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13-15 MARCH, 2023

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# 4TH EDITION OF INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE AND ENGINEERING

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13-15 MARCH


BOOK OF
**ABSTRACTS**

4TH EDITION OF
INTERNATIONAL CONFERENCE ON

# MATERIALS SCIENCE AND ENGINEERING

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# Welcome Message

Dear congress visitors, welcome to Materials 2023 meeting of the year! Significant progress has been made in synthesizing and characterizing engineered nanoparticles and nano-devices for cancer diagnosis and treatment. A few breakthrough discoveries in cancer biology and oncology have been achieved by using nanotechnology, including all-in-one nanoparticles for drug synergistic action and in vivo imaging nanoparticles for early disease detection. One of the goals of this meeting is to expand new fundamental knowledge and advanced technologies associated with developing nanotechnology-based solutions to major cancer-related challenges. It is obvious that further development and understanding of nanoparticle-based drug delivery systems and combination therapies are needed to improve the effectiveness of nanotechnology-based diagnosis capabilities and cancer interventions. I urge materials scientists to sharpen their focus on discovering multifunctional theranostic strategies and tools for reversing cancer immunosuppressive microenvironment. These efforts will enable the translation of transformative nanotechnology-based cancer interventions.

**Ass Prof. Dr. Yong Teng**

Emory University, United States

# Welcome Message

Distinguished researchers, it is indeed my honor and a pleasure to welcome you to this congress and for me to share some welcome notes about my talk. As you are aware, skin diseases are regarded as the 4th most occurring illness in the world and affects approximately 1.9 billion people worldwide. For decades sunlight therapy and phototherapy are the most prominent protagonists in the treatment of cutaneous diseases. On the other hand, prolonged exposure to sun rays produces phototoxic effects, giving way to phototherapy as a preferred choice. Artificial light in fluorescent lamps that employs a narrow band UVB light (310-313) nm is most preferred therapeutic modality for skin treatment. Development of novel sensitized co-doped $Gd^{3+}$ activated inorganic phosphor materials is an active area of research in the treatment of more than 40 types of skin diseases, such as psoriasis, eczema, vitiligo, and a number of other skin conditions.

**PROF. L. REDDY**

University Of Johannesburg, South Africa

# Welcome Message

**Dear Distinguished Scholars, Engineers, and Colleagues!**

It is my great honour and pleasure as a Committee Member to invite you to join with a contribution to the 4th Edition of International Conference on Materials Science and Engineering (MATERIALS 2023) which is scheduled as a Hybrid Event at Singapore from March 13-15, 2023.

The Conference will include Plenary and Keynote Speeches and Invited Talks which will be given by Distinguished Scholars and Experts from academic institutions and industry, and oral presentation by delegates and poster presentations by young junior participants.

The conference strives to provide a unique theme Shaping Future by Combining Knowledge and Innovations in Material Science, and it aims to provide scientists and experts with once-in-a-lifetime opportunity to stay abreast of this rapidly changing field by offering a comprehensive overview of the recent findings in the field of minerals, metallurgy, and materials. MATERIALS 2023 covers all aspects of Materials Science and Engineering, Advanced Smart Materials and other topics, and serves as a bridge between scientists, researchers, and experts in research, development, and production. International scientific activities are big scientific platforms for the scientists, academicians, and young academicians from all over the world, to interact and communicate with each other. I believe that MATERIALS 2023-Conferenc will provide this opportunity for delegates from different cultures and countries. Also, this conference will be performed successfully, in favor of the qualified scholars and experts and will be very beneficial for young delegates by encouraging them and improving their confidence of presenting research in an international platform.

I am pleased to invite prospective scholars, academicians, and engineers, to submit their original contributions to this important conference, where you are sure to have a meaningful experience with scholars and experts from different cultures and different countries, from all around the World.

**Dr. Osman Adiguzel**

Firat University, Turkey

# Welcome Message

Dear organizers, invitees, participants and visitors, it is a great honor to welcome all for presenting the latest industrial applications of nanotechnology that focus on the marvelous studies published by renowned names in the community of science and technology for the best of our globe and environment. This will open the horizons for modern ideas and projects to support our nation, save GDP, and work for the best of our people and coming generations via introducing the best researches of nanoscience and nanotechnology. It will be a new addition to graduates' students, scientists, researchers and academics. The engineering of industry and biomedical is attractive nowadays due to advantageous applications for humanity. It is obvious that the nanotechnology into solar cells, agricultures, cosmetics, computer science and others will revert back to all positively. I believe the topic I address will be attractive and benefited to all interests.

**Prof. Dr. Yarub Al-Douri**
American University of Iraq, Iraq

# Keynote Speakers

Ephraim Suhir
Portland State University, United States

Yong Teng
Emory University, United States

Thomas Webster
Interstellar Therapeutics, United States

Balasubramaniam Vaidhyanathan
Loughborough University, United Kingdom

Fiqiri Hodaj
University of Grenoble Alpes, France

Dror Malka
Holon Institute of Technology, Israel

Leelakrishna Reddy
University of Johannesburg, South Africa

Lidia Benea
Dunarea de Jos University of Galati, Romania

Osman Adiguzel
Firat University, Turkey

P Dr. Yarub Al-Douri
American University of Iraq, Iraq

*Thank You All...*

## 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 conferences 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 2023

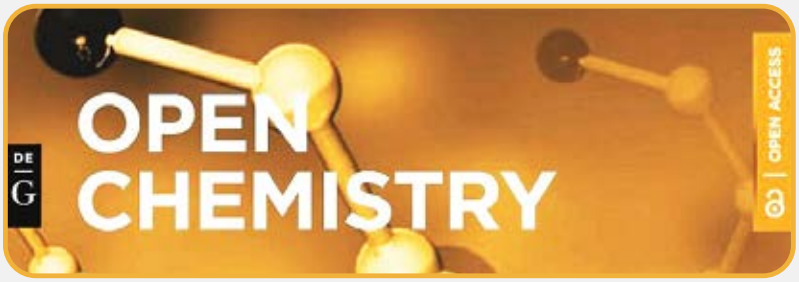
Encouraged by the success of previous editions, Magnus Group is pleased to announce its 4th Edition of International Conference on Materials Science and Engineering (MATERIALS 2023) which is scheduled as an Online Event during March 13-15, 2023.

The congress strives to provide a unique theme, Shaping Future by Combining Knowledge and Innovations in Material Science.

This scientific gathering aims to provide terrific opportunities for academicians, researchers, scientists, engineers, and industry representatives to network and share their knowledge, insightful suggestions, and cutting-edge research in the field of Materials Science and Engineering. Furthermore, this summit will provide a global podium platform discussing practical concerns, challenges, and solutions. As we go into Industry 4.0, material science and engineering research is undergoing a transformation. Materials engineers create new materials for applications, which has led to the development of everything from computer chips to healthcare devices to composites. More knowledge and research in nanotechnology, automation, and medical discoveries are required as part of Industry 4.0.

We feel that MATERIALS 2023 will provide an outstanding opportunity to expand our understanding and generate new ideas to aid in the advancement and evolution of cooperative academic research. The collaboration of material scientists and engineers can result in ideas that were previously unthinkable. Materials 2023, we believe, will be an outstanding venue for knowledge exchange and the strengthening of new collaborations in the field of materials science and engineering. Research is getting more borderless as the world grows more borderless.

It offers a glimpse into the future of materials science and allows researchers of all levels - from undergraduates to postdocs to Nobel Laureates - to share expertise, exchange technical information, and network with peers. The scientific program will focus on the most recent international advancements in materials science, with a particular emphasis on multidisciplinary research in both basic and applied domains. This would be an excellent networking opportunity, and it would foster lifelong friendships among fellow partners. We hope you have a fantastic conference, returning home with scientifically revitalized ideas and international colleagues.




## ABOUT

# Journal Collaboration

Open Chemistry is a peer-reviewed, open access journal that publishes original research, reviews, and communications in the fields of chemistry in an ongoing way. Our central goal is to provide a hub for researchers working across all subjects to present their discoveries, and to be a forum for the discussion of the important issues in the field.

There are no submission charges. In order to sustain the production of our fully-refereed open access journal, each article accepted for publication in Open Chemistry is subject to Article Processing Charges (APC).

**Note: We offer 30% discount on APC for the CCET 2023 conference participants.**

For more details about the journal,
please visit: https://www.degruyter.com/journal/key/chem/html

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# 13-15 MARCH


DAY 01

**KEYNOTE FORUM**

4TH EDITION OF

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## A review of narrow band ultraviolet- B light emissions in $Gd^{3+}$ activated phosphor host materials

In this review we have studied several research papers related to narrow-band (NB) ultraviolet light- B (UVB) emissions of $Gd^{3+}$ doped phosphor materials in different host lattices. Ideal inorganic wide band host matrices such as phosphates, borates and fluorides are considered influential in narrow band UVB emission of $Gd^{3+}$ doped ions. UVB emissions of the $Gd^{3+}$ ion in the narrow band range of 310nm – 313 nm are due to $^6P_{7/2} \rightarrow {}^8PS_{7/2}$ transitions that falls within the action spectrum of phototherapy. Phototherapy makes use of artificial UVB radiation integrated in fluorescent lamps for treatment and cure of many skin diseases and disorders. However, due to the parity 4f-4f forbidden nature of $Gd^{3+}$ transitions, $Gd^{3+}$ excitation and emissions bands are relatively low, which makes them ineffective for therapeutic treatment of various skin disorders. To ameliorate this situation, various rare earth, or transition ions sensitizers such as $Pr^{3+}$, $Ce^{3+}$, $Bi^{3+}$ are chosen, whose role is to absorb energy from the excitation source and transfer it to the $Gd^{3+}$ activator ion, thereby enhancing the narrow UVB band emission for effective therapeutic treatments of skin diseases or disorders. In addition to this, phosphorescence narrow UVB emissions for skin treatment is also considered in the emerging field of medical science. Many factors pertaining to the choice of the various host phosphor materials for suitability in phototherapy are considered in this presentation.

**Leelakrishna Reddy**

Department of Physics,
University of Johannesburg,
Gauteng, South Africa

### Biography

Prof Leelakrishna Reddy has obtained his PhD from the University of Johannesburg in condensed matter physics, where he is currently a lecturer. He has supervised several MSc and PhD students. He has given several Invited and Keynote lectures in many conferences around the world. He has published more than 70 peer reviewed articles. Presently his focus is on phosphor materials for applications in optical devices, LEDs and in the Phototherapy.

## Improving the surface properties of materials and biomaterials by electrochemical methods

In recent years, the development of nanotechnology and nanomaterials has promoted an explosion of new functional coatings and this trend will continue to grow in the coming years. Functional and intelligent coatings are undoubtedly a class of materials of enormous technological interest. Among the many processes and technologies for functionalization and surface protection, this article further discusses some examples and advantages of electrochemical methods applied in modifying the surfaces of materials to improve their properties. Two electrochemical methods are applied and improved for the functionalization of surfaces, each with specific applications, but both with the possibility of improving the surface properties of materials or biomaterials as the corrosion or tribocorrosion resistance of in specific environments of use. (i) Electrochemical deposition of metals, alloys and hybrid layers, nanostructured and nanocomposites, also framed as bottom-up nanotechnology and (ii) Controlled growth of oxide films on the surface of metals and alloys by electrochemical techniques, associated with one of the characteristic methods obtaining nanomaterials, respectively the top-down method. The paper presents a summary of the results obtained in the production of nanocomposite layers on the surface of materials and the controlled growth of oxide layers on different metals and alloys, thus improving the properties of these materials in their operating environments. Nanocomposites are composites in which the dispersed phase has dimensions of the order of nanometers (1-100 nm). These are high-performance materials belonging to the 21st century and possessing unusual combinations of unique properties and design possibilities that are not found in conventional composites. Obtaining these nanocomposite layers is a niche area in the development of international and national micro-enterprises. In the field of implants, surface modification has become essential. Currently, there is an increasing emphasis on alternative solutions, such as coatings with functional layers by electrodeposition, to solve the problems at the implant-tissue interface. Changes in surface properties can also be made by controlled anodic oxidation which is an electrochemical method to produce different types of nanoporous oxide films in order to protect metals and alloys. Anodic oxidation includes electrode reactions in combination with an electric field and the diffusion of oxygen ions, which thus lead to the formation of an oxide layer on the surface of the anode (material).

**Lidia Benea**

[1]Competences Center Interfaces-Tribocorrosion and Electrochemical Systems, Dunarea de Jos University of Galati, Romania

### Biography

Lidia Benea is Professor and Ph.D. Supervisor in Materials Science and Engineering at Dunărea de Jos University of Galati, Romania (www.ccites.ugal.ro), member of the National Council for Attesting Titles, Diplomas and University Certificates (CNATDCU), Ministry of Education and Research, România. Author and co-author of over 250 scientific articles, 106 being in ISI journals and proceedings volume, cumulating an Impact Factor of 174.76, 23 books and more than 350 presentations at scientific conferences. Her research interests are in the field of composite coatings, biomaterials and multifunctional materials and nanomaterials. Many achievements in electrochemical methods applied to surface modification and materials characterization.

## The strategies and promise of nanoparticle-based target therapeutics in head and neck cancer

Head and neck cancer (HNC) represents an aggressive and heterogenous group of cancers whose pathologies remain largely unresolved. Despite recent advances in HNC therapeutic strategies, the overall survival of HNC patients remains poor and continues to prompt efforts to develop more effective therapies. Physicochemical and pharmacokinetic profiles of anticancer drugs render optimal delivery challenging. Moreover, distribution, biotransformation, and clearance of anticancer drugs in the body must be overcome to deliver therapeutic agents to tumor cells in vivo. Nanoparticles (NPs) have shown promise as both drug delivery vehicles and direct anticancer systems, based on the quantum properties and the ability to carry and absorption. Our team has developed multifunctional NPs for selective release of targeted therapeutics, such as Src inhibitor saracatinib and AKT inhibitor capivasertib, into head and neck tumor cells. We also developed dual drug-loaded NPs to co-deliver saracatinib and AKT inhibitor capivasertib into the same population of tumor cells. The antitumor efficacy of these drug-loaded NPs was evaluated in in vitro and ex vivo 3D cell cultures and in orthotopic mice of HNSC. Our studies demonstrate that nanoparticle-based target therapeutics have superior anticancer effects than the free drug through suppressing HNC development and metastasis more efficiently. These tumor site-specific delivery of drug-loaded NPs would be straightforwardly extended from HNC to other types of solid tumors.

**Audience Take Away Notes**

- We will introduce recent advances in the field of nanoparticle-mediated targeted therapeutics for head and neck cancer, with an emphasis on the targeting points
- We will also show tremendous potential of nanoparticle-based target therapeutics to fulfill the need for viable alternative cancer therapies, and encourage audience to further study higher-specificity tumor targets and more efficient nano-carriers

### Yong Teng

Department of Hematology and Medical Oncology, Winship Cancer Institute, Emory University School of Medicine, Atlanta, GA 30322, USA

**Biography**

Dr. Teng is the inaugural recipient of the Wally Award from Winship Cancer Institute of Emory University and a fellow of IAAM and VEBLEO. He is an active member of the International Head and Neck Scientific Group, RSM, and AACR. One of his research interests lies in nanotechnology in cancer research and treatment. He has extensive experience in conducting investigator-initiated translational research. He has authored over 130 articles and book chapters relating to cancer biology, nanotechnology, and nano-based drug delivery and genome editing, providing a balanced mix of basic and translational science.

## Nano implants: Human clinical success in the spine

Nanomaterials have been widely tested in vitro and in small order animal studies for decades. Results have shown greater tissue growth, decreased bacteria growth, and inhibited inflammation. However, few, if any, studies exist examining human tissue response to nanomaterials. This study represents a cohort study of nano implants inserted into the spine of over 14,000 patients over the past 5 years. Results demonstrated no cases of infections or other implant failures which is significantly better than statistics on conventional spinal implants which have up to 20% failure rates. This study will further explain that nano implants mimic the natural nano texture of bone itself and possess surface energy that can competitively increase the adsorption of proteins known to promote osteoblast (bone forming cells) functions, decrease bacteria functions, and limit inflammatory cell functions. As such, this study represents one of the few human clinical studies on nano implants.

**Audience Take Away Notes**

- Human clinical data for nano implants
- How nano implants can increase tissue growth
- How nano implants can decrease infection without antibiotics
- How nano implants can reduce inflammation

### Thomas J. Webster

Interstellar Therapeutics, United States

**Biography**

Thomas J. Webster's (H index: 113; Google Scholar) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995; USA) and in biomedical engineering from RPI (Ph.D., 2000; USA). He has served as a professor at Purdue (2000-2005), Brown (2005-2012), and Northeastern (2012-2021; serving as Chemical Engineering Department Chair from 2012 - 2019) Universities and has formed over a dozen companies who have numerous FDA approved medical products currently improving human health. He is currently helping those companies and serves as a professor at Hebei University of Technology, Saveetha University, Vellore Institute of Technology, UFPI, and others. Dr. Webster has numerous awards including: 2020, World Top 2% Scientist by Citations (PLOS); 2020, SCOPUS Highly Cited Research (Top 1% Materials Science and Mixed Fields); 2021, Clarivate Top 0.1% Most Influential Researchers (Pharmacology and Toxicology); 2022, Best Materials Science Scientist by Citations (Research.com); and is a fellow of over 8 societies. Prof. Webster has over 1,350 publications to his credit with over 53,000 citations.

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# 13-15 MARCH


DAY 01

## SPEAKERS

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**Masahiro Ikeda[1]*, Masaru Aniya[2]**

[1]Department or General Education, National Institute of Technology, Oita College, Oita, Japan

[2]Department or Physics, Faculty of Advanced Science and Technology, Kumamoto University, Kumamoto, Japan

## Mechanism of ionic conduction in AGI-based superionic conducting glasses: A relation between charge carrier concentration and mobility of ions

Superionic conducting glasses such as AgI-based oxide glasses are known as one of the best solid electrolytes exhibiting high ionic conductivity comparable to the case of liquid electrolytes. However, the origin of the high ionic conductivity, as well as the relations with the structures and other physical quantities, remains unknown. In our previous studies, we have found an interesting relation between the ionic conduction and the medium range structures in superionic conducting glasses, and proposed a model for the temperature dependence of the ionic conductivity that exhibits a Vogel–Fulcher–Tammann (VFT)-like behaviour above the glass transition temperature Tg. Especially in the later study, the model was formulated based on the bond strength-coordination number fluctuation (BSCNF) model of viscosity.

In our presentation, after briefly reviewing our previous works related to the present study, we explore the relation between charge carrier concentrations and mobility in AgI-based superionic conducting glasses across Tg. The clarification of such a relation is not a trivial matter. To understand the microscopic mechanism of ionic conduction, we focus on a relation between the charge carrier concentration and the mobility of mobile ions. We will discuss the mechanism and the physical pictures of the ionic conduction.

**Audience Take Away Notes**

- We will provide useful knowledge from a theoretical perspective based on solid state physics
- Our study will help the audience to understand the microscopic picture of ionic diffusions in solids, especially in solid electrolytes (or superionic conductors)
- The content of the present study is closely related with the vacancy formations in solids

**Biography**

Dr. Ikeda has a background in condensed matter physics. Now he works as an associate professor at National Institute of Technology, Oita College, Japan. Since entering the doctoral course in 2007 under the supervision by Professor Aniya at Kumamoto University, he has devoted to fundamental science, especially in the fields of structural relaxation in supercooled liquids and Solid State Ionics. He is interested in the interdisciplinary research areas of a wide range of sciences involving material science and physical chemistry.

**Adriel Yan Sheng Tan[1,2]*, Faliang Cheng[1], Min Zhang[1], Michelle T.T. Tan[2], Sivakumar Manickam[3], Kasturi Muthoosamy[2]**

[1]Guangdong Engineering and Technology Research Centre for Advanced Nanomaterials, School of Environment and Civil Engineering, Dongguan University of Technology, Dongguan, China

[2]Centre for Nanotechnology and Advanced Materials (CENTAM), Faculty of Science and Engineering, University of Nottingham Malaysia (UNM), Semenyih, Selangor, Malaysia

[3]Petroleum and Chemical Engineering, Faculty of Engineering, Universiti Teknologi Brunei, Bandar Seri Begawan, Brunei Darussalam Kumamoto University, Kumamoto, Japan

## Titanium Carbide: A new 2D material for photoelectrochemical biosensors

2D materials that contain carbon such as graphene, graphitic carbon nitride and graphene oxide have been well utilized in photo electrochemical biosensing. Each of the material has its unique role, whether as a conductive material (graphene, reduced graphene oxide), a photoactive material (graphitic carbon nitride, GCN) or as a site for immobilization of biomolecules (graphene oxide). Recently, a new group of 2D carbon containing material known as MXenes were discovered and are found to have high electrical conductivity with $Ti_3C_2$ being the commonly used MXene. As a conductive material, Mxene has the potential in enhancing the photocurrent produced by a photoactive material. A nanocomposite is formed between $Ti_3C_2$ and a photoactive material, GCN. GCN was sonicated with $Ti_3C_2$ in different weight ratios (1:1, 3:1 and 5:1) to make a GCN/$Ti_3C_2$ nanocomposites and the physical properties were evaluated via Field Emission Scanning Electron Microscopy (FESEM) and X-ray Diffraction (XRD). Photo electrochemical measurements were conducted to evaluate the degree of enhancement of photocurrent in the GCN/$Ti_3C_2$ nanocomposite. The nanocomposite was deposited onto a conductive FTO electrode and the photocurrent was evaluated using a three-electrode system. Material characterizations confirmed the successful formation of GCN/$Ti_3C_2$. Photocurrent measurements concluded that $Ti_3C_2$ could enhance the photocurrent generated by GCN under illumination by 200% when $Ti_3C_2$ was added to GCN in a ratio of 3:1 (GCN: $Ti_3C_2$). The enhancement of photocurrent could have taken place via the formation of heterojunction between GCN and $Ti_3C_2$. With this breakthrough, in-depth studies can be carried out to apply GCN/$Ti_3C_2$ nanocomposite as a sensing platform for photo electrochemical biosensing for the detection of proteins, antigens, and DNA.

