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International Conference on

Minerals, Metallurgy and Materials

March 22-23, 2021

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MATERIALS 2021

BOOK OF ABSTRACTS

INTERNATIONAL CONFERENCE ON

MINERALS, METALLURGY AND MATERIALS

MARCH 22-23, 2021

Theme:

A dynamic approach to enhance and forecast M3

INDEX

Publishing Partner

International Journal of Minerals, Metallurgy and Materials

About the Journal:

International Journal of Minerals, Metallurgy (IJMMM), and Materials is an international journal devoted to publishing original research articles and reviews on all aspects of minerals processing, physical metallurgy, process metallurgy, and materials science and processing. The journal is abstracted/indexed in Science Citation Index Expanded (SciSearch), Journal Citation Reports/Science Edition, SCOPUS, EI Compendex, etc. The 2019 impact factor of IJMMM is 1.713.

It's an announcement for all the speakers/presenters who are interested can actively submit your extended manuscripts to IJMMM. Full consideration will be given to all submissions in the journal.

Publication Information:

Selected conference papers will be recommended to be published in the International Journal of Minerals, Metallurgy (IJMMM), and Materials. All submissions should be extended (~50%) and will be subject to customary peer review of IJMMM before they are considered for publication. As an Editorial Board Member of IJMMM and a Scientific Committee of the conference, Prof. Chongchong Qi will be responsible for the recommendation of conference papers after discussion with the conference committee and the journal editorial board members.

Note: The Publishing journal IJMMM is providing free of charge for the conference participants. Papers should be extended around 50% to be submitted to the journal. If a number of high-quality papers (>5) can be gathered, a special issue can be arranged. Otherwise, they will be published as individual papers.

About MAGNUS GROUP

Magnus Group (MG) is initiated to meet a need and to pursue collective goals of the scientific community specifically focusing in the field of Sciences, Engineering and technology to endorse exchanging of the ideas & knowledge which facilitate the collaboration between the scientists, academicians and researchers of same field or interdisciplinary research. Magnus group is proficient in organizing conferences, meetings, seminars and workshops with the ingenious and peerless speakers throughout the world providing you and your organization with broad range of networking opportunities to globalize your research and create your own identity. Our conference and workshops can be well titled as 'ocean of knowledge' where you can sail your boat and pick the pearls, leading the way for innovative research and strategies empowering the strength by overwhelming the complications associated with in the respective fields.

Participation from 90 different countries and 1090 different Universities have contributed to the success of our conferences. Our first International Conference was organized on Oncology and Radiology (ICOR) in Dubai, UAE. Our conferences usually run for 2-3 days completely covering Keynote & Oral sessions along with workshops and poster presentations. Our organization runs promptly with dedicated and proficient employees' managing different conferences throughout the world, without compromising service and quality.

About Materials 2021

Magnus Group is pleased to invite you to participate in the ONLINE EVENT - '**International Conference on Minerals, Metallurgy and Materials** (Materials 2021)' during **March 22-24, 2021**.

Materials 2021 is the International conference that brings together the collection of investigators who are at the forefront in the field. The scientific program will include oral presentations of sub-disciplines, keynote sessions led by eminent scientists, and poster sessions presented interactively by junior scientists and graduate students. It is the ultimate meeting place for all the experts worldwide for new interdisciplinary scientific collaborations and networking. With different scientific sessions, you are provided assurance to explore the latest technologies and breakthroughs that are specific to your area of work. No doubt the event has a broad scope of topics and continued in parallel sessions relative to the specific area of research.

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KEYNOTE FORUM | DAY 1

International Conference on

MINERALS, METALLURGY AND MATERIALS

March 22-23, 2021

Materials 2021

Eric Buhler*[1], G. Mariani[1], A. Goujon[2], J-R.Colard-Itte[2], E. Moulin[2], N. Giuseppone[2]

[1]Matter and Complex Systems Laboratory, University of Paris, France

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Integration of molecular machines and motors into supramolecular materials: Structural properties studied by small-angle neutron and X-ray scattering

Switchable functional molecules capable of producing mechanical work constitute an active focus in nanotechnologies as they can be a source of components for molecular-based devices and materials. In particular, the dynamic nature of mechanically interlocked molecules allows their components to undergo relative internal movements, which can be exploited in translation and circumrotation. When it comes to using molecular machines to facilitate the creation of materials on the macro-scale, the primary concern is whether the nano-sized machines will be able to amplify their mechanical behavior to create a response in the bulk material. Hence, one of the most fundamental and challenging objectives associated to nano-machines rests on their coupling (in space and time) in order to transfer controlled motions from the molecular arena to the supramolecular and macroscopic scale.

In the present work, we have developed two kinds of responsive contractile polymeric materials, which can behave as artificial muscles: i) The first one concerns nano-machines linked into a supramolecular polymer in which we produced micrometric motions (contraction/extension) by the integration of thousands of single contractile nano-switches by altering the pH of the solution; just like myofibrils do when packed in bundles in muscles. ii) The second one is based on the connection of light-driven rotary motors acting as reticulation units in an entangled polymer network. Small-angle neutron scattering (coupled with light and X-ray scattering) has been used to investigate the structure of the supramolecular self-assemblies of nano-machines before and after the induced structural changes as well as the dynamics of the contraction process at different length and time scales. We discuss here the relation between the local and overall structure of the self-assemblies and the properties of the materials. We show that these findings open up new possibilities of using molecular machines in smart responsive materials.

Audience take away:

- How integrating molecular motors and machines into polymeric materials
- New responsive materials, actuation between macroscopic phases
- Structure as seen using scattering techniques

Biography:

Eric Buhler currently holds a Full Professor position in soft condensed matter at Université de Paris (France). In 1996, he received his Ph.D. degree in physics at the University of Strasbourg investigating the structural and dynamical properties of wormlike micelles. Prof. E. Buhler subsequently obtained a postdoctoral position (1996-1998) at the University of North Carolina at Chapel Hill (USA), where he studied the structural behavior of copolymers in supercritical carbon dioxide using scattering techniques. In 1998, he joined the University of Grenoble, France, where he obtained an Associate Professor position (1998-2006). He spent two years (2002-2004) at the French National Research Center (CNRS) of Montpellier (Charles Coulomb Institute) as a Visiting Professor. In 2006, he joined Université de Paris, where he is currently a Full Professor. His research focuses on the structure and dynamics of supramolecular polymers, polyelectrolytes, nanoparticles complexes, and nano-machines. He has published more than 80 research articles in peer review journals.

Marek Godlewski[1]*, Rafal Pietruszka[1], Aleksandra Seweryn[1], Bartlomiej S. Witkowski[1], Anna Slonska[2,3], Michal M. Godlewski[2,3]

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Thin films of oxides by Atomic Layer Deposition – new applications

Technology of Atomic Layer Deposition (ALD) allows to grow thin films (from a few nm to few hundred nm) of wide band gap oxides (ZnO, Al_2O_3, ZrO_2, HfO_2, TiO_2) with excellent structural, mechanical, optical and electrical properties. At present such films found range of applications – as gate oxides in Silicon-based field effect transistors (HfO_2), as transparent electrodes (ZnO, ZnO:Al (AZO), Zno:Ga (GZO)) in photovoltaics, as anti-reflection layers (Al_2O_3) in optical and photovoltaic devices or as barrier layers (Al_2O_3, TiO_2) in organic-based devices. Advantageous properties of ALD-deposited high-k will first be discussed. Then, quite new applications of these films in biology and medicine will be demonstrated. The same films, which were investigated by us for electronic, optoelectronic and photovoltaic applications, show bio-activities (e.g. anti-bacterial activity). This allows range of new applications in biology, medicine or food industry. Importantly, the ALD technology allows coating of temperature sensitive substrates can be coated, such as many of materials used in hospitals or in food industry. Coating of hospitals equipment and implants was tested by us.

Audience take away:

New applications of wide band gap oxides in biology, medicine and/or food industry will be demonstrated. It will be discussed how the ALD technology may solve many of critical problems of our society. This includes new solutions for:

a) Green energy sources

b) Anti-bacterial protection

c) Production of new generation of implants.

Biography:

Professor Marek Godlewski is employed in the Institute of Physics Polish Academy of Sciences. He is head of the ON-4.2 laboratory, which develops technology of atomic layer deposition (ALD) and hydrothermal technology of oxide nanostructures. He is member of executive board of the European Materials Research Society, vice-President of the Polish Vacuum Society and was councilor of Poland in the IUVSTA. Author/coauthor of above 250 plenary and invited presentations on local and international conferences. Author/coauthor of above 30 patents and patent applications. His works are cited 6744 times, Hirsch factor 40, i10-indeks 178 (Google Scholar 9 August 2019).

Lavinia Curecheriu

Dielectrics, Ferroelectrics & Multiferroics Group, Faculty of Physics, "Al. I. Cuza" University of Iasi, 11 Carol I Bv., 700506, Iasi, Romania

Size-dependent properties in $BaTiO_3$- based ceramics

Due to the continuous trend of miniaturization in microelectronics industry, the interest concerning scale dependent phenomena in ferroelectric materials attracted a broad interest in the last years. Apart the need to understand how to preserve the functional properties comparative to ones of bulk material when reducing the size down to nanoscale, there is also a specific interest concerning the maximization of dielectric, piezoelectric and ferroelectric properties at some specific grain size. Concerning this aspect, the researchers dedicated mainly to the critical grain size (GS) of $BaTiO_3$ around 1 μm, for which enhanced dielectric, ferroelectric and piezoelectric properties have been always found, irrespective of the synthesis procedure and sintering method. However, systematic studies to find a similar critical GS in other $BaTiO_3$-based compounds have not been previously performed.

