophie Schuller[3] and **Julien Molina[4]**

[1]Univ. Lille, CNRS, INRAE, Centrale Lille, UMR 8207 - UMET - Unité Matériaux et Transformations, F-59000 Lille, France

[2]Institut Universitaire de France (IUF), 1 rue Descartes, 75005 Paris

[3]Laboratory of Macromolecular Photochemistry and Engineering (LPIM), University of Haute Alsace, Mulhouse, France

[4]Mäder Group, Parc de la Haute Borne 60 Avenue Halley 59650, Villeneuve d'Ascq, France

Self-stratification concept provides a multifunctional coating in one application step, offering an alternative to conventional multi-layer coating process as it meets current environmental and industrial constraints, such as reduction of waste production, electricity consumption and cost.

In our group, self-stratifying coatings were designed using silicone resins and oil or bio-based epoxy resins. The main parameters influencing the stratification process were investigated and revealed that the nature, surface energy and polarity of the resins, as well as the solvent volatility, curing temperature and nature of the cross-linking agent have an impact on the degree of stratification. Flame retardant agents were also incorporated in the formulations without affecting the stratification and a comparative Life Cycle Assessment was carried out to quantify the environmental impact of the self-stratifying process using oil / bio-based resins compared to the conventional oil-based multilayer process.

More recently, a vitrimer silicone (dyn-PDMS) was synthesized and a bio-based epoxy / dyn-PDMS self-stratifying coating was successfully designed. Vitrimers are covalently cross-linked materials that can change their topology via thermally triggered associative exchange reactions, inducing a thermal plasticity of the network. This led to a transparent, hydrophobic and self-healing coating on polycarbonate substrates, with an excellent adhesion.

Biography

Maude Jimenez is Full Professor at Lille University (France) to develop surface treatments for flame retardant applications, but also for biomaterials, glass treatments and antifouling applications. She works on the design and understanding of mechanism of action of various surface treatments (coatings, plasma, layer-by-layer, sol-gel, etc.) and she is looking at potential solutions to overcome ageing issues and improve their environmental print. Dr. Jimenez has published about 100 papers in peer-reviewed journals. Finally, she got in 2019 the distinction of Junior member of Institut Universitaire de France (IUF) for her research in surface treatment engineering. She is also editor of Journal of Materials Sciences.

maude.jimenez@univ-lille.fr

Mind Authors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

A simple analytic approximation for the Bessel functions Jv(x) with high accuracy and continuous values of v in the interval (0,2)

Pablo Martin
Universidad de Antofagasta, Departamento de Física, Antofagasta, Chile

In previous publications analytic approximations with high accuracy have been found for some Bessel functions of integer or fractional order by simultaneously use of power series and asymptotic expansions [1-3]. In those cases, all the parameters of the approximations were constants. In the present work, however a more general problem is considered. Now we are looking for one approximation ˜Jv(x) good for any value of v in a determinate interval, which in this case will be (0,2). Thus, do this, all the parameters will be now functions of v. The accuracy will be now high in general, and exact for v=1/2 and 3/2. The procedure will be an extension of the general technique of multipoint quasi-rational approximation, MPQR [4]. The main idea is to structure an analytic function, which could be like a bridge connecting the known power series with the no so usual analytic expansion. This kind of approximation will be very useful as an application in Material Sciences, wherein these functions are frequently used [5,6]. The parameters now are more complex than in the case wherein v was fixed. However, the number of parameters is about similar numbers. However, it is necessary now to introduce some new ideas to structure the approximation in such a way that the singularities are avoided. This can be performed looking for the symmetry conservations as it is usual in some areas of Physics.

1. F. Maass and P. Martin, "Precise analytic approximations for the Bessel function J1(x)", Results in Phys. 8 (2018) 1234-1238.
2. P. Martin, J. Olivares, F. Maass and E. Valero, "Analytic approximations for special functions, applied to the modified Bessel functions I2(x) and I2/3(x)", Results in Physics 11 (2018) 1028-1033.
3. F. Maass, P. Martin and J, Olivares," Analytic Approximation to the Bessel function J0(x)", Comput. Applied Mathem. 39 (2020) 222.
4. Martin P, Castro E, Paz JL, De Freitas A.," Multipoint quasi-rational approximants in Quantum Chemistry", Ch. 3 of book "New Developments in Quantum Chemistry", by J.L. Paz and A.J.Hernandez, (Transworld Research Network, Kerala, India) 55-78 (2009).
5. E. J. Rothwell," Exponential Approximation of the Bessel functionsI0,1(x), J0,1(x), Y0(x) and H01,2(x), with Applications to Electromagnetic Scattering, Radiation, and Diffraction [EM Programmer's Note-books]", IEEE Antennas and Propag. Mg., 51 (2009) pp. 138-147.
6. H. Khosravian-Arab, M. Dehghan, M. R. Eslahchi," Generalized Bessel functions: Theory and their applications", Math.Method. Appl. Sci., 40 (2017) 6389-6410.

Biography

Pablo Martin, born in Madrid, Spain, received his degree as Ingeniero Civil Industrial (Distinción Unánime), Universidad de Chile, 1964, and Lic. Ciencias, Especialidad Biofisica , U. Chile,1968. He received his MSc., and Ph.D.(Plasma Physics) in University of California, Los Angeles (UCLA), 1971. He was Professor in U. Simon Bolivar, Venezuela, 1974-2014, and now in U. Antofagasta, Chile, since 2014. He has edited the book "Plasma Physics" (Kluwer Academic Publishers, 1997, pp. 545). He has about 175 publications in International Journals. He has been Vice-president of the Sociedad Venezolana Física, SVF. He is Life Senior Member IEEE and OSA (USA), Fellow Member IAAM, Stockholm (Sweden), and member: APS, SEG and OSA (USA) and SOCHIFI (Chile). He is also author of 3 different International Invention Patents.

pablo.martin@uantof.cl

Theme: "Materials Innovation and Impact"

6th World Congress on Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Biocompatibility of 3D printed polycaprolactone samples for bone regeneration

Jana Frankova[1*], **Renata Novotna**[1], **Izabella Rajzer**[2], **Roman Novotny**[1], **Jarosław Janusz**[2] and **Adam Jabłoński**[2]

[1]Palacky University Olomouc, Czech Republic

[2]University of Bielsko-Biala, Poland

Healing of osteochondral defect in the field of regenerative medicine is considerable achievement. Osteochondral unit is a complex of tissue region that transitions from a top layer of hyaline cartilage through calcified cartilage into the subchondral bone layer [1]. Osteoblasts are the main cells that promote bone formation and is able to differentiated. The osteoblast differentiation process can generally be divided into three distinct stages that are defined by 1) proliferation, 2) matrix maturation, and 3) mineralization [2]. A number of marker genes/proteins are expressed at high levels for discrete periods of time during differentiation including, among others; alkaline phosphatase, collagen I, bone sialoprotein, osteopontin, osteocalcin and etc. In our preliminary research we focus on the evaluation of 3D print fabricated polycaprolactone materials supporting would healing of bone layer. Advance biocompatibility of the samples with several additives were used in our experiments e.g. silver nanoparticles, zinc oxide, hydroxyapatite and others on Saos-2 cell line. The viability and morphology of the cells were evaluated after 1 and 7 days. Differentiation markers as alkaline phosphates and collagen I after 1 and 7days incubation period will be also discussed.

This work was funded by the National Science Centre, Poland grant number: 2020/39/I/ST5/00569 (OPUS-LAP) and Czech Science Foundation (21-45449L) and IGA_LF_2023_017.

References:

1. Bedell M.L. et. al. The effect of multi-material architecture on the ex vivo osteochondral integration of bioprinted constructs. Acta Biomaterialia 2023, 155, 99-112.
2. Ha S.W. et. al. Nano-hydroxyapatite modulates osteoblast lineage commitment by stimulation of DNA methylation and regulation of gene expression. Biomaterials 2015; 65: 32–42.

Biography

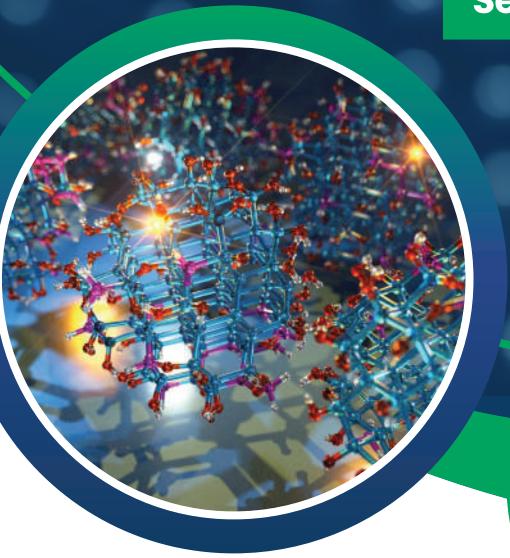
She received M.Sc. in Organic chemistry at Palacky University Olomouc and Ph.D. in Immunology at Masaryk university in Brno. At this moment she is working as Associated professor at Palacky University Olomouc at Department of Medical Chemistry and Biochemistry at Faculty of Medicine and Dentistry. The main research is focus on cell culture, toxicity, in vitro inflammation models and wound healing models in vitro.

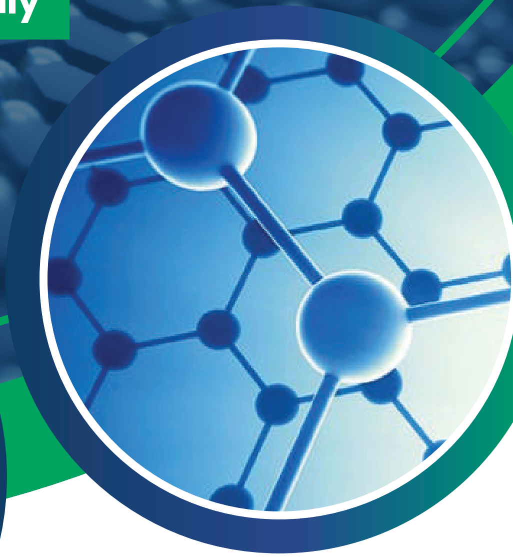
jana.frankova@upol.cz, frankova0@seznam.cz

6th World Congress on

Materials Science and Engineering

September 18-19, 2023 | Rome, Italy





Theme: "Materials Innovation and Impact"

Keynote Forum

DAY 2

(Room-1)

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Martensitic Domain Formation in the Ferromagnetic Shape Memory Compounds Ni_2MnGa

K-U. Neumann

SRH University of Applied Sciences, Ernst Reuter Platz 10, D-10587 Berlin, Germany

The compound Ni_2MnGa is a cubic ferromagnet with a transition temperature around room temperature. At low temperatures of ≈200 K it undergoes a martensitic transition to a low symmetry phase. The transition is accompanied by the occurrence of a shape memory effect.

This talk focusses on the low temperature properties of Ni_2MnGa.The question of the formation of domains is discussed, and the formation of domain walls is tackled. Using a pseudo-tetragonal approximation for the low temperature phase and with the occurrence of 36 different martensitic domains a large number of different domain walls may be formed. The question of the identification of possible domain walls between different martensitic domains, and the issue of a domain wall between a martensite and the cubic parent phase, will be discussed.

