JOINT EVENT

8th Edition of

World Nanotechnology Conference &

6th Edition of International Conference on

Materials Science and Engineering

18-20
March, 2024
Singapore

Venue:
Village Hotel Changi
1 Netheravon Rd, Singapore 508502

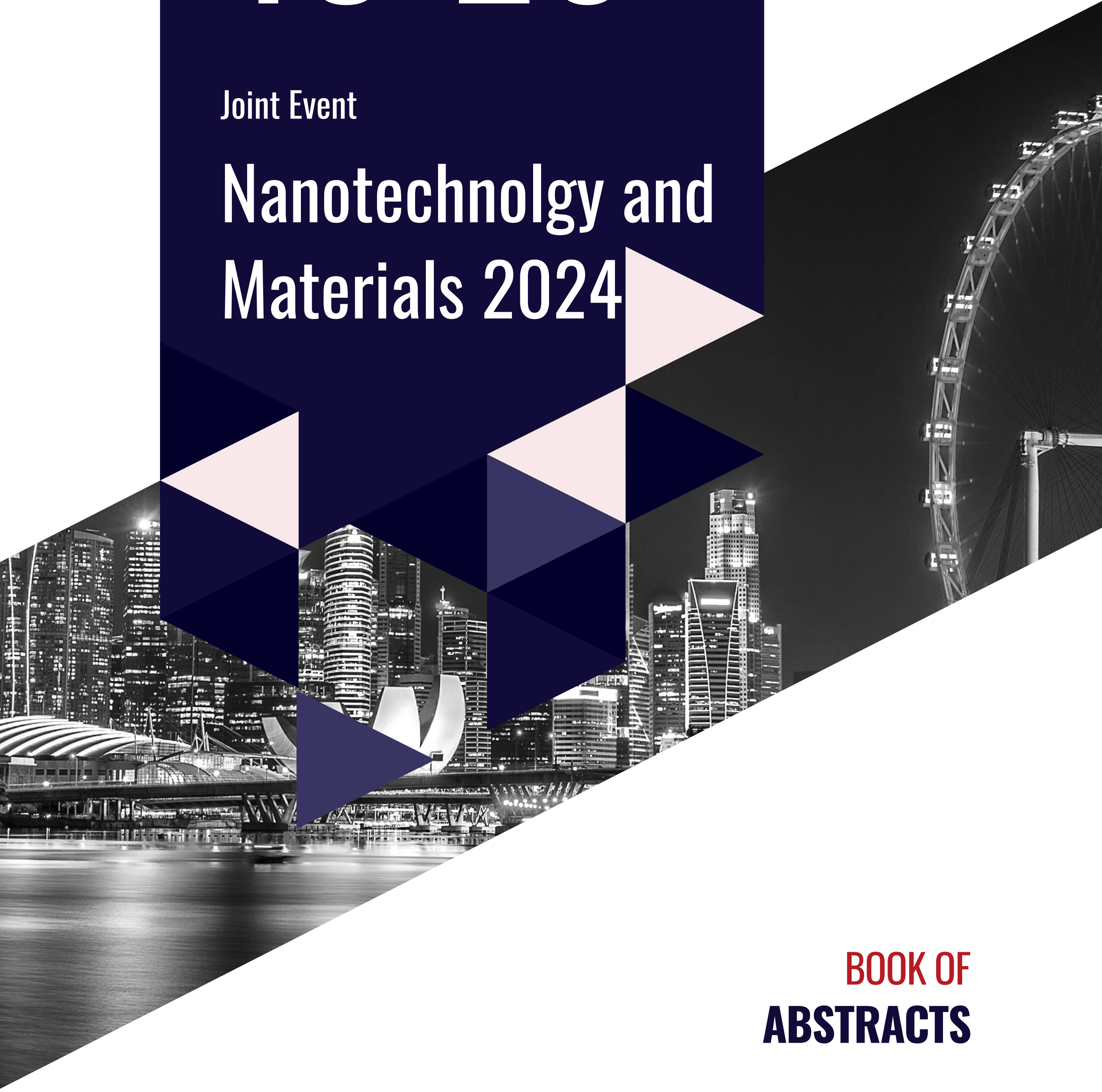
BOOK OF ABSTRACTS

MARCH

18-20

Joint Event

Nanotechnolgy and Materials 2024



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Thank You All...