In this work, a series of dense BaTiO3-based ceramics ($Ba_{0.85}Ca_{0.15}Ti_{0.90}Zr_{0.10}O_3$ and 5%Zr-BaTiO3) with grain size larger than 1μm and uniform grain-size distribution were successfully prepared by the conventional solid-state reaction, and the grain-size effects on the structural, dielectric, ferroelectric and piezoelectric properties were explored in their un-poled and poled states. The ceramics were obtained by sintering solid state powders at different temperatures between 1200-1500°C and times (from 0.2-24 hours). The grain size of ceramics determined from SEM images were between 1 μm for the samples sintered at lower temperature and ~140 μm for higher sintering temperature. The structural characterization was performed for monitoring the effect of grain size and field on the phase composition in $BaTiO_3$-based ceramics. The evolution of polar order and phase transitions with grain size has been studied using dielectric permittivity measurements at 20Hz- 2MHz between 25 and 150°C. Also, the piezoelectric properties at different poling conditions (poling temperature and electric field) were investigated and discussed according with ceramics grain size. Polarization vs. electric field (P-E) hysteresis loop study showed that exist a critical grain size (~ 9 μm) for which the remnant and saturation polarisation is higher. In addition, we develop a mesoscale modelling (Monte Carlo with Finite Element Method calculations) to describe size effects on the low-field properties in $BaTiO_3$-based ceramics. The presented data provide a complete picture of the size effect dependence of functional properties in $BaTiO_3$-based ceramics.

Biography:

Lavinia Curecheriu is Lecteur at Departament of Physics from the "Alexandru Ioan Cuza" University of Iasi, Romania. She graduated in Biophysics at the "Alexandru Ioan Cuza" University of Iasi, Romania in 2004. Afterwards, she completed the Ph.D in Physics in 2010 at the same university. She has 12 years of experience in investigating by a combined experimental and theoretical approach fundamental phenomena in multifunctional oxides with polar order (ferroelectrics and multiferroics) in relationship with their composition and micro/nanostructure. She has published 60 articles in ISI peer-reviewed journals. For her research activity, she was awarded with: Award "IUVENTAS SCIENTIAES" given by UAIC for young researcher for 2014-2015; Young researcher in Science and Engineering in 2015, and "L'ORÉAL-UNESCO Romania for Women and Science Award 2017".

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SPEAKERS | DAY 1

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Fouad Erchiqui
Ingeneering School, University of Quebec in Abitibi-Temiscamingue, Rouyn-Noranda, Quebec, Canada

Hybrid enthalpy method for Finite Element Thermal Analysis of multi-materials involving multi-orientations of the thermal conductivity tensor

The anisotropic problem of thermal conduction in a incompressible solid is generally treated in a reference coordinate system, which adequately describes its thermal conductivity tensor (Cartesian, cylindrical or spherical). For this problem, numerical treatment is delicate, especially if the thermophysical properties are non-linear or if the anisotropic medium undergoes a phase change. In this presentation, we propose an approach using only one reference system (for example the Cartesian) to treat the anisotropic thermal conduction of problems for which the multi-material solid is characterized by a set of tensors of thermal conductivity of different natures (Cartesian and/or cylindrical and/or spherical), with or without phase change. The nonlinear heat conduction problem involving phase changes is solved using hybrid three-dimensional volumetric specific enthalpy based on finite-element analysis. The proposed approach is validated with analytical testing for two anisotropic media (cylinder and spherical with convective transfer with variable circumference) and with two experimental tests related to the heating of frozen woods. An example on the characterization of the phytosanitary treatment time of wood by microwaves, in accordance with FAO International Standard No.15, will be presented.

Audience take away:

- The proposed approach can be deployed or integrated into several areas of the engineering sciences. By way of example, in thermal science, it makes it possible to analyze the heat absorbed in multi-material anisotropic media, with or without phase change, involving thermal conductivities of different nature (cylindrical, Cartesian, etc.). Here are some examples :
  1. Thawing or Drying of multi-material products (wooden products for example);
  2. Phytosanitary treatment of multi-material products
  3. Electromagnetic radiation absorbed by surrounding areas of target tissues (human or animal)
  4. Cooling of Li-ion batteries characterized by strong anisotropy of thermal conduction in Li-ion cells, etc.

Biography:

Dr. Erchiqui studied physics at the University of Quebec and in 1996 obtained a PhD in Mechanical Engineering from Laval University. He then joined the Industrial Process Modeling and Optimization Research Group at the National Research Council of Canada. In 2000, he obtained the position of professor at the University of Quebec in Abitibi-Temiscamingue and published more than 90 research articles in SCI Journals (E).

Waldemar Swiderski
Military Institute of Armament Technology, Zielonka, Poland

Detection of defects in CFRP composites by Optical Thermography methods

CFRP (Carbon Fiber Reinforced Plastic) composites are increasingly used in a variety of applications. Non-destructive testing methods are used for evaluating their condition both as a finished product and during their use. Damage that may occur in these types of composites includes air bubbles, non-uniform arrangement of fibers, regions of fibers not saturated with resin, delamination, and micro-cracks. Various methods of non-destructive testing are used to detect defects in such structures among the most effective of which are infrared thermography methods, the most common being optical heating with various types of lamps and the method of optical lock-in. Pulsed thermography is one of active IR techniques in which a surface of tested material is stimulated by a short heat pulse and the thermal response of the material is analysed. Flash thermography is used when the specimen is stimulated using a short energy pulse. The response contains information about subsurface material defects. After the heat pulse the temperature decrease rate is different on surface over defect in comparison to that over the sound material. In lock-in thermography, an amplitude modulated heat wave is applied to the inspected specimen in steady state. This paper seeks to compare the results obtained from pulsed and flash thermography with results from using optical lock-in thermography. The paper presents selected results of defect detection in a multilayer CFRP composite structure. The tests were carried out on a sample consisting of three plates made of CFRP connected with resin, in which the inner middle layer is made of four non-adherent elements.

Audience take away:

The presentation will allow: choosing the most effective non-destructive testing method for CFRP composites, determining the limitations of the described methods, and improving the results obtained with these methods.

Biography:

Dr. Swiderski studied at the Department of Electro- Mechanical Arms of Military University of Technology and graduated as MS in 1978. He received his DSc degree in 2000 at the Military Institute of Armoured & Automative Technology. Post-doctoral degree in technical sciences received in 2012 (construction and operation of machinery). Since 1980, an employee of Military Institute of Armament Technology, at present an associate professor. Research interests include non- destructive testing using infrared thermography and uses infrared technology in military applications. Author and co-author of more than 200 publications and 11 patents. He received numerous state and scientific awards and distinctions for scientific activity.

N Ruiz-Marin*[1], D F Reyes[1], L Stanojevic[2], V Braza[1], T Ben[1], A Gallego-Carro[2], E Luna[3], J M Ulloa[2] and D Gonzalez[1]

[1]Institute on Electron Microscopy & Materials,(IMEYMAT). Universidad de Cádiz, 11510 Puerto Real, Spain

[2]Institute for Optoelectronic Systems and Microtechnology (ISOM), Universidad Politecnica de Madrid, Madrid, Spain

[3]Paul-Drude-Institut fur Festkorperelektronik, Hausvogteiplatz, D-10117, Berlin, Germany

The use of thin AlAs capping layers in the InAs/GaAs quantum dot system for intermediate band solar cells

Recently, the covering of InAs quantum dots (QDs) with AlAs capping layers (CLs) has attracted special attention as it has been shown to be an excellent way to enhance the photovoltaic efficiency in QD solar cells (QDSCs), with the removal of the wetting layer (WL) being the putative cause of this improvement. Certainly, analysis by DCTEM imaging using chemistry-sensitive g200 DF conditions evidences a gradual fading of the contrast of the InAs WL as the thickness of the AlAs CL increases being finally almost replaced by that of AlAs itself. However, the changes in the structure and recombination mechanisms after deposition of AlAs CL on the InAs QDs layer remain unclear. In this work, a comprehensive compositional analysis of several layers of AlAs/InAs/GaAs QDs with different CL thicknesses (0, 1, 2, 2, 3 and 5 MLs) is carried out by STEM-related techniques on a Titan Cubed3 FEI operated at 200 kV. In particular, energy dispersive X-ray spectroscopy (EDX) using ChemiSTEM technology and low-loss electron energy loss spectroscopy (EELS) were performed to obtain compositional and sample thickness mappings at the nanoscale level to analyse different regions of both CLs and QDs. First, nanoscale EDX analysis demonstrates that Al atoms do not replace In atoms, but rather there is an overlapping In/Al distribution from the second CL monolayer that hides the presence of the WL when using the DCTEM technique. Secondly, the size, composition and density of QDs are evaluated as they are key properties in the efficiency of QDSCs. A significant increase of QDs heights with the AlAs thickness is found, in agreement with previous works. The average volume and density of the QDs together with the measurements of the In content in the WL allowed us to calculate a linear increase of the average In content with the CL widening. Finally, the disposition of Al around the QD is analysed. Elemental analysis of the AlAs layer showed that the real Al content above the QD apex increases when the CL thickness is raised, which is consistent with higher and In-richer QDs. Initially there is an Al accumulation at the QD edges at the expense of Al deposited at the apex, that results in a low base diameter expansion. Only from the layer with 5 MLs onwards the Al levelling in the QD apex and in the regions between QDs is achieved.