Biography

Klaus-Ulrich Neumann is professor at the SRH University of Applied Sciences in Berlin. His interests include material science and wave and scattering phenomena, in particular neutron scattering. With work in areas of theory as well as experiment the author is able to address both experimental as well as theoretical challenges. His interests include: shape memory materials, neutron scattering, phase transformation, domain formation.

Klaus-ulrich.neumann@srh.de

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Hydrogenation of Carbon Dioxide on Iron group metal oxides

Libor Kvitek

Department of Physical Chemistry, Palacky University Olomouc, Czechia

Increasing the concentration of CO_2 and other greenhouse gases in the atmosphere is the main reason for global warming and climate change. One of the possible ways to reduce emissions of CO_2 is based on its chemical conversion into value-added products, e.g., e-fuels or other chemicals utilizable in the chemical industry. Metal oxides of iron, cobalt, and nickel are commonly used as effective catalysts for CO_2 methanation. In composites with other metals, higher hydrocarbons or oxy derivates (alcohols) can be produced with these catalytic metals. The presented study is aimed at comparing of catalytic activity of the oxides of metals from the iron group in CO_2 hydrogenation to evaluate the best way to improve this catalytic process. The obtained results showed that nickel is the best methanation catalyst of these three metals. However, iron and cobalt-based catalysts can produce higher hydrocarbons which are more valuable products than C1 product methane.

The authors acknowledge financial support by Internal Grant of Palacky University, grant number IGA_PrF_2023_29.

Biography

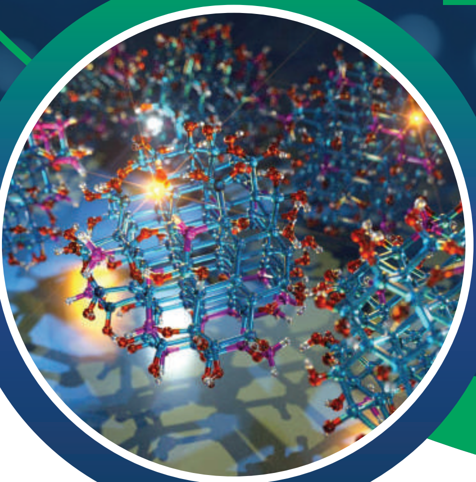
Prof. Libor Kvitek obtained an MSc. degree (Physical Chemistry) at Charles University in Prague in 1984 and Ph.D. degree at the same university in 1993. Since 1991 he has been working at Palacky University in Olomouc, now as a full Professor. Research specialization is the preparation, characterization, and application of metal nanoparticles. He studies mainly their antibacterial and catalytic activity. In the field of catalytic activity, he is interested in the catalytic hydrogenation of carbon dioxide using metal oxide-based catalysts and in the size dependency of the catalytic activity of the noble metal nanoparticles..

libor.kvitek@upol.cz

CITY ATTRACTION OF ROME

6th World Congress on Materials Science and Engineering

September 18-19, 2023 | Rome, Italy



Theme: "Materials Innovation and Impact"

Invited Speaker Presentations

DAY 2

(Room-1)

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Plasmatic proteins adsorption states on poly(styrene sodium sulfonate) functionalized silicone surfaces using atomic force microscopy

C. Falentin-Daudré[1*] and **M. Lam**[1]
[1]LBPS/CSPBAT, UMR CNRS 7244, Institut Galilée, Université Sorbonne Paris Nord, 99 avenue JB Clément 93430- Villetaneuse, France

Protein adsorption occurs spontaneously on biomaterial upon insertion within the body. The resulting protein layer influences biomaterial biocompatibility through enhanced bio-integration or, on the contrary, adverse reactions. It closely depends on their conformation, or structure leading to diverse interactions with the surrounding biomolecules. Previously, it was shown that the grafting of poly(styrene sodium sulfonate)-polyNaSS on silicone surface had enhanced cell viability. PolyNaSS is supposed to promote changes in the structural state of adsorbed plasma proteins reducing the odd for a biofilm to form. Detailed insights related to the mechanism are still scarce. In this context, atomic force microscopy (AFM) is an interesting tool to access the surface organization of these proteins in contact with modified silicone surfaces. AFM uses a probe to map surfaces by measuring the difference in heights, resulting in a well-detailed topographic feature. The present work addresses more in-depth structural investigations of the adsorbed state of Bovine Serum Albumin (BSA), studied as a model protein, and fibronectin (FN), for its role in cell adhesion. AFM images highlighted that polyNaSS showed no significant impact on the BSA structure conversely to the FN one. However, imaging findings clearly outlined a change in the structural organization of FN, going from a nanofibrillar assembly with an average length of 130 nm to a globular one when the surface was grafted. PolyNaSS interacts specifically with FN. Cell spreading assays of L929 fibroblasts on FN-coated surfaces with standard optical microscopy indicated no significant impact of the change in FN structure upon fibroblasts adhesion, which displayed active elongated shapes. The present features are crucial for understanding the cell adhesion mechanism induced by surface modification.

Biography

Education:

2018: HDR, University of Sorbonne Paris North (USPN), France.
2009: PhD in organic chemistry, University of Amiens, France.

Career:
Since 2021: Director of the Biomaterials for Health Team (CSPBAT laboratory, UMR CNRS 7244, USPN, France).
Since 2012: Assistant Professor (Biomaterials for Health Team (CSPBAT laboratory, UMR CNRS 7244, USPN, France).
2010-2012: Postdoctoral fellowship (CERM, University of Liege, Belgium).

Research interests:
Elaboration and functionalization of biomaterials surfaces to improve the biological response.

falentin-daudre@orange.fr

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Development of an electrospun patch for the treatment of myelomeningocele

Khaoula Benabdderrahmane[1*], Julien Stirnemann[2], Salah Ramtani[1], Céline Falentin-Daudré[1]

[1]LBPS/CSPBAT, UMR CNRS 7244, institut Galilée, Université Sorbonne Paris Nord, 93430, Villetaneuse, France

[2]Obstetrics and Maternal-Fetal Medicine, Hôpital Necker Enfants Malades, AP-HP; EA7328, Faculté de Médicine Université de Paris, 75015, Paris, France

Myelomeningocele (MMC) is a congenital malformation caused by a primary defect in neural tube closure during the embryological period. It is characterized by protrusion of the meninges and spinal cord through the open vertebral arches causing cognitive and motor dysfonctions. Fetal surgical repair has been shown to reduce cognitive symptoms but remains late for a better motor outcomes, so an earlier foetoscopic repair would be preferable to reduce motor neurological symptoms and fetomaternal risks, by covering the defect with a patch intended to protect the exposed neural tissue. Previous work by the LBPS team allowed to develop a highly effective bioactive Polycaprolactone membrane, with excellent mechanical and biological properties. Based on this work, the aim of this study is to develop a biodegradable and waterproof bilayer patch, designed to cover and protect the spinal cord exposed in utero, with a bioactive side, suitable for cell proliferation, and an anti-adhesive side to avoid its attachment to the spine.

Keywords: Myelomeningocele; PCL; Electrospinning; Bioactive polymer.

Biography

Khaoula Benabdderrahmane is currently a second year PhD student in biomaterials at the University Sorbonne Paris Nord, working under the supervision of Dr Céline Falentin-Daudré and Pr Salah Ramtani in the laboratory of biomaterials for health (LPBS). Before coming to the LPBS team, she completed six years of dentistery and a master degree in biomaterials. Her thesis work focused on developing a patch and functionalizing its surface as part of an intrauterine treatment for myelomeningocele.

khaoula.benabdderrahmane@sorbonne-paris-nord.fr

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Meltblown-Polypropylene membrane: a material for biomedical application

M. Lam[1]*, M. Baudoin[2], B. Mougin[2] and **C. Falentin-Daudré[1]**

[1]*Université Sorbonne Paris Nord, Institut Galilée, LBPS/CSPBAT, CNRS UMR 7244, Villetaneuse, France*

[2]*MeltBio, 56 Rte de Ferrossière, 38110 Saint-Didier-de-la-Tour, France*

The melt-blowing process is an innovative technic to produce high-quality nonwoven structures composed of thousands of entangled microfilaments. The principle relies on a melted state polymer that goes through tiny nozzles, then blown by hot air flow to create randomly aligned micro-stretched filaments to compose a final membrane(1). Using no solvents and being easy to implement makes it the preferred method for applying biomedical devices. Membrane structures are commonly used for tasks such as filtration or wound dressing(2). Depending on the intended use, it is important to control the pore sizes, thickness, and compacity of the membrane, and the melt-blowing process is ideal for adjusting these parameters.

Herein, we study polypropylene melt-blown membranes and their bioreactivity resulting from grafting a bioactive polymer on top of the surface. Despite the acceptable biocompatibility that widens the use of polypropylene, it is not exempt from drawbacks. For some reason, bacterial issues and lack of integration exemplified this statement(3).

Thus, a suitable and reliable method was developed to graft the poly (styrene sodium sulfonate) – PolyNaSS over a hydrophobic polypropylene surface to achieve new properties targeting controlled biological responses. The grafting method uses UV irradiation (365nm) to create radical species from the surface, enabling the polymer's direct and progressive growth over the surface with a radical polymerization mechanism(4). The resulting surface properties were investigated using colorimetry, water contact angle measurements, and scanning electron microscopy. Differences related to the grafting rates and improved surface wettability were evidenced. The next step is looking for cell responses to these surface contact. Ultimately, outcomes enlighten enhanced cell adhesion with improved cell morphology. In addition, fibroblasts adopted an active stretched shape on a grafted surface, whereas they took a non- active round shape on bare polypropylene. These results open new perspectives for melting-blown processing and polypropylene membrane applications.

1. H.-G. Geus, Woodhead Publishing Series in Textiles, 2016, 133-153.
2. https://www.protechnic.fr/fr/procomp-fr/solutions-de-masques/
3. M. Lam, V. Migonney, C. Falentin-Daudre, Acta Biomaterialia, 2021, 121, 68–88.
4. M. Lam; V. Moris; V. Humblot; , V. Migonney, C. Falentin-Daudre, European Polymer Journal, 2020, 128, 109608.

Biography

My research mainly deals with solid material functionalization for improving and controlling biological response at the interface material/biological medium. I obtained my Ph.D. in chemistry (biomaterials) in 2021 at the Sorbonne Paris Nord University, where I worked on grafting a bioactive polymer on silicone surfaces using UV irradiations to improve protein and cell adhesion. After that, I continued with my first postdoctoral experience at the University of Liège (Belgium), where I worked on developing polyurethane hydrogels via a non-isocyanate pathway for drug delivery application. And now, in the laboratory of biomaterials for health (France-Paris), I am studying the advantage of non-woven fibers membranes elaborated by the melt-blowing method and their biological potential through the grafting of an anionic polymer to confers them targeted features like antibacterial, hydrophilic, and biocompatible properties.

mylan.lam@univ-paris13.fr

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Mitigating Thermal Runaway and its Propagation in Lithium-ion Battery Packs using Composite Phase Change Materials

Jayson Cheyne[1,2*], **David Butler**[1,2] and **Iain Bomphray**[2]

[1]Department of Design Manufacturing and Engineering Management, University of Strathclyde, United Kingdom

[2]National Manufacturing Institute Scotland, United Kingdom

Lithium-ion cells are used extensively in battery electric vehicles due to their high energy density and excellent cycle life. That said, the thermal safety of lithium-ion cells remains a significant concern due to the hazards associated with thermal runaway - including fire, explosion, and the release of toxic gases. Furthermore, since the thermal runaway phenomenon occurs at individual cell level, the risk increases if the cells operate in high-voltage battery packs, where thermal runaway can propagate from one cell to another. Using phase change materials (PCMs) between lithium-ion cells is a promising strategy to improve thermal safety due to their ability to absorb and store heat during phase transition. That said, the practical application of PCMs in battery packs is limited due to their low thermal stability, poor shape stability, and poor heat dissipation characteristics.