Welcome Message

Prof. Kyoungtae Kim

Missouri State University, United States

Welcome to the 2024 World Nano conference. We look forward to your presentations in all areas of nanoscience, whether you are involved in biomedicine, biochemistry, chemistry, physics, engineering, or any other field that uses nanomaterials in your research. The conference will be a hybrid format, with both poster and oral presentations, and we will arrange our schedule so that every single one of you can present your work. We will do our best to organize your presentations into sections appropriate to your field of research, so that you can discuss your work with other researchers in the same field. Please help us make this conference a success by spreading the word to your colleagues who have not yet registered for this conference. We hope to see you all on March 18th.

Welcome Message

Prof. Mark Rainforth

The University of Sheffield, UK

Dear congress visitors, it is an honour and pleasure to write a few welcome notes. Materials Science and Engineering is undergoing a transformation and is entering into exciting, transformative, times. We face the challenges of promoting resource efficiency, sustainability and the circular economy. At the same time, we enter the fourth industrial revolution, so called Industry 4.0, where the use of AI techniques will lead to smart machines and factories, greatly increasing efficiency and productivity. Indeed, several argue that we are entering Materials 4.0, the fourth revolution in materials research, where we can use artificial intelligence to bring about a step change in materials research and materials manufacturing. This conference is timely in this respect where we will hear many of the individual contributions to this international revolution.

Welcome Message

Prof. DR. Antonio VASSALLO

University of Basilicata, Italy

Dear congress visitors, it is an honor and pleasure to write a few welcome notes. Nanoscience and nanotechnology are cross-disciplinary fields that have an impact on everything from smart coatings to electronic devices to medicine. This agenda incorporates nano-electronics and photonics, nanomaterials and nanofabrication, energy and sustainability, and biological sciences, among others, due to the transversal nature of Nanoscience. WORLD NANO 2024 is a scientific meeting that is intended to attract a large number of participants and listeners, with invited speakers, researchers, scientists, academicians, engineers, nanotechnologists, healthcare professionals, clinicians, pharmacists, toxicologists and industry spokesperson that will not only display exciting new breakthroughs in nanotechnology, but will also illustrate nanotechnology's transformative significance in a variety of physical and biological sciences. This is a fantastic opportunity to present your research findings to a large audience, foster information sharing, and network in the field of Nanotechnology.

Welcome Message

Prof. Thierry Meyer

EPFL, ISIC, Switzerland

Dear congress visitors, it is an honor and pleasure to write a few welcome notes. Nanotechnology, the manipulation of matter at the atomic and molecular levels, has emerged as a transformative force across diverse scientific realms. This investigation traces its evolution, from early theoretical underpinnings to contemporary breakthroughs. Beginning with foundational insights into quantum mechanics and surface science, we traverse pivotal milestones that have propelled nanotechnology to the forefront of innovation. Through retrospection, we discern patterns and insights that illuminate its potential applications, from advanced materials to biomedical technologies. By transcending traditional boundaries, nanotechnology promises to revolutionize industries and address pressing global challenges. This journey through its history underscores its enduring impact and underscores the exciting possibilities that lie ahead.

Welcome Message

Prof. DR. Paulo C De Morais

Catholic University of Brasilia, BRAZIL

Dear congress visitors, it is an honor and pleasure to write a few welcome notes. Materials Science and Engineering provided tremendous and unambiguous progress, since the nano-tools and nano-concepts were introduced in the 1990's. These new avenues opened up opportunities to manipulate matter and tailor its applications in all areas of technology; from geological prospecting to space science. It is not a coincidence that our society has been gifted with access to a tremendous broad palette of facilities, services and technologies not conceivable a few decades ago. Worldwide communication platforms and remote and reliable health care systems are just examples of such benefits. Much more are presently available and contributing to improve all aspects of human welfare. In this broad picture, Materials Science and Engineering play a central role and Materials2024 represents a unique opportunity to grab a fresh view of these two interconnected roads.

Welcome Message

Prof. Thomas J. Webster, Ph.D.

Entrepreneur
Founder of over a dozen companies
Developer of over a dozen FDA approved implants

If only for a nanosecond, it is time to stop, reflect, and develop a plan forward !

Can you believe it ? The U.S. National Nanotechnology Initiative was announced by President Bill Clinton in 2000 ! Over two decades ago ! With many countries around the world quickly following, this effort significantly increased funding and research activity in nanotechnology propelling the field into the spotlight. I remember jealous researchers claiming nanotechnology was all hype and saying "Just wait a nanosecond. Nanotechnology will pass like the trend it is" – some of those same envious researchers are still around today (usually on social media, not at conferences debating) hurting all of research. Envious that they missed the "nano-boat" !