Audience take away:

- The audience will be able to use this work to learn about the enormous possibilities offered by new aberration-corrected STEM-related techniques in the analysis of nanostructured semiconductor materials at the atomic scale.
- Our work represents a great information that will help in the design of new quantum dot based nanostructures for the implementation of high efficiency intermediate bandgap solar cells.
- In this work it has been shown that performance improvements in these devices are not produced by an elimination of the wetting layer but by the large mixing from the first monolayers between the wetting layer and the capping layer. Quantification procedures of 3 elements by different STEM techniques are presented which have allowed the best structural and compositional description of the system.

Biography:

Nazaret Ruiz Marin is a PhD. student in Nanoscience and Materials Technology, Nazaret Ruiz Marin studied Chemistry at the Faculty of Chemistry in Seville and graduated as MS in 2011. Subsequently, she joined the research team of Professor David Gonzalez at University Research Institute on Electron Microscopy & Materials, (IMEYMAT) in Cádiz. During this time, she has worked with Esperanza Luna from the Paul Drude Research Institute in Berlin. She has published 6 research articles in Q1 journals and has attended more than 10 conferences.

S Flores*[1], T Ben[1], N Ruiz-Marin[1], D F Reyes[1], V Braza[1], L Stanojevic[2], A D Utrilla[2], A Gonzalo[2], A Gallego-Carro[2], J M.Ulloa[2] and D Gonzalez[1]

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[2]Institute for Optoelectronic Systems and Microtechnology (ISOM), Universidad Politecnica de Madrid, Ciudad Universitaria s/n, 28040 Madrid, Spain

Comparative of different capping approaches in the preservation of InAs/GaAs quantum dots in terms of content, size and density

Self-assembled InAs/GaAs quantum dots (QDs) fabricated by the Stranski-Krastanov epitaxial growth mode have attracted great interest due to their enormous potential in a wide range of optoelectronic applications such as lasers or solar cells. The emission properties of these QDs are very sensitive to their size, shape, deformation state, density and composition, so precise control of the capping process is necessary to avoid significant modifications of the QDs due to different phenomena such as intermixing, segregation, etc. In general, two different capping strategies have been widely used (i) by changing the nature of the capping layers (CL), e.g., using compressive GaAsSb layers, and (ii), altering the growth kinetics during capping by reducing the surface diffusion, e.g., controlling the growth rate. In this work, a comprehensive structural and optical analysis has been performed to describe the InAs/GaAs QDs system using both capping strategies, by combining different transmission electron microscopy (S)TEM techniques and photoluminescence (PL) measurements. Changes in the mean volume, composition and density of the capped QDs covering a statistically significant number of buried QDs were performed, along with wetting layer (WL) analyses for each strategy. We have observed that faster growth rates and increased Sb content reduce the decomposition of QDs, but act differently. From the comparison, 3 important conclusions have been drawn: (i) QD volume measurement is a better parameter than QD height for assessing QD decomposition and photoluminescence redshift, (ii) higher QD volume is not always related to higher In content and (iii) increasing the average volume of QDs leads to a reduction of the QD density. As we will show, the three parameters are connected, albeit with significant differences for each strategy.

Audience take away:

- The audience will be able to use this work to discover the enormous opportunities offered by new aberration-corrected STEM techniques in the analysis of nanostructured materials.
- They will have access to a useful information on the parameters for the design of new self-assembled nanostructures based on InAs/GaAs quantum dots (QDs), which are crucial for developing optimal optoelectronic devices.
- The mechanism and effects of two different capping strategies to protect the integrity of InAs/GaAs QD have been compared in this work: the growth rate of CL and the use of SRL with Sb. Comparison allows to conclude that faster growth rates and SRL with Sb reduce QD decomposition, although with significant differences.

Biography:

Sara Flores Gallegos is a PhD. student in Nanoscience and Materials Technology, Sara Flores, studied Chemistry at the, Spain, and graduated as MS in 2017. She then joined the research group of Professor David González at the Department of Materials Science, Metallurgical Engineering and Inorganic Chemistry, at the University of Cádiz. She is now beginning her PhD in this research group with whom she has already published 7 research articles in Q1 SCI(E) journals and participated in more than 10 conferences.

Orlando Vaselli[1,2*], Barbara Nisi[2], Daniele Rappuoli[3], Jacopo Cabassi[2], Marta Lazzaroni[1], Franco Tassi[1,2], Francesco Bianchi[4]

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[3]Unione dei Comuni Amiata-Val D'Orcia, Castiglion d'Orcia, Siena, Italy
[3]S.B.C. Geologi Associati, Florence, Italy

Remediation activities in the former mercury mine of Abbadia San Salvatore (Tuscany, central Italy)

The former mercury mining district at the foothill of the 200-300,000 years old volcanic complex of Mt. Amiata (Tuscany, central Italy) were one of the most important mines worldwide and the mining site of Abbadia San Salvatore (ASS) was the core of the exploitation of cinnabar and the production of liquid mercury. It also represented a technologically advanced site for Hg-estraction where Gould and Nesa furnaces were operating. During about 130 years (1847-1974) of activity about 100,000 tons of mercury were produced. Presently, the mining complex of ASS covers about 65 ha and contains more than 90 mining structures and workers' edifices. Since 2008, the local municipality has been in charge of the environmental issue and a lot of efforts are currently carried out to turn the mining site into a historic museum and a mining park, the archaeometallurgic structures being an invaluable treasure to be safeguarded, maintained and transmitted to future generations. Evidence of contamination by mercury were found in both geological, i.e. soils, underground and surface waters and air, and anthropogenic, e.g. wood, metals, building materials, matrices. The present work reports an update of the actions that were and are to be undertaken to minimize as much as possible the environmental impact that was evaluated according to the most recent regulatory laws. Consequently, a geochemical characterization of the geogenic and anthropogenic material was carried and operational cleanings during the reclamation activities were already started following an environmental sustainability code, considering that no many examples of decontamination of abandoned Hg mines are available worldwide.

Audience take away:

Decontamination of mercury in abandoned mining sites is relatively infrequent? Some solutions to solve the Hg contamination are proposed, thus providing practical solutions to solve remediation problems. This study provides interesting environmental issues about the mercury geochemistry, since they involve both geological and anthropogenic materials.

Biography:

Past and present Position: Head of the Dept. of Earth Sciences. Prof Geochemistry and Volcanology (Dept. Earth Sciences, Florence). Grants from the It. Ministry Education at the ELTE University (Budapest), Naz. Lincei-Royal Society of London and CNR at the Dept. Geol. Sci., Birkbeck College (London). Co-organiser of Schools of Fluid Geochemistry and Courses in Geothermal Exploration: geochemical methods in Sana'a, Sfax and Sofia by UNESCO and CNR-IGG. UN consultant for the crisis of Nyiragongo volcano (DRC). P.I. national and international projects. Co-author of 200 papers published in peer-review journals. From January 1, 2020, President of the Italian Society of Geochemistry.

Anchal Nahata[1]*, K.S. Tun[2], M. Gupta[2], S. Vincent[1]

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Extrusion, microstructure and mechanical characterization of a new magnesium based multicomponent alloy

A new magnesium multicomponent alloy Mg70Al18Zn6Ca4Y2 (atomic pct.) synthesized using the technique of Disintegrated Melt Deposition was hot extruded. The extruded samples were characterized in terms of density, hardness, and microstructure. Investigations were carried out to account for compressive properties by testing the samples using a strain rate of 5 X 10-3 per minute. Scanning electron microscopy (SEM), energy dispersive x-ray (EDX) analysis and x-ray diffraction (XRD) analysis were used to examine the presence and formation of phases and microstructural evolution. Hardness tests were used to determine the mechanical properties of the extruded rod. Significantly high microhardness (170 HV) and macrohardness (75 HRB) values were realized in the extruded samples of the said alloy. The measured hardness values in the extruded sample of this alloy were much higher as compared to its corresponding as-cast material.

Audience take away:

- This new Magnesium based Multicomponent Alloy has shown excellent qualities as compared to commercial Mg Based Alloys.
- Being lightweight and exhibiting excellent hardness and compression properties, this material has possible applications in automotive industry to increase fuel efficiency and also reduce GHG emissions.

Biography:

Ms. Anchal Nahata is currently pursuing B.E. in Mechanical Engineering from Bits Pilani Dubai Campus. She first started researching on materials when she joined Dr. Manoj Gupta's group in NUS, Singapore. She has been continuing her research on Magnesium based alloys under her Research Advisor Dr. Vincent Shantha Kumar. She has published an article in the journal Materials Today: Proceedings.

Maryam Al-Ejji*[1, 2], Fariza Amman[3], Mohamed A. Koronfel[2], Miguel A. Gomez-Gonzalez[2,5], Nikolaos Voulvoulis[4], Angela Erin Goode[2], Julia E. Parker[5], Paul D. Quinn[5], Ian Thompson[3], Thomas Bligh Scott[6], Fang Xie[2], Marian L. Yallop[7], Alexandra E Porter[2], Mary P. Ryan[2]

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[4]Centre for Environmental Policy, Imperial College London, SW7 2AZ, London, UK
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[6]Interface Analyses Centre, University of Bristol, BS2 8BS, UK
[7]School of Biological Sciences, University of Bristol, BS8 1TQ, UK.