**Audience Take Away Notes**

- The presentation will introduce on the various 2D carbon-based nanomaterials
- The audience will be exposed to a relatively new 2D carbon-based material: MXenes and their uses
- Introduction to modification strategies of MXenes for biosensing applications
- Significant knowledge creation/transfer on the use of modified MXenes in photo electrochemical biosensing and its mechanism and advantages over conventional methods

**Biography**

Adriel Tan Yan Sheng is a student at the University of Nottingham Malaysia pursuing his PhD in Chemical Engineering under the supervision of Assoc. Prof. Dr. Kasturi Muthoosamy in the Faculty of Science and Engineering. He graduated with MEng in Chemical Engineering in 2017 from the same university and had a short stint in the industry before continuing PhD studies. His research interests include the synthesis and development of 2D carbon-based nanocomposites and its application in the development of photo electrochemical biosensors for biological analyte detection, with a special focus on cancer biomarkers.sciences involving material science and physical chemistry.

**Joanna Wycislik-Sosnierz[1]*, Jolanta Matusiak[2]**

[1,2]Research Group of Friction and Resistance Welding Technologies, Adhesive Bonding and Environmental Protection, Centre of Welding, Łukasiewicz Research Network - Upper Silesian Institute of Technology, Gliwice, Poland

## Fume hazard during laser and hybrid welding of stainless steel

Due to their properties, stainless steels are used in many industrial branches, e.g. power, chemical, petrochemical, automotive and food industries. The main joining methods of these materials are gas shielded arc welding processes – (MIG/MAG and TIG). However, in recent years, the application of laser and hybrid laser arc welding techniques for joining stainless steels has been more and more popular.

Welding processes are associated with the welding fume emission into the work environment, what influences negatively on health. According to International Agency for Research on Cancer (IARC) guidelines since 2017 welding fume has been classified as carcinogenic factor to humans (Group 1).

Therefore, the application of welding technologies in the industry is connected with the necessity for research conducting and determination of work safety and health protection conditions.

The assessment of the risk related to exposure to welding fume depends on the amount of fume generated, its chemical and phase composition and morphology. The combined analysis of these factors is decisive on the toxicity of fume and its impact on the human health.

The amount of fume generated depends on the welding method, the type of base and filler materials and the technological parameters. The chemical composition of fume is determined by the grade of welded material and filler metal. The next step is to conduct an analysis of the phase composition of welding fume in order to determine in which form a given element occurs. In turn, the size of welding fume particles determines the depth of their penetration into the human body, there is an inverse relationship - the smaller the particles, the deeper they penetrate into the human body.

This presentation is focused on the first step - the assessment of fume emission rate. Research of fume emission rate was carried out during laser and hybrid welding of stainless steel in grade 1.4301 (X5CrNi18-10). The obtained results showed the influence of the technological parameters of the process on emission rate, what allows for the modification of the process in the environmental aspect.

**Audience Take Away Notes**

- The audience will able to learn about the hazard connected with welding fume emission
- The complex analysis of welding fume hazard will allow for welding process selection which is characterized by lower risk in terms of welding fume emission
- Obtained results will be useful for welding personnel in industrial branches connected with stainless steels joining

**Biography**

Joanna Wycislik-Sosnierz studied Chemical Technology and Engineering at Silesian University of Technology in Gliwice and graduated as M.Sc. in 2008. She graduated in 2010 postgraduate studies Hygiene and occupational safety at Silesian University of Technology in Gliwice. Since 2008 she has been working in Research Group of Friction and Resistance Welding Technologies, Adhesive Bonding and Environmental Protection of the Centre of Welding, in Łukasiewicz Research Network - Upper Silesian Institute of Technology, Gliwice, Poland. She participates in research projects connected with environmental engineering during welding and allied processes. She is co-author of 30 scientific articles.

**Soban Muddassir Dar**
School of Materials Science and Engineering, Jiangsu University, Zhenjiang City, Jiangsu Province, 212013, China

## External fields assisted synthesis of high performance aluminum matrix composites

Automotive and aircraft industries have great potential for use of high performance aluminum matrix composites (AMCs) in light-weight and energy efficient vehicles. External field assisted synthesis of in-situ AMCs provides greater control over ceramic reinforcement particles' size and wettability as compared to conventional AMCs. This talk is divided into two consecutive parts. In the first part of this talk, we will look at the synthesis of in-situ AMCs using three different external fields (electromagnetic, ultrasonic field and pressure) and the governing mechanisms will be descried briefly. In the second part, as an example, microstructure and properties of in-situ ($Al_3Zr/Al_2O_3+ZrB_2$) particles reinforced 6016Al matrix composites, produced under electromagnetic field and solidified under 10-30MPa, are investigated. Results show that the microstructure of squeezed 6016Al matrix composites has finer gain size than monolithic 6016Al alloys. The size of ($Al_3Zr/Al_2O_3+ZrB_2$) reinforcement particles in squeezed 6016Al matrix composites varies in 100-200nm range. The grain size of 1vol.%-6016Al matrix composite continuously decreases from 100μm to nearly 60μm; the grain size of 2vol.%-6016Al matrix composite decreases from 80μm to 50μm and ceases to decrease beyond it due to the high volume fraction of reinforcement particles. The reinforcement particles have relatively less inter-particles spacing in 2vol.%-6016Al matrix composite squeezed under high pressure. It is also observed that squeezed 6016Al matrix composites, in aged state, demonstrate higher strength and improved ductility as compared to 6016Al alloys. In addition, aged 1vol.%-6016Al matrix composite exhibit greater fracture strain than cast composite while 2vol.%-6016Al matrix composite exhibit negligible fracture strain difference in aged and cast states. The improved ductility of squeezed composites is attributed to the amorphous phase present at the α-Al/θ-$Al_2O_3$ interface which is expected to be the residual amorphous-$Al_2O_3$ phase left un-transformed to stable θ-$Al_2O_3$ phase. Thus, an amorphous phase layer at the particle/matrix interface is beneficial for the improved ductility of AMCs.

**Audience Take Away Notes**

- The audience will be able to know the current challenges in synthesis and applications of aluminum matrix composites
- External field assisted synthesis of AMCs will be introduced as a promising and novel technique for high performance composites
- The audience will be able to understand the strength-ductility paradox in alloys and composites
- This research outcomes can find practical applications in the automotive and aircraft industry

**Biography**

Dr. Soban Muddassir Dar received his doctoral degree (2020) in Material Science and Engineering from Southeast University (Nanjing) China. Thereafter, he joined High Performance Alloys and Composites Group at Jiangsu University (Zhenjiang) China as postdoctoral researcher. Currently he is an associate professor at Jiangsu University, China. He has published several research articles in SCI/EI journals of international repute; presented his work at well-known conferences and also acting as a reviewer for international journals (Elsevier, Springer). Dr. Soban's research interests are: solidification and processing of materials, mechanical behavior of materials, electron microscopy and materials characterization.

**Bing Bai[1]*, Rui Zhou[2], Fan Bai[3]**
School of Civil Engineering, Beijing Jiaotong University, Beijing 100044, P R China

## Cotransport of heavy metals and suspended particles at different temperatures by seepage in porous materials

The transport of heavy metals (HMs) in groundwater and the resulting interactions between HMs and the soil medium are vital topics in environmental geotechnology. The cotransport of HMs and shell powders (SPs) in a porous medium ($SiO_2$ particles) at different temperatures was investigated by one-dimensional laboratory column experiments. Considering the significant differences in particle size and dielectric property between HMs and SPs, a theoretical model describing their cotransport was developed. For the transport of HMs in porous media, we propose a nonlinear attachment-detachment model. The test results show that temperature and Darcy velocity have a negligible effect on the transport of individual HMs and that the recovery ratio of $Cd^{2+}$ is higher than that of $Pb^{2+}$, which can be attributed to the lower adsorption of $Cd^{2+}$ on the solid matrix. The presence of SPs can facilitate the transport of HMs due to the strong adsorption of positively charged HMs on negatively charged SPs. However, this effect tends to decrease with the size of the $SiO_2$ particles. An increase in temperature results in a decrease in the recovery ratio of HMs because more HMs adsorbed on SPs can be deposited at high temperatures. The adsorption of HMs on SPs can also change the dielectric properties of the SPs, thus causing a reduction in the repulsion between the SPs and the solid matrix and a consequent decrease in the recovery ratio of HMs. In addition, the results show that the developed model fits well with the experimental results. The proposed nonlinear attachment-detachment model uses an adsorption function and scanning desorption isotherms to model the deposition process of HMs. By distinguishing the differences in particle size and dielectric property between the HMs and SPs, the proposed theoretical model is capable of describing the cotransport processes of HMs and SPs.

**Roberta Cappabianca[1]*, Paolo De Angelis[2], Annalisa Cardellini[3], Eliodoro Chiavazzo[4], Pietro Asinari[5]**

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## Towards a more rational design of polymer-based coating of gold nanoparticles

The rapid development of nanotechnology has strongly encouraged scientific research in the field of manufacturing, characterization, and use of nanoparticles. Recently, gold nanoparticles (AuNPs) have become the subject of intense research due to their optical, electronic, and molecular recognition properties. In a wide range of applications AuNPs are relevant, such as energy (e.g. solar desalination and medicine (e.g. diagnosis and In the medical field, the biocompatibility and the biodegradability of nanoparticles are one of the main challenges. Surface coating of AuNPs with Poly(Lactic-co-Glycolic Acid) (PLGA) polymers is generally adopted as a solution, i.e., to improve their biodistribution However, a greater theoretical understanding of the adsorption phenomenon of PLGA polymers onto the AuNPs surface would be a key step to enhance the effectiveness of AuNP design and loading into the PLGA matrix for various biomedical applications. Here, we demonstrate the efficiency of coupling different computational approaches to investigate the interactions of an AuNP with PLGAs, aiming at determining the most favorable surface shape for adsorption. First, we carry out classical molecular dynamics simulations by tuning the PLGAs concentration in an aqueous solution. Then, we investigate the time evolution of the self-assembly phenomenon of PLGAs with consequent adsorption of polymer clusters on the AuNPs using an unsupervised machine learning scheme. In addition, a thorough analysis of PLGA coating of the AuNP surface, combined with the AuNP-PLGA free energy landscape calculation during the adsorption mechanism shed light on its anisotropic nature. In particular, our findings unveil a preferential PLGA adsorption on the {1 1 1} crystalline planes of the AuNP model. The modeling framework suggested in our work provides physical insights into the PLGAs adsorption onto AuNPs and suggests some guidelines to rationally design PLGA-coated AuNPs

**Audience Take Away Notes**

- Using classical molecular dynamics simulations, here we clarify how the coating process of gold nanoparticles is achieved and how this is influenced by surface morphology in addition to surface chemistry
- The suggested modelling framework is based on open-source software packages (e.g. GROMACS) and in-house codes written in Python language Importantly, the methodological approach is user-friendly and can be adopted to study similar phenomena at the nanoscale interface
- This research may also be useful to other faculty because it allows them to improve the physical-chemical insights in NP interaction potentials
- In addition, it draws preliminary guidelines for the rational design of nanoparticle suspension Specifically, we demonstrate that the surface morphology of the gold nanoparticle with a predominance of {1 1 1} planes allow for a more effective coating of polymers on the surface, by tuning the surface ratio between the tested crystalline planes of the nanoparticle

**Biography**

Roberta received her BSc in Mechanical Engineering at Università degli Studi di Napoli Federico II in 2017. She continued her studies at Politecnico di Torino, where she graduated in MSc in Mechanical Engineering in 2020. She carried out her master thesis on investigating the bio-nano interfaces and the interactions with inorganic matter through molecular modelling approach at Leiden University. Currently, she is a Ph.D. student in Energetics at the Politecnico di Torino and she is working on multi-scale modelling of advanced colloid for energy applications.

**Khalid Sultan[1]*, Shohaib Abass[2]**

[1,2]Solid State Research Lab, Department of Physics, Central University of Kashmir, Ganderbal, J and K, India

# Oxygen vacancies based modifications in properties of SR doped $Nd_2NiMnO_6$

In this paper we have discussed about the structural and dielectric properties of Sr doped $Nd_2NiMnO_6$. There is no effect on the structure of compound $Nd_2NiMnO_6$ if doped upto the SR concentration of x=0.3 in $Nd_2$-xSrxNiMnO$_6$ and the observed structure is monoclinic indexed with P21/n space group. Raman spectroscopy depicts the existence of disorder in the samples due to Sr doping and a rise in disorder with increase in concentration of SR has been observed. All samples have a mixed valence of $Ni^{2+}$, $Ni^{3+}$, $Mn^{2+}$, $Mn^{3+}$ and $Mn^{4+}$ associated with oxygen vacancies. Dielectric studies on all the samples show a decrease in dielectric constant as well as dielectric loss with increase in frequency, the usual behavior of polar dielectrics. The temperature effect on the dielectric properties shows an increase with increase in temperature. Conductivity and impedance studies have been investigated for all the three samples of $Nd_{2-}$xSrxNiMnO$_6$ (x=0.0, 0.1, 0.3) and the results obtained are inter-related with each other.

**Audience Take Away Notes**

- In this talk I will talk about the dielectric properties of oxide double perovskite and their modifications by doping and creating defects
- By doping the dielectric constant increases and thus the doped compound becomes a potential candidate for energy storage devices
- Researchers can modify this material either by doping with other dopant or depositing thin films of same compound

**Biography**

Dr. Khalid Sultan is an Assistant Professor in the Department of Physics, Central University of Kashmir. He has been awarded Ph. D in Solid State Physics from the National Institute of Technology Srinagar. Dr. Khalid has qualified CSIR-NET/JRF twice and is a recipient of various awards, including Bharat Vikas Award 2017 and Best Paper award in JK Science Congress 2013. He is one among the six outstanding students from all over India felicitated by the Honorable President of India. Dr. Sultan has a good research background, and his research interest is in Rare-earth based transition metal oxides and their irradiation study. He has a good number of publications in National and International Journals of repute. He has also completed a major Research project, and another project is in progress. Currently, Dr. Sultan is working on double perovskites and is guiding five Ph. D scholars.

**Nikita Das[1], Damini Jagankar[1], Chandan Maity[1]***

[1]School of Advanced Sciences (SAS), Vellore Institute of Technology (VIT) Vellore, Tamil Nadu, India

## Control over self-assembly towards smart material formation

Control over the formation of molecules and molecular architectures with specific precision are well known in Nature, directing vital process such as cell motility, intercellular transport etc. As a class of fascinating molecules, enzymes act as biological catalyst accelerating specific reactions in aqueous environment and can modulate their catalytic activity in presence of physicochemical stimuli. Therefore, enzyme catalysis and related mechanism are the important source of inspiration for developing artificial biomimetic systems. In comparison, the examples of controlled formation of molecules and materials for artificial systems are limited. Generally, in the artificial systems, (catalytic)reactions take place with initially chosen reaction conditions. Hence, the control over the chemical process is difficult, which would be necessary for smart applications. On the other hand, most of the artificial chemical reactions takes place in organic solvents, which have toxicity issues and other risk factors such as flammability, explosivity. With that respect, water is a safe reaction medium, which is abundant, cheap, and environmentally safe. Here, I will show how organocatalytic activity of an artificial system can be controlled in an aqueous atmosphere by the application of stimuli. Besides, control over in-situ formation of molecular building block, which could result in the formation of smart material will also be discussed. Property modulation of the material could be achieved via the presence of a stimulus. I will also demonstrate stimuli-induced controlled release of molecule(s) towards application of smart material in biological environment.

**Audience Take Away Notes**

- Biomimetic approach for smart material formation
- Control over formation/defragmentation of material for smart application
- Organocatalysis in aqueous media

**Biography**

Dr. Chandan Maity has received his M. Sc. From IIT Bombay and Ph.D. from Humboldt University of Berlin, Germany. Thereafter, he did his postdoctoral research work in Delft University of Technology, the Netherlands and Technical University of Munich, Germany. Currently he is an Assistant Professor at School of Advanced Sciences (SAS) in Vellore Institute of Technology (VIT), Vellore campus, India. He has received Start-up Research Grant from SERB, India. His research group is interested developing stimuli responsive material in nature-like environment using functional organic molecules aiming at catalysis, controlled delivery, and biomedical application.

**Yogesh Kumar Sharma**

Department of Physics Pt. L.M. S. Shri Dev. Suman Uttarakhand University Campus Rishikesh (Dehradun) 249201 India

## Spectroscopic analysis of rare earth ions doped nanomaterial

Rare Earth ions doped nanomaterial were prepared by chemical precipitation method and characterized by XRD, SEM, TEM and EDAX. Their absorption and fluorescence spectra have been recorded in UV-Visible and NIR region. The XRD study revealed the spherical wurtzite structure without second phase. The TEM images confirmed the spherical morphology of the nanomaterial with size in the quantum dots range. From absorption spectra various parameters i.e. Slater – Condon (Fk ), Racah (Ek ), Landeç( z4f ) and Judd-Ofelt parameters have been computed for each nanomaterial specimen by using partial regression method taking into consideration all the absorption peaks observed. The spontaneous emission provability, Fluorescence branching ratio, Radiative lifetime and stimulated emission cross section have also been computed with help of fluorescence spectra.

**Keywords:** CdS nanomaterial, XRD, TEM, Absorption and Fluorescence Spectra

### Biography

Dr Sharma is working as Professor and Head, Department of Physics, Sri Dev Suman Uttarakhand University, Pt L.M.S. Campus Rishikesh (Dehradun) India. He obtained his Ph.D. degree from The University of Jodhpur. He has worked as Principal, Govt. Degree College Someshwar (Almora), Honorary Director, Deen Dayal Upadhyay Kaushal Kendra, Rudrapur, Senior Scientific Officer at Physics Department, I. I.T. New Delhi, Associate Professor, Assistant Professor at Department of Higher Education, Govt. of Uttarakhand and Assistant Professor at J.N.V. University, Jodhpur (Rajasthan). He was awarded DRDO fellowship for doctoral work and Young Scientist Project awarded by Department of Science and Technology, Govt of India, New Delhi. He is teaching physics for graduate and post graduate classes for last 25 years. He has completed four major research project funded by U.G.C. Govt of India, New Delhi and UCOST, Govt of Uttarakhand. Five students have been awarded Ph.D. degree and four others are pursuing research in rare earth doped nanomaterial. Dr Sharma has to his credit three books for graduate students and study material in physics developed for Uttarakhand Open University Haldwani. He has participated in 50 International and National seminar and presented his papers. More than 60 research papers have been published in reputed national and international peer reviewed journals. He is reviewer of various Journals. He has organized three national conferences and two workshops sponsored by UGC, UOU and UCOST.He has worked as an Executive member of National Committee of IAPT. He is also Life member of IAPT, IPA and Material Science Society.

**Thangavel Ponrasu*, Vignesh Muthuvijayan**

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## Jelly fig polysaccharide based biocompatible hydrogel loaded with lauric acid for wound tissue regeneration: An in vitro study

Tissue regeneration is an essential process to maintain, restore a normal anatomical structure and function of the skin. Natural biopolymer-based polymeric hydrogels are capable of absorbing a large quantity of water to maintain the moisture environment at the wound site. The eminence of hydrogels should be biocompatible, non- toxic, maintain the moist environment to supply oxygen and nutrients, protect the wound against microbes and absorb enough wound exudates. Here, we have prepared hydrogel using jelly fig polysaccharide extracted from achenes of jelly fig (Ficus pumila var. awkeotsang) as base material and loaded with Lauric acid (0.5 and 1%) as a bioactive ingredient to promote the tissue regeneration. The physiochemical properties of the hydrogels such as FTIR, swelling, degradation, morphology, TG/DSC, and release were thoroughly characterized. The biocompatibility of the hydrogel was also studied using NIH 3T3 fibroblasts by MTT assay, live/dead and cell proliferation by DAPI/FDA staining. Further, tissue regeneration ability was assessed by in vitro scratch wound assay. MTT assay showed that jelly fig (JF) hydrogel and Lauric acid loaded jelly fig (JF + LA) hydrogels were biocompatible. DAPI staining showed more live cells on hydrogels compared to control (Tissue culture plate). Increased cell proliferation was observed in JF + LA 1% hydrogels compared to control. In vitro scratch wound assay revealed that (JF + LA 1%) hydrogels improved the cell migration and completed wound closure within 24 h. Hence, the JF + LA hydrogels can be used as an ideal wound dressing for the acceleration of wound repair and tissue regeneration.