Instead, very quickly thereafter, world class researchers improved products for construction, alternative energy, batteries, space exploration, and health (just to name a few). In my personal journey, I started nanomedicine in the mid to late 1990s, building new orthopedic implants out of nanoparticles. My research team showed greater bone growth when doing so. We quickly then demonstrated the ability to decrease infection and inflammation when using just nanoparticles, avoiding the use of drugs (such as antibiotics that bacteria have since developed a resistance to). I'm glad our research didn't contribute to that ! Then, we were off to killing cancer cells, fighting auto-immune diseases, and destroying SARS-CoV-2.

Jump forward 24 years and we can easily see the impact that nanotechnology has made in our lives. From more efficient cars to planes light enough to be powered by electricity alone to vaccines that helped us get out of COVID, nanotechnology is everywhere. But where exactly have we been ? What have we accomplished ? Do you know that many researchers (some of the same envious researchers mentioned above) don't even know that nanomaterials are in humans today improving their health proving the strong science behind such advances ? I know since I lived it ! Nanotechnology. A proven science.

But where is nanotechnology going ? I have heard murmurs around picotechnology ? Even smaller dimensions ? The role of artificial intelligence (AI) in automating nanotechnology ? What about nanosensors ? So many future directions !

As with any technology growing at the speed of light, it is so important to take a moment. Stop. Reflect. What have we learned ? What did we all miss ? And most importantly, where are we going ?

I encourage you to attend World Nano 2024 and I welcome you to World Nano 2024 where we will stop. Reflect. And collectively develop a path forward.

The next 24 years starts now.

Can't wait to see what we all develop !

ABOUT
MAGNUS GROUP

Magnus Group, a distinguished scientific event organizer, has been at the forefront of fostering knowledge exchange and collaboration since its inception in 2015. With a steadfast commitment to the ethos of "Share, receive, grow," Magnus Group has successfully organized over 200 conferences spanning diverse fields, including Healthcare, Medical, Pharmaceutics, Chemistry, Nursing, Agriculture, and Plant Sciences.

The core philosophy of Magnus Group revolves around creating dynamic platforms that facilitate the exchange of cutting-edge research, insights, and innovations within the global scientific community. By bringing together experts, scholars, and professionals from various disciplines, Magnus Group cultivates an environment conducive to intellectual discourse, networking, and interdisciplinary collaboration.

Magnus Group's unwavering dedication to organizing impactful scientific events has positioned it as a key player in the global scientific community. By adhering to the motto of "Share, receive, grow," Magnus Group continues to contribute significantly to the advancement of knowledge and the development of innovative solutions in various scientific domains.