Investigated the behaviour of engineering nanoparticle materials during the anaerobic digestion

The growth of using engineered nanoparticle materials (ENMs) has been rapid, and their applications are extensive, particularly in personal care and cosmetics. However, concerns had raised about the impact of these particles on human health and the environment. They may reach the environment depending on their application by different pathways such as fresh water, via wastewater treatment plants (WWTPs), sludge and soil. Silver nanoparticles Ag-NPs and ZnONPs have been selected due to a wide range of applications, unique antimicrobial properties, and the fact that they are commonly found as toxic pollutants in WWTP. A lab scale anaerobic digestion system was used to incubate both AgNPs and ZnONPs to investigate their complexation/speciation, and bioavailability to soil and microorganisms. Different characterisation techniques were applied such as transmission electron microscopy and X-ray fluorescence microscopy to map both the ENMS and to show the sulfiding and/or phosphiding that occurs during anaerobic digestion.

Audience take away:

- The transformation of engineering nanomaterials (ENMs) is vital to understand their impact after disposal and reach environmental system.The characterization of ENMs can help to identify their bioavailability after usage.
- Using powerful techniques and apply data processing can help the scientist to find out the behavior of ENMs within the living organism. The morphology of microorganism before and after treatment can provide the impact of ZnON

Biography:

Dr Maryam Alejji works as research associate in center for advanced materials in Qatar University. She holds a Bachelor of Physics degree from Qatar University and master of material science and engineering from University of Sheffield. She received her PhD in material science and engineering from Imperial college of London. Her research focuses on the characterization of engineering nanomaterials (ENMs) during their transformation in environmental system. The impact, bioavailability and speciation of ENMs in marine organisms.

N.Al-Qahtani[1]*, Noora Al-Thani[1], Sherine El-Menshawy[2], Aboubakr M. Abdullah[1], Faisal Al-Nuaimi[3], Mariam Al-Maadeed[4]

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Coins from Al-Zubarah, Qatar: A historical-scientific study

A surface archaeological coins "Zu/111 found at the old town of Al-Zubarah, Qatar" has been analysed complementarily using historic and scientific characterization techniques. For example, a scanning electron microscope coupled with energy dispersive x-ray (EDS) unit, an x-ray fluorescence (XRF) microprobe and an x-ray Diffractometer(XRD) were used in order to investigate the chemical composition and the different phases of the coin alloy. This research used integrated methodologies and techniques to examine and interpret the coin and link it to its original archaeological context. A description of the front and rear sides of the coin followed by comments on the design, engraved text, coin calculation method, geographical locations, minting techniques, calligraphy, currency was analyzed in details. This work investigated historically using scientific tools how this coin travelled from Istanbul, Turkey to Al-Zubarah, Qatar

Biography:

Noora Al-Qahtani joined Qatar university in 2008, and she is currently a Research Associate, Center for Advanced Materials at the Qatar University. She is also in a final year in her PhD study at a department of material science and engineering at Imperial College London-UK. Noora earned her MSc. from the University of Sheffield in 2015, in Materials Science and Engineering. She is also introducing higher-level research among high school students to promote the young researcher towards scientific education. She also authored numerous peer-reviewed journals and conference papers. Her current research focus in areas of applied electrochemistry and corrosion, and educational research for young students. In addition, her interests encompass archaeology from a scientific aspect. She is a member of the Institute of Materials Mining and Minerals from 2015 and a member of the NACE International-The Worldwide Corrosion Authority and Electrochemical Society (ECS) from 2015. Noora is also the Co-team leader of the Al-Bairaq whose vision is to develop Qatar as a knowledge-based society, enriching its human capital through prioritizing the importance of forging links and building bridges between high school students and educational institutions. Over the years she has been actively involved in Teaching, Research along with Admin works in various capacities.

M. Oubaaqa[1]*, M. Ouakki[2], A. Zarrouk[3], M. Ebn Touhami[1]

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[3]Laboratory of Materials, Nanotechnology and Environment, Faculty of Sciences, Mohammed V University, Av. Ibn Battouta, P.O. Box 1014 Agdal-Rabat, Morocco

Evaluation of ecofriendly compounds performance as corrosion inhibitors for mild steel in molar hydrochloric acid: Electrochemical study and theoretical approach

Mild steel has been extensively used in several industrial processes due to its distinctive characteristics. However, it can unavoidably be corroded due to the harsh environment around it. Recently, the use of organic corrosion inhibitors is the most effective and economical approach of all anticorrosive methods. The corrosion inhibition performances of two ecofriendly compounds (amino acids) (P1) and (P2) for mild steel in 1.0 M HCl solution were investigated using potentiodynamic polarization and Electrochemical Impedance Spectroscopy (EIS) techniques. Data obtained from EIS studies were analyzed to fit inhibition process through appropriate equivalent circuit model. The results of the electrochemical methods showed that the studied molecules imparted high resistance and behaved as cathodic type inhibitors. The inhibition efficiency for the optimal concentration of 10-3M was 87% and 89% for P1 and P2 respectively. Both thermodynamic and kinetic parameters were calculated and discussed. The adsorption of the inhibiting molecules on mild steel surface was found to be chemisorption and followed the Langmuir isotherm. Surface analyses were also carried out by the mean of SEM-EDX and FTIR to confirm inhibiting process. The reactivity of P1 and P2 was quantum chemically analyzed by the DFT method to investigate the effectiveness of these water soluble Green inhibitors.

Audience take away:

- Audience will understand new corrosion inhibiting mechanism using green compounds.
- Audience (mainly industrials) could be interested in identifying and using new corrosion inhibitive molecules and appreciate the way they act in. International exchange and future collaborations could be beneficial.

Biography:

Dr. M. Oubaaqa is presently associate researcher in materials and environment chemistry department in the sciences faculty of Kénitra at Ibn Tofail University. In 1997, he graduated from Sciences faculty at Cadi Ayyad University of Marrakech. He previously worked on electrochemical heavy metals analysis and removal in wastewaters and urban sludges. Since 1996, he is member of the International Humic Substances Society, and since 1997 he is member of the Mediterranean Scientific Association for Environment Protection. Now, his research area is also turned towards the synthesis and study of new green inhibitors for mild steel corrosion in acid medium.

Francisco M Monticeli[1]*, Maria Odila Hilario Cioffi[1], Herman Jacobus Cornelis Voorwald[1]

[1]Department of Materials and Technology, São Paulo State University, Guaratinguetá, SP, Brazil

On the enhanced in interfacial strength through carbon/glass hybrid composite: Mode I fatigue delamination

The laminated hybrid composites (e.g., carbon/glass fibre) application creates diversity in material design – higher stacking sequence possibilities. The main question raised by the scientific community is: how carbon/glass hybrid laminate affects interfacial adhesion, considering physical quantification? This work aims to answer the previous question applying mode I fatigue delamination in hybrid and non-hybrid composite. The hybrid laminate shows a greater strain energy release ratio (SERR) for delamination growth, associated with higher resistance to overcome the interlaminar resistance presented by the carbon/glass/epoxy interface. This behaviour indicates a higher lifetime for hybrid laminates than non-hybrid composites. Following the Paris model, the SERR (ΔG) range related to crack propagation (da/dN) was similar for carbon fibre and fibreglass composite. The value of β represents the slope of the curve, a factor that indicates the need for energy for crack growth. The values presented are higher for the carbon fibre composite (12.5), intermediate for the fibreglass composite (11.7), and the lesser inclination for the CH (8.9). For the hybrid composite, the energy region range is significantly higher, associated with greater interfacial resistance. The hybrid composite exhibits a rougher surface trend due to micro-change in crack direction between carbon/epoxy and glass/epoxy interfaces. The maximal number of carbon/glass/epoxy interfaces in hybrid laminates is a feasible option for delamination resistance increase, resulting in longer fatigue life.

Audience take away:

- A reduction in material cost using hybrid laminate composite.
- A synergic behavior of stiffness between both reinforcements, resulting in mode I fatigue delamination resistance.
- A rougher surface in hybrid laminate fracture trend due to micro-change in crack direction between carbon/epoxy and glass/epoxy interfaces.
- The use of interleaved hybrid stacking sequence enhanced delamination resistance and longer fatigue life.

Biography:

Francisco Maciel Monticeli is Ph.D. student in Mechanical Engineering at the Sao Paulo State University UNESP (2017). MS in Mechanical Engineering - Materials and Processes for Aeronautical and Aerospace Engineering, at the Sao Paulo State University UNESP (2015-2017). Graduated in Industrial Engineering with emphasis on Mechanics at the State University of Rio de Janeiro UERJ (2009-2014) and at the Universitat Pompeu Fabra, in Barcelona - Spain (2012-2013). He has published more than 30 research articles in SCI(E) journals.