**Audience Take Away Notes**

- Jelly fig polysaccharide based hydrogel will be an interesting new biomaterial in the field of biomedical applications
- Jelly fig based hydrogel will be biocompatible and patient-friendly
- This will be an advantage to use many natural polysaccharides for the biomaterials preparation.
- This kind of materials will be cost-effective and affordable to all
- Jelly fig polysaccharide based materials are easy to prepare and use as efficient wound dressings

**Biography**

Dr. T. Ponrasu obtained his Ph.D. at CSIR-Central Leather Research Institute affiliated to University of Madras, India in August 2013. Later, he carried out his postdoctoral research (July 2014 – June 2017) in the Department of Biotechnology, Indian Institute of Technology Madras, India and in the Department of Chemical and Materials Engineering, National Yunlin University of Science and Technology, Taiwan (Sep 2018-Dec 2020). He has developed a variety of wound dressing biomaterials for skin tissue engineering and diabetic wound healing applications. He has published 35 articles in peer-reviewed journals and he has been serving as a reviewer of many reputed journals.

**Seongwoo Woo**

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## Improving the reliability design of mechanical systems such as refrigerator

To enhance the lifetime of mechanical system such as automobile, new reliability methodology – parametric Accelerated Life Testing (ALT) – suggests to produce the reliability quantitative (RQ) specifications—mission cycle—for identifying the design defects and modifying them. It incorporates: a parametric ALT plan formed on system BX lifetime that will be X percent of the cumulated failure, a load examination for ALT, a customized parametric ALTs with the design alternatives, and an assessment if the system design(s) fulfil the objective BX lifetime. So we suggest a BX life concept, life-stress (LS) model with a new effort idea, accelerated factor, and sample size equation. This new parametric ALT should help an engineer to discover the missing design parameters of the mechanical system influencing reliability in the design process. As the improper designs are experimentally identified, the mechanical system can recognize the reliability as computed by the growth in lifetime, LB, and the decrease in failure rate. Consequently, companies can escape recalls due to the product failures from the marketplace. As an experiment instance, two cases were investigated: 1) problematic reciprocating compressors in the French-door refrigerators returned from the marketplace and 2) the redesign of hinge kit system (HKS) in a domestic refrigerator. After a customized parametric ALT, the mechanical systems such as compressor and HKS with design alternatives were anticipated to fulfil the lifetime – B1 life 10

**Audience Take Away Notes**

- Parametric Accelerated Life Testing (ALT) for design alterations
- Quantum/transport based generalized life-stress (LS) model
- Sample size formulation for generating reliability quantitative (RQ) specifications

**Biography**

Dr Woo has a BS and MS in Mechanical Engineering, and he has obtained PhD in Mechanical Engineering from Texas A&M. He majors in energy system such as HVAC and its heat transfer, optimal design and control of refrigerator, reliability design of thermal components, and failure Analysis of thermal components in marketplace using the Non-destructive such as SEM & XRAY. In 1992.03–1997 he worked in Agency for Defense Development, Chinhae, South Korea, where he has researcher in charge of Development of Naval weapon System. He was working as a Senior Reliability Engineer in Refrigerator Division, Digital Appliance, SAMSUNG Electronics. Now he is working as associate professor in mechanical department, Ethiopian Technical University.

**Saman Momeni[1]*, Abolghassem Zabihollah[2], Mehdi Behzad[3]**

[1]Sharif University of Technology, School of Mechanical Engineering, Iran

[2]Tarleton State University, Department of Mechanical, Environmental, and Civil Engineering, USA

[3]Sharif University of Technology, School of Mechanical Engineering, Iran

## Damped response of sandwich composite structures integrated with MR fluid under impulse loading

Laminated sandwich beam structures are being used in many applications, including wind turbine blades, helicopter blades, industries, and automobiles. The stability and integrity of such structures under impulse loading is a major concern for designers to ensure performance and functionality while in operation. Laminated sandwich structures integrated with MR fluid provide excellent controllability while maintaining integrity when subject to impulse loading. By applying the magnetic field, damping coefficients and the dynamic behavior of structures are improved. In the present work, applying a finite element model based on the N-layer model, the dynamic response and damping coefficients of laminated sandwich structures under impulse loading have been investigated. Various composited materials, including E-glass, Kevlar, and fiber carbon, have been used for modeling to study the effects of materials on the dynamic response of the structure. An in-house experimental setup has been developed to validate the experimental results with theoretical ones. The results of the present work help designers of the sandwich structures integrated with MR fluid to reduce the cost of the materials by selecting suitable materials and appropriate magnetic fields to build sandwich structures for stability and structural integrity.

**Audience Take Away Notes**

- The benefits of sandwich structures compared with metallic counterparts
- Effects of materials (E-glass, Fiber-carbon, and Kevlar) on damping coefficients and dynamic behavior of sandwich structures
- Influences of magnetic fields on damping coefficients and dynamic behavior of structures
- Fabrication of sandwich structures and set up of an experimental procedure

**Biography**

Dr. Momeni received his Ph.D. in Mechanical Engineering from the Sharif University of Technology, Iran, in 2018. He has published several research articles in peer-reviewed journals and conferences and taught several courses at Universities at Post-graduate and undergraduate levels. As a professional engineer, Dr. Momeni has extensive experience in mechanical engineering, including oil and gas and renewable energies. He is researching and developing his studies in various fields, including biomechanics, control, and smart structures.

**Samy A. Elsayed**
Physics Dept., Faculty of Science, Beni-Suef University, Beni-Suef, Egypt

## Inside the electron, a tentative theory about the electron nature

The Phenomenological description of the electron motion as elliptic motion is observation from outside the electron. What happening inside the electron itself? What is the cause of the wave-particle duality of the electron? What is the mechanism of the electron absorbing or emitting energy? The idea of electron orbital motion means that the electron changes its place with respect a certain point in space. A suggestion of another meaning of the circular motion may be possible. That is the electron consists of a mass and energy considering that the electron is a system composed of mass and energy. Taking one point inside the electron relative to another point, one can freely use Einstein mass energy relation for electron at rest. Based on mass energy equivalence, proposing that the electron is composed of mass - energy system this system has a phase transform property from energy to mass in periodical manner with velocity equal to light velocity

**Audience Take Away Notes**

- Unifying the physics laws via application the phase transition concepts on micro systems, as well as, macroscopic bodies vapor Liquid Solid phase transition or ferromagnetic àparamagnetic phase transitions. It is a great step toward unifying physics laws Of course, this this search helps to explain, any experimental results, in the field of electrical conductivity, the concept of polarons, BCS electron pair theory
- Application the quantum phase transition in sup-atomic structure is reported in literature Enhancing quantum phase transitions in the critical point of Extended TC-Dicke model via Stark effect By: ahmed Salah, Scientifi Reports, DOI:10.1038/s41598-018-29902-9. See Also, GH. Saleh, R.Alizadeh, E. Dalili, and A.Noorbakhsh,. The Structure of Photon Based on Saleh Theory. International Journal of Science and Technology, (2020) 6(2), 41-45 It will improve the accuracy of a design, or provide new information to assist in a design problem

**Biography**

Ph.D.in nuclear electronic physics; at Semiconductor Physics Department, Faculty of Physics, Byelorussian State University, Minsk, Republic Belarus, July 1992. The Title of Ph.D. Thesis is Low temperature electrical properties of Germanium structural disordered by irradiation reactor neutronsM.Sc. of solid state physics; Ain Shams University, Cairo, Egypt, April 1986.The Title of M.Sc. Thesis is Addition effect of Thallium on Some Physical Properties of amorphous As2Se3 B. Sc. of Physics; Ain Shams University, Cairo, Egypt, May 1982, grade very good.

**Filipe M.B. Gusmao[1], Teodora Duric[2], Jadranka Milikic[2], Sara Knezevic[3], Kristina Radinovic[2], Diogo M.F. Santos[1]*, Dalibor Stankovic[3,4], Biljana Sljukic[1,2]**

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[2]University of Belgrade, Faculty of Physical Chemistry, Serbia

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[4]VINCA Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade, Mike Petrovica Alasa, Serbia

## Polyoxometalates as electrocatalysts for rechargeable metal-air batteries

Metal-air batteries (MABs) are promising electrochemical energy conversion and storage devices due to having high energy density, while being safer than most batteries. They are composed of a pure metal anode and use air in the cathode, making them significantly lighter and cheaper than other models. By using bifunctional electrocatalysts, MABs can be rechargeable. In that case, atmospheric $O_2$ is reduced in the cathode during discharge by the well-known oxygen reduction reaction (ORR), while the metal is oxidized to its ionic form. During the charge, the ions are reduced back to their metallic form, and the oxygen evolution reaction (OER) takes place at the positive electrode. Thus, efficient and lower-cost bifunctional electrocatalysts are required for the oxygen electrode to ensure good performance and commercial availability of MABs. Polyoxometalates (POMs), due to their unique structure and properties, have recently shown promise for energy storage and conversion applications. The present study analyses the potential application of POMs as cathodes for MABs, as cheap alternatives to noble metal-based electrocatalysts, further considering their contribution to facing the challenges of upgrading modern energy systems into more sustainable ones. Composites of different POMs with reduced graphene oxide (POM/rGO) were synthesized and characterized in terms of their structure, surface functional groups, surface morphology, and atomic composition. Fundamental studies were carried out for five transition-metal-based POMs containing manganese, iron, cobalt, nickel, and copper, all coordinated with rGO to ascertain their viability as catalysts for the OER and ORR. Finally, laboratory-scale MABs were built and tested to maximize their power density, testing each POM to determine the most active ones. This work paves the way for using low-cost POMs as cathode electrocatalysts for rechargeable MABs, enabling the development of these devices for efficient energy storage.

**Audience Take Away Notes**

- The audience will deepen their understanding of electrochemical methods and novel electrocatalytic materials
- This research shows promising results in using POMs for electrochemical conversion and storage devices
- The work could lead to further studies on this class of materials in the field of electrochemistry or to further research on other applications for POMs
- The study shows POMs as viable alternatives to high-cost noble-metal based electrocatalysts

**Biography**

Diogo M.F. Santos is an Invited Assistant Professor at Instituto Superior Técnico (IST, ULisboa, Portugal) and a Researcher at the Center of Physics and Engineering of Advanced Materials (CeFEMA), studying electrodes and membranes for application in fuel cells and electrolysers. D.M.F. Santos has authored over 170 papers, and his current h index is 33. He is on the World's Top 2% Scientists list of Stanford University for the impact in 2020 and 2021. D.M.F. Santos has presented more than 70 oral communications and 80 posters at international conferences. His main research interests are related to electrochemical energy conversion and storage.

**F.J. Pallares*, L. Pallares**

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# Seismic isolator for masonry infill's to reduce dynamic interaction with RC frames and steps towards a more environmental friendly design

In seismic design, conventional enclosures and partitions are usually treated as non-structural elements. Many seismic experiences around the World, such as the one that occurred in Lorca (Spain) in 2011, among others, emphasize the importance of considering all the elements taking part in the dynamic response of a building, as claimed by many Standards.

Most of the seismic Standard around the World, and particularly the Spanish seismic standard NCSE-$0_2$ (in 4.2.4) and the European EC-8 (in 4.3.6.2 and 4.3.6.4) indicate that non-structural elements that can alter the conditions of the structure should be taken into account for the preparation of the structural analysis model, and checked; or, alternatively, constructive solutions which guarantee the non-participation of these elements could be adopted.

A seismic isolator has been developed to isolate the response of the structural skeleton of buildings from the interior/exterior partitions response, with the aim of avoiding dynamic interactions that could lead to beam/column failures or heavy damage in walls. This seismic isolator made with conventional materials is currently being redesigned, blending different materials mainly from demolition waste to get a more environmental-friendly isolator.

The aim of this communication is to present results obtained from a laboratory campaign that makes clear the changes in stiffness when infills are considered in the calculations. It is shown the important changes in the response of the frames that should be addressed in the designing phase, either taking the walls into consideration in the calculations or adopting isolation measures. Furthermore, the advances in getting a seismic isolator with a mix of materials more friendly from an environmental point of view are also reported.

**Audience Take Away Notes**

- The audience will be aware of the interaction between masonry infills and RC frames in buildings
- It will help the audience in the design of more resilient seismic buildings
- This research could be used by other faculty to expand their research or teaching
- It is a practical solution to the problem of seismic interaction between masonry infills and RC frames in buildings
- This solution improves the design of buildings from a seismic point of view when masonry partitions take a role in the construction
- Steps on the design towards an eco-friendlier material using construction demolition waste could be interesting for the audience

**Biography**

Dr. Francisco Pallarés is a researcher in the Universitat Politecnica de Valencia devoted to study the seismic response of historical masonry structures and seismic interaction between infills and RC frames. He works in the Institute of Concrete Science and Technology conducting experimental full scale laboratory tests to study structural responses to cyclic loads. He has contributed in more than 100 conference and journal papers and currently is also interested in developing more environmental-friendly materials to be used in construction.

magnus Group

# 13-15 MARCH


DAY 02

**KEYNOTE FORUM**

4TH EDITION OF
INTERNATIONAL CONFERENCE ON

# MATERIALS SCIENCE AND ENGINEERING

## 2D/3D manufacture of advanced ceramics for demanding applications

The processing of advanced functional ceramic powders and suspensions into useful engineering components has been investigated via a series of research projects each focusing on a different stage of the manufacturing route viz., (i) the ability to control the agglomerates present in the ceramic powder resulting in the production of a free-flowing and crushable powders, (ii) the formation of low viscosity but high solids content nanoceramic suspensions suitable for 2D and 3D additive layer manufacturing (Screen Printing and 3D printing) and (iii) the use of novel field assisted sintering techniques (FAST). This holistic approach helped to transfer the developments achieved in each stage of the manufacturing process to the next and resulted in the ability to form fully dense advanced ceramic components whilst restricting the grain growth to a minimum.

The methodology has been employed to develop various advanced functional ceramic components such as Multilayer X8R Ceramic Capacitors, 3D printed $BaTiO_3$ based light-weight PTCR heaters for automotive and aerospace applications that surpasses existing commercial counterparts, ultra-low loss microwave dielectrics for beyond 5G communication devices, additively manufactured (AM) zirconia based biomedical components exhibiting vastly superior hydrothermal ageing resistance and mechanical performance suitable for use in biomedical implants (eg., hip/knee prosthesis, finger joints, dental and jaw repairs), petro-chemical valve parts as well as for ballistic armour applications. Significant sustainability advantages were noted with AM compared to conventional subtractive manufacturing methods in terms of reduction in material wastage and process efficiency. 3D printing of hydrothermally immune nanostructured dental implants was regarded as one of the six best modern technological developments in materials science by a recent BBC documentary (Materials of the Modern Age: The Secret Story of Stuff). These novel advancements are covered by a series of patents and papers and this talk will provide an overview of some of these developments.

**Audience Take Away Notes**

- The researchers, academics and industrial colleagues will learn the state-of-the-art developments in the rapidly growing field of additive manufacturing of ceramics
- It will help the audience to understand the parameters that control the 3D printing of advanced ceramics, the challenges associated the ink formulations and post processing of printed parts
- They will be able to understand the advantages of using field assisted sintering methods for the rapid densification of advanced ceramic components and how to effectively employ them to minimize grain growth whilst maximizing densification

**Bala Vaidhyanathan**

Department of Materials, Loughborough University, United Kingdom

**Biography**

Bala Vaidhyanathan is a Professor of Advanced Materials and Processing and was the Associate Dean for Enterprise at the School of Aeronautical, Automotive, Chemical and Materials Engineering at Loughborough University. He leads the Advanced Ceramics Research Group in the Materials Department, won 45 research grants worth >£30.2M and has over 200 peer reviewed publications, named inventor on 17 patents, delivered >60 Plenary/keynote/invited presentations, organizing committee member for >10 global conferences and written six book chapters. He is the Editor of Advances in Applied Ceramics and on the Editorial Board for many International Materials' Journals. He had been a research staff at the Pennsylvania State University, USA, and a Lead Scientist at General Electric.

## Joining of ceramic materials by brazing: Relations between wetting, reactivity and interface microstructure

Conventionally, joining of ceramic materials by brazing is performed by a two-step process. The first step consists in coating the ceramic surface with a metal layer in order to improve wettability and the second one consists in brazing using a non-reactive brazing alloy with the ceramic material. Another method, presented in this talk, is to braze directly by using appropriate reactive alloys. In general ceramic substrates are not wetted by liquid metallic alloys, the contact angle being higher than 90°. However, a good wetting is a necessary condition for obtaining a good adhesion at interfaces. A way to improve wettability is to add specific solutes to the metallic matrix which react with the ceramic substrate and form wettable continuous layers of reactive compounds at the interface. In this work, the wetting experiments are performed under high vacuum by using either the classical sessile drop or the deposited drop method and the spreading process is followed by a CCD camera (25 frames/second) or a rapid camera (1500 frames/s). The brazing experiments are performed in sandwich configuration under high vacuum. Reactive interfaces for wetting and brazing samples are characterized by SEM, DRX and TEM. The purpose of this presentation is to focus on the fundamental issues of wetting and interfacial reactions in metal/ceramic systems and to analyse the main thermodynamic and kinetic factors governing them. Some examples of wetting and brazing of ceramic materials such as carbon, aluminium nitride, zirconia and silicon carbide will be presented and discussed. In particular, the confinement and size effect as well as the role of atmosphere on the microstructural evolution of the interfacial system in both wetting and brazing configurations will be discussed in detail.

**Audience Take Away Notes**

- People can enhance knowledge acquisition about non-reactive and reactive wetting of ceramic materials by liquid alloys
- This presentation will contribute to help audience in their job whose research and/or teaching works relate to interfaces
- It will contribute to enhance knowledge on the role of confinement and size effect on the evolution of a reactive interfacial systems
- Relation between wettability and brazability of ceramic materials

**Fiqiri Hodaj**

Univ. Grenoble Alpes, CNRS, Grenoble INP, SIMAP, F-38000 Grenoble, France

**Biography**

Fiqiri Hodaj is full Professor of Materials Science at University of Grenoble Alpes (Grenoble INP - Phelma). He received his PhD degree in Materials Science from Grenoble INP in 1988. He joined Grenoble INP in 1993 as Associate Professor and is full Professor since 2002. His research activities at SIMAP (Science, Engineering, Materials and Processes laboratory) are focused on the fundamental aspects of solid-liquid and solid-solid interfacial interactions (thermodynamics, wetting, nucleation, diffusion, reactivity) with particular applications to metal/ceramic and ceramic/ceramic joining by brazing alloys as well as to soldering in microelectronics. He is author of 5 monographs, 7 patents, about 100 publications in referred scientific journals and presented more than 30 invited talks at international conferences. He has supervised 20 PhD theses.

## Combining SiN MMI waveguides based on slot waveguide technology

Optical transceivers that function under a high-speed rate condition are demanded to have more optical power ability to overcome the power losses which is a cause of the need of using a larger RF line connected to the Mach-Zehnder modulator for fulfilling the high-speed condition. The classic solution to this problem is to use a better power laser with a high level of 120 milliwatts. However, this solution can be complicated for a photonic chip circuit due to the high cost and nonlinear effects, which can increase the system noise. Therefore, we propose a better solution to increase the power level using a 4x1 power combiner which is based on multimode interference (MMI) using a silicon nitride slot waveguide structure. The combiner was solved using the full-vectorial beam propagation method and the key parameters were analyzed using Matlab script codes. Results show that the combiner can function well over the O-band spectrum with high combiner efficiency of at least 98.1% and after a short light coupling propagation of 28.8 μm. This new study shows how it is possible to obtain a transverse electric mode solution for four Gaussian coherent sources using silicon nitride slot waveguides technology. Furthermore, the back reflection (BR) was solved using a finite difference time domain method and the result shows a low BR of 40.1 dB. This new technology can be utilized for combining multiple coherent sources that work with a photonic chip at the O-band range.