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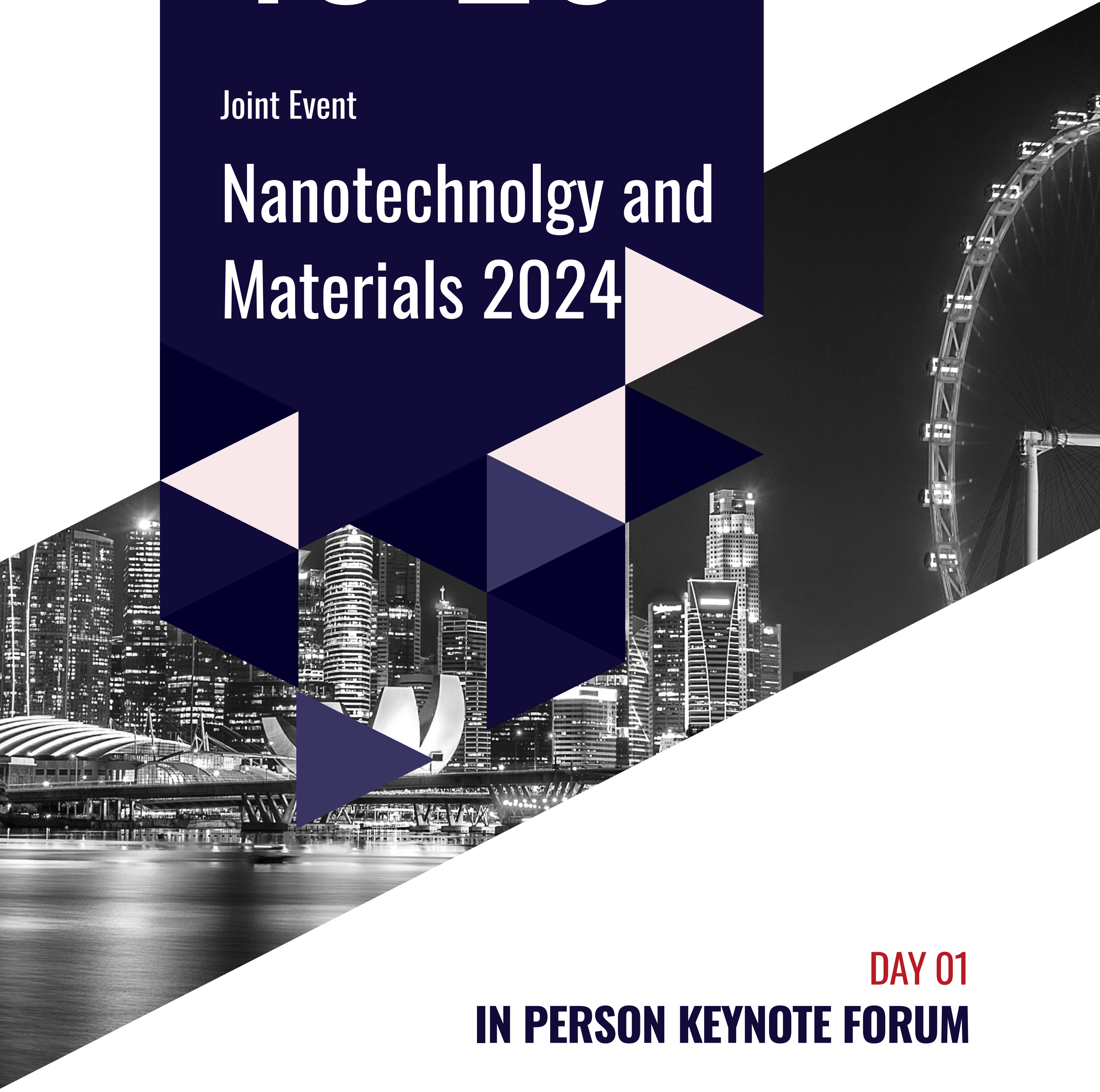

DAY 01

IN PERSON KEYNOTE FORUM

Safety management for nanomaterials in research environments

Health and safety experts face an ongoing challenge in evaluating the risks linked to the increasing utilization of Engineered Nanomaterials (ENM) in research. Given the constantly changing characteristics of these materials, there is a scarcity of information regarding their toxicology, compounded by the continuous development of new materials. Initial scientific studies indicate potential harmful impacts of ENM on human health, underscoring the importance of implementing effective measures to mitigate these risks.

In order to effectively evaluate risks, it is essential to gather accurate and comprehensive information from multiple sources, including safety data sheets and toxicological data. However, ENM often exhibit distinctive properties that set them apart from their bulk counterparts, offering new possibilities for innovative applications as well as potential hazards. Therefore, it is crucial to take into account the specific characteristics of ENM when assessing risks and implementing suitable safety precautions.

The limited understanding of ENM means that it may take several years to accurately identify the specific types and quantities that present risks to human health and the environment. In the absence of comprehensive information, it is advisable to adopt a precautionary approach, which involves implementing control banding methods. Nevertheless, due to uncertainties related to exposure and the potential effects, taking a cautious stance often leads to conservative estimations of risk levels. Consequently, stringent protective measures are necessary to address the perceived high level of risk.

Research and teaching institutions are dynamic environments with multiple laboratories, inexperienced students, and high staff turnover. To address these challenges, we present a practical "Nano safety" management system. Based on control banding and 15 years of experience, it has been successfully implemented in over 120 ENM research labs. The system includes risk assessment, preventive measures, and protection implementation. We will discuss its achievements and challenges in this evolving environment.