This research aims to explore multi-material composite PCMs (consisting of non-flammable Fatty-Acid-Ester, Silicone, and Expanded Graphite) to inhibit thermal runaway in battery packs. Throughout this research, the shape-stability, and thermal properties of composite PCMs will be examined - varying the weight fraction of Silicone and Expanded Graphite to understand their influence. Following this, numerical modelling will be carried out to explore the composite PCMs' ability to provide thermal management and thermal runaway mitigation for a group of lithium-ion cells.

Biography

Jayson Cheyne is a Ph.D. student at the University of Strathclyde in Glasgow, UK. His focus is exploring composite materials for passive thermal runaway mitigation in lithium-ion battery packs. His academic journey began at the University of Strathclyde where Jayson studied mechanical engineering - obtaining a Master of Engineering. It was during Jayson's final year that he became fascinated with material science and composites design. Other research interests include automotive design, fire standards and regulations, Computation Fluid Dynamics, and Finite Element Analysis.

jayson.cheyne@strath.ac.uk

Mind Authors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Optical properties of InAs/GaSb and InAs/InAsSb type-II superlattices

Marcin Motyka

Department of Experimental Physics, Faculty of Fundamental Problems of Technology, Wroclaw University of Science and Technology, Poland

State-of-the-art optical gas detection systems employ tunable diode lasers and efficient detectors for different applications in medicine, manufacture, or science. Tuning the wavelength of the emitter within the system makes it possible to detect in situ the presence and concentration of trace gases in the atmosphere with their limit reaching single ppb range. By growing the active structures within a 6.1 Å family of semiconductors i.e. InAs and GaSb alloys, the device can also cover mid-infrared spectral range hosting a number of strong absorption lines of several gaseous substances of interest. Superlattices within this material system having the type-II band alignment have the potential to exceed the working parameters of commercially used optoelectronic devices, such as HgCdTe infrared photodetectors. Type-II superlattices were grown through molecular beam epitaxy process and then their optical properties were characterized using Fourier-transform infrared spectrometer and later on, via pump-probe experiment. Two sets of structures were studied with this method – InAs/GaSb and InAs/InAsSb superlattices designed for room temperature applications between 5 and 9 µm spectral range. First set of samples varied through the approach to interface-engineering with the samples being either "Sb-soaked" or an InSb monolayer was put between each superlattice period which was also considered in our previous works. Second set of superlattices had different periodicity (5, 6 and 8 nm) shifting the main optical transition over the aforementioned spectral range. Presented findings could provide valid insights in the fundamental properties such as carrier lifetimes within InAs/GaSb and InAs/InAsSb SLs to further optimize and improve the working parameters of possible future applications in the field of infrared optoelectronics.

Biography

Marcin Motyka (1980), University Professor.

At the beginning, his research was focused on investigating of quantum dots designed for second and third telecommunication windows and simultaneously, structures utilizing gallium nitride, which resulted in a thesis defended in 2008. Further, he had started a new research field, associated with optical sensing in mid-infrared, which stayed in his area of focus to the present day. This branch of science fits in the leading trends in contemporary solid state physics, being extraordinarily relevant in many aspects of life, such as medicine, or environment preservation. He is an author of more than 100 papers, with his research works cited more than 1000 times which results in his Hirsch factor of 17.

marcin.motyka@pwr.edu.pl

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Formation and Growth Mechanism of Silver Nanocubes in a Binary Apolar Solvent

Christina Graf, Maximilian Joschko, Moritz Schattmann,
and **Deniz Grollmusz**

Darmstadt University of Applied Sciences, Germany

The controlled formation of anisotropic metal nanoparticles, such as silver nanocubes, is essential for many applications in plasmonics and catalysis. Shape-controlled synthesis of metallic nanoparticles in hydrophobic solvents, unlike aqueous solvents, has been little investigated. The low solubility of shape-directing agents in organic solvents, combined with the preferential formation of twinned particles with crystalline defects, is a major challenge in synthesizing monocrystalline nanocubes. Therefore, the oxidation of the forming particles by selective etching agents is essential.

Silver nanocubes are prepared by hot injection synthesis in a binary solvent mixture.[1] $AgNO_3$ dissolved in oleylamine is injected into dimethyldioctadecylammonium chloride dissolved in dibenzyl ether and oleylamine at 250-260 °C. Synthesis parameters are systematically investigated, and a detailed synthesis mechanism is developed. Crucial to the synthesis is adding an iron component as catalyst and regulating the inert gas flow during the reaction, as gaseous intermediates are present at different synthesis stages.

HCl forms in situ while heating dimethyldioctadecylammonium chloride and dibenzyl ether and reacts with oleylamine to oleylammonium chloride. Upon the injection of $AgNO_3$ in oleylamine, AgCl forms abruptly and is subsequently reduced by oleylamine to silver, presumably with the participation of Fe^{2+} ions. The resulting silver particles are initially mainly twinned crystals. Single crystals are formed by oxidative etching, likely mainly by Fe^{3+} ions. Due to the affinity of chloride for the {100} crystal faces, oleylammonium chloride blocks their growth and nanocubes are formed.

We expect that our results will be essential for understanding the formation of other anisotropic metal nanoparticles in apolar solvents.

1. Peng et al. Chem. Mater. 2010, 22, 6272-6279.

Biography

Christina Graf studied chemistry at the Mainz University/Germany, where she received her doctorate in 1999. Afterward, she was a postdoc at the Utrecht/University/Netherlands. She then worked at the Würzburg University/Germany and the Freie Universität Berlin, where she completed her habilitation in 2009. Afterward, she had a professorship in Physical Chemistry for five years at Freie Universität Berlin. Since 2016 she is a professor for Physical Chemistry at Darmstadt University of Applied Sciences. Her research focuses on the synthesis, functionalization and characterization of multifunctional inorganic nanoparticles, their arrangement in ordered structures and the investigation of their interaction with biological systems.

christina.graf@h-da.de

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

QUANTEP - Experimental Platform for Quantum Technologies

F. De Matteis[1,2]*, T.H. Dao[1,2], R. Francini[1,2], M. Salvato[1,2], V. Bonaiuto[1,2], F. Sargeni[1,2], A. Salamon[2], F. Spinella[3], E. Pedreschi[3], S. Cammarata[3,4], A. Toncelli[3,4], L. Frontini[5,6], V. Liberali[5,6], A. Stabile[5,6], F.B. Armani[6], S. Iadanza[7], J. Shojaii[8], P. Piergentili[9,10], R. Gunnella[9,10], G. Di Giuseppe[9,10] J. Forneris[11], G. Andrini[11], S.D. Tchernij[11], V. Bellani[12], C. Lacava[12], S. Cornia[12], A. Fontana[12], A.E. Kaplan[12], V. Vitali[12], V. Demontis[13], V. Rigato[14], M. Campostrini[14], C. Roncolato[14] and **F. Rossella[15]**

[1]University of Rome Tor Vergata, Italy
[2]INFN Rome Tor Vergata, Italy
[3]INFN Pisa, Italy
[4]University of Pisa, Italy
[5]University of Milan, Italy
[6] INFN Milan, Italy
[7]Paul Scherrer Institute (PSI), 5232 Villigen, Switzerland
[8]University of Melbourne, Australia
[9]INFN Perugia, Italy
[10]University of Camerino, Italy
[11]University of Turin, Italy
[12]University and INFN Pavia, Italy
[13]NEST-CNR Pisa and INFN Pavia, Italy
[14]INFN-National Laboratory of Legnaro, Italy
[15]University of Modena and INFN Pavia, Italy

The QUANTEP project aims at the development and implementation of a complete Silicon Photonics Integrated Circuit for Quantum Computation with linear quantum optics circuits and single photons. A prototype of this kind of circuit is the universal two-qubit Controlled-NOT (C-NOT) gate. This scheme makes use of a linear, coincidence basis gate that performs all the operations of a controlled-NOT gate and requires only single photons at the input. This scheme could be a useful testbed for the implementation of more sophisticated quantum circuits, which eventually will require on-chip single-photon sources and detectors.

The technology selected for silicon photonics integrated circuits is a 250 nm Silicon On Insulator CMOS process. A special production process is foreseen in which a reduced set of masks is used in the standard Multi-Project Wafer runs and some special reworking is done, after the run, in the research facilities of the QUANTEP team.

The quest for single-photon sources is performed through ion implantation in silicon with the aim to identify appealing classes of emitter centers in the telecom C-band.

For the detection stage, the investigated solution is an integrated Bi2Se3/n-Si heterojunction. Bi2Se3 is a topological insulator, which efficiently absorbs IR light and delivers the photo charges to the external circuit without backscattering due to its Dirac–like metallic surface.

The potential of novel quantum-device concepts, realized by using as basic building blocks heterostructured semiconductor nanowires, graphene, and other 2D materials will be explored focusing on their capability to provide control over light-matter interaction mechanisms, such as polarization modulation.

The integrated linear optics quantum circuits will be characterized and the logic tested in the fully integrated version.

Biography

Fabio De Matteis, Master Degree in Physics (Rome 1987), Ph.D in Physics (Antwerp 1993). Assistant professor at the Industrial Engineering Department of the University of Rome-Tor Vergata.

Since 2017 he is associated with INFN and participates in several INFN activities in the field of development and characterization of integrated silicon photonic circuits for optical communications, sensors and quantum optics. He also participates in the Virgo Coating R&D group, as a member of the INFN Section of Rome Tor Vergata, with regard to optical characterization by ellipsometric techniques.

Main fields of interest:

- Optical properties of color centers in insulators;
- Nonlinear optical characterization of hybrid materials for optoelectronics;
- Ellipsometric characterization of materials for coating with high performances;
- Biocompatible 3D scaffolds for tissue engineering by means of photolithographic techniques;
- Optical measurements in silicon photonic circuits for signal modulation in optical communications, sensors and quantum optics.

fabio.dematteis@uniroma2.it

Theme: "Materials Innovation and Impact"

6th World Congress on

Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Thermal and strength properties of alkali-activated foams with natural fibers and phase change materials

Agnieszka Bąk[1*], **Joanna Marczyk**[1], **Kinga Pławecka**[1], **Patrycja Bazan**[1] and **Michał Łach**[1]

Chair of Materials Engineering, Faculty of Material Engineering and Physics, Cracow University of Technology, Jana Pawła II 37, 31-864 Cracow, Poland

Geopolymer materials are made from anthropogenic raw materials and waste materials from the energy industry. In order to produce them, an alkaline activator is needed, which is responsible for the processes of dissolution of raw materials and their subsequent binding. Currently, geopolymers are considered a future-oriented material that can replace previously used cement-based products. Geopolymer insulation materials are becoming increasingly popular. This paper presents the results of the study of foamed geopolymer composites based on fly ash, natural fibers, and phase change materials. The study used 3 different types of fibers and 2 phase change materials from Rubbitherm Technologies GmbH of Germany. The PCMs differed not only in the temperature of the phase change but also in the form they are in. A 10-mole solution of sodium hydroxide with an aqueous solution of sodium silicate was used to activate the geopolymers. The publication presents the results of the thermal conductivity coefficient and specific heat of the finished foams. Compressive strength tests of the samples were also carried out after 28 days. Using an optical microscope and a scanning electron microscope, macroscopic and microscopic images of the fabricated composites were also taken. The results showed that the material has the potential to be used in various industrial sectors, but the main area of application is construction and structural insulation materials. The presented research results indicate the great potential of these composites as an energy and environmentally sustainable material.