**Audience Take Away Notes**

- Yes It will help to understand how to combined waveguides using MMI technology
- Yes It will help them to design silicon photonic chips
- Yes, it can be used to improve the power losses which is a cause of the need of using a larger RF line
- Yes, it will improve the accuracy of the slot-waveguide design

**Dror Malka**

Faculty of Engineering, Holon Institute of Technology (HIT), Holon 5810201, Israel

**Biography**

Dror Malka received his BSc and MSc degrees in electrical engineering from the Holon Institute of Technology (HIT) in 2008 and 2010, respectively, Israel. He has also completed a BSc degree in Applied Mathematics at HIT in 2008 and received his Ph.D. degree in electrical engineering from Bar-Ilan University (BIU) in 2015, Israel. Currently, he is a Senior Lecturer in the Faculty of Engineering at HiT. His major fields of research are nanophotonics, super-resolution, silicon photonics and fiber optics. He has published around 50 refereed journal papers, and 50 conference proceedings papers.

## Avoiding low cycle fatigue conditions in solder material of IC packages

The presentation is an extension of the contents of the CRC book E. Suhir, Avoiding Inelastic Strains in Solder Joint Interconnections of IC Devices, CRC Press, Boca Raton, Florida, 2021. Three practically important problems associated with the reliability of solder joint interconnections (SJI) in IC packages are addressed:

1) Could inelastic strains in the solder material be avoided by a rational physical design, and if not, could the sizes of the inelastic strain areas be predicted and minimized? SJIs are the most vulnerable structural elements in the today's IC packages: the solder material often experiences inelastic strains, and, because of that, suffers from low cycle fatigue conditions, and its fatigue lifetime is often shorter than required for many applications. There is an obvious incentive therefore to explore ways to bring down the induced stresses and strains in this material, even, if possible, to an extent that the inelastic strains are avoided. If this is impossible, the size of the inelastic zones could be, desirably, predicted and minimized. 2)The difference between an highly reliable and an insufficiently reliable IC product is merely in the level of their never-zero probability of failure. Since SJIs are usually the most vulnerable structural elements in an IC package design, could this probability be assessed at the design stage and, if possible, made adequate for the given application? The recently suggested probabilistic design-for-reliability (PDfR) concept enables assessing the probability of the operational failure by using predictive analytical (mathematical) modeling that determines this probability from the highly focused, highly cost-effective, carefully designed and thoroughly conducted, when developing a new manufacturing technology, failure-oriented-accelerated testing (FOAT). Highly physically meaningful and flexible multi-parametric Boltzmann-Arrhenius-Zhurkov (BAZ) equation, developed about a decade ago, could be applied to predict this probability from the FOAT data. The BAZ equation is based on the Boltzmann's equation in classical thermodynamics, Arrhenius equation in physical chemistry and Zhurkov's equation in experimental fracture mechanics.

3) Should temperature cycling accelerated testing for SJIs be replaced with a more physically meaningful, less costly, less time- and labor- consuming and, most importantly, less misleading test vehicle? Temperature cycling, the most widespread accelerated test today, is costly, time- and labor consuming, and, most importantly, can result in misleading information. This is mostly because electronic materials' properties are temperature dependent, and testing is done in a temperature range, which is, as a rule, much wider than what the material will most likely encounter in actual operation. Since the highest thermal stresses occur in SJIs at low temperature conditions and, as is known from fracture

**Ephraim Suhir**

Portland State University, Portland, OR, and ERS Co., Los Altos, CA, USA

### Biography

Ephraim Suhir is on the faculty of the Portland State University, Portland, OR, USA, Technical University, Vienna, Austria and James Cook University, Queensland, Australia. He is also CEO of a Small Business Innovative Research (SBIR) ERS Co. in Los Altos, CA, USA, is Foreign Full Member (Academician) of the National Academy of Engineering, Ukraine (he was born in that country); Life Fellow of the Institute of Electrical and Electronics Engineers (IEEE), the American Society of Mechanical Engineers (ASME), the Society of Optical Engineers (SPIE), and the International Microelectronics and Packaging Society (IMAPS); Fellow of the American Physical Society (APS), the Institute of Physics (IoP), UK, and the Society of Plastics Engineers (SPE); and Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA). Ephraim has authored about 500 publications (patents, technical papers, book chapters, books), presented numerous keynote and invited talks worldwide, and received many professional awards, including 1996 Bell

mechanics, fatigue crack propagation is effectively accelerated by random vibrations, a low-temperature/ random-vibrations bias is suggested as an attractive substitute for temperature cycling, especially for applications, when such a bias reflects the actual loading conditions. The general concepts, findings and recommendations are illustrated by detailed numerical examples.

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13-15 MARCH


DAY 02

## SPEAKERS

4TH EDITION OF
INTERNATIONAL CONFERENCE ON

# MATERIALS SCIENCE AND ENGINEERING

**Maoyan Wang[1]*, Haider Ali[2], Simin He[3]**

[1]School of Physics, University of Electronic Science and Technology of China, Chengdu, Sichuan, China

## Probing chiral biomolecules based on a surface plasmon resonance sensor

A Kretschmann configuration surface plasmon resonance (SPR) sensor is proposed to detect the chirality parameter and refractive index of chiral biomolecules based on the propagation matrix method in this paper. Biomolecules exhibit optical activity (chirality, enantiomerism) that a molecule is not identical to its mirror image. The chirality parameter can strongly influence their functionalities. Therefore, the sensing, detection, and characterization of the chirality parameter are important for the concentration of a chiral sample, enantiomeric purity test, biological processes, and so on. Four wave vectors in a chiral medium and 4 × 4 transfer matrices are derived by using magnetoelectric coupling constitutive relations for a chiral medium. The transfer matrix connects four eigenstates and traces four transverse field components through adjacent layer to explain cross-polarization coupling because of the chirality parameter. The validation of the propagation matrix method is confirmed by means of numerical results. A sandwich-like sensor composed of graphene is employed. The effects of the temperature and chemical potential, which can be tuned either by the carrier density (chemical doping) or by a gate voltage, of the graphene on the sensing characteristics of the SPR sensor are discussed. The reflectivity and resonance angle of the SPR biosensor influenced by media parameters of the senor and chiral molecules are demonstrated. This work may provide some guidelines for a better design of surface plasmon resonance sensors against the chirality parameter and refractive index variations and may speed up prism SPR sensors' applications in detecting the chirality parameter of chiral molecules in the solid state, as well as in the solution state.

**Audience Take Away Notes**

- The propagation matrix method is given to probe chiral biomolecules via a Kretschmann configuration SPR sensor
- Structure of a Kretschmann configuration surface plasmon resonance sensor is presented
- Effects of Graphene on sensing characteristics of the SPR sensor are discussed

**Biography**

Maoyan Wang was born in Shandong, China, in 1979. She received the B. S. degree in physics from Ludong University, Yantai in 2004, M. S. degree from Xidian University, Xi'an, China, in 2006 and Ph. D. degree from University of Electronic Science and Technology of China (UESTC), Chengdu, China, in 2009. She is currently an associate professor with School of Physics, UESTC. Her main research interests include chiral sensing, computation electromagnetic, radio wave propagation, electromagnetic theory and its application.

**Ji-Young Shin[1]*, JinKwang Hwang[2]**

[1]Graduate School of Engineering, Nagoya University, Nagoya, Japan
[2]Graduate School of Energy Science, Kyoto University, Kyoto, Japan

# Exploration of secondary batteries with porphyrinoid electrode materials

Electrical power suppliers have addressed a significant amount of energy consumption while stimulating the invention of different types of energy sources. Secondary batteries are a powerful energy storage technology for portable electric instruments and vehicles, mostly relying on inorganic compounds. On the other hand, sufficiently superior organic molecules per compartment, especially organic molecules exposed to p-conjugation networks, adequately represent battery behaviour as potential electrode materials in terms of unique electrochemical activities induced by multiple, reversibly stable molecular oxidation steps. In the spotlight for their structural tunability and versatility, chemists and engineers explored sustainable organic electrode materials for practical rechargeable batteries in the present study. We paid attention to addressing the sequential contributions of electrochemical/electrophysical processes, which is the vital key to driving the cell's fast charge/discharge performance and long-term cyclability.

**Audience Take Away Notes**

- The presenter wants to introduce electromagnetic features of organic molecules that can play an essential role tin sustainable cell performances
- We should improve the efficient preparation methods for the desired organic molecules
- Organic compounds probably provide relatively secure systems

**Biography**

Dr. J.-Y. Shin studied Chemistry at the Seoul Women's University, Seoul, Korea, and graduated with an MS in 1997. She then joined the research group of Prof. Atsuhiro Osuka at Kyoto University, Kyoto. She received her Ph.D. degree in 2001 from the same institution. After three years of postdoctoral fellowship followed by three and half years of research associate supervised/directed by Prof. David Dolphin at the University of British Columbia, BC, Canada, she joined the research group of Prof. Kimoon Kim at Pohang University of Science and Technology (Postech), Korea, as a research assistant professor. She then obtained the position of a Designated Associate Professor, followed by a Designated Professor at G30 International Education Program at Nagoya University, Nagoya, Japan. She was promoted to a tenured professor in 2021. She has published more than 60 research articles in SCI (E) journals.

**Cornelia G. Palivan**
Department of Chemistry, University of Basel, Basel, Switzerland

## Clusters of catalytic bio-nano compartments for applications in biomedicine

Compartmentalization is fundamental in nature, where the spatial segregation of biochemical reactions within and between cells ensures optimal conditions for the regulation of cascade reactions. One of the most promising strategies to mimic nature compartimentalization is to combine synthetic nano-compartments with biomolecules in order to develop artificial organelles and to generate a more complex architecture and functionality, as cell mimics. Here, we present how clusters of bioinspired catalytic nanocompartments support cascade reactions able to enhance production of specific compounds in vitro. First, we generate individual catalytic nanocompartments (CNCs) by encapsulating within polymersomes enzymes involved in a cascade reaction and then, tether the polymersomes together into clusters. DNA hybridization between single DNA strands and complementary DNA strands exposed on different CNCs droves the clusterization process and controls the distance between the respective catalytic nanocompartments. The cascade reaction between spatially segregated enzymes is significantly more efficient than when the catalytic nanocompartments are not linked together by DNA duplexes. Additionally, single DNA strands not engaged in clustering CNCs could be used to attach clusters to the cell surface, as evidenced by A549 cells, where clusters decorating the surface endowed them with a non-native enzymatic cascade. The self-organization into clusters of catalytic nanocompartments confining different enzymes of a cascade reaction allows for a distance control of the reaction spaces which opens new avenues for highly efficient applications in domains such as catalysis or nanomedicine, as for example as theranostic systems.

**Audience Take Away Notes**

- New technology to generate nanocompartments equipped with biomolecules
- Various medical applications can be addressed by changing the combination of biomolecules (e.g. protein therapy, nanotheranostics, dual biosensing)
- More efficient medical application for sensitive biomolecules that should be kept protected

**Biography**

Prof. Dr. Cornelia Palivan is currently Professor in the Chemistry Department at the University of Basel. The main focus of her research group is at the interface between physical-chemistry, nanoscience and biophysics, with particular emphasis on bio-nano-systems for translational applications. Her research interests are in the field of developing hybrid functional materials based on combinations of biomolecules with synthetic assemblies, and their interactions with cells or microorganisms. She published more than 170 research articles and reviews in the field, and received various prizes. She is international expert for evaluation of research projects (e.g. ERA-Chemistry and ERC grants program EU.

**Marianna Rotilio**
Department of Civil, Construction-Architectural and Environmental Engineering, University of L'Aquila, L'Aquila, Italy

## Smart and green panels for energy transition

Considering the European Union, the construction and built environment sector is responsible for 5-12% of total greenhouse gas emissions in connection with the extraction of materials and the manufacture of construction products. It has been estimated that more efficient materials could save 80% of $CO_2$ emissions. Intervening to make buildings sustainable does not only mean insulating the envelopes or improving their performance, but also considering the embodied energy, by valorizing alternative materials, such as recycled materials. The study of the state of the art, highlighted that a very important aspect is to stimulate the construction sector to open up experimentally towards new materials and their alternative supply chains. For these considerations, For these considerations, a research project will be presented that is part of the field of studies that aims to bring technological innovation within the construction industry, through the use of secondary raw materials, according to the paradigms of the circular economy, and thanks to additive manufacturing. The aim of the project was to create a new product according to the Key Enabling Technology of 'advanced materials', intended for the thermal insulation of buildings. It is realized from waste, in particular from the industrial processing of paper and cardboard and embeds a series of wireless and battery-free sensors to monitor the environmental conditions and workers safety in the workspaces. This project leads to product and process innovation and is effective as a new strategy for the energy transition and for Industry 4.0

**Audience Take Away Notes**

- The research developed succeeds in overcoming the critical issues related to additive manufacturing and the use of a specific type of waste. Therefore, it is considered to be of great impact as it is able to open up new hypotheses for the use and utilization of secondary raw materials. It also has a very high TRL and is therefore ready for technology transfer (it has resulted in three patents that are currently being examined)
- The project has a high interest with a high economic impact and, from the market point of view, will create new business opportunities as it is able to address different target sectors. Specifically, the main target markets are recycling materials and energy efficiency, all of which are currently experiencing exponential growth, building materials companies, and automation
- The multifunctional panel aims to provide a concrete answer to the growing demand for building management and control, and therefore offers numerous development potentials in the collaboration between elements and products equipped with ICT sensors. One only has to think of the integration between such a panel and high-tech systems for data storage and management, such as BIM software for example, an integration that represents the future scenario for intelligent buildings

**Biography**

Marianna Rotilio earned her Ph.D. in EU Building-Architectural Engineering in 2011 and currently working as senior researcher at the Department of Civil, Construction-Architecture, Environmental Engineering of the University of L'Aquila, Italy. Her research has been focused on issues relating to building production and components, also in a multidisciplinary key; to technologies and processes for the reuse, re-manufacturing and recycling of products, components and materials and the definition of new materials and new technologies for safety During her research career, she published over one hundred papers and participated in several conferences to present her research.

**Laurent Bernard[1]*, Flavien Ivol[2], Sandrine Lyonnard[3], Lionel Picard[1]**

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## Thermotropic ionic liquid crystals: Self-assembled single-ion conductors for lithium batteries

Lithium-ion batteries have been widely used in electronic device due to their high energy density, long cycling stability, and long lifespan compared to other battery technologies. However, their large-scale implementation in electric vehicles and energy systems of power stations is restricted mainly due to safety concerns

One of the most promising strategies to overcome these issues is the replacement of liquid electrolytes by solid-state

**Materials:** State-of-the art solid electrolytes are based on PEO and derivatives but their practical use is still hindered by low chemical stability and low ionic conductivity at operational temperature Nanostructured materials such as Thermotropic Ionic Liquid Crystals (TILCs) comprising a moving cation (Li+), are currently attracting a growing interest, for several reasons: tunable self-assembly, high ionic conductivities (~$10^{-3}$ $S.cm^{-1}$) and single-ion conduction (Transference number t+ 1). We are investigating the properties of TILCs made of a versatile family of TILC building blocks designed to encode advantageous properties. In this presentation, we will present our most recent results on the structural and functional properties of this new class of lithium-ion electrolytes. The various self-organized structures were established in function of molecular architecture by combining electrochemical, optical and scattering techniques. Liquid-crystals properties were established by combining results from POM (Polarized optical microscopy), DSC (Differential scanning calorimetry) and SAXS (Small angle X-Ray scattering) characterizations techniques. The structure-transport interplay was further investigated by performing advanced characterization at large-scale facilities including Quasi-Elastic Neutron Scattering and SAXS experiments, used to probe lithium-ion dynamics at molecular scale and nanoscale organization, respectively. Electrochemical characterizations such as EIS (Electrochemical Impedance Spectroscopy) was used to highlight nanostructure – ionic transport correlations. The potentialities of this class of materials as single-ion conductors and further routes for improvement will be discussed.

**Audience Take Away Notes**

- A new class of solid-state electrolyte will be presented. That will allow to widen the possibilities of solid-state electrolyte used in the next battery generations (4A-4B) for the scientific community
- Unusual techniques and/or combinations of techniques will be presented as well as the results extracted from them. In this case, quasi-elastic neutron scattering is a very powerful techniques but not used as much as it should to describe molecular dynamics in materials. It could be applied and used in many other research fields
- The use of TILCs can in fine facilitate the process to make lithium batteries due to their mechanical properties. It also improves the safety of the final cell by having a shut-down effect in case of thermal runaway: if the temperature inside the cells increases above the mesophase transition, the ionic conductivity is reduced thus decreasing the thermal runaway

**Biography**

Dr. Laurent Bernard studied chemistry and materials science at the Lyon 1 university, France and CPE Lyon engineer school and graduated in 2015. He then joined the CEA (French Alternative Energies and Atomic Energy Commission), France and received his PhD in 2019. His research focused on organic solid-state electrolyte for lithium batteries. He continued his research work as junior researcher in the material Laboratory at CEA, France. He has published 4 research articles and several patent on battery electrolytes.

**Michal Urbanczyk[1]*, Janusz Adamiec[2]**

[1]Tukasiewicz Resarch Network—Institute of Welding, Btogostawionego Czesława Gliwice, Poland

[2]Faculty of Materials Engineering, Silesian University of Technology, Krasinskiego Katowice, Poland

## The welding of two-layer (composite) tubes with the use of laser technology

Welding technologies are the most popular technologies used in the joining of steels. Increasing demands concerning the quality of welded joints and the need to increase the efficiency of the welding process force designers and technologists to look for new and innovative joining methods.

Power generation is one of the most important sectors of the economy. Today, innovative materials and technologies are key elements of power generation development.

The development of new-generation steels is closely linked to the ever-growing power industry. Elements of power boilers are protected against the aggressive effects of combustion products by ceramic liners or overlay welds characterised by high corrosion resistance and heat resistance. Flue gases formed during waste combustion contain very aggressive and environmentally harmful compounds, including sulphides, chlorides and fluorides.

To date, the most popular process used in the power industry to increase the durability of boiler components involves surfacing the latter with nickel-based alloys. Nickel alloys are characterised by very good service properties. The above-named materials are resistant (within a wide temperature range) to the effects of a corrosive environment, and, in particular, to pitting as well as intergranular and crevice corrosion.

Another solution applied to protect boiler components from the aggressive effects of combustion products is the use of double-layer tubes (commercially referred to as composite tubes).

A two-layer tube is used where conditions outside and inside the tube require material properties which cannot be provided by only one material. Such a tube consists of two different alloys, combined metallurgically to achieve good heat transfer properties. One alloy is used to resist corrosion, while the other one is tasked with preventing creep processes.

The paper presents the results of research concerning the application of laser welding technologies used for the butt joining of double-layer tubes.The tests were carried out on 3R12/4L7 and Sanicro 38/4L7 grade two-layer tubes produced by the Sandvik company. The research also included the adjustment of parameters of the laser welding of the inside layer (steel 4L7 - 1.0425) as well as of the hybrid welding (laser + MAG) and of the surfacing of the outside layer (steel 3R12 - 1.4301, steel Sanicro38 - 2.4858).

The welding of double-layer tubes was carried out in two steps. First, the inside layer of the tube (4L7) was made with a beam of laser radiation (without the filler metal). The second stage of the process involved hybrid surfacing with the use of the filler metal (3R12, Sanicro38).

The research revealed that the laser welding method used to join the test tubes (4L7 - inside layer) made it possible to obtain quality butt joints with the uniform face and the properly formed root (meeting the requirements of quality level B according to ISO 19319-1).

The use of the hybrid surfacing process for the deposition of the outside layer of the pipe enabled the obtainment of the overlay weld with the properly shaped face (meeting the requirements of quality level B according to ISO 12932).

**Audience Take Away Notes**

- The audience will able to learn about the laser and hybrid welding process
- The developed welding technology is a new and innovative solution
- The results can find practical application in the economic sector (e.g. power industry)

**Biography**

Michat Urbanczyk, PhD, received his doctoral degree in 2018 from the Faculty of Materials Engineering and Metallurgy at the Silesian University of Technology. He currently works as an Area Leader in the Welding Technologies Research Group in the Laser Technology Laboratory at the Lukasiewicz Research Network - Institute of Welding. The author and co-author of over 30 projects concerning industrial implementations of laser and hybrid welding technologies. The co-author of 2 patents and 3 patent applications in laser and hybrid welding. The author and co-author of over 20 scientific publications on laser and hybrid welding in reputable journals.