Thierry Meyer

Chemical and Physical Safety Group, Institute of Chemical Sciences and Engineering, Ecole Polytechnique Federale de Lausanne, Station 6, 1015 Lausanne, Switzerland

Biography

MER Dr. Meyer obtained his MS in Chemical Engineering from the Swiss Federal Institute of Technology (EPFL) in 1985. He completed his PhD at the same institution in 1989. Following his graduation, he worked in the chemical industry for several years at Ciba-Geigy, Novartis, and Ciba Specialty Chemicals Inc., where he served as a development chemist, head of development, and production manager. In 1999, he joined EPFL as the director of a research group and, since 2005, he also heads the university's occupational health and safety service. He has published over 150 research articles in SCI(E) journals and authored 10 books.

Pentacyclic triterpenoid nano formulations as bioavailable drug delivery agents at cellular level

The last decade an increasing scientific interest was focused on pentacyclic triterpenoids (betulin, betulinic acid and lupane), considering their antitumor effects without so many secondary adverse actions comparative to other synthetic anticarcinogens (e.g. Doxorubicin). Considering that pentacyclic terpenoids have a low bioavailability, new nano formulations can overcome this challenge. Our aim was to find best solvents for these molecules and to obtain nano formulations (liposomes, nano lipid particles, self- assembled structures) from a standardized extract of Betula pendula bark, in order to build bioavailable agents for targeted delivery to normal vs tumour cells (e.g. Walker 256 cells). The nano formulations obtained were characterized by size DLS measurements, UV-VIS spectrometry, fluorescence microscopy and high-performance liquid chromatography coupled with mass spectrometry (LC_MS) and compared with similar formulations containing Doxorubicin. Comparatively, the viability tests and the apoptotic effects demonstrated that nano formulated triterpenoids can reach increased bioavailability and similar antitumor effects as Doxorubicin, but with less toxicity on normal cells.

Audience Take Away Notes

- Basic knowledge about pentacyclic terpenoids and their natural sources, as well the recent data related to their impact on health and disease
- To see new innovative ways to make nanoformulations for future applicxations
- This research that other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer'sjob more efficient
- It willimprove the accuracy of a design, or provide new information to assist in a design problem
- Other benefits
    - o New ways to make these valuable compounds to be used, as nano formulations in vitro and in vivo, as anticancer agents

Dr. Carmen Socaciu[1]*, Mihai Adrian Scaciu[2]

[1]Department of Plant Biotechnology, Biodiatech Research Centre, Cluj-Napoca, Romania

[2]Department of Imaging medicine, Biodiatech Research Centre, Cluj-Napoca, Romania

Biography

Dr. Carmen Socaciu studied Chemistry at the Bbabes-Bolyai University, Cluj-Napoca, Romania and graduated as MS in 1977. She received her PhD degree in 1986 at the same institution. She got differentpostdoctoral grants at the University Bordeaux-France, University of Bern-Switzerland, University of Bremen-Germany. She was acting as full professor at the Department of Biochemistry at the Unoversity off Agricultural Sciences and Veterinary Medicine in Cluj-Napoca for more than 2 years and now she is the Director of the Proplanta Research Centre for Applied She has published more than 300 research articles in ISI journals (Hirsch index 38).

Rapid manufacturing anywhere, anytime

Rapid manufacturing on space/air/sea/land missions, where either gravitational force is missing or severe random disturbance may present continuously, is highly in demand. However, till today, there is no reliable technique for such working environments. The purpose of this study is to develop a technology for rapid 3D printing in solid state of polymeric materials to get rid of the problems in harsh working environment.

The basic concept is to cross-link by either UV-light or photo-induced-heat of polymeric materials in the solid state for rapid volumetric additive manufacturing. The uncross-linked parts can be removed by heating or cooling for melting, or washing away by solvent. Finally, the Shape Memory Effect (SME) of the cross-linked polymers is applied to ensure high accuracy of the printed items.

We have successfully demonstrated this concept using thermal gel, UV cross-linkable vitrimer and other conventional materials.

Keyword: Rapid 3D Printing, Solid State, Cross-Linking, Thermal Gel, Vitrimer.

Wei Min Huang

School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore

Biography

Dr. Wei Min Huang has over 25 years of experience on various shape memory materials (alloy, polymer, composite and hybrid), he has published over 200 papers in journals, such as Accounts of Chemical Research, Advanced Drug Delivery Reviews, and Materials Today, and has been invited to review manuscripts from over 300 international journals (including Progress in Polymer Science, Nature Communications, Advanced Materials, and Advanced Functional Materials, etc), project proposals from American Chemical Society, Hong Kong Research Grants Council, etc., and book proposals from Springer, Elsevier and CRC. He has published two books (Thin film shape memory alloys – fundamentals and device applications, Polyurethane shape memory polymers) and is currently on the editorial board of over three dozen of journals.