Biography

I am a first-year student at the Doctoral School at the Cracow University of Technology. My research work is carried out within the field of materials engineering. My publications mainly describe geopolymer materials as new materials for construction. I already have about 15 publications to my credit. For my Ph.D., I am focused on studying the thermal insulating properties of geopolymer composites with natural fibers and phase change materials. I am also currently pursuing a project under the Pearls of Science program. The topic of the project is

"Research on functional lightweight porous structures based on alkali-activated aluminosilicates". I am interested in music and crime movies and series.

agnieszka.bak@pk.edu.pl

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Effect of the addition of phase change materials on the properties of foamed geopolymers

Joanna Marczyk[1*], **Agnieszka Bąk**[1], **Beata Figiela**[1], **Patrycja Bazan**[1] and **Michał Łach**[1]

Chair of Materials Engineering, Faculty of Material Engineering and Physics, Cracow University of Technology, Jana Pawła II 37, 31-864 Cracow, Poland

Geopolymers are amorphous materials belonging to the group of inorganic aluminosilicate binders. The geopolymerization process takes place by activating reactive pozzolanic raw materials, such as e.g. fly ash or metakaolin, with alkaline solutions. Geopolymers, because they emit less CO2 than traditional Portland cement, are an excellent alternative for use in the construction industry. Moreover, the production of geopolymer foams can have a particular impact on reducing the environmental footprint of building materials. The porous structure of the geopolymer improves its thermal insulation properties, which may contribute to reducing the energy consumption of buildings.

As part of this work, foamed geopolymer materials with the addition of phase change materials (PCM) were prepared. These are materials with absorptive and accumulation abilities. In the paper, the impact of the addition of phase change materials on the thermal and mechanical properties of geopolymer foams was assessed. Acrylic PCM under the trade name Micronal 28S (Microtek Laboratories, Inc, United States) was introduced into the geopolymer paste in the proportion of 0%, 5%, 10%, and 15%. The prepared materials were tested for specific heat, thermal conductivity, compressive strength, and microscopic observations.

From a sustainability point of view, foamed geopolymers have many advantages over traditionally used materials. Mainly because their use can significantly reduce the burden on the environment. In addition, due to their good thermal resistance, geopolymers can be widely used in the construction industry.

Biography

I am a PhD student at the Doctoral School of the Cracow University of Technology in the discipline of Materials Engineering. As part of my doctoral thesis, I deal with the subject of developing a technology for manufacturing elements using the Binder Jetting method, which belongs to additive techniques. In addition, I also deal with geopolymer materials. I am a co-author of about 20 scientific publications. I spend my free time hiking in the mountains. I am also interested in photography.

joanna.marczyk@pk.edu.pl

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Mechanisms of friction and wear of polymer surfaces at the nanometer scale

Arnaud Caron* and **Jae Moo Kim**
KOREATECH – Korea University of Technology and Education,
School of Energy Materials and Chemical Engineering, Cheonan, Republic of Korea

This work investigates the mechanisms governing friction and wear of various polymer surfaces in sliding contact with SiOx single asperities by atomic force microscopy. We distinguish three mechanisms: stick-slip motion of AFM-tip, continuous sliding, and surface rippling.

We rationalize the stick-slip motion of an AFM tip on a soft polymer based on the formation, deformation, and rupture of adhesive junctions. For stiffer polymer surfaces, we find that the continuous sliding of an AFM follows a similar dependence on the normal force as predicted by the JKR model for the adhesive contact between elastic bodies. Above the yielding contact pressure, we observe the formation of surface ripples induced by plowing and a locking/unlocking mechanism of the AFM tip.

Biography

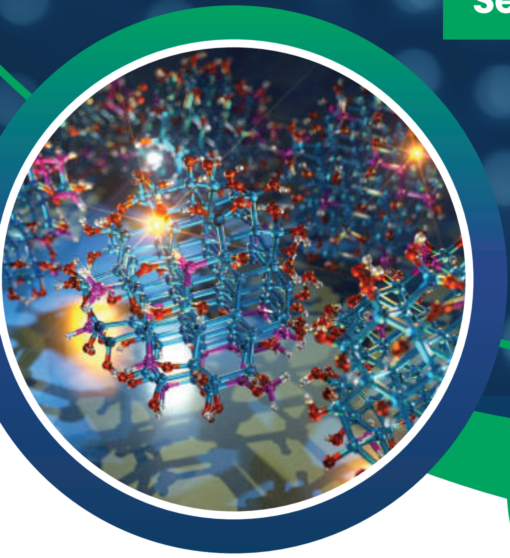
Arnaud Caron is a materials scientist with expertise in the multi-scale mechanical behavior of materials, surfaces, and micro-components. Since 2015 Arnaud Caron has been an Assistant Professor at KoreaTech – Korea University of Technology and Education, Republic of Korea. Arnaud Caron obtained his engineering degree in Materials Science in 2004 from the University of Saarland, Germany, and he was awarded the Schiebold Medal. In 2009, he earned his doctoral degree in Materials Science from the University of Saarland, Germany. From 2007 to 2015, Arnaud Caron worked as a research associate at the Institute of Micro- and Nanomaterials of the University of Ulm, Germany, the WPI-Advanced Institute of Materials Research at the Tohoku University, Japan, and the Leibniz – Institute for New Materials, Germany.

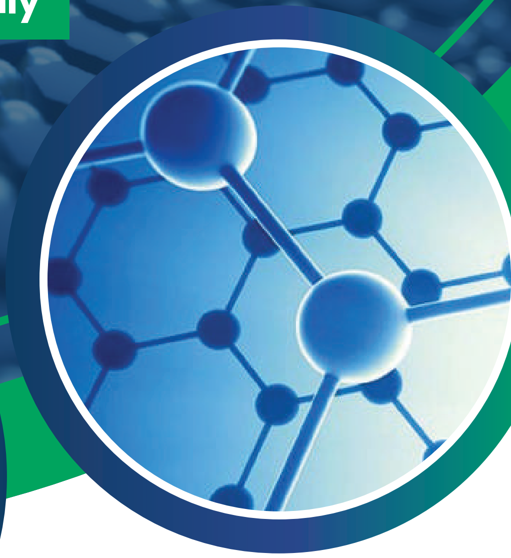
arnaud.caron@koreatech.ac.kr

6th World Congress on

Materials Science and Engineering

September 18-19, 2023 | Rome, Italy





Theme: "Materials Innovation and Impact"

Keynote Forum

DAY 2

(Room-2)

Theme: "Materials Innovation and Impact"

6th World Congress on

Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

The Surface Engineering of the Additive Manufacturing of Metallic Materials

Matjaž Godec

Institute of Metals and Technology, Slovenia

Nowadays, many metallic materials can be successfully synthesised using the additive manufacturing process as powder bed fusion or direct energy deposition. Such a process leads to specific microstructures due to rapid solidification and the formation of dislocation substructure, specific grain shapes, porosity, nano oxide particles, micro or nano segregations, as well as accumulation of stress. The corrosion and wear properties are very important for most metallic materials. That is why various surface-hardening procedures are increasingly used. Plasma nitriding greatly improves the corrosion as well as the wear properties. During surface treatments, such as plasma nitriding, all these microstructure specifics of additive manufacturing can have an impact on the formation of surface compounds and diffusion layers. The research on the plasma nitriding of stainless steel AISI 316L, maraging steel M300, tool steel H13 and nickel super alloy Inconel 625 and others will be presented. The microstructural results of the compound and diffusion layer will be shown and compared with conventionally processed materials. In addition, the influence of different heat treatments on the development of the nitride layers will also be considered. The results will be supported by corrosion and wear measurements.

Biography

Prof. Dr Matjaž Godec is the director of the Institute of Metal and Technology (IMT), as well as group leader of the Department of Physics and Chemistry of Materials at the institute since 2011. He is the head of a six-year National Research Program "Physics and Chemistry of Metallic Materials", funded by the Slovenian Research Agency with a budget of 3.5 M€. From 2016-2019 he was the head of the 10 M€ budget European project MARTINA, funded by Structural Funds. He is also a leader of three of the three-year national and international projects, and he currently leads the Slovenian part of the European Horizon 2020 InShaPe project. He is also the First Assistant Chief Editor of the journal Materials Science and Technology. He is the author of 153 original scientific papers, 230 conference contributions, 8 invited lectures, 1 keynote lecture, 1 chapter in a monography, 286 industrial reports and expertise and has supervised 3 doctoral theses and co-supervised 3. He has 1979 citations, and his h-index is 22.

matjaz.godec@imt.si

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Multifunctional cellulose-carbon nanomaterials (CNMs) hybrid materials