**Aluri Sai Sree Sarayu**

Department of Chemical Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India

## General processing characteristics of low temperature co-fired ceramic (LTCC) technology and the creation of 3-D structures for micro-fluidic devices

The foundation of low temperature co-fired ceramic technology (LTCC) is the sintering of multi-layered thick-film sheets (50-250 m) or green tapes, which are screen-printed with thick-film pastes like conductors, resistors, and other components. The words low temperature and co-fired refer to the simultaneous firing of tapes and screen-printed thick-film materials and the relatively low sintering temperatures (9000 c) compared to typical ceramics, respectively. These qualities are attained by enhancing the tapes' inherent qualities and adapting the physical and chemical features of thick films to those of tape, while yet maintaining their inherent functional qualities. Evidently, mastering the technology necessitates a fundamental comprehension of the problems with tape and paste compatibility and how processing conditions affect this relationship. The reason for using carbon-black sacrificial paste to create 3-D micro-fluidic devices without the channel walls sagging is the origin and degree of chemical and physical interactions between co-fired components. Recently, one of the most alluring microtechnology options for a variety of applications has been LTCC technology. It has long been recognised as the best substrate for high-frequency electronics that need quicker communication speeds and smaller dimensions. This is made possible by LTCC tapes' low dielectric constant and loss, which allow them to be burned at low temperatures with low-resistance conductors (Au, Ag, Cu, etc.). Furthermore, the method is appealing for additional applications like sensors and micro-fluidics due to the ease of handling of tapes for 3-D structuration, screen-printing with thick-film electrical components, chemical inertness, and hermeticity. An alternative approach for better processing is proposed. Additionally, the creation of comparable structures and the production and use of a carbon-sacrificial layer will be discussed.

**Audience Take Away Notes**

- Address the processing-related issues that LTCC technology frequently encounters
- Discuss about how to prepare and use a carbon-sacrificial layer, and appropriate structures will be made
- Explains an efficient way to reduce the extent of the problem

**Biography**

Aluri Sai Sree Sarayu is currently studying B.Tech in Chemical Engineering at Chaitanya Bharathi Institute of Technology. She took part in two conferences.

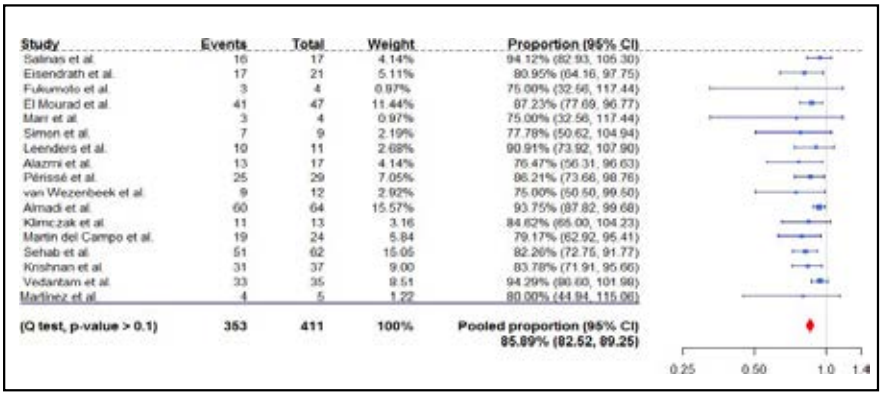
**Andreu Martinez Hernandez[1*], Homero Beltrán Herrera[1], Vicente Martinez Garcia[2]**

[1]Department of General Surgery, University General Hospital, Castellon, Spain.
[2]Professor of Applied Mathematics. Department of Mathematics, Jaume I University, Castellon, Spain.

# Stent management of leaks after bariatric surgery: A systematic review and meta-analysis

**Background:** Despite the low rates of complications of bariatric surgery, gastrointestinal leaks are major adverse events that increase post-operative morbidity and mortality. Endoscopic treatment using self-expanding stents has been used in the therapeutic management of these complications with preliminary good results. The aim of our study was to examine the safety and efficacy of the use of stents for the treatment of leakage after bariatric surgery. Methods: We performed a systematic review and meta-analysis of self-expanding stents placement for the management of gastrointestinal leaks after obesity surgery. Overall proportion of successful leak closure, stent migration and reoperation were analysed as primary outcomes. Secondary outcomes were patients' clinical characteristics, duration and type of stent, other stent complications, and mortality.

**Results:** A meta-analysis of studies reportin stents (between 2005 and 2020) was performed, including 488 patients. The overall proportion of successful leak closure was 85.89% (95% CI, 82.52- 89.25%), median interval between stent placement and its removal of 44 days. Stent migration was noted in 18.65 % (95% CI, 14.32-22.98%) and the overall proportion of re-operation was in 13.54 % (95% CI, 9.94-17.14%). The agreement between reviewers for the collected data gave a Cohen's □ value of 1.0. No deaths were caused directly by complications with the stent placement.




**Conclusion:** Self-expanding stents can be used for the management of gastrointestinal leaks after bariatric surgery with a high rate of effectiveness and a low mortality rates. Nevertheless, reintervention and stent migration represents a real problem with rates as high as 13.54% and 18.65 %, respectively. Therefore, more studies (probably, endoscopic combined methods) are still needed to establish a definitive basis for leak management after bariatric surgery and reduce migration rates.

**Audience Take Away Notes**

- The aim of our study was to examine the safety and efficacy of the use of stents for the treatment of leakage after bariatric surgery
- Overall proportion of successful leak closure, stent migration and reoperation were analysed as primary outcomes
- Self-expanding stents can be used for the management of gastrointestinal leaks after bariatric surgery with a high rate of effectiveness and a low mortality rates

**Biography**

Graduate in Medicine from the Catolic University of Valencia, Spain. General and Digestive Surgeon. Master University in General and Digestive Surgery. Master University in trauma and bullhorn injuries. Master University in Obesity Surgery. Training Fellowship in Trauma and Acute Care Surgery at Sotero del Rio Hospital, Santiago de Chile. Consultant Endocrine, Bariatric and Metabolic Surgery at University General Hospital of Castellon, Spain.The scientific research was in line with this addressing various areas of investigation, including general surgery and endocrine-metabolic-obesity surgery; in addition to trauma and bullhorn injuries studies.

**Eugeny M. Pestryaev**
Physics department, Ufa State Petroleum Technological University, Ufa, Russia

## The cage effect and the frenkel line in the phase diagram

The self-diffusion coefficients and particle lifetimes (t) of the Lennard-Jones liquid in the first coordination sphere of their neighbors were studied by the molecular dynamics simulation for system packing fractions from 0.1 to 0.8. It turned out that the distribution of □ is characterized by a wide peak in the region of short times, extending over several decimal orders. It is shown that using a coordination number Z as an argument for the studied characteristics clearly demonstrates emerging and developing the cage effect. The observed self-diffusion-coefficient dependence on the packing fraction is described by the latest self-diffusion theoretically based equation, excluding the system gaseous state, for which this equation was not intended.

The interval Z=5-7, in which the system condensation starts and finishes, coincides with its theoretical value that is necessary to close the cage over the total system. Completing the cage closure leads to the possibility of propagation in such medium of high-frequency transverse elastic waves and, according to the definition, transforms it from a soft state to a solid one, characterized by appearing the shear viscosity. Locating this transition in the phase diagram with a change in thermodynamic parameters forms a continuous curve, has recently been discovered in experiments by academician V.V. Brazhkin with coauthors and called the Frenkel line in honor of the scientist, who has introduced the fruitful cage concept into the liquid theory.

**Audience Take Away Notes**

- The report presents the physical foundations of the cage effect and its quantitative structural characteristic
- This structural characteristic allows to select on the phase diagram a new thermodynamic phase transition in a supercritical fluid, discovered experimentally in 2012
- There has always been a long road from knowledge of fundamental regularities to their implementation in some technologies: a researcher who understands the fundamental properties of matter can describe what these properties are and under what conditions they are realized, but he does not give recommendations to process engineers of various profiles on their use

**Biography**

Dr. E.M. Pestryaev is a molecular physicist by training and received his PhD degree at the Kazan State (Federal) University on studying the structure and dynamics of polymer systems by NMR relaxation. Currently he is an associate professor at the USPTU physics chair. His scientific work focuses on the molecular dynamics simulating the self-diffusion features and their influence on spin-spin magnetic relaxations in condensed media – the long-standing highly specialized problem. He has published more than 40 research articles in Scopus journals, the most of which are without coauthors.

**Dr. Tushar R. Dandekar**

Department of Metallurgical Engineering and Materials Science Indian Institute of Technology Bombay Powai, Mumba, Maharashtra, India

## Effect of microstructure and texture on the evolution of mechanical properties in a cold rolled and annealed UNS S32101 lean duplex stainless steel sheet

In the present investigation, the effect of microstructure and texture on the evolution of mechanical properties during recrystallization for 80% unidirectionally cold rolled UNS S32101 lean duplex stainless steel (LDSS) sheet was investigated. Microstructures were observed using optical microscope (OM), scanning electron microscope (SEM) and electron backscattered diffraction (EBSD), while bulk texture was measured by X-ray Diffraction (XRD). Cold rolled samples showed Brass-type texture for austenite and strong □-fiber (RD//<110>) and □-fiber (ND//<111>) for ferrite. Increase in cold rolling resulted in the formation of strain-induced martensite (a', SIM) from austenite (g). However, with annealing, γ seems to increase as the process leads to reversing the effect of cold rolling i.e., reversion of a' to g. The morphology of grains changed from lamellar to near globular with an increase in the annealing time. The texture intensity reduced after recrystallization for both austenite and ferrite. A sharp decrease in stored energy (275 kJ/$m^3$ to 650 J/$m^3$ (austenite) and 293 kJ/$m^3$ to 520 J/$m^3$ (ferrite)) and hardness was observed with increase in fraction recrystallized. Tensile properties and hardness were obtained for deformed and fully recrystallized samples. After annealing for 2 minutes and above, hardness reached a constant value of ~180±5 Hv. and ΔR calculated from tensile tests increased with increase in annealing time.

**Keywords:** Lean duplex stainless steel, Formability, Texture, EBSD, Recrystallization.

**Audience Take Away Notes**

- Microstructure evolution and texture development during annealing was linked with mechanical properties
- Cold rolling resulted in the formation of strain-induced martensite (a', SIM) from austenite (g) while annealing reversed the effect of cold rolling i.e., reversion of a' to g
- The morphology of grains changed from lamellar to near globular with an increase in the annealing time
- Cold rolled samples showed Brass-type texture for austenite and strong □-fiber (RD//) / γ-fiber (ND//) for ferrite
- The texture intensity reduced after recrystallization for both austenite and ferrite

**Biography**

Dr. Tushar R. Dandekar is postdoctoral project research associate from Indian Institute of Technology, Bombay (IITB) India in the department of Metallurgical Engineering and Materials Science. He has recently (June 2022) completed his Ph.D. from Visvesvaraya National Institute of Technology (VNIT) Nagpur, INDIA. He has more than 10 publications in reputed SCI/SCI-E international journals in the field of Mechanical Engineering and Material science. He also serves as a reviewer in more than 5 SCI/SCI-E international journals.

**M. Senthil Kumar**

Department of Physics, Indian Institute of Technology Bombay, Mumbai 400076, India.

## Magnetotransport properties of metal-silicon multilayers

Thin film multilayers composed of alternating layers of magnetic and nonmagnetic layers have attracted the scientific community due to their interesting magnetic properties and industrial applications. We have investigated metal-silicon multilayers in which the Fe layers are the ferromagnetic layers. Silicon layers were used as the spacer layers. Several multilayers of the form $[Fe(tFe)/Si(tSi)]_{20}$ were prepared by dc magnetron sputtering. X-ray diffraction studies show that the Fe layers are polycrystalline whereas the Si layers are amorphous. X-ray reflectivity measurements showed the formation of periodic multilayers. High resolution transmission electron diffraction patterns also confirmed the formation of nanocrystalline Fe layers. M-H and M-T magnetization studies on the samples indicated the formation ferromagnetic layers of Fe. Anomalous Hall effect studies showed large enhancement of anomalous Hall coefficient. The results indicated the role of Fe/Si interfaces on the enhancement of the anomalous Hall effect. Scaling law studies showed that the side jump is the dominant scattering mechanism. Further investigations also showed high Hall sensitivity when compared with other Fe based multilayers.

**Audience Take Away Notes**

- The presentation will describe the experimental results obtained on the multilayers and analysis of the data
- The audience working in the area of magnetic multilayers will be able to use the knowledge in this area for their research
- Faculty and students in the relevant areas will be able to expand their research activities

**Biography**

Prof. M. Senthil Kumar received his PhD degree from IIT Madras, India. He then joined as a postdoctoral fellow in Geneva University, Switzerland. Later he joined as a postdoctoral fellow at Paul Scherrer Institute-ETH Zurich, Switzerland. In 1999, he joined the Physics Department in IIT Bombay, India and he is currently working as a Professor.

**Shahnaz Ghasemi[1*], Mohsen Padervand[2]**

[1]Sharif Energy, Water, and Environmental Institute, Sharif University of Technology, Tehran, Iran

## An overview of heterogonous photocatalysts and their application in wastewater treatment: Reactor design and operational conditions

Over the last few years, rapid urbanization and poor regulation have resulted in continuous degradation of the natural ecosystem due to unrestrained wastewater flow from numerous industries, hospital wastes, and labs. However, traditional treatment methods, primarily biological wastewater treatment, cannot eliminate resistant compounds in most cases, depending on the wastewater source. As a result, these compounds, denoted non-biodegradable compounds, remain unchanged in treated water and were more concentrated in food chains following irrigation with such water. Whether these materials will affect humans or aquatic organisms over the long term is unknown.

Nevertheless, trace concentrations of such materials can result in the development of resistant bacteria or genes. Advanced oxidation processes have been considered as effective alternative methods that can be implemented as post-treatment methods. These methods are based on the generation of hydroxyl radicals which act as powerful oxidation agents and can oxide all chemical compounds. The utilization of sunlight as a sustainable source for the generation of hydroxyl radicals as oxidation agents has recently attracted great interest. one of the efficient strategies for utilizing sunlight in water treatment relies on photocatalytic techniques Photocatalysis, especially heterogeneous photocatalysis technology, is one of the most promising approaches to using sunlight energy to overcome environmental contamination issues. In this regard, green synthesis and application of semiconductor-based nanocomposites for treating residual contamination in wastewater are considered as practical solutions for eliminating such contaminations. In this research, Ionic liquids (ILs) as low vapor pressure and green solvents have been applied to synthesize different photocatalysts such as $TiO_2$, $BiVO_4$, and $FeVO_4$. The effect of IL on crystal structure, surface area, bandgap, and photocatalytic activity of mentioned photocatalysts has been investigated. Moreover, the impact of treatment conditions and operational parameters on the photocatalytic degradation of pollutants has been extensively studied.

**Audience Take Away Notes**

- Challenges associated with water reuse
- Weaknesses of traditional wastewater treatment techniques
- Reuse of treated water and concerns about water quality
- Technology for posttreatment of different wastewater
- Green solvent-based synthesis of photocatalysts

**Biography**

Dr. Shahnaz Ghasemi received her MSc and Ph.D. degrees in physical chemistry from Sharif University of Technology, Tehran, Iran. Her studies focused on both environmental and energy issues. She also complished her post-doctorate in Material Sciences with special attention on synthesis and properties of materials for Lithium-ion Batteries within TUM CREATE –a joint research program between TUM (Technical University of Munich), Germany, and NTU (Nanyang Technological University), Singapore. Currently, she is an assistant professor at Sharif University of technology, working on environmental and energy challenges.

**[1,2*]Barbara Flora, [1]Stefano Di Girolamo, [2]Di Nardo Paolo[3-4]Alba Scerrati, [5]Federica Trovalusci, [5]Silvia Vesco**

[1]Department of Otorhinolaringology, Tor Vergata University of Rome, Rome, Italy
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[5]Department of Enterprise engineering , Tor Vergata University of Rome, Rome, Italy

## Strategies of additive manufacturing in cranioplasty

With advances of 3D printing technologies, possibilities to produce patient specific cranioplasty emerged, as an alternative to the use of autologous bone.

In our study, three different strategies were applied exploiting Fused Deposition Modeling (FDM) additive manufacturing, and compared: (i) direct printing of PLA (polylactic Acid) prosthesis, mold casting of Poly(methyl methacrylate) (PMMA) prosthesis using (ii) silicone mold, (iii) Thermoplastic Poly Urethane (TPU).

All the techniques studied returned good results in terms of geometrical accuracy, and cosmetic appearance.

Direct printing of PLA prosthesis resulted the fastest strategy, followed by PMMA casting into silicone mold, and TPU mold, in the order. In terms of costs, TPU mold featured the lowest price, followed by silicone mold, and direct printing of medical-grade PLA skull-cap.

Nevertheless, the definitive choice of procedure still strongly depends on the expertise of the team, facilities available within the hospital structure, and a contingent preference on a specific material over another.

**Audience Take Away Notes**

- To reproduce new TPU molds
- Could be a different mold material for PMMA
- Could be a cheaper material to produce mold

**Biography**

Dr. Barbara Flora studied Otorhinolaryngology at the Tor Vergata University of Rome with the guide of Professor S. Di Girolamo, and graduated as a MD at the La Sapienza University of Rome in 2014. She then joined the research group of Prof. Paolo Di Nardo (CIMER Center of regenerative medicine) during the PhD in Tissue Engenieering and Technology for body function in 2019, during her last yeatr of residency in Otorhinolaryngology. She will disccuss her PhD thesys this year at the same institution. She just completed her one year of fellowship program in Facial Plastic Surgery for the European Academy of Facial Plastic Surgery (EAFPS) supervised by Dr Neves in Lisbon, Portugal. France she obtained the position of an Associate Professor at the IGIC. She has published differents articles in SCI(E) journals.)

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# 13-15 MARCH


DAY 03

**KEYNOTE FORUM**

4TH EDITION OF
INTERNATIONAL CONFERENCE ON

# MATERIALS SCIENCE AND ENGINEERING

## Lattice reactions governing reversibility and pseudo elasticity in shape memory alloys

Shape memory alloys take place in a class of adaptive structural materials called smart materials by giving stimulus response to changes in the external conditions. These alloys exhibit a peculiar property called shape memory effect. These alloys are functional materials with these properties and used as shape memory elements in many interdisciplinary fields. This phenomenon is initiated with thermomechanical treatments on cooling and deformation and performed thermally on heating and cooling, with which shape of materials cycles between the original and deformed shapes in reversible way. Therefore, this behavior can be called thermal memory or thermoelasticity. Deformation in low temperature condition is plastic deformation, with which strain energy is stored in the materials and released on heating by recovering the original shape. This phenomenon is governed by the thermomechanical and thermoresponsive reactions, thermal and stress induced martensitic transformations. Thermal induced martensitic transformations occur on cooling with cooperative movement of atoms in <110 > -type directions on a {110} - type plane of austenite matrix, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures. The twinned structures turn into detwinned martensite structures by means of stress induced martensitic transformations with deformation. These alloys exhibit another property, called pseudoelasticity or superelasticity, which is performed in only mechanical manner with stressing and releasing the material in elasticity limit at a constant temperature in the parent austenite phase region, and shape recovery occurs instantly on releasing by exhibiting elastic material behavior. Superelasticity is performed in non-linear way; loading and releasing paths are different, and cycling loop refers to the energy dissipation. Superelasticity is also result of stress induced martensitic transformation, and the ordered parent phase structures turn into the detwinned martensite structures by stressing. Copper based alloys exhibit this property in metastable beta-phase region. Lattice twinning is not uniform in these alloys and cause the formation of unusual complex layered structures. In the present contribution, x-ray diffraction and transmission electron microscopy (TEM) studies were carried out on copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns reveal that both alloys exhibit super lattice reflections inherited from parent phase due to the displacive character of martensitic transformation.

**Keywords:** Shape memory effect, martensitic transformation

### Osman Adiguzel

Department of Physics, Firat University, Elazig, Turkey

**Biography**

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied on shape memory alloys. He worked as research assistant, 1975- 80, at Dicle University and shifted to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has been retired on November 28, 2019, due to the age limit of 67,following academic life of 45 years. He published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Also, he joined over 70 online conferences in the same way in pandemic period of 2020-2021.

**Audience Take Away Notes**

- Shape memory alloys are sensitive materials to the external conditions, and they are used shape memory elements in many fields from biomedical application to the aeronautical industry. Shape memory effect is an interdisciplinary subject, and in principle, I introduce the basic terms and definitions related to the shape memory, reversibility, and crystallographic transformation at the multidisciplinary conferences, and tell the experimental results

## Engineering applications of nanotechnology

This seminar focuses on the usage of nanotechnology in different fields of engineering. So, the listener or readers will find valuable information as to how nanotechnology can help in improving our life of materials exposed to many circumstances, starting from the medieval period of time until processes in medicine, energy, environment, communications, technology, engineering, manufacturing and others including the studies and researches on physics, chemistry, biology, mathematics and others. Moreover, this unique information and knowledge present the latest research on nanoscale phenomena to display the multi-application for a brilliant future.

**Audience Take Away Notes**

- Elaborate the industrial application of nanotechnology
- It will help the researchers and scientists
- Present the advantages of nanotechnology
- Avoid the disadvantages of nanotechnology

### Yarub Al-Douri

American University of Iraq, Sulaimani, Iraq

**Biography**

Prof. Dr. Yarub Al-Douri is from American University of Iraq, Sulaimani. Al-Douri has initiated Nanotechnology Engineering MSc Program and Nano Computing Laboratory. He has received numerous accolades including World's Top 2% Scientists by Stanford University, USA 2022, 2021 & 2020, OeAD Award, Austria 2020, JSPS Award 2019, AUA Award 2019, IFIA 2019, TWAS-UNESCO Associateship (Twice) Award 2015 & 2012, the total is 70 awards. Al-Douri is Associate Editor of Nano-Micro Letters (Q1), Editor-in-Chief of Experimental and Theoretical NANOTECHNOLOGY, Editor-in-Chief of World Journal of Nano Science and Engineering.