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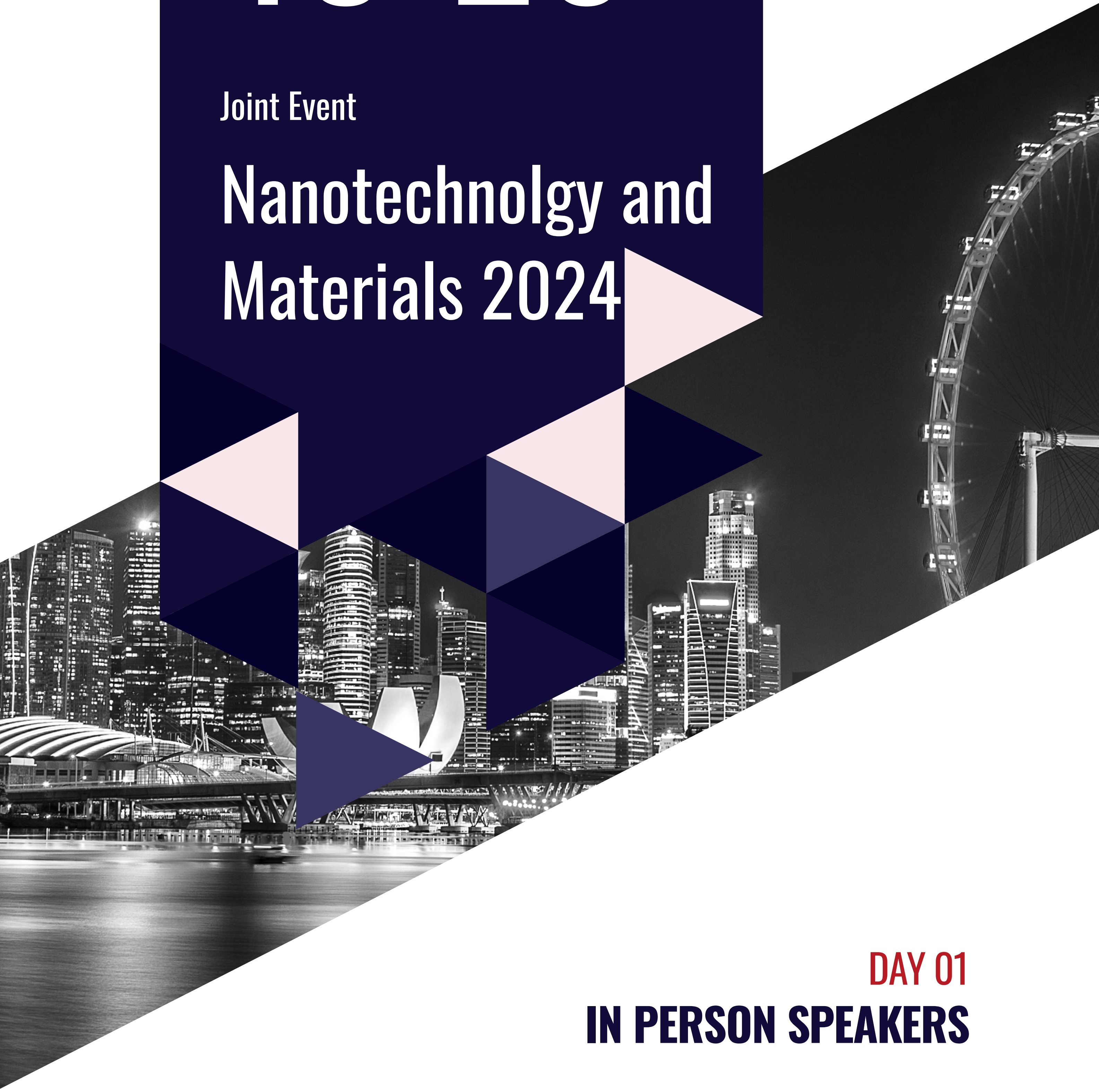

DAY 01
IN PERSON SPEAKERS

Etelka Chung[1]*, Kun Luo[2], Ya Li[2], Tong Lui[2], Xiangqun Zhuge[2], Andrew R. Timms[1], Simon P. Graham[3], Guogang Ren[1]