Teboho Clement Mokhena

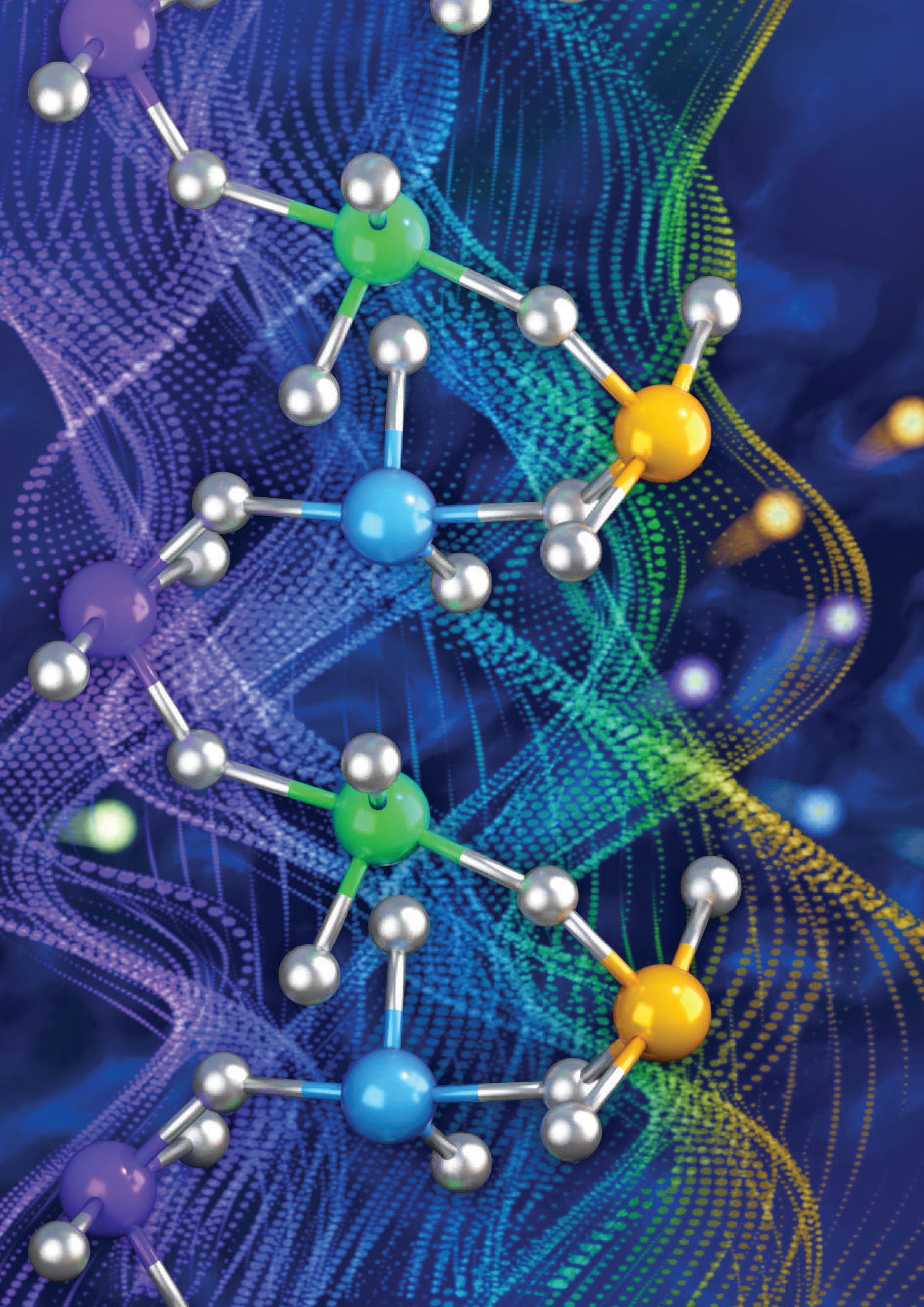
DSI/Mintek- Nanotechnology Innovation Centre, Advanced Materials, Mintek, South Africa

Cellulose is the most abundant natural polymer which can obtained from different renewable sources. It has been used in several applications due to its distinctive properties such as: sustainability and affordable. Therefore, cellulose hybrid materials can be utilized as adsorbents, filtration membranes, and hydrogels to widen their applications in different fields. Polymer hybrid systems have been a focus of many research studies. Amongst these hybrids, cellulose-carbon nanomaterials (CNMs) received great attention due to their unique attributes, such as ease functionalization, simple processing, and compatibility. They have a great potential to be employed in various fields such as in wastewater treatment, energy storage and biomedicine. These hybrids can be used as suitable adsorbents to remove different pollutants including dyes, metalloids, oils and emerging contaminants from wastewater streams. They have been applied to encapsulate different materials for energy storage applications. In this talk, the use of cellulose-CNMs in wastewater treatment and energy storage will be covered.

Biography

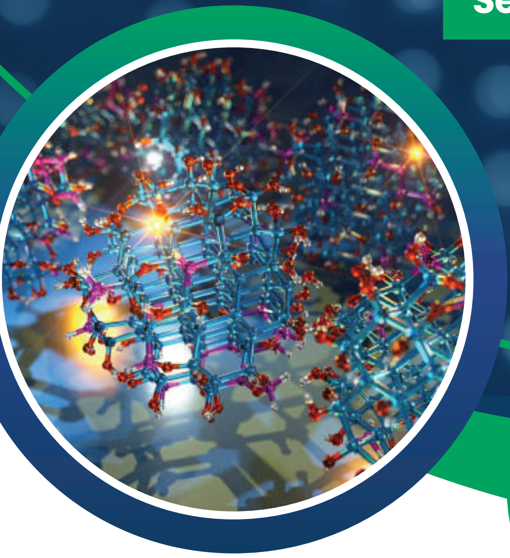
Dr Teboho Clement Mokhena is a Principal Research Scientist heading Nanominerals unit within Advanced Materials Division (AMD) at MINTEK. In this position, he oversees different industrial and academic related R&D projects as well as technical and scientific support to different industries, especially nanotechnology based industries. His research is centered around the use of waste materials to generate value-added products, such as gas sensors, biomedical devices, costumed 3D printed devices etc. He has published more than 70 research outputs in the form of articles, and book chapters.

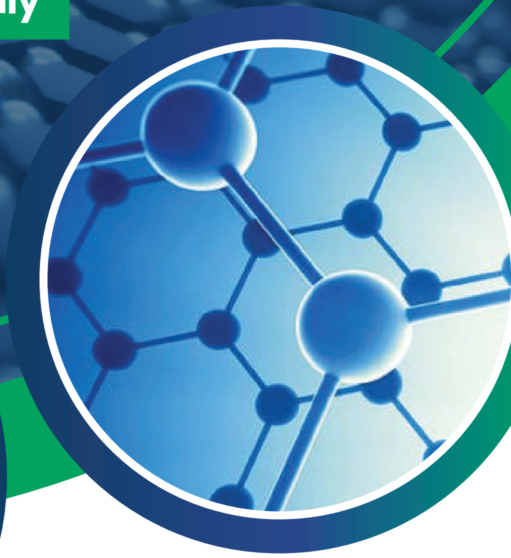
tebohom@mintek.co.za



6th World Congress on Materials Science and Engineering

September 18-19, 2023 | Rome, Italy





Theme: "Materials Innovation and Impact"

Invited Speaker Presentations

DAY 2

(Room-2)

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Gradient-Type Theory of Elastic Dielectrics Incorporating Polarization Inertia, Flexodynamic and Microstructure Effects

Olha Hrytsyna[1,2*], **Yuriy Tokovyy**[2] and **Maryan Hrytsyna**[1]
[1]Institute of Construction and Architecture Slovak Academy of Sciences, Slovakia
[2]Pidstryhach Institute for Applied Problems of Mechanics and Mathematics, National Academy of Sciences of Ukraine, Ukraine

Abstract A non-classical theory of nonferromagnetic thermoelastic dielectrics which incorporates the local mass displacement, polarization inertia, and flexodynamic effects is developed. The process of local mass displacement is linked to the changes of the material microstructure including atomic reordering at the surface/interface regions. Using the fundamental principles of continuum mechanics, electrodynamics, and non-equilibrium thermodynamics, the gradient-type constitutive equations are derived. Due to accounting for the polarization inertia and dynamic flexoelectric terms, the rheological constitutive equation for the polarization vector is obtained. It is shown that within this extended theory, the interaction between electric, thermal, and mechanical fields can be studied in linear elastic media including isotropic centrosymmetric materials. The theory avoids the singularity of the electric potential of the point electric charge in an infinite dielectric medium. It describes surface, scale and thermopolarization effect in dielectrics and allows for capturing the high-frequency dispersion of longitudinal elastic waves. Classical piezoelectricity fails to explain the electro-thermo-mechanical coupling in isotropic materials, high-frequency dispersion of longitudinal elastic waves, as well as to cover the surface and size effects in solids. Thus, the developed theory could be potentially useful for modeling coupled fields and processes in nano-dielectrics and polarized systems of heterogeneous internal structure.

Acknowledgements

Financial support from the Slovak Research and Development Agency and Ministry of Education and Science of the Ukraine under the bilateral grant Nos. SK-UA-21-0010 and 0122U002392 is gratefully acknowledged.

Biography

Olha Hrytsyna (Dr. of Sci., Senior Scientific Researcher) has graduated Applied Mathematics and Mechanics Department of Ivan Franko National University of Lviv (Ukraine). She is a mathematician/physicist, specialist in the area of nonequilibrium thermodynamics and mathematical modelling of coupled fields and processes in continuum mechanics, author of over 150 scientific papers and 4 books.

Yuriy V. Tokovyy (Dr. of. Sci., Senior Scientific Researcher) has graduated Applied Mathematics Department of Ivan Franko National University of Lviv, (Ukraine). He is a specialist in analytical and semianalytical methods of mathematical physics, direct and inverse problems of mechanics of deformable solids, thermomechanics of inhomogeneous and thermosensitive solids, author of over 250 scientific works.

Maryan Hrytsyna has graduated Applied Mathematics and Mechanics Department of Ivan Franko National University of Lviv (Ukraine). He is the specialist in computational mechanics.

olha.hrytsyna@savba.sk, hrytsyna.olha@gmail.com

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Clinical performance of Customized Bone Graft Made by Robocasting Hydroxyapatite and Tricalcium Phosphates VS Polycaprolactone loaded with nano-Hydroxyapatite for Oral Surgery.

Javier Montero Martín

Universidad de Salamanca, Spain

Objectives: To assess the clinical usefulness of beta-tricalcium phosphate (β-TCP) with hydroxyapatite (HA) bioblocks in comparison with Polycaprolactone (PCL) loaded with HA scaffolds for the ridge reconstructions of edentulous jaws of 20 patients. Methods. The ceramic scaffolds were produced by robocasting ceramic inks containing 80%/20% β-TCP and HA, respectively with an overall porosity of 60%, with a macropore size between 300 μm and 500 μm. The PCL scaffolds were printed by using hybrid inks with 90% PCL +10%HA with global porosity of 500 μm. The clinical study was performed on 20 edentulous patients who received either ceramic bone bioblocks or polymeric bone bioblocks to restore the maxillary volumes. After 10- 16 weeks of osseointegration, the bioblocks were explanted with trephine for histological analysis by Goldner and Von Kossa staining. Results. Regarding the ceramic grafts the results showed some cellularity inside the 68.4% of the ceramic samples, indicating biologically active bone, and adequate calcification was found in 31.7% of the samples. In terms of biomaterial degradation, 73.2% of the samples were completely resorbed or showed significant resorption (Figure 1). However for the PCL grafts, were not osseointegrated and by contrary were mostly encapsuled by connective tissue although the ridge volume can be satisfactorily restored.

Significance: The 80%/20% β-TCP and HA grafts customised by robocasting seems adequate for regenerating self-contained defects, however PCL grafts could be used to resotre gingival defects but not maxillary bone.

Keywords: bone regeneration; bone graft; robocasting; Hydroxyapatite; Tricalcium Phosphates; Polycaprolactone; 3D scaffold.

Comments: This project was supported by the Spanish Ministry of Science and Innovation (Ref: PID2019-111740RB-I00).