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# 13-15 MARCH


DAY 03

## SPEAKERS

4TH EDITION OF
INTERNATIONAL CONFERENCE ON

# MATERIALS SCIENCE AND ENGINEERING

**Vladislav Bogdanov**
Progressive Research Solutions, Sydney, NSW, Australia

## About problem of plane strain state of two-layer body in dynamic elastic-plastic formulation

The design of composite and reinforced or armed materials is a requirement of the modern level of production and life. Many methods of calculation and design of such materials are successfully used. In this article, for the design of composite and rein-forced materials, a technique for solving dynamic contact problems in more precise an elastic-plastic mathematical formulation is used. To consider the physical nonlinearity of the deformation process, the method of successive approximations is used, which makes it possible to reduce the nonlinear problem to a solution of the sequences of linear problems. In contrast to the traditional plane strain, when one normal stress is equal to a certain constant value, for a more accurate description of the deformation of the sample, taking into account the possible increase in longitudinal elongation, we present this normal stress as a function that de-pends on the parameters that describe the bending of a prismatic body that is in a plain strain state. The problem of a plane strain state of a beam made from the composite reinforced two layers material is being solved. The reinforced or armed material consists of two layers: the upper (first) thin layer of solid steel and the lower (second) main layer of glass. Glass is a non-crystalline, often transparent amorphous solid that has widespread practical and technological use in the modern industry. The most familiar types of manufactured glass are silicate glasses based on the chemical compound silica (silicon dioxide, or quartz). Glass has high strength and is not affected by the pro-cesses of aging of the material, corrosion, and creep. In addition, this material is cheap and widely available. Glass can be strengthened, for example, in a melt quenching process. If the cooling is fast enough (relative to the characteristic crystallization time), then crystallization is prevented, and instead the disordered atomic configuration of the supercooled liquid is frozen into a solid state. This increases the strength properties of the glass. The reinforced composite beam is rigidly linked to an absolutely solid base and on which an absolutely solid impactor acts from above in the centre on a small area of initial contact.

**Audience Take Away Notes**

- Solution of plane strain state problem in elastic-plastic mathematical formulation
- Simulation of the impact of hard body on elastic base
- Determination of strain-stress state of the composite two layers material

**Biography**

I've studied at the Mathematical Department of Odessa National University, Ukraine. In the S.P. Timoshenko Institute of Mechanics of National Academy of Sciences of Ukraine (NANU) I made doctoral work An impact of fine elastic shells on an elastic half-space. From 2001 to 2005 I worked as Senior Research Associate in the E.O. Paton Institute of Electricwelding of NANU. I've worked as an Associate Professor at the Academy of Municipal Administration and at the National Transport University, Kyiv, Ukraine, since 2011. In 2013 I migrated to Australia where I've opened my own company Progressive Research Solutions.

**J.A. Mateu-Sanchez[1]*, J.R. Marti-Vargas[1], J. Navarro-Gregori[1], M.C. Castro-Bugallo[1], E. Gimenez-Carbo[1], P. Serna[1]**

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## Testing methods for the assessment of prestressed concrete members

Two common procedures are used for prestressing a concrete member through reinforcement: pre-tensioning and post-tensioning. In the former case, the prestressing reinforcement is tensioned in a casting bed prior casting the concrete, and the prestressing force is transferred to the concrete by bond when the reinforcement is released after sufficient strength is attained by the concrete. In the second case, the prestressing reinforcement is tensioned after concrete casting, and the prestressing force is introduced by anchor heads at the member ends.

National and international main codes provide specifications and requirements for prestressing design of prestressed concrete members, so the designer set the initial prestressing force and must estimate the prestress losses along the service life of the member. Upon service loads, overestimating prestress losses can lead to excessive camber and inefficient designs, while underestimating prestress losses can result in excessive deflection and unexpected cracks.

The accurate determination of the residual prestressing force is essential in the assessment of existing prestressed concrete members. However, the residual prestressing force is usually unknow since construction common practice has neglected the use of measurement devices for tracking prestress losses from the initial stage after prestress.

It should be pointed out that the residual prestressing force is not allways in agreement with the expected value. In the case of old prestressed concrete members, additional complexity must be considered in relation to the initial prestress, the materials (prestressing reinforcement and concrete) properties and the short- and long-term prestress losses.

Prestress losses can be experimentally assessed by using non-destructive testing techniques, which, in turn, usually require back-calculations based on theory of mechanics concepts. Researchers continually seek to propose and apply reliable non-invasive methodologies with the aim of preserving and/or extending the life cycle of existing prestressed concrete members.

In this context, this contribution offers a practical perspective on specific destructive and non-destructive testing methods to asses prestressed concrete members, not only from the perspective of the evolution of prestress losses but also from cases analyzing the effects of damage due to impacts, corrosion, fire, etc.

Among the destructive methods available to empirically assess the actual condition of PCM, it can be found: crack initiation, crack re-opening and tendon cutting. Since destructive methods are not suitable for application to in-service structures, non-destructive methods or with conditions that only require aesthetic restitution (e.g. exposed tendon deformation, hole drilling and saw-cuts) appear as an alternative of increasing interest.

**Audience Take Away Notes**

- The audience will be aware of the complexity of assessing old prestressed concrete members
- It will help the audience in improving knowledge about specific testing methods
- This research could be used by researchers and engineers to expand their research and good practice
- It is a first step to obtain feed-back from experimental tests carried out on unmonitored full-scale prestressed concrete members over the years
- Non-destructive methods or with conditions that only require aesthetic restitution appear as an alternative of increasing interest

**Biography**

Phd juan a. Mateu sánchez is a researcher at the icitech (institute of concrete science and technology) at the universitat politecnica de valencia (spain). After studying civil engineering and a master in concrete engineering, he was granted with a training predoctoral contract from the agencia estatal de investigación (state research agency) of spain (human resources funding pre2021-098777) to developd the competitive research project looking for the lost prestress: multi-level strategy and non-destructive method for diagnosis of existing concrete structures (pid2020-118495rb-i00).

**Prabha Samudre[1]*, Kuldeep Singh[2], Govind Kumar[3]**

[1,2,3]Centre for Product Design and Manufacturing, Indian Institute of Science, Bangalore, India,

## Development of high strength aluminium matrix composites using accumulative roll bonding (ARB)

Aluminium matrix composites (AMCs) are widely used in the automotive, aerospace, and shipping industries owing to their high strength-to-weight ratio properties. Several well-established processes are reported in the literature to produce AMCs. However, accumulative roll bonding (ARB) is a potential severe plastic deformation technique for the mass production of metal sheets that improves the material's strength through grain refinement. In the present study, we develop aluminium composites where open-pore metal foam is employed to infuse polymer-derived ceramics in an aluminium matrix through ARB. The interconnected cellular structure of metal foams uniformly distributes polymer particles as reinforcement in the aluminium matrix. After the tenth pass of the ARB, processed samples underwent heat treatment at 550 °C for in-situ pyrolysis, which turns polymer particles into ceramic. Results show that three additional passes of ARB i.e., post pyrolysis ARB, further increase the strength of the Al-composite due to the removal of porosities. The developed composite exhibits a 3.5-fold increase in hardness (74 HV). Furthermore, the yield strength and tensile strength of the composite increased by 2 times (160.82MPa) and 1.6 times (190.35MPa) respectively which is attributed to ultra-fine grain refinement and homogeneous distribution of the nanoscale ceramic particles.

**Audience Take Away Notes**

- The use of open-pore metal foam in producing high strength metal matrix composites by ARB
- This article provides the solution to the problem of uniform distribution of reinforcements in metal matrix by using metal foam
- This research article can be extended to study the effect of pore diameter and porosity on distribution of reinforcements in metal matrix composites

**Biography**

I am Prabha Samudre. I have studied the MSc. Engineering in centre for product design and manufacturing department from Indian Institute of Science, Bangalore in 2015. My master's research work involves manufacturing and evaluation of foam heat exchangers (HX). I have completed the defence for Ph. D. degree and my degree will be awarded in July, 2023. I have developed a simple and cost-effective method for producing metal foam and foam heat exchangers with significantly reduced thermal contact resistance, and high thermal performance for this contribution in research the patent has been filed and published research article in reputed journal of applied thermal engineering.

**Kazimov Mobil Vahab[1*] Ibragimov Guseyn Behbud[2]**
Ministry of Science and Education Republic of Azerbaijan, Institute of Physics

## X-ray and Morphological analysis of InAs-CrAs eutectic systems

InAs-CrAs systems are synthesized by the vertical Bridgman–Stockbarger method. XRD analysis and microstructural study of InAs-CrAs composites show that CrAs metallic inclusions are uniformly distributed in the InAs matrices. By investigating of microstructure of InAs-CrAs eutectic composite by electron microscope, it has been established that the interfacial zone between the semiconductor matrix and metallic inclusions is generated. In computations of effective electrical and thermal conductivity of the composite were taken into account the role of these interfacial zones.

**Keywords:** XRD, SEM , EDX analysis, Eutectic composites.

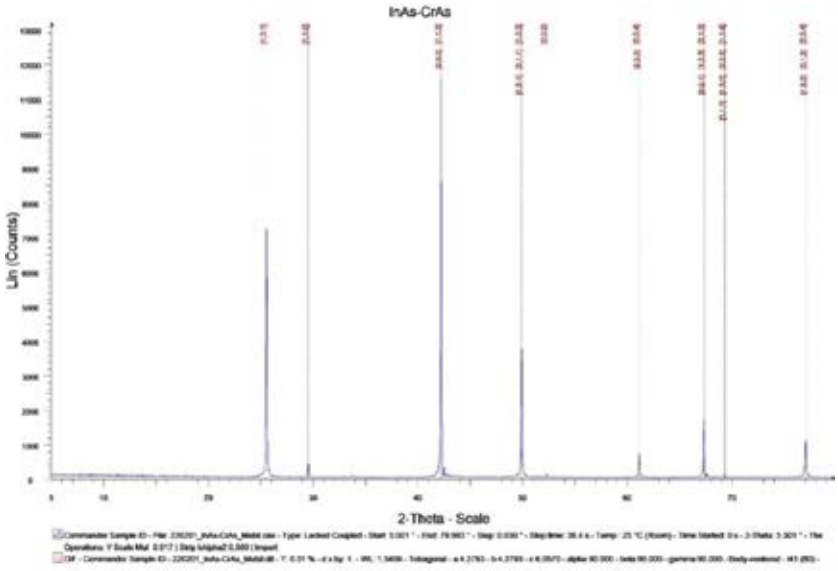
**Introduction:** Diluted magnetic semiconductor materials based on A3B5 compounds and 3d-metals eutectic composites, having a stable composition and properties,are promising materials for spintronic devices. One of the main features of eutectic composites obtained based on InAs, InSb, GaSb, GaSe and 3d - transition elements is the anisotropy in kinetic coefficients depending on the direction of metal needles. These composites, which combines both semiconductor and metallic properties, behave as nonhomogeneous semiconductors since metal needles are distributed parallel to the crystallization direction. The composites formed by the 3d-transition metals are considered to be diluted magnetic semiconductors. Recently, the recent discovery of superconductivity in chromium arsenide CrAs has attracted a lot interest because this material has been synthesized looking for superconductivity on the verge of the antiferromagnetic order by means of the application of external pressure. According to the results of these studies, the connection between the ferromagnetic constituents perpendicular to the crystallization axis in the CrAs junction is antiferromagnetic. Consequently consideration of the InAs-CrAs systems is of substantial interestl. The present paper is devoted to synthesis and structure investigated of InAs-CrAs systems

**Experimental:** Preparation of eutectic composites based on GaSb, InSb semiconductor compounds and 3d transition metals has been described in our previously published articles. The structure of InAs-CrAs eutectic composites was studied with an electron microscope (FESEM) and X-ray spectrograph.

InAs-CrAs systems are synthesized by the vertical Bridgman–Stockbarger method. To obtain the InAs-CrAs eutectic composite, 98.3 wt% InAs and 1.7 wt% CrAs are filled into a quartz ampoule and a vacuum is created at a pressure of 10-2 Pa. The ampoule is kept in an electric oven at a temperature of 1250 K for 4 hours with vibration, it is turned off and cooled to room temperature. Then, oriented crystallization is carried out using the vertical Bridgman method. InAs-CrAs eutectic composites were synthesized with different crystallization rates. Temperature gradient 20÷30K, crystallization speed 1.2 mm/minute; 0.6 mm/min and 0.3 mm/min were selected. It has been determined that a coating is formed around needle-shaped metal phases that are arranged parallel to each other along the crystallization axis and are evenly distributed in the main matrix

**Results and discussion:** Diffraction patterns of InAs-CrAs eutectic composite are shown in Fig. 1. These figures also show data on the diffraction patterns for InAs and CrAs compounds. Analysis of XRD spectra confirmed that this system is diphasic: the most intense peaks corresponding to the (101), (200), (112), (121),

(220), (004), (301), (123), and (312) Muller index are identical to the InAs matrix, while the weak peaks found at 2□ = 29.6 °, 44.08°, 52.2°, and 69.13° coincide with the CrAs lines having a orthorhombic structure.




Based on SEM examinations (Figs.2), the needle-shaped metallic inclusions with a diameter of about 0.6-1.5 μm, a length of 20÷50 μm and a density of ~5.8x104 mm-2 are uniformly and parallel distributed in the InAs matrix phase.

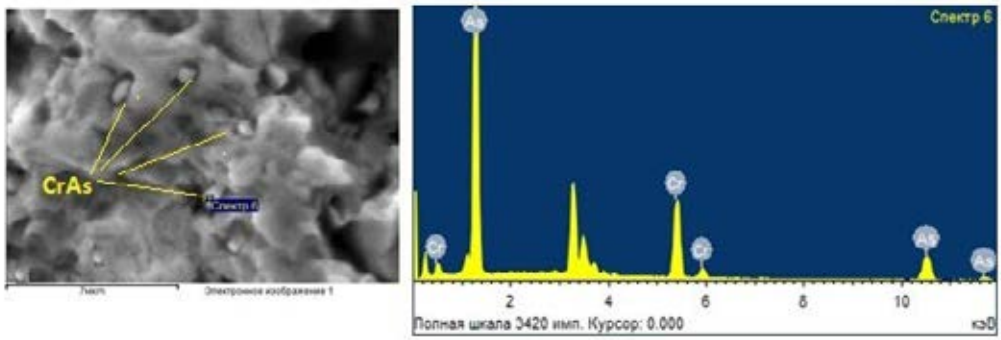
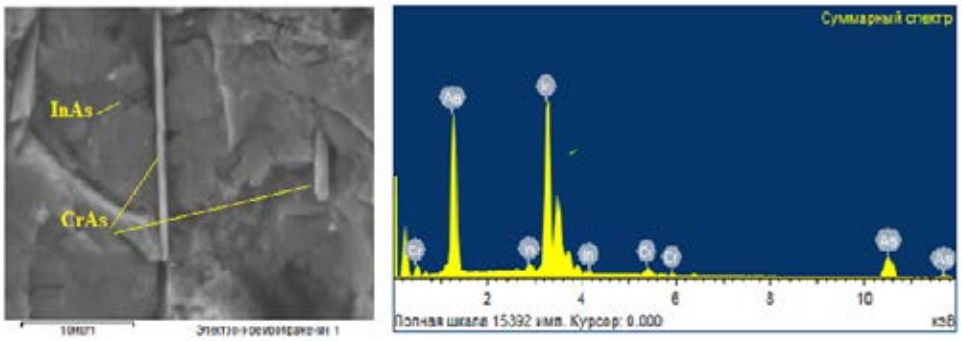



Fig. 2. SEM micrographs of InAs-CrAs showing cross sections of the samples along the lateral directions of the CrAs




It was found that the matrix contains In = 63.2wt%, As= 36.8 wt% (Fig.3, spectrum 1), the inclusion are contained Cr = 17.8 wt%, As = 82.2 wt% (Fig.3, spectrum2).

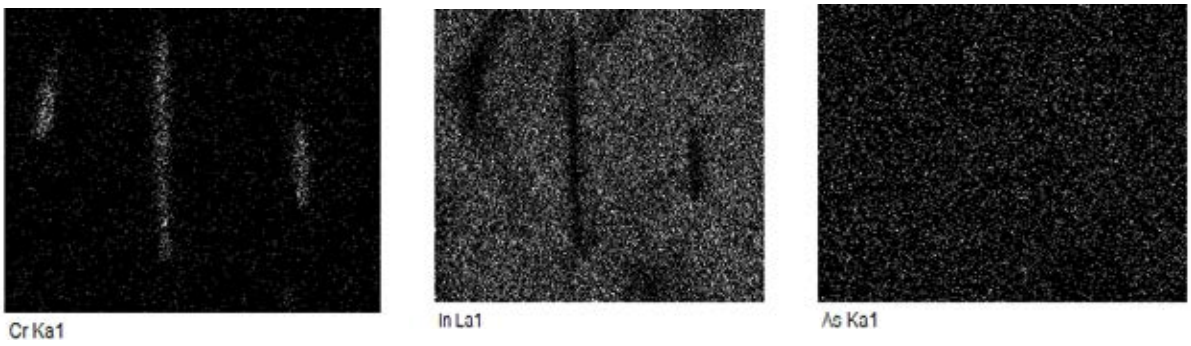



Fig. 4. Element map of the InAs-CrAs composite

The results corresponded to the composition of the matrix and inclusions. Fig.4 shows elemental maps of Cr, In and As from the cross sections along the lateral direction of the needle phases, respectively and black colour indicates the absence of this element.

**Conclusions:** XRD, SEM and EDX analysis show that the obtained composites present two phase system, so that the observed intense peaks are related to the InAs matrix and weaknesses - to the CrAs inclusions. In the InAs-CrAs eutectic, the length of the metal needles is 30-50 μm, and the diameter is ~1.6 μm. As can be seen from the pictures, the metal rods are evenly distributed in the direction of crystallization in the matrix. The two phaseness of the InAs-CrAs composite have been confirmed by the microstructure and morphology studiesFig. 3. X-ray spectra of InAs-CrAs eutectic obtained with SEM–EDX from the needle and matrix phases along the lateral directions of the specimens

**Biography**

Dr. Mobil Kazimov studied Physics at Azerbaijan University, and graduated as MS in 2004. He then Azerbaijan National Academy of Sciences received his PhD degree in 2018 at the same institution. He has published more than 40 research articles in journals.He is currently researching electric charge and heat transfer mechanisms in eutectic composites based on III-V group elements and 3D transition metals.

**V.Yu. Goltsev[1], A.V. Osintsev[1], E.L. Strizhakov[2], S.V. Nescoromniy[2], S.O. Ageev[2, 5], A.N. Chumakov[3], I.S. Nikonchuk[3], O.O. Kuznechik[4], E.G. Grigoryev[5]***

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[3]Laboratory of Radiation Plasmodynamics, B.I.Stepanov Institute of Physics, Minsk, Belarus
[4]Research Laboratory New Materials and Technologies, SSI PMI, Minsk, Belarus
[5]Department of High-Energy Methods for the Synthesis of Ultrahigh-Temperature Ceramic Materials, ISMAN, Chernogolovka, Russia

## Advances of high-voltage consolidation of powder materials

The main features of the method of high-voltage consolidation of powder materials and the resulting advantages and limitations of this method are considered. The method of high-voltage consolidation of powders is effective for the production of refractory composite materials that retain their strength properties at ultrahigh temperatures under aggressive external influences. The short duration of high-temperature exposure in the process of high-voltage consolidation makes it possible to preserve the structural-phase state of the initial powder material in the consolidated compact material. A feature of this method is the high density concentration of the released energy in the area of contacts between powder particles. In this case, the initial state of the surface of powder particles (the thickness and structure of oxide films, the presence of foreign impurities, etc.), the shape of powder particles and their sizes significantly affect the regularities of high-voltage consolidation processes. Along with the characteristics of the powder, the determining factors are: the rate of input of the energy of the electromagnetic field into the powder material, the magnitude and nature of the mechanical pressure acting on the powder compact in the process of high-voltage consolidation. The high energy density in the particle contact zones leads to a local change in the state of aggregation of the powder substance in these zones. Along with the inhomogeneity of powder heating in interparticle contacts, a macroscopically inhomogeneous distribution of the current density in the volume of the consolidated sample is possible. The formation of the structure of a powder material during high-voltage consolidation is determined by processes of different scales occurring at interparticle contacts, in powder particles, in the bulk of the entire sample, and by the mutual influence of these processes.