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KEYNOTE FORUM | DAY 2

International Conference on

MINERALS, METALLURGY AND MATERIALS

March 22-23, 2021

Vasily Lutsyk[1]*, Vera Vorobjeva[1], Maria Parfenova[1]
[1]Institute of Physical Materials Science SB RAS, Ulan-Ude, Russia

Computer models of T-x-y diagrams: Verification of Ag-Cu-Ni & A-Sb-Sn (A = Ag, Au, Bi, Co, Cu, In, Ni) ternary system

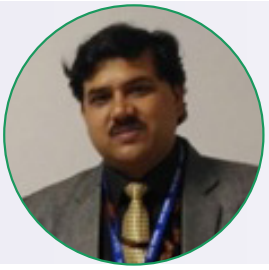
Systems A-Sb-Sn (A= Ag, Au, Bi, Co, Cu, In, Ni), and more complex ones, like Ag-Cu-Ni-Au-Sn, have been elaborated to change the lead-containing solders. Ternary systems with the binary Sb-Sn will be discussed more thoroughly. A contradiction was found in these systems (e.g. Ag-Sb-Sn), which is that the incongruently melting binary compound Sb2Sn3 on some data decomposes at 242.4oC to SbSn and Sn, and on others – it exists down to 300 K. Therefore, two variants of the mono- and nonvariant states scheme were drawn up and two versions of 3D models were built and considered. The Ag-Sb-Sn T-x-y diagram, if Sb2Sn3 compound exists down to 300 K, consists of 99 surfaces, that serve as boundaries of 45 phase regions. If you consider the option, in which Sb2Sn3 decomposes at 242.4oC on SbSn and Sn, the phase diagram is built on 82 base points and consists of 103 surfaces and 49 phase regions. Ternary alloys of these systems have important applications as the lead-free solders. For the best understanding of the phase relations, firstly a 3D model of the phase diagram prototype has been assembled, visually and easily explaining graphically all the intricacies of the geometric structure of the T-x-y diagram, encoded in a table form in the scheme of mono- and nonvariant transformations. Further, after entering the real base points by which the 3D model is being built and correcting the curvature of the lines and surfaces, the prototype was transformed into a 3D model of the T-x-y diagram of the real system. The model reproduces the iso- and polythermal sections, allowing you to build any other incisions and analyze the crystallization of any original melt up to the final formation of the microstructure. These diagrams may generate the vertical (for the given center of masses) and horizontal (for the isothermal state of isopleth) material balances. This work was been performed under the program of fundamental research SB RAS (project 0336-2019-0008).

Audience take away:

- Main innovations in the field of multicomponent systems investigation will be discussed
- Editors (designers) software to assemble the multidimensional phase diagrams of multicomponent systems
- Spacious computer models for isobaric T-x-y (3D) & T-x-y-z (4D) diagrams
- Verification and validation of the experimental & thermodynamic phase diagrams
- Phase regions prototyping for the exploded phase diagrams
- DTA, electro conductivity & X ray spectra simulation to imitate the ternary, quaternary and quinary systems investigation

Biography:

Dr. Lutsyk is a head of Materials CAD Sector, IPMS SB RAS, and professor of Banzarov Buryat State University. Session Organizer and Session Chair: "Phase Diagram as a Tool of Materials Science" - for the four International Conferences IC-CMTP (2012, 2014, 2016, 2018, Hungary, Miskolc). Invited Lecturer: 2011 & 2012 International Youth Industrial Forums "Engineers of the Future" (Russia, Goloustnoye); HighMatTech (Ukraine, Kiev. 2011); ICCMTP2 & IC-CMTP4 (Hungary, Miskolc, 2012 & 2016); Physical Chemistry 2016 (Serbia, Belgrade, 2014); OMEE-2017 (Ukraine, Lviv, 2017), CMSE-2020 (Ukraine, Kyiv, 2020), Chemistry Virtual 2020 Webinar (2020), Online Conference on Chemistry and Nano Science" (2021).



Ashish Kumar[1]*, Sumayah Bashir[1], Abhinay Thakur[1], Hassane Lgaz[2], Ill-Min Chung[2]

[1]Department of Chemistry, Faculty of Technology and Sciences, Lovely Professional University, Phagwara, Punjab, India

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Computational, thermodynamic and experimental studies on acid corrosion inhibition of Aluminium by Acarbose

The potential of acarbose as corrosion inhibitor of aluminium in 0.5M HCl was studied in various concentrations and temperatures (25–550C) by utilizing weight loss estimations, Potentiodynamic polarization techniques, Electrochemical impedance spectroscopy (EIS), Monte Carlo simulation studies, Quantum chemical computations and AFM study. The overall outcomes indicate that acarbose exhibits its highest efficiency of 94% at 4000 ppm acting as efficient inhibitor to retard aluminium corrosion in 0.5 M HCl solution. The topographical and morphological analysis of corrosion inhibition on aluminium surface was observed by AFM study which revealed the formation of thin film on the aluminium surface by acarbose. A quantum chemical calculation with DFT-theory was also done to substantiate the mechanism of inhibition. The values of the several adsorption energies derived from Monte Carlo simulations also correlates the experimental inhibition efficiency.

Audience take away:

- Understand and identify new corrosion inhibitors and its study.
- Can apply in various industries for corrosion inhibition.
- Work on international collaborations.

Biography:

Dr. Ashish Kumar is presently as Professor and heading chemistry department in School of Civil and School of Mechanical Engineering at Lovely Professional University , India. He has been a member of review boards of various journals from American Chemical Society, Springer, Bentham, Taylor and Francis etc and conferences in India and abroad. He has also authored and reviewed diverse chapters in refereed books with Springer nature and Elsevier, Wiley etc. He is editor/Editorial Board member of more than 15 international Journals. He also published one book on Engineering chemistry. He also evaluated Ph.D thesis's from India and Abroad. He himself guided more than 20 (Ph.D / Masters and UG) students. He has published more than 50 Research papers in SCI journals. He was recipient of Research Excellence Award from LPU for last three consecutive years.

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SPEAKERS | DAY 2

INTERNATIONAL CONFERENCE ON

MINERALS, METALLURGY AND MATERIALS

MARCH 22-23, 2021

Lenka Zajickova*[1,2], Lucie Blahova[1], Miroslav Michlicek[2], Jirina Medalova[2], Petra Cernochova[2], David Necas[1], Anastasiya Solovieva[3], Anton Manakhov[3]

[1]Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic
[2]Faculty of Science, Masaryk University, Brno, Czech Republic
[3]Scientific Institute of Clinical and Experimental Lymphology—Branch of the ICG SB RAS, Novosibirsk, Russia

Plasma-processed nanofibrous electrospun mats as functional scaffolds or drug delivery systems

Regenerative medicine stands before the problem to replace non-functional tissues or improve the wound healing. Therefore, many laboratories try to develop resorbable tissue scaffolds that could support the patient´s cells or breathable wound dressings that could immobilize biocide particles. The scaffold material should be biocompatible, biodegradable, and easy to manufacture, thus economically viable. A possible answer is to produce a structure made of a biodegradable polymer that mimics extracellular matrix (ECM), which would be peacefully received and gradually degraded when the new tissue has formed. The solution for wound dressings can also benefit from the nanofibrous structures that have bioactive surface able to immobilize biomolecules and particles. One of the promising polymers is FDA-approved polycaprolactone (PCL) due to its relatively low cost, excellent processability and mechanical properties, non-toxicity and low immunogenicity. However, the pristine form of PCL has a bioinert and hydrophobic surface causing problems with protein adsorption resulting in reduced cell adhesion. PCL nanofibrous mats can be efficiently modified by plasma polymerization. It leads to the formation of bioactive surface exhibiting increased cell attachment and proliferation. It offers also a possibility to attach proteins or blood platelets. In this contribution, various aspects important for plasma processing of polymer nanofibrous mats we will be discussed and the promising results will be demonstrated.

Audience take away:

- The audience not familiar with plasma processing will learn about this versatile surface modification method, applicable to many different materials and structures, including microporous materials. It can expand their research or teaching activities.
- The attendees will gain information to propose efficient and eco-friendly solutions for chemical activation of inert surfaces or preparation of hydrophilic surfaces, especially for advanced health care.
- Designers will not need to care about the bulk material properties when requesting specific surface functional properties because the introduced method is independent of the supporting material.
- Plasma-processed polycaprolactone nanofibrous mats, discussed in the talk, open a wide range of applications.

Biography:

Lenka Zajicková received her Ph.D. in plasma physics from the Masaryk University in Brno (Czech Republic) in 1999. She stayed as a post-doc at Ruhr University Bochum, and University of Minnesota in Minneapolis. She currently works at Central European Institute of Technology and Faculty of Science, Masaryk University, as an associate professor. Osaka University appointed her as a visiting professor. She published 133 papers in plasma processing of materials, bioapplications, and carbon nanomaterials. She chairs Technology Advisory Committees for Plasma Processing and Atomic Layer Processing at Society of Vacuum Coaters and the Czech representative to IUPAP Commission for Plasma Physics.

Ashwini Kumar[1]*, Poorva Sharma[1], Qi Li[2], Jingyou Tang[1], Guolong Tan[1,3]

[1]Key Laboratory of Multifunctional Materials, Department of Electronic Engineering, Luzhou Vocational and Technical College, Luzhou, Sichuan – 646000, China

[2]School of Physics, Southeast University, Nanjing - 211189, China.