Recent Publications:

1. Shao H, Sun M, Zhang F, et al. Custom Repair of Mandibular Bone Defects with 3D Printed Bioceramic Scaffolds. J Dent Res. 2018;97(1):68-76.
2. Goh BT, Teh LY, Tan DB, Zhang Z, Teoh SH. Novel 3D polycaprolactone scaffold for ridge preservation: a pilot randomised controlled clinical trial. Clin Oral Implants Res. 2015;26(3):271-7.
3. Noronha Oliveira M, Rau LH, Marodin A, Corrêa M, Corrêa LR, Aragones A, Magini RS. Ridge Preservation After Maxillary Third Molar Extraction Using 30% Porosity PLGA/HA/β-TCP Scaffolds With and Without Simvastatin: A Pilot Randomized Controlled Clinical Trial. Implant Dent. 2017;26(6):832-840.
4. Xu H, Han D, Dong JS, Shen GX, Chai G, Yu ZY, Lang WJ, Ai ST. Rapid prototyped PGA/PLA scaffolds in the reconstruction of mandibular condyle bone defects. Int J Med Robot. 2010;6(1):66-72.
5. Gendviliene I, Simoliunas E, Rekstyte S, Malinauskas M, Zaleckas L, Jegelevicius D, Bukelskiene V, Rutkunas V. Assessment of the morphology and dimensional accuracy of 3D printed PLA and PLA/HAp scaffolds. J Mech Behav Biomed Mater. 2020;104:103616.

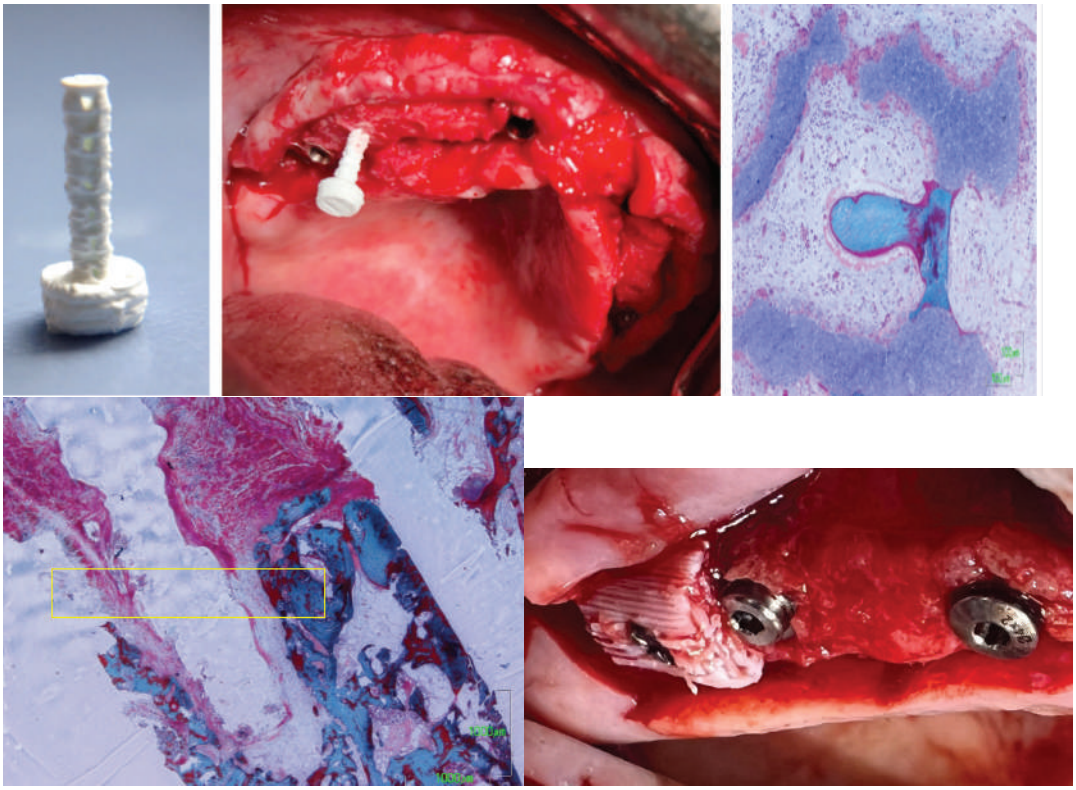


Figure 1. Histological microphotographs of the implanted 3D printed bioblocks by Goldner trichrome staining.

Biography

Since 2019 Montero J is a Full Professor in Prosthodontics. Faculty of Medicine. Department of Surgery, University of Salamanca, Spain. He also is the Director of the Master's degree in Implantology and Prosthodontics and the Head of the Research Group named: Advances in Oral Health

http://avancessaludoral.usal.es. Prf Javier Montero is the author of more than one hundred of indexed publications in the field of dentistry, mainly in the research line of prosthetic treatment, dental implants and bone regeneration..

javimont@usal.es

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Joining of Dissimilar Metals for High-Speed Electric Motor Applications: A Molecular Dynamics Study

Jiayi Chena*, Johannes Nokelainen[b,c], Bernardo Barbiellini[b,c], Hemantha Kumar Yeddu[a]

[a]Department of Mechanical Engineering, School of Energy Systems, LUT University, FI- 53851 Lappeenranta, Finland

[b]Department of Physics, School of Engineering Science, LUT University, FI-53851 Lappeenranta, Finland

[c]Physics Department, Northeastern University, Boston, MA 02115, USA

The fossil-fuel emissions can be reduced by substituting fossil-fuel based engines with high-speed electrical motors, such as axially laminated anisotropic synchronous reluctance motor (ALASynRM). The rotor of this motor is constructed by joining Inconel and steel by using vacuum brazing with copper (Cu) filler. However, the experiments show poor wettability of Cu on IN718 during vacuum brazing. In this work Molecular Dynamics (MD) simulations are performed to study the nanoscale interfacial phenomena that occur during brazing of steel with IN600 and IN718 using Cu. The results show that IN600 coheres well with liquid Cu, whereas IN718 containing Niobium impedes the atoms diffusing from Inconel into liquid Cu. Additionally, liquid Cu atoms diffuse well into the precipitate (γ'' phase), whereas Cu atoms barely diffuse into the parent γ phase in IN718.

Biography

Jiayi Chen is a PhD student in the Materials Modelling group in the LUT University, Finland. He received his MSc degree in Mechanical Engineering in 2019 from Newcastle University, UK. His research interests are molecular dynamics simulations, multiscale materials modelling, shape memory materials and engineering materials.

Jiayi.Chen@student.lut.fi

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

The effect of low and high temperatures on the mechanical performance of hybrid fibre-reinforced polymeric composite laminates

Glen Bright*, **Getahun Aklilu** and **Sarp Adali**
Discipline of Mechanical Engineering, University of KwaZulu-Natal, Durban, South Africa

This paper investigates the effects of low and high temperatures on the storage modulus, loss modulus, and damping performance of hybrid laminates. The top and bottom layers of hybrid laminates were specified as carbon fibre-reinforced polymers and the middle layer as glass fibre-reinforced polymers. Before testing, laminates were preserved in a deep freezer at -80, -20, 0, and 25°C for 60 days and tested using a dynamic mechanical analysis tool. Storage and loss modulus properties of hybrid laminates, which were preserved for longer periods under lower temperatures, increased in a glassy state and then decreased as the temperature increased. This happened due to the intact molecules, which increased their elasticity and then reduced it because of the presence of mobilization of the epoxy molecules on the glass transition regions. Additionally, a beta transition temperature was obtained when laminates persevered at -80 °C. It may happen due to molecular relaxation. The damping performance of laminates as a function of temperature and frequency was characterized. Results confirm that the highest damping factor was observed when the laminates were preserved at a temperature of -80 °C. Relationships between the glass transition temperatures of the laminates and the targeted frequencies were assessed. The glass transition temperature of the laminates shifted to higher temperatures as the frequency increased due to a reduction in the gaps between the crosslinking of the epoxy network. The accuracy of the storage modulus results was compared with empirical models. The model developed using the Arrhenius law provided the closest correlation.

Biography

Professor Glen Bright graduated with BSc (Mechanical Engineering), MSc (Engineering), and PhD (Engineering) degrees from the University of KwaZulu-Natal in the areas of Mechatronics, Robotics, and Advanced Manufacturing Systems. He graduated with an MBA degree from UKZN, Durban, in 2011. He has been working as a Professor of Mechatronics, Robotics, and Advanced Manufacturing Systems since 2002. He worked as head of the Mechatronics degree program at Massey University, Auckland, New Zealand, and as head of the School for Mechanical Engineering at Howard College, University of KwaZulu-Natal, South Africa. He is currently the dean of the School of Engineering at College of Agriculture, Engineering, and Science at UKZN. Since 2008, he has held the James Fulton Chair in Mechanical Engineering.

Brightg@ukzn.ac.za

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Conformation and dynamics of poly(methyl methacrylate) chain in thin film

Hiroyuki Aoki[1,2,*]

[1]*Japan Atomic Energy Agency*

[2]*High Energy Accelerator Research Organization, Japan*

Polymeric materials are often used in a form of thin film such as food wrap and surface coating. In such the applications, polymer films thinner than 100 nm have been often used. The thickness of such the ultra-thin film is less than the unperturbed size of a polymer chain; therefore, the polymer chain in an ultra-thin film is strongly constrained. However, the details on the constrained dynamics of polymer molecules in ultra-thin films is still unclear. In the current study, the dynamics of the polymer chains was investigated by quantum beams: neutron and laser. Neutron reflectometry (NR) provides the structure information in the depth direction on the thin film with the sub-nanometric spatial resolution. On the other hand, super-resolution laser microscopy (SRM) enables the lateral information with the spatial resolution of 10 nm. The diffusion dynamics of polymer chains during the thermal and solvent vapor annealing processes was studied by the NR analysis for the deuterium-labeled polymer and the SRM for the fluorescence-labeled sample. The NR and SRM revealed the characteristic dynamics in thin films.

Biography

Hiroyuki Aoki is a Principal Scientist of J-PARC Center, Japan Atomic Energy Agency (JAEA) and a Professor of Institute of Materials Structure Science, High Energy Accelerator Research Organization (KEK). He obtained his PhD degree from Kyoto University in 2001. He had been an Assistant Professor and Associate Professor of Department of Polymer Chemistry, Kyoto University since 2001. He moved to JAEA in 2016. He has been also a Professor of KEK since 2018. His research interests are focused on structure and dynamics of polymer thin films.

hiroyuki.aoki@j-parc.jp

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

The use of sunflower pellets as an alternative reducer for pyrometallurgical processes of obtaining metals

Tomasz Matula[1*]

Department of Metallurgy and Recycling, Faculty of Materials Science, Silesian University of Technology, Krasinskiego 8, 40-019 Katowice, Poland

The article presents the results of a study on metallurgical slags reduction using biomass such as sunflower pellets. The proposed solution is a new aspect of searching for alternatives to standard reducers used in pyrometallurgical processes of metal production. The performed thermogravimetric tests of sunflower pellets showed that during its gasification yields significant amounts of hydrocarbons, which are excellent reducing agents in such proces. The research results of copper slag reduction with the use of sunflower pellets indicate the decrease of copper content in the slag, which corresponds to the in-crease of so-called relative decopperisation degree. This may prove the possibility of using sunflower pellets in selected metallurgical processes.