Further development of this method is associated with a detailed experimental study of thermal processesduring high-voltage consolidation of powders of refractory materials using pulsed photometry. Experimental studies of the parameters of high-voltage electrical impulse action in the process of consolidation of high-temperature TaC and HfC powder compositions have been carried out. Registration of the parameters of a high-voltage current pulse and the intensity of thermal radiation of the consolidated powder materials was carried out using a measuring complex developed by the authors. This complex includes: a Rogowski coil with an integrating circuit, which registers the parameters of a high- voltage current pulse; photodiode sensors that register the intensity of thermal radiation, which is transmitted through a special optical waveguide from consolidated powder compacts; systems for triggering and synchronizing the components of the measuring complex. The analysis of the emerging thermal electromagnetic radiation from the surface of the consolidated powder sample in the process of high-voltage consolidation is carried out in the visible radiation range, ranging from $\lambda r$=650 nm to $\lambda r$=950 nm.

A criterion has been established that determines the range of optimal technological parameters of high-voltage consolidation for the creation of refractory high-density materials. Possible directions for further research into the process of high-voltage consolidation of powder materials are proposed.

**Audience Take Away Notes**

- The audience will be able to use the experimental complex for registration of a high-voltage pulse current parameters and the intensity of thermal radiation of the consolidated powder materials
- This experimental complex will help the audience in their study of the process of high- voltage consolidation of powder materials
- This research of high-voltage consolidation processes of powders other faculty could use to expand their research and teaching
- The results of this research provide a practical solution to a problem of powder consolidation that make a designer's job more efficient
- This research provides new information to assist in a design problem consolidation of powder materials

**Biography**

Dr. Evgeny Grigoryev studied theoretical nuclear physics at Moscow Engineering Physics Institute (MEPhI), Russia and graduated as MS in 1975. He received his PhD degree in 1980 at the same institution. He has the next work experience In Moscow Engineering Physics Institute: Researcher, Senior Researcher, Associate Professor, Leading Researcher, Scientific Chief of Key Laboratory of Electromagnetic Field- Assisted Methods for Processing of Novel Materials. Since 2017 to the present, Grigoryev is the Head of the Laboratory of High-Energy Methods for the Synthesis of Ultrahigh-Temperature Ceramic Materials in Merzhanov Institute of Structural Macrokinetics and Materials Science Russian Academy of Sciences. He has published more than 180 research articles in SCI(E) journals, 23 patents.

**Govind Gupta**[1,2]

[1]Sensor Devices & Metrology Group, CSIR - National Physical Laboratory (CSIR-NPL), Dr K. S. Krishnan Road, New Delhi 110012, India
[2]Academy of Scientific & Innovative Research,(AcSIR),CSIR-HRDC Campus, Ghaziabad, Uttar Pradesh 201002, India

## Fabrication of detectors based on semiconductor hetero structures for optical communication

Heterostructure based devices has shown great potential in optoelectronic field especially in optical communication. Heterostructure optoelectronic devices have been fabricated with unique morphology which exhibit higher photocurrent generation and significantly enhanced responsiveness towards UV illumination. The fabricated device display substantial low dark current and fast time-correlated transient response and very high photo responsivity in self-powered mode of operation. Further, chemically synthesized novel quantum dots have been utilized as sensitizer alongwith various metal selenides for the fabrication heterostructure. The fabricated device exhibits broadband optical response with state-of-the art performance parameters. I'll discuss these findings in details with possible mechanism.

### Biography

Dr. Govind Gupta is Senior Principal Scientist & Head, Sensor Devices & Metrology Group, CSIR-NPL, New Delhi, India and Professor, Academy for Scientific & Industrial Research .His core area of expertise is growth of III-Nitrides, metal-oxide and TMDCs, fabrication of smart optical & gas sensors, etc. He has published ~270 research articles in SCI journals. He is a Fellow of The Royal Society of Chemistry (FRSC), UK, Fellow of the Institute of Physics (FInstP), UK, Institute of Electronics & Telecommunication Engineers (FIETE), Senior Member- IEEE, USA and Associate Academician-APAM. He has received numerous awards & fellowships including MRSI medal, Young Scientist Medal-National Academy of Sciences, India, BOYSCAST fellowship, etc.

**S. Thirugnanasambandam[1]*, G.Padmanaban[2]; R.Pranamika[3]; T.Suriyakumar[4]**

[1]Department Civil and Structural Engineering, Annamalai University, Annamalai Nagar, Tamil Nadu, India

## Route to geopymer concrete through cement replacement

Concrete is the most important material in the construction sector because of easy availability, high strength, fire resistance and easy to form to a required shape, etc. Concrete is made by mixing of cement, fine aggregate, coarse aggregate and water. Every year, the need for concrete increases simultaneously and the consumption of cement also increases. Because of the production of cement, it will release the $CO_2$ and it elevates the global warming. Cement is partially replaced by Class C fly ash, Class F fly ash and GGBS. Replacement percentage of Fly ash and GGBS varies from 0% to 100% with 10% increment. The M20 grade concrete was used for all the mixes. The age of testing of concrete is 7, 14 and 28 days, respectively. Test results show that the 7 day compressive strength of conventional concrete (C100FC0) is 22.35 MPa and 23.25MPa respectively, which is higher than the concrete using Class C and Class F fly ashes. As the percentage of fly ash content increases the compressive strength of concrete reduces. The 14 days and 28 days compressive strength of 20%, 30%, 40% GGBS concrete show higher strength than that of conventional cement concrete. But at the same time the compressive strength of GGBS based concrete reduces beyond 40% of GGBS content.The entire cement replacement is possible by means of Geopolymer Concrete. In GPC, cement is replaced by industrial by-products such as fly ash, GGBS etc. In GPC, an activator solution contains sodium hydroxide and sodium silicate can be used. The compressive strength of GGBS based geopolymer 32.45 MPa which is higher than all the other combinations.

**Audience Take Away Notes**

- By replacing cement completely the major problem $CO_2$ emission will be reduced
- It will be useful for the other faculties to enrich their knowledge on Geopolymer Concrete
- Geopolymer Concrete is practical solution for replacement of cement
- Audience will gain knowledge on properties and elements of Geopolymer Concrete
- It will be helpful to understand the characteristics of other industrial waste materials that can be used as replacement of cement

**Biography**

Dr.S.Thirugnanasambandam is presently working as Professor in Annamalai University. He obtained his Bachelor's Degree from Government College of Technology, Coimbatore, Masters Degree and Doctoral Degree from Annamalai University. He is working in the department of Civil and Structural Engineering since 1999. Nine of his scholars have completed Ph.D., Degree and presently guiding eight Ph.D., Scholars. He has published 112 Research articles in Journals and Conference Proceedings.His area of interest is development of Geopolymer Concrete Products.

**Lebogang Manamela[1]*, Phumlani Mdluli[2], Nolwazi Nombona1**

[1]Department of Chemistry, University of Pretoria, Pretoria, Gauteng, South Africa

[2]Advanced materials division, Mintek, Randburg, South Africa

## Evaluation of cellulose acetate supported MOF-5/crystalline nanocellulose nanocomposite as an adsorbent for methylene blue removal from water

In this study, a novel, low-cost and efficient adsorbent was fabricated through a solvothermal method. The adsorbent consists of cellulose acetate (CA) substrate as a support membrane and MOF-5/crystalline nanocellulose embedded on it. The performance of the material was evaluated for the adsorptive removal of methylene blue (MB) from aqueous solution. The adsorbent illustrated a rapid increase in MB adsorption during the first hour of the adsorption process with equilibrium being achieved 4 hours into the adsorption process. The maximum adsorption capacity and percentage MB adsorption were determined to be 2.92 mg/g and 70.5%, respectively. The MB adsorption process was found to conform to a Freundlich isotherm model with a 1/n value of 0.672, suggesting a favourable adsorption process. The adsorption process favoured a pseudo-second-order rate implying that adsorption occurs through chemisorption. This study has shown that CA-supported MOF-5/CNC is a promising adsorbent for the treatment of contaminated water.

**Audience Take Away Notes**

- The audience will learn to design efficient adsorbents for water purification
- The presentation will help the audience to learn the importance of developing nanocomposites from nanocomposites and polymers for various applications
- This research will highlight benefits of using nanomaterials and polymer nanocomposites for the development of economic and efficient adsorbents in water purification
- This research can be extended to various faculties outside chemistry such as chemical engineering and environmental sciences
- The research provides an accurate design of the adsorbent that is not only economic and efficient but eliminate secondary contamination
- The research provide solutions for quest of cheaper and efficient adsorbents for water purification

**Biography**

Mr Lebogang Manamela studied Bachelor of Science (B. Sc) majoring in chemistry and biochemistry, at University of Limpopo (UL) and graduated in 2016. He enrolled in his B. Sc honours in Chemistry at UL and graduated in 2017. In 2018 he joined Dr Nombona's research group at the University of Pretoria (UP) and graduated his masters in chemistry (M. Sc) in 2020. He is currently enrolled for PhD in chemistry at the UP. He has published one manuscript and currently preparing the second.

**Narayan Sharma[1], Prasant Kumar Swain[2], Dipak Kumar Maiti[1]***

[1]Department of Aerospace Engineering, Indian Institute of Technology Kharagpur, West Bengal, India
[2]Department of Mechanical Engineering, C V Raman Global University, Bhubaneswar, Odisha, India

## Stochastic aero elastic response of variable stiffness laminated composite plates

The influence of uncertainty in material properties on free vibration and the aeroelastic response of variable stiffness composite laminated plates is investigated in this work. Free vibration analysis is conducted by a finite element model based on third-order shear deformation theory. The developed finite element model is further coupled with MSC.Nastran to carry out aeroelastic analysis of variable stiffness laminates in the subsonic regime. MSC.Nastran helps to extract the aerodynamic influence coefficient matrix at discrete values of reduced frequencies using the Doublet Lattice Method. The implementation of variable stiffness laminates in the aerospace application can be helpful to reduce the structural weight, but the alteration of mode shapes due to stiffness variation with a plane of the lamina may cause the two modes to come closer and could be the reason for aeroelastic failure. Moreover, during the complex manufacturing process of variable stiffness laminates, free from any sort of variation in the composite properties is quite impossible which may further deteriorate the structure performance, and probably enhance the chance of early failure of structures. Thus, to investigate the stochastic free vibration and the aeroelastic response of the variable stiffness laminates, the highly efficient radial basis neural network-based surrogate model is developed. The accuracy and adaptability of the developed surrogate model are checked by comparing the result with that of the Monte Carlo simulation. Stochastic analysis of natural frequencies and flutter characteristics of variable stiffness laminates are conducted through various parametric studies. Variance-based sensitivity analysis is used to calculate the contribution of individual material properties to the free vibration and aeroelastic response of variable stiffness laminates. Further, the influence of the highly sensitive properties on structural failure due to dynamic instability is estimated. This research can be leveraged to predict the probability of failure of the structure at different levels of material uncertainty present in it.

**Audience Take Away Notes**

- We always support the collaborative research culture, so if anyone from the audience is having any interest in a similar domain, please reach us
- Faculty members can include stochastic and failure probability analysis work to enhance their research domain. These stochastic-based design approaches could provide safer and more reliable design
- The variable stiffness laminates used in the present work are made up of curved fiber that may provide the same strength with lesser weight compared to traditionally used straight fiber laminates
- The proper utilization of fiber orientation within a lamina could be helpful to adjust the mode shapes favorably and reduce the chance of aeroelastic failure. Thus, these laminates could be pretty useful for aerospace applications

**Biography**

Dr. Dipak Kumar Maiti is currently holding full professor post at Indian Institute of Technology Kharagpur since April 2014. Dr. Maiti had also served as Scientist/Engineer during 1998-2004 and worked in Prestigious National Project, Light Combat Aircraft. He did his B.E. degree in civil engineering and Master of Technology and Doctor of Philosophy in Aerospace Engineering. He has published over 100 international journal papers, over 80 national and international conference papers, over 60 project reports, handled several research projects sponsored by ARDB, ADA, DST, ISRO, etc. of worth a few crores. So far 18 research students have obtained their PhD degree under his supervision. Currently 5 research students are pursuing their doctoral research work under his supervision. He has guided as guided several M.Tech and B.Tech students for their Master's Projects and B.Tech Projects. His primary research areas are analysis of composite structures under static and dynamic loadings employing various higher-order shear deformation theories, damage modelling of isotropic and composite materials, smart structures, aeroelasticity / aeroservoelasticity, structural health monitoring, etc.

**Sangeeta Tiwari**

Amity Institute of Applied Sciences, Amity University, Noida, Uttar Pradesh, India

## Functional nano fibrous mats for removal of toxic contaminants from water

Polymer Nanofibers (NFs) produced by electrospinning technique, are an appealing alternative to traditional water treatment methods because of their unique properties such as high porosity, high gas permeability, small pore size and large surface area to volume ratio, resulting in rapid adsorption with high adsorption capacity when compared to powder materials. Electrospinning (ES) is unusual in that it may create nanofibers from a variety of materials in a variety of fibrous assemblies. ES is appealing to both academia and industry because of its relatively high production rate, low cost and ease of the setup.

Some significant work, done by our group, on preparation of various composite nanofibrous mats for removal of As (III) from wastewaters, has been reported here. Poly-vinyl alcohol (PVA)/ (CHT) chitosan NFs were prepared and modified with Cerium for the removal of As (III). More than 80% removal of As (III) was achieved within the first 10 minutes, with adsorption capacity of 18.0 mg/g. The purification was achieved below the prescribed limit of WHO/USEPA up to 1000 ppb. Being biodegradable and nontoxic, PVA/CHT/ Ce NFs does not affect the quality of water and work at near neutral pH range (6-7).

Similarly, work was carried out on preparation of PAN/$TiO_2$ NFs modified with nano zero valent iron (nZVI) for removal of As (III). The fibers were found to have better strength and water absorption characteristics than PVA/CHT NFs. It could be observed that the fabricated CNFs (nZVI@PAN/$TiO_2$) purify water within the permissible limits, prescribed by WHO/EPA from initial concentration (1000 µg/L) of As (III). Furthermore, the composite nanofibers are capable of eliminating As (III) at extremely low concentrations (less than 100ppb). The maximum adsorption capacity of nZVI@PAN/$TiO_2$ composite nanofibers with 10 mg/L As (III) solution is 12.18 mg/g. The nanofibrous mats are a good alternative to treat waste waters.

**Audience Take Away Notes**

- The audience will learn about electrospinning technique for production of polymeric nanofibers
- The audience will know and understand the significance of a very important category of functional materials, their synthesis and applications
- The research work being presented will help other faculty to work on other important aspects of these materials
- Removal of toxic metals is an important area as it is directly related to the environment

**Biography**

Dr. Sangeeta Tiwari is Professor in Chemistry at Amity Institute of Applied Sciences, Amity University Noida. She is actively associated in teaching, research and other important developmental activities at Amity University. She did her PhD from CSIR-Advanced Materials Processes and Research Institute (AMPRI), Bhopal, India, in the year 1999. During her early research career, she was awarded M.P. State Young Scientist as well as Indian Science Congress -Young Scientist Award. She had two granted patents with CSIR-AMPRI and research project from Building Materials Technology Promotion Council, New Delhi. After Ph.D., she joined Amity University where she is a Professor in Chemistry at present and Head (Academic Co-ordination) AIAS. She has quite a good number of high impact research publications to her credit, produced Ph.Ds and has filed no of patents with Amity University, out of which two are granted. Her current area of research is functional materials for various applications like removal of toxic contaminants from water, carbon dioxide conversion and NIR reflective coatings. She has sponsored National and International collaborative projects.

**Arun Kumar Singh**

Department of Pure and Applied Physics, Guru Ghasidas Vishwavidyalaya, Bilaspur 495009(C.G.), India

## Modification in the electronic properties of CVD grown SLG by deposition of thin transparent conducting polymer

The development of flexible and stretchable electronic devices such as solar cells, touch screen displays, light emitting diodes, flexible batteries, and sensors are the essential requirement of modern era. The essential components of these devices are electrodes, which should be thin, lightweight, and highly transparent so that they can be stretched and flexed without compromising their electrical and optical assets. Recently, graphene has received considerable interest for the electrode material due to its remarkable properties, including atomically thin, high mechanical strength, thermally stable, and highly transparent two-dimensional sheets. However, graphene shows low carrier concentration. The modulation of charge carrier and doping type of graphene is a potential step for the realization of multifunctional use in current electronic devices. Here, we present tuning in electronic features of the chemical vapour deposition (CVD) grown mono layer graphene by deposition of transparent conducting polymer. The effect of deposition on graphene samples were examined by Raman spectroscopy, electrical transport measurement, atomic force microscopy, and Kelvin probe force microscopy. Our finding will be useful for understanding the device physics as well as improvement of photovoltaic devices based on PEDOT:PSS coated graphene.

**Audience Take Away Notes**

- All those who interested in 2D materials especially graphene and related work will enjoy
- It will also be of great interest to material scientists from diverse backgrounds
- Participants may learn about electronic properties of graphene
- Participants may learn analysis of data

**Biography**

Dr. Arun Kumar Singh is working as Associate Professor at Department of Pure and Applied Physics, Guru Ghasidas Vishwavidyalaya, Bilaspur, India. He received his M.Sc. degree in Physics from Banaras Hindu University, Varanasi, India and received his Ph.D. degree from School of Materials Science and Technology, IIT (BHU), India. After Ph.D., he joined postdoctoral research work at Graphene Research Institute, Sejong University, South Korea. He got India most prestigious research award, INSPIRE Faculty awards from DST, India. He has published many papers as a main author and co-author in international journals/conferences in the area of materials science/physics. His research work basically includes the charge transport in organic semiconductors/two dimensional nanomaterials and their electronics device applications. He is life member of many scientific societies and reviewer of International scientific journals.

**Najam UL Hassan[1,2]*, Ishfaq Ahmad Shah[2]**

[1]Department of Physics, Division of Science & Technology, University of Education, Lahore, Pakistan

[2]School of Materials Science and Engineering, Nanjing University of Science and Technology, Nanjing, China

# Structural, martensitic and magnetic properties of NiMnCoTi ferromagnetic shape memory alloys

Ni-Mn based ferromagnetic Heusler alloys have gained much attention because they have applications in many areas such as magnetic refrigeration, sensors, magneto-mechanical devices and energy-harvesting devices. In present work we investigate the structural, martensitic and magnetic properties of $Mn_{35}$+x$Ni_{35}$-x$Co_{15}Ti_{15}$ (x=0, 1, 2 and 3) alloys using X-ray diffraction (XRD), Scanning electron microscopy (SEM), Differential scanning calorimetry (DSC) and magnetic measurements. XRD analysis shows two sets of diffraction patters, with increase in values of x: the proportion of cubic B2 type increases while 5M modulated structure decreases. Large endothermic/exothermic peaks with distinct thermal hysteresis in DSC measurement indicate the martensitic/reverse martensitic transformations and martensitic transformation temperature decreases with increase in x. Thermal magnetization (M-T) curves show an abrupt change of magnetization from paramagnetic martensite to ferromagnetic austenite near MT temperature. Isothermal magnetization (M-B) curves for $Mn_{35}$+x$Ni_{35}$-x$Co_{15}Ti_{15}$ show that magnetic field can induce the magnetostructural transformation. A magnetic entropy change of 12 is observed at room temperature (290 K) in $Mn_{35}$+x$Ni_{35}$-xCo15$Ti_{15}$

**Audience Take Away Notes**

- The materials showing martensitic transformation (MT) exhibit various multifunctional phenomena such as magnetocaloric effect (MCE), exchange bias (EB), magnetothermal conductivity (MC) and magnetoresistance (MR). This coupled transition is obtained around the MT temperature
- The MCE is a magneto-thermodynamic phenomenon in which temperature is changed in the material when exposed to the external-non-constant magnetic field
- Magnetic refrigeration is a best alternate conventional gas cooling technology, showing many, such as environment friendly, high refrigerant efficiency, low cast, occupying less space, low mechanical vibration, and harmlessness

**Biography**

Dr. Hassan is working as Assistant Professor at Department of Physics, Division of Science & Technology, University of Education, Lahore, Pakistan. Before this he has worked as Assistant Professor of Physics at department of Physics, University of Central Punjab, Lahore, Pakistan. He has published more than 25 research papers in well-known International journals of Physics & Materials Science. He has also served as committee member, reviewer and keynote speaker in various International Conferences/Symposiums. Dr. Hassan did his Ph.D. in Materials Science & Engineering from Nanjing University of Science & Technology, Nanjing, China. Before commencing his doctoral degree, he has worked as subject specialist in Higher Education Department, Punjab Province, Pakistan.