[3]Institute of New Materials, Wuhan University of Technology, Wuhan - 430070, China

Observation of spin-reorientation transitions in BiFeO3 multiferroics modified by lead and titanium

We report the synthesis and basic characterization details of Bi1−xPbxFe1-xTixO3 (x = 0.05 and 0.1) samples. The polycrystalline bulk sample of Bi1−xPbxFe1-xTixO3 (x = 0.05 and 0.1) have been synthesized by conventional solid-state reaction method. The effects of partially doping of Pb and Ti ion on structural, vibrational and magnetic properties of BiFeO3 have been investigated. Structural studies are carried out using X-ray diffraction (XRD) and Raman scattering spectroscopy. Rietveld refinement of XRD data confirmed the phase formation of the compounds and suggest that samples possess rhombohedral (R3c, 100%) symmetry for x = 0.05 and R3c (99%) + P4mm (1%) symmetry for x = 0.1, respectively. X-ray absorption spectroscopy has been probed at Fe L2,3 and O K-edges to determine the valence (charge) state of Fe in BiFeO3. Interestingly, magnetic measurement results reveal the existence of spin-reorientation transition in Pb and Ti modified BiFeO3, which indicates that these studied samples of BiFeO3 may find promising application in memory and spintronic devices.

Audience take away:

- In recent years, multifunctional multiferroics, which have two or more ferroic properties (such as ferroelectricity, (anti) ferromagnetism, or ferroelasticity), have generated increasing levels of interest in the world of novel multifunctional materials, due to the possibility of controlling magnetic order with an electric field, and vice-versa. Due to the interaction between spin and charge, the coexistence of ferroelectricity and ferromagnetism has the potential to exhibit magnetoelectric effects.
- Magnetoelectric effects on multiferroics are expected to have great impact on the production of future advanced devices.

Biography:

Dr. Ashwini Kumar studied Physics and graduated his doctoral degree (PhD) from Devi Ahilya University Indore - India in 2014. He then joined research group of Professor Qi Li at the Southeast University as a postdoctoral fellow. After completion of postdoctoral fellowship, he obtained the position of an Associate Professor at the Department of Electronic Engineering, Luzhou Vocational and Technical College, Luzhou, Sichuan, China. He was awarded by Fellowship from Madhya Pradesh Council of Science and Technology, Bhopal (India) for training of Young Scientist. His research is focused on novel multiferroic, spinel ferrites, as well as metal oxides materials. He has published more than 25 research articles in SCI(E) indexed journals.

Xinqi Chen
School of Physics and Mechanical & Electrical Engineering, Hubei University of Education, Wuhan, Hubei, China

Copper sulfide composite thermoelectric materials: Structure design and performance boost

Based on the development of high-performance necessity and urgency of the thermoelectric conversion material, copper sulfide has been regarded as a promising thermoelectric material with relatively high thermoelectric performance and abundant resources. The low intrinsic thermal conductivity and high electrical transport of these materials are born out of the "phonon-liquid electron-crystal" structure between the copper and chalcogens. However, three thermoelectric parameters, Seebeck coefficient, electrical conductivity, thermal conductivity, are interrelated with each other. To further improve the thermoelectric properties of copper sulfides must be decoupled these parameters. We discuss the strategies for designed nanostructures to improve the thermoelectric performance of copper sulfides based on reducing lattice thermal conductivity of single-component material and tuning compositions for optimizing thermoelectric properties. Copper sulfide composite nanostructures synthesized by room-temperature wet chemical method, including the composite structure of micro/nano copper sulfides multiscale architecture at different mass ratios, and carbon encapsulated copper sulfide particles composite structure. Analysis of the thermoelectric properties of two kinds of composite structure, and the relationship between the structure and performance of the composite structure. The results confirmed that these two strategies are effective for the enhancement of thermoelectric performance.

Audience take away:

- The design of composite structure in copper sulfide is an effective strategy to enhance thermoelectric performance.
- The wet chemical method for synthesizing thermoelectric materials is a facile method to some extent.
- The stability of copper sulfide composite thermoelectric materials can be improved through pre-annealing process and sintering process.
- The zT value can reach 1.0 and above in these copper sulfide composite thermoelectric materials.

Biography:

Dr. Chen studied Condensed Matter Physics at Central China Normal University, China and graduated as MS in 2012. She received her Ph. D. degree in nanomaterials engineering at the Institute for Superconducting and Electronic Materials (ISEM), University of Wollongong, Australia in 2016. Then she joined Hubei University of Education (HUE) and carried out her research of copper chalcogenide thermoelectric materials in Donghua University as a post-doctorate. She obtained the position of an Associate Professor at the HUE in 2020. Her research focuses on the design and synthesis of novel copper chalcogenides nanostructures for energy conversion and storage.

M.H. Abdelaziz*[1,2], A.M. Samuel[2], H.W. Doty[3], F.H. Samuel[2]

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[2]Departement des Sciences appliquees, Universite du Quebec a Chicoutimi, Canada

[3]General Motors Materials Engineering, 823 Joslyn Ave, Pontiac, MI 48340, USA

Mechanical behavior of transition metals-containing Al-Si-Cu-Mg cast alloy subjected to prolonged thermal exposure

Al-Si-Cu-Mg Cast (354) alloys are extensively used in automotive engine components owing to their outstanding performance after applying the proper heat treatment. Transition elements (Zr, Ni, and Mn) were added in order to avoid the deterioration in mechanical properties of these Al-alloys upon the exposure to elevated temperatures for long times. In this study, static (continuous) and dynamic (interrupted) thermal exposure were employed in order to reveal their effect on tensile and hardness properties of the newly tailored alloys. Results showed that there is deterioration in strength and hardness values; however, the ductility values improved. This reduction in mechanical performance was attributed to coarsening of the strengthening precipitates following the long exposure time. It was obvious that there are no significant variations in the results obtained from the static and dynamic thermal exposure techniques. This finding may allow using the simple static exposure technique widely at laboratory scale to simulate the behavior of the material under dynamic thermal exposure conditions as in the case of the automotive engine components. The deterioration in the mechanical properties was almost flattened after 100h of thermal exposure which may reflect the decelerating coarsening kinetics of strengthening precipitates due to the continuously increasing distance between the precipitates.

Audience take away:

- They will realize the importance of minor additions of certain elements in making Al-alloys suitable for elevated-temperature applications and thus overcome the problems associated with utilizing Al-alloys in applications such as: automotive engine components.
- They will be introduced to the promising role of manganese to the mechanical behavior of aluminum alloys.
- The conclusions out of the paper may open the door for a great set of research ideas.

Biography:

Dr. M. H. Abdelaziz is an Assistant Professor at the French University in Egypt (UFE) since September 2019. Dr. Abdelaziz joined the research group of Prof. F.H. Samuel at University of Quebec in Chicoutimi (UQAC) in 2015. Three years later, he received his PhD in Manufacturing and Materials Engineering at the same institute. Previously, Dr. Abdelaziz received his MSc and BSc degrees in Mechanical Design and Production Engineering from Cairo University, Egypt. His current research activities focus on the development and characterization of light innovative materials aiming at reducing harmful emissions and promoting sustainable and greener societies.

Peter Kessels Dadzie[1]*, Martin Amoah[2], Paul Inkum[3]

[1]Snr. Lecturer, Interior Design and Materials Technology Department, Kumasi Technical University, Box 854, Kumasi, Ghana.
[2]Associate Prof. and Dean, Faculty of Vocational Education, University of Education Winneba, Kumasi Campus, Kumasi, Ghana.
[3]Lecturer, Interior Design and Materials Technology Department, Kumasi Technical University, Box 854, Kumasi, Ghana.

The worth of tropical hardwood branchwood as supplementary material to its stemwood for wood products manufacturing

Materials play vital roles in human existence, and wood is one of such materials on accounts of its application in areas such as housing, furniture, construction, paper making etc. The trees from which wood is obtained also perform unique duty to sustain lives of other living things on account of absorbing and storing CO2, and releasing O2 to keep a good balance in the atmosphere. Wood, especially tropical wood should therefore be used judiciously for forest conservation. We assessed branchwood as a readily available supplementary material to stemwood by comparing site and wood type influence on density, MOE, MOR, and compressive strength, all of which are important properties needed to ascertain the structural performance of materials, and using Entandrophragma angolense. Samples were obtained from two natural forest reserves and tested at 10 ± 3 %MC using ISO 3131-1975 and BS 373-1957 protocols. Results were that, though branchwood had significantly ($p < 0.05$) higher density, MOE, MOR and compressive strength were equivalent to those of stemwood, and site had non-significant influence on them. Density significantly ($p < 0.05$) influenced either MOE or MOR but not compressive strength. It was concluded that the responses of branchwood of E. angolense in terms of mechanical performance is very positive that they are as good as their stemwood counterparts. It is therefore recommended that the branchwood of E. angolense is a potential supplement to stemwood for wood products manufacturing. However, further studies on natural durability, finishing characteristics, shear strength etc. will be needed to enrich this positive response of branchwood as supplementary material to stemwood.

Audience take away:

- The density of tropical hardwood branchwood, unlike softwood is higher than that of stemwood and has influence on the mechanical properties (bending MOE and MOR) and compressive strength//grain.
- Forest site had no significant influence on the density, bending MOE, MOR, and compressive strength//grain in stemwood as in branchwood of E. angolense.
- Mechanical properties of branchwood and stemwood are equivalent for E. angolense and therefore the two wood types can be used either separately or in mix for wood products manufacturing, especially where those properties are the priority.
- Branchwood of E. angolense is as good as its stemwood, and therefore wood users such as those in building and construction, furniture making, car body works etc. should consider utilizing branchwood to reduce the pressure on stemwood extraction in order to conserve the forest.