Biography

Tomasz Matuła is Ph.D. at Department of Metallurgy and Recycling, Faculty of Materials Science, Silesian University of Technology in Poland. Following doctoral study, he worked as a engineering and technical specialist at university from 2017. He was one of the organizers of the international Iron and Steel Making conference, which was held in Poland. Tomasz also works as a science and development specialist in the project: Smart Growth Operational Program 2014-2020 "Development of a globally innovative technology for locating, recovering and disposing of sunken chemical warfare agents using a floating mobile installation". His research interests include pyrometallurgy, hydrometallurgy, issues related to the recycling of metals and industrial waste, the use of biomass in metallurgical processes and the process of destroying biological weapons.

tomasz.matula@polsl.pl

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

In situ x-ray spectroscopic study of energy materials

Chung-Li Dong
Department of Physic, Tamkang University, Tamsui 25137, Taiwan

Materials scientists play a crucial role in addressing the issues of increasing global demand for sustainable and clean energy. To pave the way for a zero-emission future, developing advanced renewable energy materials holds significant importance, and thus we must tackle these challenges from multiple perspectives, with a specific emphasis on the materials that enhance energy conversion, storage and conservation efficiencies. Improving the efficiency of existing energy materials is straightforward, but is presents technically challenges. The physical and chemical properties of materials are strongly correlated with their atomic and electronic structures. Gaining a deep understanding of these fundamental characteristics, particularly their behavior at work, is essential for effective engineering and practical application. Synchrotron x-ray spectroscopies, including x-ray absorption and x-ray emission spectroscopies, serve as powerful tools for investigating the atomic and electronic structures of energy materials. By employing in situ techniques, the dynamic changes in the atomic and electronic structures during operation can be monitored. The emerging scanning transmission x-ray microscopy offers spatially resolved x-ray spectroscopy, holding great potential for exploring energy science. This presentation aims to underscore the significance of x-ray spectroscopies in characterizing the atomic and electronic structures of energy material systems, such as artificial photosynthesis materials, advanced nanocatalysts, and smart materials. It will also encompass recent advancements in in-situ techniques. Tamkang University (TKU) end-stations at the Taiwan Photon Source (TPS) 45A & 27A beamlines, which are specifically dedicated to energy science research will be also introduced.

Biography

Chung-Li Dong received his Ph.D. in Physics from Tamkang University in 2004. He conducted the postdoctoral research at the Institute of Physics, Academia Sinica, Taiwan, and Advanced Light Source, Lawrence Berkeley National Laboratory, USA during 2005-2009. In 2009-2015, he was an assistant scientist at the National Synchrotron Radiation Research Center. He is currently an associated professor at Tamkang University, Taiwan. His research focuses on the synchrotron-based and in situ/operando spectroscopic studies of electronic structures of advanced and energy materials.

cldong@gms.tku.edu.tw

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

High Speed 3D Printing Technologies with Design for Additive Manufacturing

Jeng-Ywan Jeng[1,2,3*], **Chih-Hua Hsieh**[2], **Chi Pin Hsu**[2], **Chun-Ming Chen**[2], **Ajeet Kumar**[4], **Saurav Verma**[1,2], **Chinmai Bhat**[1,2], **Mayur Jiyalal Prajapati**[1,2], **Shu-Cheng Liu**[1,2], **Ritik Raj**[1,2], **Sandeep Kumar Paral**[1,2] and **Shang-Chih Lin**[2,5]

[1]*Department of Mechanical Engineering, National Taiwan University of Science and Technology, No. 43, Section 4, Keelung Rd, Taipei 106, Taiwan, ROC*

[2]*High Speed 3D Printing Research Center, National Taiwan University of Science and Technology, No. 43, Section 4, Keelung Rd, Taipei 106, Taiwan, ROC*

[3]*Academy of Innovative Semiconductor and Sustainable Manufacturing, National Cheng Kung University, No. 1, Dasyue Rd, East District, Tainan 701, Taiwan, ROC*

[4]*Department of Design, Indian Institute of Technology, Guwahati, Assam 781039, India*

[5]*Graduate Institute of Biomedical Engineering, National Taiwan University of Science and Technology, No. 43, Section 4, Keelung Rd, Taipei 106, Taiwan, ROC*

3D printing, also known as Additive manufacturing (AM), has revolutionized the manufacturing industry by providing enormous design freedom. AM enables the manufacturability of complex structures, including topology-optimized structures, multi-material designs, functionally graded parts, and bio-inspired mesoscale lattice structures such as sea urchins, honeycombs, and trabecular cones. However, complex structural designs are process and material specific. Under these circumstances, the design for additive manufacturing (DfAM) tool is necessary to enhance the printability, by utilizing the capabilities and constraints of AM. DfAM enables efficient mass customization, material selection, weight reduction, and improvement in part performance. High-speed 3D printing technologies are indispensable to execute the effectiveness of DfAM in actual mass production industries. Presently, 50-inch liquid crystal display (LCD) vat photopolymerization (VPP) and 448 semiconductor-based page-wide diode laser (PWDL) sintering processes can potentially compete with the mass production technologies due to their high volumetric print rate. The photopolymer resin in LCD VPP across the cross-section is cured by a particular wavelength of light, emitted from an LCD through light-emitting diodes (LEDs). Simultaneously, in PWDL, multiple arrays of diode lasers are used to sinter the powder (polymer, ceramic, and or metal) across the cross-section of the powder bed with a single scan. However, critical issues such as separation force, resin refilling, uncollimated LED, and low transmission rate of LCD limit large-area LCD VPP. Conversely, process parameter optimizations for different powders and laser module cooling techniques are essential for PWDL to emerge as a benchmark in the sintering process.

Biography

Professor JY Jeng was the Director and PI of "High Speed 3D Printing Research Center" founded by the Taiwan Minister of Education. Both the research performance of High Speed 3D Printing and the Q1 Journal paper publication in the Design for Additive Manufacturing is the leading position worldwide. He was the 3D Printing Fellow Professor of XYZ Printing Inc. and the consultant to several Taiwan 3D Printing companies or businesses, like PouChen, Franz, and AvioCast. Currently, he serves as the Independent Director of GlobalWafer and ANT Precision Co. Ltd. He was also the Founder and President of Taiwan 3D Printing Association and Taiwan 3D Tech LLC with the business of Smartphone 3D Printer. Dr. Jeng served as the Dean of the College of Engineering and R&D Office at the National Taiwan University of Science and Technology (Taiwan Tech) during 2013/8 - 2016/7 and 2007/8 - 2009/7 respectively. He was on leave from Taiwan Tech to serve as the Diplomatic Director of the Science and Technology Division in the Taipei-Moscow Representative Office in Moscow from Jan. 2010 - July 2012 and to establish and serve as the Director General of Teco Group Research Institute Taiwan during 2005 - 2007. He was the Founder of EU FP7 National Contact Point Taiwan in 2008. He graduated from National Cheng Kung University in 1985 in Tainan, Taiwan with the bachelor's degree in mechanical engineering. And then he gained the Advanced Manufacturing Technology MSc from The University of Manchester (Institute of Science and Technology) in 1990, and Laser Material Processing PhD from The University of Liverpool in 1992 UK. He was also a visiting scholar at UC Santa Barbara USA in 2002 and Cambridge University UK in 2008.

jeng.jengywam@gmail.com

Mind Authors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Development of hyaluronic acid based self-assembling nanoparticles for inhibiting ocular angiogenesis treatment

Ching-Li Tseng*and **Yu-Yi Wu**

Graduate Institute of Biomedical Materials and Tissue Engineering, Taipei Medical University, Taiwan

Topical drug delivery such as eye-drop is the major method to deliver medication for ocular diseases. However, ocular barrier can impede delivery efficiency; and solution-type eye drops is quickly removed with less therapeutic effect. For posterior eye such as retina/choroid diseases, intravitreal injection is used, but frequent injection would lead to hemorrhage, endophthalmitis, and retinal detachment. Find an effective and safe way to transport drug to eye especially for posterior is needed. Nanomedicines offer an alternative formula for ocular diseases treatment with longer ocular retention, higher drug availability and slow-release properties. Therefore, eye drops with nanomedicine is used to treat the anterior (cornea) and posterior (choroid) eyes with abnormal vessels formation in this study. The functional peptide, gp91 tst, can work on the anti-inflammatory and anti-angiogenetic pathway of cells was used to complex with hyaluronic acid (HA) to form a self-assembling nanoparticle (NPs) via electrical attraction. This nanoparticle was used to inhibit corneal/choroidal neovascularization delivered by topical way. These peptide-HA NPs with particles size in the rage of ~260 nm and zeta potential in positive (~18 mV) charge were prepared. HUVEC cells activity and tube formation capacity were inhibited by this peptide-HA NPs. Mice with corneal neovascularization and choroidal vessels formation were established and treated by eye drops contained peptide-HA NPs once daily. Overall, vessels area shrank in cornea/choroid were observed using slit lamp/fundus fluorescein angiography (FFA) and histological examination via these nano-formulated eye drops treatment. This provides a promising and friendly way for ocular disease treatment.

Biography

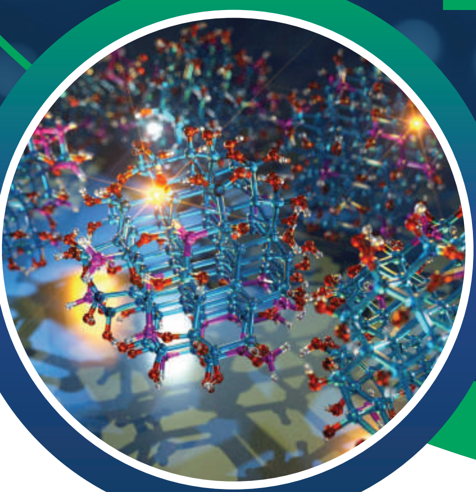
Dr. Tseng received her PhD degree from National Taiwan University and proceeded postdoc training at National Health Research Institute (NHRI, Taiwan). She was recurred to Taipei Medical University (TMU) as an assistant professor in 2011. Now, she is a professor/director at Graduate Institute of Biomedical Materials and Tissue Engineering, TMU. She focuses her research on design/synthesizes variant nanoparticles with drug/gene/contrast agent loading for disease treatment/diagnosis such as nanoparticles for ophthalmic application. She serves as a reviewer for many journals such as Advanced Science, Biomaterials, Acta Biomaterial, ACS applied interface, J Material Chemistry B, Int J Nanomedicine, and etc. She is expanding international collaboration to work with researcher in specific drug delivery system for disease treatment.

chingli@tmu.edu.tw

6th World Congress on

Materials Science and Engineering

September 18-19, 2023 | Rome, Italy



Theme: "Materials Innovation and Impact"

Poster Presentations

DAY 2

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Effect of manganese and zinc addition on the properties of geopolymers

Patrycja Bazan*, **Kinga Pławecka** and **Michał Łach**
Cracow University of Technology, Chair of Material Engineering and Physics, Poland

The work aimed to investigate the influence of the addition of zinc waste and manganese waste on the mechanical properties of geopolymers. The use of waste in geopolymer materials is one of the methods of utilization and immobilization of materials that harm the natural environment. As part of the research, manganese and zinc wastes were introduced in the amount of 5% by and 45% by weight to the geopolymer material. The mechanical properties of the produced geopolymer were investigated. As strength tests like a static bending test and a static compression test were performed. The waste used in the amount of 5% by weight positively affects the strength properties - increasing the bending strength by about 50% compared to the base material. A much better effect was obtained by introducing zinc into geopolymer materials in relation to the addition of manganese. Increasing the content of additives causes a decrease in strength properties, but they are still at a satisfactory level, which suggests that the geopolymerization process can be used as one of the methods of immobilizing waste that threatens the environment.