[1]School of Physics, Engineering and Computer Science, University of Hertfordshire, Hatfield, Hertfordshire, United Kingdom
[2]School of Materials Science and Engineering, Changzhou University, Changzhou, China
[3]The Pirbright Institute, Ash Road, Pirbright, Woking, Uinted Kingdom

Antimicrobial properties of functionalized copper nanoparticles doped with gold nanoclusters

Nanoparticles are referred to materials with dimensions typically between 1 to 100 nm. It has been found that these materials have enhanced properties, such as antimicrobial activity, due to their large surface area to volume ratio. The conditions during the synthesis of nanoparticles can be controlledto form their required physiochemical properties, including size, surface functionality, and stability, resulting in theirstrong antimicrobial properties. During the past 2 years, we have developed novel Au-nanocluster (<5 nm) decorated copper nanoparticles (Au@CuNPs) with overall diameter sizes around 10-30 nm using galvanic displacement. The Au@CuNPs are constructed as a bimetallic formation which displayed a high selective production of H2O2 via a two-electron (2e-) Oxygen Reduction Reaction (ORR). The optimised Au@CuNPs exhibited a high 2e- selectivity of 95% H2O2 production. Herein, this work will explore these functionalized bimetallic Au@CuNPswith a selectiveAu to Cu ratio varying from 0.5:10 to 2:10 and different salt condition treatments of CuNPs prior to the displacement reaction. The morphology and composition of the synthesised Au@CuNPs were characterised through Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and X-ray diffractometer (XRD).A ZetaSizer was used to characterise theirzeta potential and their hydrodynamic sizes in fluid suspensions. The Au@CuNPs were also tested against common nosocomial microbes using the cut well diffusion method and found to provide better antimicrobial properties than their single element nanoparticles. The antimicrobial evaluation results showed thatAu@CuNPs were more effective against gram positive Staphylococcus aureus in comparison to gram negative Escherichia coli. It is suggested that their H2O2 electrocatalytic yielding ability aids to their mechanism of action against Gram-positive bacteria by generating high levels of oxygen species which increasesoxidative stressand leads to cell death.

Audience Take Away Notes

- Synthesis of Cu-Au nanoparticles using simple galvanic displacement reaction
- Antibacterial activity of Cu-Au nanoparticles
- The connection between the physiochemical properties of nanoparticles and their antibacterial activity
- Potential antimicrobial applications of nanoparticles

Biography

Dr. Etelka Chung earned a bachelor's degree inBiomedical Sciences at the University of Hertfordshire (UH). Prior to graduation, she received a bursary from The British Society for Plant Pathology for a summer project. She continued to work as a research assistant in plant pathology beforeshe received a PhD scholarship from the School of Physics, Engineering and Computer Science at UH to study antimicrobial nanoparticles. Currently, Etelka is working as a Postdoc Research Fellow as part of the Microfluidics and Microengineering Research Group at UH. She is interested in a range of topics and likes to learn new things.

Nicola Montinaro, Mario Fustaino, Antonio Pantano*
Engineering department, University of Palermo, 90128, Palermo, Italy

Non-destructive evaluation technique for assessing nanoparticle dispersion in composite materials

Extensive production of polymer composites reinforced by nanoparticles is hindered by the lack of Non-Destructive Evaluation (NDE) methods capable of ensuring product quality and compliance with specifications. It is widely recognized that the dispersion level of nanoparticles in the polymer matrix significantly influences their enhancement capabilities more than any other parameter. In this study, an active infrared thermography NDT (IR-NDT) inspection, combined with pulsed phase thermography (PPT), was applied for the first time to nanocomposites to assess the dispersion level of nanoparticles. The PPT approach was tested on various nanocomposite samples with different levels of nanoparticle dispersion, including a nanocomposite with a very low nanofiller concentration (less than 0.05% by weight). The phasegrams obtained with this technique clearly reveal clusters or bundles of nanoparticles when present. Consequently, this new NDE approach can be employed to verify that the expected dispersion levels are maintained during the production process. The study also identifies the mechanisms underlying the effects of nanoparticle dispersion on the thermal response of polymer composites.