Biography:

Dr. Peter Kessels Dadzie is a Ghanaian professional teacher and holds BEd. Technology Education in Wood and Construction (2002), MSc. Wood Technology and Management (2007) and PhD. Wood Science and Technology (2014) from the University of Education, Winneba, and Kwame Nkrumah University of Science and Technology, all in Kumasi, Ghana. Currently, he is a senior lecturer at the Interior Design and Materials Technology Department of Kumasi Technical University, Kumasi, a member of the Society of Wood Science and Technology (SWST) and Forest Products Society (FPS) and has published over 17 research articles in various very reputable journals.

Selcuk Poyraz
Department of Textile Engineering, Faculty of Engineering, Adıyaman University, 02040 Adıyaman, Turkey

A novel microwave energy-based approach to hybrid nanomaterial preparation for electrochemical energy storage purposes

Hybrid nanomaterials (HNMs), composed of carbonized conducting polymer (CCP), e.g. polypyrrole (PPy), nanoparticles (NPs) with simultaneously grown carbon nanotubes' (CNTs) and metal oxide nanowires' (MONWs) coverage on their surface were prepared for electrochemical energy storage purposes. In order to both obtain this novel HNM and to overcome the common challenges in conventional synthesis methods, a simple and straightforward in-situ polymerization/coating approach was systematically combined with the modified version of a well-established, facile, and rapid ex-situ microwave (MW) energy-based approach, i.e. PopTube. This highly efficient and easily scalable combined approach could effectively manage the production of targeted HNMs, in an affordable manner, with unique morphological (SEM/TEM), elemental (EDX), spectroscopic (XRD, Raman) and electrochemical (CV) features, all of which are strongly supported by both indicated material characterization test results and the relevant literature data. Thus, it is believed that the as-prepared CNT and MONW decorated CCPNPs (CNT&MONW@CCPNP) through this combined approach would soon become a preferred material for the above-mentioned purposes with respect to its promising features.

Audience take away:

- The audience will be able to use the information that they learn from this presentation when starting a new research about the use of hybrid nanomaterials in electrochemical energy storage applications.
- If the audience is interested in nanomaterials' preparation and characterization, this presentation will effectively help them to overcome the possible future problems that they will encounter during their studies.
- Other faculty or relevant graduate students working in this field can use the as-obtained information from this presentation to expand their research or teaching activities.
- The information given in this presentation will provide a practical solution to simplify the preparation of hybrid nanomaterials in an efficient manner.

Biography:

Dr. Selcuk Poyraz studied Polymer and Fiber Engineering at Auburn University, USA and graduated as MS in 2010, and as PhD in 2014, respectively. He then joined the Departments of Textile Engineering at Tekirdağ Namık Kemal University in 2015, and at Adıyaman University in Turkey in 2018 as an Assistant Professor, respectively. He has published more than 20 research articles in SCI(E) journals.

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POSTERS DAY 2

INTERNATIONAL CONFERENCE ON

MINERALS, METALLURGY AND MATERIALS

MARCH 22-23, 2021

MATERIALS 2021

Danuta Olszewska
AGH University of Science and Technology, al. A. Mickiewicza 30, 30-059 Cracow, Poland

Preparation anode materials for Li-ion batteries like catalysts materials with transitions metals

Commonly used catalysts for removing impurities from waste gases can be prepared using techniques of applying active material to carriers with a developed surface and porosity. There are many uncomplicated methods known to achieve materials that are satisfactory in terms of activity, stability and viability. On the other hand, in the era of e-mobility, special attention is paid to the creation of optimal batteries for communication purposes, especially lithium-ion batteries. In particular, solid-state-ionic syntheses are used in which stoichiometric amounts of substrates are used to obtain electrode materials to obtain single-phase materials. The author proposed the use of methods for producing transition metal catalysts for the production of anodic material for lithium-ion batteries and showed that the use of a suitable method leads to obtaining composite materials with good electrochemical properties.

Audience take away:

Anode materials prepared like catalyst, Application of metal oxides, Energy storage

Biography:

Prof. Danuta Olszewska studied at the Jagiellonian University, Poland and graduated as MS in 1996. She then joined the research group of Prof. T. Grzybek at the Department of Fuels Technology and next the research group of Prof. J. Molenda the Department of Hydrogen Energy at the AGH University of Science and Technology, Poland. She received her PhD degree in 2002 at the same institution. She is specialist on the environmental catalysis and Li-ion Batteries. She obtained materials with transitions metals.

Paulina Piotrkiewicz[1]*, Justyna Zygmuntowicz[1], Bartłomiej Bulski[1], Aleksandra Miazga[1], Marcin Wachowski[2], Waldemar Kaszuwara[1]

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Influence of the metal content on microstructure and selected properties of Al_2O_3-Cu-Ni composites manufactured by uniaxial pressing

This work investigated the influence of metal phase content on the microstructure and selected properties of composites from Al_2O_3-Cu-Ni system. The following powders were used as the initial materials: nanometric Al_2O_3 and micrometric metal powders: Cu and Ni. Microscopic observation indicated that the copper powder was characterized by dendritic morphology, while nickel powder had a spheroidal shape of particles with developed surface area. The composites were obtained by the uniaxial pressing. Four series with 50 vol.% of solid content and different volume of metal content with respect to the total solid volume were prepared. The metallic phase in all series contained an equal volumetric share of both metal components. Selected physical properties were determined using Archimedes method. Phase composition of sintered samples was examined by X-ray diffraction analysis. Microstructural observations were carried out with the use of Scanning Electron Microscopy. Vickers hardness and fracture toughness were specified. Physical properties revealed a high relative density of sintered composites.

Base on the obtained X-ray analysis results, it can be concluded that fabricated samples consisted of three phases: Al_2O_3, Ni and solid solution CuNi. The macroscopic observations indicated the homogeneous distribution of the metallic phase in the ceramic matrix in obtained samples. Conducted mechanical properties analysis showed that an increase of metal content in the composite results with a decrease of its hardness with simultaneous increase of fracture toughness. Based on the conducted research it was concluded that uniaxial pressing allows to obtain composites from the ternary Al_2O_3-Cu-Ni system. The experimental results indicate the amount of metallic phase in the composite has a significant impact on its properties and microstructure. The results of the study could help to understand and design a more effective process of production of composites from Al_2O_3-Cu-Ni system.

Audience take away:

This paper describes a preliminary investigation on the composites from the ternary Al_2O_3-Cu-Ni system manufactured by uniaxial pressing. The studies carried out included description of the influence of metallic phase content on the final microstructure and properties of composite material. We believe that these results of the study could help to understand and design a more effective manufacturing process of composites from Al_2O_3-Cu-Ni system.

Biography:

Paulina Piotrkiewicz is a PhD Candidate at the Faculty of Material Science and Engineering Warsaw University of Technology. She graduated as a MS in 2018 and joined the research group of Prof. W. Kaszuwara at the same institution.

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Fabrication of Al_2O_3-Cu-Mo composites by centrifugal slip casting method

In the present research, the Al_2O_3-Cu-Mo hybrid composites were prepared by centrifugal slip casting technique. This technique is a method for powder processing that combines the effects of slip casting and centrifugation. The aim of the work is to determine the possibility of forming microstructure of composites from Al2O3-Cu system with the addition of the third component. A commercially available powders were used as the starting materials.

The Al_2O_3-Cu-Mo composites were characterized by X-ray diffraction (XRD), scanning electron microscope (SEM), and energy-dispersive X-ray, spectroscopy (EDS). The stereological analysis allows for obtaining information about the distribution of metal particles in the sintered composites. The density of the fabricated materials was examined using the Archimedes method. In addition, selected mechanical properties were characterized.

The results obtained in the experiment gave high cognitive value and application potential. In the investigation was had applied the original concept of formation of materials as hybrid gradient composites. The two innovative technologies were used: formation by centrifugal slip casting and sintering with varying proportion of liquid phase. This was allowing creating a gradient (zone) structure with properties that vary across the sample. It was found, that the composites fabricated by centrifugal slip casting have the shape of hollow cylinders. The obtained composites were distinguished by negligible porosity due to the application of centrifugal force. The X-ray phase analysis demonstrated that the reducing atmosphere used for sintering composites prevents the formation of new phases in the fabricated composites.

Audience take away:

- The results presented in the paper will be useful for scientists who work on the preparation of ceramic-metal composites with gradient distribution of metal particles.
- The investigations presented in this article shown possibility used of the method of centrifugal slip casting for the production of hybrid gradient composites from the Al_2O_3-Cu system with the addition of molybdenum.
- The implementation of the research proposed in the presentation proposal will allow knowing the correlation between chemical composition, forming and sintering conditions and basic properties of obtained hybrid composites with gradient microstructure.

Biography:

Dr. J. Zygmuntowicz studied Chemical and Process Engineering at the Warsaw University of Technology, Poland and graduated as MS in 2012. At the same time, she studied Materials Science and Engineering at the same University, where she graduated as MS in 2013. She then joined the research group of Prof. Konopka and Prof. Szafran at the same University. She received her PhD degree in 2018 at the Faculty of Materials Science and Engineering. The aim of her Ph. D. thesis was to create Al2O3-Ni composites with a gradient Ni particles by centrifugal slip casting. At the present time, Dr. joined the research group for a one-year postdoctoral fellowship supervised by Prof. Kaszuwara at the Division of Structural and Functional Materials at the Warsaw University of Technology, Warsaw. She has published more than 30 research articles in SCI(E) journals.