Biography

Ph.D. Patrycja Bazan is a specialist in polymer materials and composites based on thermoplastics. In her work, she deals with the issues of mechanical and thermal properties as well as aging processes occurring in composite materials. She broadens her interests in geopolymer materials and conducts research on the possibility of using geopolymer materials as an alternative to cement, as well as researches the immobilization of hazardous materials.

patrycja.bazan@pk.edu.pl

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Optimalization of the electrophoretic deposition parameters of Ag-TiO_2 nanocoating on a NiTi shape memory alloy

Jacek Podwórny* and **Karolina Dudek**

Łukasiewicz Research Network - Institute of Ceramics and Building Materials, Poland

To functionalize and improve the biocompatibility of the NiTi shape memory alloy surface, multifunctional layers composed of Ag/TiO2 nanocomposite and hydroxyapatite (HAp) were produced. First, to improve the corrosion resistance, the thin amorphous TiO2 interlayer was created in an autoclave. Then, electrophoretic deposition (EPD) was applied to produce multifunctional hybrid coatings. This method enables creating different types of layers within a wide range of thickness by controlling the deposition parameters (such as voltage/current or deposition time). This is extremely important in the case of NiTi alloys because excessively thick and/or stiff layers can limit or completely block the shape memory effect. To optimize the parameters of electrophoretic deposition of homogenous coatings the design of experiment and analysis of variance was applied. The EPD was carried out under the voltage of 20 and 60 V with deposition time of 90 and 120 s. The answer function was SEM observation of the quality of deposited layers. Based on the obtained results, the optimal parameters of production coatings with different HAp / nanoparticles ratio, were determined.

Biography

Researcher at Łukasiewicz Research Network - Institute of Ceramics and Building Materials in Krakow, Centre of Refractory Materials in Gliwice, Poland. A graduate of the University of Silesia in Katowice (M.Sc.). PhD degree in inorganic chemical technology obtained at the Faculty of Chemistry of the Silesian University of Technology in Gliwice. Habilitated doctor degree obtained at the Faculty of Materials Science and Ceramics of the AGH University of Science and Technology in Krakow in the field of materials engineering. Scientific interests include, among others, the development of various experimental research methods used mainly in the study of ceramic materials, studies of chemical reactions in the solid phase and phase transitions at elevated temperatures as well as studies of thermomechanical properties.

jacek.podworny@icimb.lukasiewicz.gov.pl

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Functionalization of the NiTi shape memory alloy surface by innovative hybrid coatings

Karolina Dudek[1*], Jacek Podwórny[1], Mateusz Dulski[2] and **Anna Nowak[3]**

[1]Łukasiewicz Research Network - Institute of Ceramics and Building Materials, Poland

[2]Institute of Materials Engineering, University of Silesia, Poland

[3]Institute of Biology, University of Silesia, Poland

The aim of this work was to develop a solution that functionalizes the surface of the NiTi shape memory alloy, so as to enable its long-term use in implant medicine. This goal was achieved by creating innovative multifunctional hybrid layers. The first synthesized complex nanometric molecular systems Ag-TiO2, exhibiting antibacterial properties, was used to modify the alloy surface and the layer composed of bioactive calcium phosphates (hydroxyapatite, HAp), in different ratio HAp : nanoparticles. A matrix of polymorphic titanium oxides enables the incorporation of metal ions in low concentrations and their gradual release into the environment, which ensures a long-lasting antibacterial effect. On the other hand, ceramics based on calcium phosphates are characterized by bioactivity and a very high biocompatibility, which results from the high similarity of its chemical and phase composition and properties to apatites found in bones and teeth. In the work, repeatable procedures for producing thin, homogeneous layers that do not block the unique shape memory effect characteristic of NiTi alloys was developed. Multi-functional coatings were producing using the electrophoretic deposition method (EPD) under the voltage ranging from 20 to 90 V and deposition time from 20 to 60 s. The deposited coatings were subjected to heat treatment (800 °C / 2h) to coalesce the particles and to increase their adhesion. The applied procedures contributed to obtaining a new generation of materials with a different structure and unique properties compared to the starting materials.

Biography

Researcher at Łukasiewicz Research Network - Institute of Ceramics and Building Materials in Krakow, Centre of Refractory Materials in Gliwice, Poland. PhD degree in material engineering obtained at the Institute of Materials Science of University of Silesia in Katowice. My scientific interests include widely understood materials science, in particular surface engineering and issues related to the subject of biomaterial surface modification, nanomaterials and ceramic materials.

karolina.dudek@icimb.lukasiewicz.gov.pl

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Nodular iron austemperized with carbides (cadi): process window and applications

J. Alejandro García H.[1*], **Agustín G. Ruiz T.**[1] and **V. Antonio Aranda V.**[2]

Departamento de Ingeniería Metalúrgica, Facultad de Química; Instituto de Investigación en Materiales, Universidad Nacional Autónoma de México, Mexico

Summary: One of the most recent developments in nodular iron is the production of nodular iron with carbides and with austempering heat treatment, it promotes an ausferrite matrix with high tenacity combined with the hardness and wear resistance of the carbides present in the matrix. One of the main problems in the heat treatment applied is the stability of the carbides, as well as determining the process window of the isothermal treatment (time and temperature), this due to the lack of information on TTT and/or CCT diagrams, with which these parameters can be determined. In this work the two stages for the manufacture of CADI irons are presented, the manufacture of the base nodular iron (nodular iron with carbides as cast) by casting process in green sand mold and the austempering heat treatment process (CADI iron), with particular emphasis on the process window to obtain totally ausferrite matriz with stable carbides. Finally, some prototype applications of CADI irons are mentioned.

jagarcia@unam.mx

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Theme: "Materials Innovation and Impact"

Development of an Artificial Bioresorbable Ligament Based on pNaSS Grafted PCL

C. Falenitn-Daudré* and **M. Abdallah**
LBPS/CSPBAT, UMR CNRS 7244, Institut Galilée, Université Sorbonne Paris Nord, 99 avenue JB Clément 93430- Villetaneuse, France

The anterior cruciate ligament (ACL), known to stabilize the knee movement, is one of the most frequently injured structure during sport activities. Autograft and allografts are considered as the current methods for surgical intervention, however, these strategies represent many drawbacks such as donor site morbidity and risk of disease transmission. Therefore, the development of a synthetic scaffold able to maintain the main function of the damaged ACL and consequently to regenerate the native ACL synthesis is the alternative approach. PCL as scaffold material is widely used in various biomedical applications as tissue engineering due to the appropriate properties such as biocompatibility, biodegradability, high mechanical strength and surface hydrophobicity that affect the cells interaction. In the present study, PolyCaproLactone (PCL) has been chosen to develop biodegradable synthetic ligaments mimicking the desired properties of ACL. The PCL surface was functionalized with poly (Sodium Styrene Sulfonate) (pNaSS), characterized by the presence of hydrophilic sulfonate group having an impact on cells behavior as cells adhesion, proliferation and differentiation. PNaSS is as well characterized by the low toxicity and

the high thermal stabilit4. A thermal grafting method was processed to functionalize the PCL surface with pNaSS. The colorimetric assay (Toluidine Blue) has indicated the success of pNaSS grafting. Moreover, it has been demonstrated that the pNaSS grafted onto the PCL ligament surface did not alter the physico-chemical properties of PCL. The grafted pNaSS enhance also the cellular response by increasing the affinity of Fibroblast cells adhesion and proliferation comparing to ungrafted PCL ligaments.

Biography

Education:

2018: HDR, University of Sorbonne Paris North (USPN), France.
2009: PhD in organic chemistry, University of Amiens, France.

Career:

Since 2021: Director of the Biomaterials for Health Team (CSPBAT laboratory, UMR CNRS 7244, USPN, France).
Since 2012: Assistant Professor (Biomaterials for Health Team (CSPBAT laboratory, UMR CNRS 7244, USPN, France).
2010-2012: Postdoctoral fellowship (CERM, University of Liege, Belgium).

Research interests:

Elaboration and functionalization of biomaterials surfaces to improve the biological response.

falentin-daudre@orange.fr

MindAuthors
INNOVATING MINDS FOR EXCELLENCE

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering

September 18-19, 2023 | Rome, Italy

Effect of type and size of ceramic particles on wear of composite castings with Hadfield cast steel matrix

Daniel Medyński

Witelon Collegium State University, Poland

The investigations consisted in evaluating the impact of size and type of ceramic macroparticles (ordinary alumina and zirconium alumina) on abrasive wear of Hadfield cast steel matrix composite and the impact of corrosion processes on abrasive wear resistance. The obtained results indicate that the abrasive wear of the composite reinforced with ordinary alumina and zirconium alumina of the same fraction was similar. In turn, the influence of particle size on abrasive wear was noticeable. The composite reinforced with particles of a larger fraction showed greater resistance to abrasive wear. Slightly higher corrosion resistance was found in steel castings compared to composites. The results of corrosion tests also indicate that the composites reinforced with ordinary alumina were slightly more resistant to corrosion than the composites reinforced with zirconium alumina. On the other hand, corrosion processes caused the castings reinforced with corundum (regardless of its type) to wear slightly faster than non-reinforced castings, but these differences were negligible.

Biography

Doctor in the scientific discipline of mechanical engineering, in which he specializes in materials engineering and foundry. Manager and member of research teams implementing research and development projects (co-financed from EU funds) for the needs of enterprises in the field of: renewable energy, materials engineering, technological processes as well as automation and robotization of production.

Co-organizer of the International Conference Innovative Solutions in the Economy dedicated to representatives of the world of science and business. Participant of numerous national and international scientific conferences, organized e.g. by: Polish Academy of Sciences, research institutes, technical associations, national and foreign universities. Author and co-author of several dozen scientific articles. Reviewer of journals indexed in international databases. Co-creator of patented inventions.

Chairman of the Polish Production Management Society - Lower Silesian Branch. Member of the Polish Foundrymen's Technical Association.

daniel.medynski@collegiumwitelona.pl

Theme: "Materials Innovation and Impact"

6th World Congress on
Materials Science and Engineering
September 18-19, 2023 | Rome, Italy

Processing of waste materials from Al alloys into composite foams

Janusz Grabian[1*], **Marek Murmyło**[1] and **Adam W. Bydałek**[1,2]

[1]Eco Harpoon Recycling, Cząstków Mazowiecki 128, 05-152 Czosnów, Poland

[2]Faculty of Mechanical Engineering, Institute of Materials and Biomedical Engineering, University of Zielona Góra, Prof. Z. Szafrana 4, 65-516 Zielona Góra, Poland

The concept of processing secondary materials from aluminum alloys into composite porous materials - metallic foams will be presented. The results of the obtained porous materials will be shown - strength and structural analyses.

Biography

Professor, initiator of the production of foamed composite materials, former vice-rector, dean of the faculty, director of the institute.

j.grabian@pm.szczecin.pl

INDEX

MATERIALS INFO 2023

https://materialsconferences.mindauthors.com/

9450 SW Gemini Dr
Suite 71868
Beaverton, Oregon 97008 US
Email: info@mindauthors.us
Phone:+1 (302) 208 0029
www.mindauthors.com