**Uroosa Ejaz**

Department of Biosciences, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology (SZABIST), Karachi, Pakistan

## Fabrication of methylcellulose/polyvinyl alcohol as porous composite

Halophytic biomass is an abundant source of polysaccharides as they have a boundless supply of carbohydrates, which could be thought as the ultimate substrate and can be renewed into valuable chemicals and compounds such as methylcellulose and cellulosic nanofibers. Due to its morphology and characteristic physical properties, cellulose nanofiber is seen as a promising material for use in a wealth of fields, including filter material, high gas barrier packaging material, electronic devices, foods, medicine, cosmetics, and health care. Therefore, this study was designed to use halophytic plants for the first time to extract cellulose and its conversion into cellulosic nanofibers. Pectin, hemicellulose, lignin and cellulose were extracted from the sample. Extracted components were analyzed by SEM and FTIR analysis. Extracted cellulose was methylated and converted in to Methylcellulose/PVA composite (nanofibers). Degradability of nanofibers in soil sample was also monitored. Furthermore, by-products of the process which were pectin, hemicellulose and lignin were evaluated for antimicrobial testing. Results confer the structural changes in cellulosic nanofibers which were observed by SEM and FTIR analysis. Extracted pectin, hemicellulose and lignin possessed antimicrobial activity which showed that by-products of the process can also find application. It was observed that PVA and cellulosic nanofibers composite is biodegradable which confer its use in industrial sector. Due to excellent biocompatibility, cellulose/PVA composite can be used in drug delivery system, packaging and barrier films, filter membranes, automotive, construction and medical implants. In addition, the cellulose nanofibers have the high yield and low cost, which is economic for civil engineering at large consumption.

**Audience Take Away Notes**

- Extraction of cellulosic nanofibers from less explored source such as halophytic plants
- Formation of PVA with halophytic plant based extracted cellulose
- Utilization of by-products of cellulose extraction as an antimicrobial agent

**Biography**

Ms. Uroosa Ejaz studied Microbiology at the University of Karachi, Pakistan and graduated as MPhil in 2019. She has published more than 24 articles in SCI (E) journals. She has work experience from Agha Khan University and Hospital, Patel Hospital, Bahria University and University of Karachi. She also worked as a research assistant in HEC funded NRPU project. Currently, she is serving as a Lecturer at SZABIST and she is also a PhD scholar in University of Karachi, Pakistan.

**Abdulqader, Ahmad M**
South Ghawar Producing Department, Saudi Aramco, Saudi Arabia

## Vessels conditional R&A

Saudi Aramco/South Ghawar Producing Department (SGPD) has exerted substantial efforts toward executing a seldom project of replacing numbers of extraordinary vessels. These horizontal vessels were recommended for replacement due to major and excessive Step Wise Cracking, irregular blister and inclusions identified in several traps. These vessels are subject to Hydrogen Induced Cracking, known as HIC and this is mainly SGPD facilities constructed on old time where SAES(Saudi Aramco Engineering Standard) was not mandating to utilize HIC resistance material. During the previous year, a companywide survey started and, as a result, 27 out of 121 were identified with HIC damage. To overcome these challenges, SGPD developed a robust action plan, which consists of two parts:

- Long Term Plan, which is replacing the impacted vessels with upgraded material or HIC resistance material
- Short Term Plan to continue the safe and reliable operation of impacted vessels until the vessels are replaced by managing and monitoring HIC growth.

With the short and long-term action plans, SGPD controlled HIC concerns in the affected vessels.

But the department didn't want to stop here and wanted to go the extra mile by adding a proactive measure rather than just reactive. Therefore, we partnered with R&DC to implement a proactive initiative at SGPD as the first department at Aramco called Step-Wise Hydrogen Induced Cracking Toolkit, which falls under IR.4.0.

**Audience Take Away Notes**

- This is to capitalize on Saudi Aramco/SGPD experience on how to handle such situation of having non-HIC resistance material and ensure continue delivering the production without any interruption
- We will reference to Saudi ARAMCO approach and understand lessons learned and best practices to overcome such challenge to operate system impacted with HIC/SWC
- The presentation will look the issue from engineering, design and maintenance perspective

**Biography**

Ahmad Al-Abdulqader, a professional Maintenance Engineer in Saudi Aramco, worked in multiple functions covering Engineering, Maintenance and Operations. Ahmad graduated from University of King Fhad Of Petroleum and Minerals (KFUPM) majoring in Mechanical Engineering. During his career path, he has been appointed to lead multiple capital projects and turnarounds including vessel replacement projects. Moreover, Ahmad acquired accredited local & international certifications Including certified Maintenance Reliability Professional (CMRP) accredited by the American National Standards Institute (ANSI). Currently, Ahmad is leading Hawyiah Producing Division as Operations Supt. for South Ghawar Producing Department (SGPD).

**Mahesh Naik[1]*, Dineshsingh. G. Thakur[1]**

[1]Department of Mechanical Engineering, Defence Institute of Advanced Technology (DU), Pune- 411025, Maharashtra, India

# Experimental investigation of the effect of fiber orientation and sliding speed on wear properties of additively manufactured continuous GFRP composites

Additive Manufacturing(AM) is a new technology that gives new possibilities for the manufacturing of complex-shaped products. It enables designers to create a real product based on a CAD model. In AM, Fused Deposition Modelling (FDM) is one of the widely used and promising extrusion-based techniques. FDM is widely used for the fabrication of polymer components. The mechanical properties of polymer components produced by the FDM technique are weak. To enhance the mechanical properties, 3D printing of polymer composites is done by reinforcement of particles, nanomaterials, and short and continuous fibers into thermoplastic polymers. In the present investigation, the wear properties of continuous glass fiber reinforced additively manufactured polymer composite under dry sliding conditions have been investigated. The effect of fiber orientation (0°, 30°, 45°, 60°, 90°) and sliding speed (100 rpm, 150 rpm, 200 rpm) has been examined on the wear properties of AM polymer composite specimens. The composite 3D printer named Mark Two was used for the fabrication of specimens. The wear test of AM polymer composite specimens was conducted on pin-on-disk test equipment. The results show that the fiber orientation and sliding speed significantly affect the wear properties of specimens. The wear and coefficient of friction (COF) increase as the fiber orientation angle and sliding speed increase. Finally, morphological analysis is conducted using an optical micrograph of the worn-out surfaces to understand the failure type that has occurred for different fiber orientations.

**Biography**

Mahesh Naik is a Ph.D. Scholar in Mechanical Engineering at Defence Institute of Advanced Technology, Pune, Maharashtra. He has completed B.E in Mechanical Engineering from Sanjivani College of Engineering, Kopargaon, Maharashtra, India (2015) and M.Tech in Manufacturing Engineering from Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat (2017). His Ph.D. research area is Additive Manufacturing of polymer composite for Aerospace applications. He has worked for one year as Assistant Professor at Sandip Institute of Management and Technology, Nashik. Additive manufacturing, optimization of process parameters, mechanical and material characterization of fiber-reinforced polymer composite, and metal additive manufacturing are his research area of interest. He has published more than 15 research papers in National & International Conferences and Reputed Journals. He has been granted three International Travel Grants by DST, CSIR and DIAT.

**Hira Ijaz**

Department of Pharmaceutics, Pak-Austria Fachhochschule: Institute of Applied Science and Technology, Mang, Haripur, KPK, Pakistan

## Thiolation of arabinoxylan and its application in the fabrication of pH: Sensitive thiolated arabinoxylan grafted acrylic acid copolymer

Current research work was conducted to synthesize Thiol modified arabinoxylan and its application in fabrication of hydrogel. Thioglycolic acid was esterified with arabinoxylan to prepare Thiolatedarabinoxylan. Appearance of peak at 2533.34 $cm^{-1}$ in FTIR and thiol content showed successful thiolation. The pH-dependent Thiolatedarabinoxylan/acrylic acid (TAX/AA) hydrogels of perindopril erbumine were prepared via free-radical co-polymerization. Perindopril erbumine (PE) was employed as model drug. Different batches with different feed ratio of TAX, AA, and MBA were prepared and their influence on swelling, solvent penetration, and consequent drug release was investigated. Swelling coefficients increased with increase in pH. TAX/AA hydrogels were characterized by Fourier-transform infrared spectroscopy (FT-IR), Thermal Analysis (TA), X-Ray diffraction (XRD), and scanning electron microscope (SEM). Dissolution studies were performed at pH 1.2 and 7.4 in which drug release showed direct correlation with TAX and AA ratio. *In vivo* studies showed that $C_{max}$ of TAX-*co*-AA based hydrogel was 81.57 ± 0.35 ng/ml which was maintained for a longer time after its administration. All the results of *in vivo* studies were significant and TAX-*co*-AA based hydrogel enhances the bioavailability of perindopril erbumine.

**Audience Take Away Notes**

- They can develop pH responsive carrier
- It helps to protect acid as well as heat labile medicaments and aids in cancer targeting
- Yes Is this research that other faculty could use to expand their research or teaching
- Yes this provide a practical solution to a problem that could simplify or make a designer's job more efficient
- Yes Will it improve the accuracy of a design, or provide new information to assist in a design problem

**Biography**

I have done PhD (Pharmaceutics) in November 2020. I have served as Lecturer at Department of Pharmacy, University of Agriculture Faisalabad as assistant Professor in Department of Pharmacy, The University of Faisalabad. Currently, Working as Assistant Professor Pharmaceutics at Department of Pharmaceutical Sciences, Pak-Austria Fachhochschule: Institute Of Applied Science And Technology. I have received Young Scientist Award in 2022. My fields of interest include polymerization, solubility enhancement and drug product development by designing hydrogel micro-particles, microneedle patches, microgels, solid dispersions, inclusion complexes, orodispersible tablets and hydrogels etc. My current projects include development of various carrier systems from natural polymers for anticancer drug delivery.

magnus Group

13-15 MARCH


DAY 03

POSTERS

4TH EDITION OF
INTERNATIONAL CONFERENCE ON

# MATERIALS SCIENCE AND ENGINEERING

**Omar Shakarneh**
Novosibirsk State University of Architecture, Russian Federation

## Compressive strength and deformability of masonry made ceramic blocks

The work is devoted to an experimental study of the effect of reinforcement on the strength and stiffness characteristics of masonry made of ceramic blocks. Laboratory tests were carried out on masonry reinforced with metal and fiberglass reinforcement mesh. Experimental data on evaluation of effectiveness of reinforcement meshes application in masonry are given. Loads values of cracking and failure have been determined. The results of full-scale tests were compared with the results of calculation of deformation process of masonry. Calculation of fragments of masonry was carried out using the finite-element analysis implemented in the Abaqus program. Different approaches to modeling masonry as a homogeneous isotropic body and as a structurally in homogeneous anisotropic body were considered. Comparison of experimental and calculated data showed that models of a homogeneous isotropic body are not applicable to the calculation of structural elements made of masonry.

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## Study of optimal conditions for extraction by toluol and humic acids from lignite

The aim of the study is to develop optimal conditions for obtaining toluene extract and humic acids from brown coal of Ukraine, as well as to determine their proximate and ultimate analysis, aromatic carbon content, degrees of hydrogen unsaturation and molecular association of organic matter.

To determine the yield of toluene extract and humic acids used standardized methods such as ISO 975:2021 Brown Coals and lignites – Determination of yield of benzene-soluble extract – Semi-automatic method та ISO 5073:2021 Brown coals and lignites – Determination of humic acids.

In addition, 3 methods were developed for obtaining toluene extract and humic acids, which differed from the standardized by weight of the sample, extraction conditions, volume and concentration of reagents, the procedure for extracting toluene extract and humic acids.

It has been found that milder extraction conditions lead to a decrease in toluene extract yield from 14.86 to 5.32%. At the same time, increasing the amount and concentration of NaOH leads to an increase in the yield of humic acids from 41.0 to 51.7%. If the quality indicators of toluene extract were practically unchanged, the quality of humic acids has undergone some changes: the carbon content has fallen from 57.4 to 51.8%; hydrogen content increased from 3.8 to 4.5%, Nd+Sdt+Odd content increased from 34.9 to 38.4%.

Determination of the yield of free humic acids to determine the yield of toluene extract from brown coal leads to the fact that the yield of free humic acids is 47.39-48.32% and the yield of toluene extract 1.79-5.28%, moreover, the use of the extraction apparatus significantly (almost 3 times) increases the yield of toluene extract. Indicators of ultimate analysis of humic acids are: Cd=61.7-61.8%; Hd=4.0-4.1%; Nd+Sdt+Odd=29.1-29.2%, quality indicators of toluene extract are: Cd=79.6-79.9%; Hd=12.6-12.9%; Nd+Sdt+Odd=6.9-7.5%.

The yield of toluene extract from humic acids was further determined. It was found that it is possible to further remove 0.48% of toluene extract from humic acids.

For the first time, studies were performed on the influence of conditions (weight of the sample, extraction conditions, volume and concentration of reagents, procedure for extraction of toluene extract and humic acids) of toluene extract and humic acids on their yield and quality indicators.

The implementation of the research results will allow to regulate the yield and quality indicators (proximate and ultimate analysis) of toluene extract and humic acids. The use of the developed methods will help increase the profitability of enterprises specializing in the extraction of toluene extract and humic acids from brown coal in Ukraine.

**Keywords:** humic acids, brown coal, toluene extract, yield, quality, extraction

**Audience Take Away Notes**

- As a result of familiarizing the audience with the report, they will be able to optimize the method for extracting humic acids and benzene extract from brown coal
- This will help specialists to get the maximum benefit from the available resources of brown coal, significantly increase the efficiency of their work, as well as receive a theoretical basis for further research

**Biography**

Serhiy Pyshyev studied Chemical technology of fuel and carbon materials at the Lviv Polytechnic National University, Ukraine and graduated in 1994. In 2001 he became an Associate Professor of the Department of Chemical Technology of Oil and Gas Processing in Institute of Chemistry and Chemical Technologies, Lviv Polytechnic National University. In 2014 Serhiy became a Professor at the same institution. He became a Doctor of Technical Sciences, Chemical Technology of Fuel and Fuel-lubricating materials in 2013. Also, he is member of the editorial board of the Journal of Coal Chemistry since 2018, and CHEMISTRY & CHEMICAL TECHNOLOGY since 2021. Besides, he is Co-Chairman of the Organizing Committee, Advance in Petroleum and Gas Industry and Petrochemistry (APGIP-11), XI International Scientific-Technical Conference. Serhiy has published more than 50 research articles in SCI(E) journals.

**Soraya Hoornam[1], Zeinab Sanaee[2]***

Energy Storage Laboratory, Department of Electrical and Computer Engineering, College of Engineering, University of Tehran, Tehran, Iran

## Prelithiation of silicon based nanomaterial anode for lithium ion battery application

Lithium ion batteries are widely used for providing energy of mobile electronic devices. Graphite is a traditional anode material that has been used in almost all of the commercialized Lithium ion batteries. It gives a specific capacity of 372 mAh/g for Lithium storage. But there are multiple better choices for storing Lithium that propose significantly higher specific capacities. As an example, Silicon based materials such as $SiO_2$ can be mentioned. $SiO_2$ material can offer a huge specific capacity of 1965 mAh/g, as the anode of Lithium ion batteries.Due to this high Lithium storage ability, large volume change occurs in this electrode material during insertion and extraction of Lithium, which may lead to cracking and destroying of the electrode, loosing the contact to the current collector and finally deteriorating the performance of battery. Use of nanomaterials instead of bulk material, can significantly solve this problem. In addition, If we insert Lithium in the active material of the battery, before its cycling, which is called prelithiation, a further enhancement in the performance is expected. Here, we have fabricated anode electrode of the battery using $SiO_2$ nanomaterial mixed with Graphite, and assembled a Lithium ion battery half cell with this electrode. Next, a prelithiation was performed on the $SiO_2$ nanoparticle containing electrode, and the resulted anode material was investigated. This electrode has a great potential for high performance Lithium ion batteries.

**Audience Take Away Notes**

- Introduction to Lithium ion batteries will be explained
- Silicon based anode material is introduced as the pioneer anode in the modern Lithium ion batteries
- Prelithiation is explained which is an enhancing step toward having better Lithium ion batteries
- These topics are part of the emerging technologies in the Lithium ion battery field, that can help the audience to be familiar with these topics and expand their research or teaching
- This research subject can lead to having higher performance Lithium ion batteries

**Biography**

Zeinab Sanaee received her BSc, MSc and PhD in 2005, 2009, and 2011, all in Electrical Engineering from University of Tehran. Then she started working at University of Tehran as an assistant professor in 2012. Her research interest is focused on fabrication of Lithium ion batteries and supercapacitors, and synthesis and implementation of nanostructured materials for their performance improvement.She is also director of Energy Storage Laboratory, where Fabrication of Silicon based Lithium ion batteries is followed as one of the main research subjects of the lab.

**Ravi Kikar Sinha**
A Private Indian Researcher, India

## The expanding universe and the cooling sun

It is now generally agreed that our universe is expanding. As the universe expands, the points in the universe move away from the central hot portion. Therefore these points undergo a process of cooling, and our sun, is not an exception to this

Phenomenon

As the sun moves away from the central axis of the universe, it will transform from the hot gaseous state, to liquid and finally to the semisolid cold state. It is bound to get dim and dark and stop illuminating the earth and other vicinial planets.

But life will have the last laugh, as life will emerge on the solid planet like sun, and other planets which will be illuminated by some vicinial star.

But i have not taken into account, the cosmic winds. They may increase or decrease the cooling of the sun and preserve its gaseous state.

**Biography**

Ravi kikar sinha(ghanshyam ji) is a former research student of l.s. College, muzaffarpur and university college of swansea(1974-75) dept. Of genetics.

Swansea, uk.

He is a member, aaas, washington dc, usa. He has 10 copyrights on scientific topics

From, canadian copyrights office in Quebec, canada. He also has the honour of writing to nasa and whitehouse.

**Mohammadreza Yasoubi[1], Zeinab Sanaee[2]***

Energy Storage Laboratory, Department of Electrical and Computer Engineering, College of Engineering, University of Tehran, Tehran, Iran

## Synthesis of silicon nanowires as a high performance anode material for lithium ion batteries

Today, Lithium ion batteries have been used extensively in mobile electronic devices. Especially for electric vehicles, usually these kind of batteries are widely implemented. These intensive applications of Lithium ion batteries have motivated the researchers to focus a great deal of attention on their performance improvement. Anode is one of the main components of these batteries, and for a long period of time graphite has been used for this section, offering a specific capacity of 372 mAh/g. On the other hand, Silicon is a high potential material for anodes of Lithium ion batteries, presenting a very high theoretical capacity of 4212 mAh/g, more than 10 times that of graphite. This ability to accept huge amount of Lithium inside its material, results in a high volumetric expansion for Silicon after lithiation that can lead to cracking of the active material, loosing its contact with the current collector and finally degrading the battery performance. Nanostructures of Silicon can significantly help to solve this problem, by providing enough void space between nanowires, in addition to their better tolerance to the volume expansion compared to the bulk material. Here we have synthesized Silicon nanowires on stainless steel substrate, using VLS approach in a CVD system. This structure has been used as a binder-free anode material for Lithium ion battery application. 1 M LipF6 in EC/DEC with 5% FEC have been used as the electrolyte. Lithium ion half-cell have been assembled in a Glove box with Ar ambient with Oxygen and humidity of less than 0.1 ppm. The results show high specific capacity of about 2400 mAh/g.

**Audience Take Away Notes**

- Introduction to Lithium ion batteries will be explained
- Silicon based anode material is introduced as the pioneer anode in the modern Lithium ion batteries
- CVD synthesis of Silicon nanowires is explained, which is one of the important approaches for growth of Si nanostructures
- These topics are part of the emerging technologies in the Lithium ion battery field, which can help the audience to be familiar with these topics and expand their research or teaching
- This research subject can lead to having higher performance Lithium ion batteries

**Biography**

Zeinab Sanaee received her BSc, MSc and PhD in 2005, 2009, and 2011, all in Electrical Engineering from University of Tehran. Then she started working at University of Tehran as an assistant professor in 2012. Her research interest is focused on fabrication of Lithium ion batteries and supercapacitors, and synthesis and implementation of nanostructured materials for their performance improvement. She is also director of Energy Storage Laboratory, where Fabrication of Silicon based Lithium ion batteries is followed as one of the main research subjects of the lab.

**Ravi Kikar Sinha**
A Private Indian Researcher, India

## Innovation in submarine design

Some theoretical aspects of submarine research imparting the submarine with greater speed and reducing it's vulnerability.

I suggest, minimising the vulnerability of an aircraft or a submarine by an arrangement concealing the posterior portion of the aircraft/submarine in the body of the aircraft/submarine except at the time of attack by the aircraft/submarine.

For greater strength of engine imparting much greater Speed, i suggest use of a number of electron positron contact based portable engines.

**Biography**

Ravi kikar sinha(ghanshyam ji) is a former research student of l.s. College, muzaffarpur and university college of

swansea(1974-75) dept. Of genetics.

Swansea, uk.

He is a member, aaas, washington dc, usa. He has 10 copyrights on scientific topics

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https://materials.magnusconferences.com/

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## Materials Science and Engineering

March 18-20, 2024 | Singapore | Hybrid Event

https://magnusconferences.com/materials-science/

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