Research interests: Research on ceramic matrix ceramic-metal composites fabrication via centrifugal slip casting, gel centrifugal casting and centrifugal slip casting in the magnetic field. Research on the shaping of ceramic powders by methods based on colloidal chemistry such as gel casting, gel-tape casting, slip casting, etc.

Barbara Nisi[1]*, Orlando Vaselli[2,1], Daniele Rappuoli[3], Jacopo Cabassi[2], Marta Lazzaroni[1], Franco Tassi[1,2], Francesco Bianchi[4]

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Recovering abandoned mining areas: The case study of Abbadia San Salvatore (Siena, Tuscany Region, Central Italy)

The former Hg-mining area of Abbadia San Salvatore (Siena, Tuscany, central Italy), was one the most important districts of Hg production worldwide, whose activity was closed at the end of the seventies. The exploited ore had a mercury content of 0.6 to 2.0 wt.% and was extracted down to the depth of 400 m. It has been estimated that 103,000 tons of liquid mercury were produced and that about 10,000 tons were dispersed in the environment. The mining activities ended up without any clean-up strategy. This occurred without strict environmental regulations that became State laws in 1999. Since 2008 the former owner (ENI Ltd. - AGIP Division) transferred properties and mining concessions to the municipality of Abbadia San Salvatore. The Tuscany Region issued a regulation for recovering abandoned mining areas. Suited criteria and threshold concentration limits for mercury were established where a high "natural background" was present. Since 2012, a reclamation project in the abandoned Hg mining district started with a geochemical characterization of surface and ground waters, soil, air and mining structures at which hydraulic, cleaning and engineering activities were coupled. The mining areas were divided in 6 sub-areas (lots) in accordance with the local Environmental Protection Agency, on the basis of the type of operations to be performed for reclaiming the mining area. In this paper, we present the actions carried out since 2011 for the remediation process, which is focused on environmental restoration, and has as ultimate aim the site recovery for historic museum and mining park purposes.

Audience take away:

Abandoned mining sites are an important environmental issue. The geochemical characterization of the different areas where the mining activity developed is important prior any remediation actions. Remediation activities in mining areas where mercury was exploited and treated are relatively uncommon.

Biography:

Researcher at the Institute of Geosciences and Earth Resources (CNR-IGG) of Florence (Italy). She received her PhD degree in 2004 in Earth Sciences at the Department of Earth Sciences of the University of Florence. From 2017 to 2019 she was a teaching titular in the courses of Geochemistry at the Department of Pure and Applied Sciences of the University of Urbino. P.I. of bilateral and international projects. Co-author of 70 papers published in peer-review journals.

Kunilova I.V*[1], Lavrinenko A.A[1], Golberg G.Y[1], Kravchenko V.N[1]
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Physical and chemical basis of new process recovery of valuable elements from waste of solid fossil fuels

In fossil coals many fields there is a set of valuable elements, which allows cost-effective to extract them when the content is even lower than in industrial ores. In this regard, very relevant is the problem of scientific justification of process of associated recovery of precious metals and other valuable elements from coals and products of their combustion. Since coal, even with increased content of valuable metals, will not be considered as raw material to produce metals and energy as the raw material from which, after the full use of its energy potential, it is possible to extract valuable elements, noble metals (gold, silver, platinum group metals) and rare earths (lanthanum, yttrium, ytterbium).To improve the efficiency of extraction of valuable components - noble, platinum group metals, rare earth elements, waste from the combustion of brown coal Kansk-Achinsk basin was studied the process for preparation of the waste to leaching. Based on the analysis of the elements content and distribution in the organic and mineral phases of waste the combustion of brown coal Kansk-Achinsk basin, the data on reactive mode of processing and composition of leach solution the proposed scheme and the initial data for the development of bases of technology of processing of ash and slag waste. The scheme includes crushing, flotation separation of organic part (underburning) and then extraction of the leaching of valuable elements from concentrate and flotation tailings. For the selective leaching of valuable elements from the cakes primary acid treatment is first applied the reagent on the based on phosphinates. Defined reagent modes for these operations.At the same time of the implementation of the technology of extraction of valuable elements from waste coal combustion is simultaneously prevented the emission of large quantities of hazardous substances (lead, copper, zinc, arsenic, selenium, etc.) in the surrounding space.

Audience take away:

- The audience will expand their knowledge in the field of extracting valuable components from ash and slag waste from coal combustion. The huge scale of the environmental problem of ash and slag waste processing can give impetus to new ideas for their use.
- Researchers can find analogies for recycling their substances. They may be interested in applying our research methods, processes and scientific collaboration.

Biography:

Dr. Kunilova studied Chemistry at the D.Mendeleev University of Chemical Technology of Russia and received my specialist diploma in 1997. She then joined the research group of Prof. Vigdergauz at the Institute of Comprehensive Exploitation of Mineral Resources Russian Academy of Sciences (ICEMR RAS). She received her PhD degree in 2007 at the same institution. Currently works as a senior researcher in the laboratory of ICEMR RAS. She has published more than 30 research articles.

M. Cortez Valadez

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Silver nanoparticles in zeolites matrix incorporated in commercial coating

In this report, results about the incorporation of silver nanoparticles in coatings are shown. The results were obtained using clinoptilolite-stilbite, clinoptilolite, and chabazite natural zeolites. The ion exchange properties of the zeolite promoted the obtaining and stabilization of the nanoparticles. The particle size of 2-20 nm was determined by TEM microscopy. Absorption bands around 400 nm were detected and associated with surface plasmon resonance. The bactericidal efficiency of the coatings was evaluated after incorporated on surfaces against Gram-positive and Gram-negative bacteria. The results indicated a higher bactericidal effect than the positive control.

Audience take away:

- Effective synthesis of nanomaterials
- Potential applications in coatings
- Properties of natural zeolites
- The detailed processes related to the obtaining of nanoparticles will allow its reproducibility for anyone interested.

Biography:

Dr. Manuel Cortez studied Physics at the Sonora University, México and graduated as MS in 2006. He obtained a PhD degree in CINVESTAV, Querétaro, México in 2014. He is currently a member of the National System of Researchers. Dr. Manuel is currently a member of the Cátedras-CONACYT program. He has published about 44 scientific articles and participated in the direction several of PhD students.

Maria Borrego*, Jose. E. Martin-Alfonso, M. Carmen Sanchez, Concepcion Valencia, Jose M. Franco

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Development of lignin-PVP micro- and nano-structures by electrospinning and their thickening capacity in oil media

Developing oleogelators and oil thickeners from natural polymers with adequate properties is a challenge today. This work explores the ability of the different micro- nano-architectures based on low-sulfonate lignin (LSL)/polyvinylpyrrolidone (PVP) to structure castor oil. LSL and PVP were dissolved in DMF and micro- nano-structures were generated from the solution by electrospinning. PVP acted as a cospinning polymer in the process to improve the spinnability of LSL. The LSL: PVP ratio was varied in order to obtain different architectures at different concentrations (8-15 wt.%). Physico-chemical properties and rheological behaviour of the polymer solutions were assessed to explain the electrospinnability for fiber formation. The morphology of electrospun nanostructures was mainly dependent on the rheological properties of the solution. Electrosprayed nanoparticles or micro-sized particles connected by thin filaments were obtained from solutions with low LSL: PVP concentrations and/or high LSL: PVP ratios, whereas beaded nanofibers or bead-free nanofiber were produced by increasing concentration and/or decreasing LSL: PVP ratio, as a consequence of enhanced extensional viscoelastic properties and non-Newtonian characteristics. Electrospun LSL: PVP nanofibers were able to form oleogels simply by dispersing them into castor oil at concentrations between 10 and 30 wt.%. The rheological properties of the oleogels may be tailored by modifying the LSL: PVP ratio and concentration of nanofibers.

In summary, electrospinning of lignin/PVP solutions can be proposed as a simple and effective method to produce nanofibers for oil structuring. These findings may find diverse application in fields like food techonology and lubricant industry, as advanced functional materials for diverse.

Audience take away:

- This work explores the search for new bio-sourced polymeric materials and the procedures for incorporating them into an oil matrix by promoting its structuration.
- Electrospinning technique was chosen as the technology to obtain micro- and nano-structures due to its great versatility, easy handling, low cost and the possibility of controlling the morphology of the structures obtained.
- Therefore, this study shows the feasibility of using the electrospinning technique to develop nano-architectures capable of physically structuring vegetable oil for lubricant applications, avoiding chemical modifications that are not completely friendly to the environment

Biography:

Maria Borrego received a B.S. in Industrial Chemical Engineering from University of Huelva (Spain) in 2018. After graduation she joined for the R&D and Development Department of Fertiberia factory. She got her M.Sc. degree in Chemical Engineering from University of Huelva in 2020 and she entered UHU's Chemical Engineering PhD program in January 2021 under the guidance of Prof. José M. Franco and L. José E. Martín-Alfonso in the Chemical Product and Process Technology Research (Pro2TecS) center. María's research interests include developing functional materials such as oleogels and nanostructures via electrospinning based on biodegradable and biocompatible ligno cellulosic derivatives among other biopolymers.

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