Funding: MUR, PNRR-M4C2, ECS_00000022

Acknowledgement: Proghetto: Sicilian Micro nanotech Research and Innovation Center "SAMOTHRACE" (MUR, PNRR-M4C2, ECS_00000022), spoke 3- University of Palermo"S2-COMMs - Micro and Nanotechnologies for Smart & Sustainable Communities

Audience Take Away Notes

- Participants will be introduced to an innovative non-destructive evaluation technique for assessing nanoparticle dispersion in composite materials
- People from industry may be very interested in a non-destructive evaluation method capable of ensuring product quality and compliance with specifications
- This research may be useful to other faculty to expand their research or teaching on non-destructive evaluation of nano composites
- This NDE technique could offer a practical solution to address the challenge of testing the production of components made of nanocomposites, mitigating issues related to poor nanoparticle dispersion
- The non-destructive evaluation method presented here enhances design accuracy by ensuring adherence to strict requirements, given that nanoparticle dispersion can be readily tested

Biography

Antonio Pantano is full professor at the Engineering Department of the University of Palermo (Italy). He earned is M.S. (1999) and Ph.D. (2002) in Engineering Mechanics from Michigan State University. From 2002 to 2004 he was Postdoctoral Associate at the Massachusetts Institute of Technology working on carbon nanotube enabled materials. In 2004 he moved to the Department of Mechanics, University of Palermo, where he was professor “Rientro dei Cervelli”, a position for outstanding scientist. From 2007 he is professor, first associate and later full, at the University of Palermo. He has published 9 books and more than 100 research articles.

Dr. Igor V. Reshetov[1]*, Alexey V. Dub[1], Pavel A.Karalkin[1], Dmitriy V. Shtanskiy[2]

[1]Institute Claster Oncology, Sechenov University, Moscow,Russian Federation
[2]Department ofnanotechnology, National University "MISIS",Moscow, Russian Federation

Functional surface films for individual reconstructive implant in maxillofacial surgery

Trauma, disorders, oncology in head and neck organs have growing level. Actually to make reconstructive technologies for restoration this main region of human body. But metals and alloys meet many of these requirements, and the bond strength between the implant and the bone is insufficient. One of the effective ways to initiate the formation of a bone-like layer on the surface of the implant is to cover it with a bioactive multifunctional coating.

We to performed innovative trial for manufacturing additive reconstructive implants for maxillofacial surgery. TiC 0.5+10%(Ca10(PO4)6(OH) were synthesized composite targets using the combined forces SHS-pressing technology. The targets were subjected to magnetron sputtering in a mixture of argon and nitrogen. The diameter of the target was 125 mm, the distance from the substrate to the target was 100 mm. The total pressure P was maintained at 0.2 Pa, the partial pressure of nitrogen was 14% of the total pressure.

Ti-Ca-P-C-O-N coatings with a thickness of 0.7-0.8 µm were deposited on titanium medical grids. During the deposition process, the substrate temperature was maintained at 2000C. The total deposition time of the coatings was 60-90 minutes.

MBNPS possessed a unique combination of chemical, mechanical and tribological properties. Especially - low coefficient of friction in physiological media 0.12-0.25. After this implants performed in biomedical experience and clinic trial. Clinic stage showed better results than pure titanium implants.

Audience Take Away Notes

- The results are aimed at improving the treatment of patients
- The information obtained in the study can be used in teaching technologists and doctors
- Theresults can help the audience in their job
- This research could use other faculty to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- It willto improve the accuracy of a designall other benefits

Biography

Dr. Igor V. Reshetov studied medicine at the N.I.Pirogov Moscow Medical University University, USSR in 1987 and graduated as PhD in 1992. He then to the continued research in P.A.Herzen Cancer Research Institute, Moscow. After in same institute he defensed dissertation Doctor of Medicine in 1998 about microsurgical reconstruction organs and tissues in oncology, since2014 he relocated in Sechenov University, Moscow and in 2019 till now has position Director Institute cluster oncology. As a opinion lieder in field interdisciplinary access to treatment and rehabilitation in oncology associated in Russian Academy of Science in 2004 and in 2016 has full member of RAS.He has published more than 100 research articles in SCI(E) journals.) Index Hi 26.

Igor V. Reshetov[1]*, Arina V. Voitova[2], Artem A. Shiryaev[1]
[1]Institute claster oncology, Sechenov University, Moscow, Russian Federation
[2]Biospec Ltd., Moscow, Russian Federation

Photodynamic inactivation of antibiotic-resistant microflora using photosensitizer nanoforms

Purulent wounds treatment of soft tissues is associated with certain difficulties, which are caused by multiple factors, including occurrence, formation and wound nature specificities. Purulent complications significantly increase a treatment time and a process cost. We propose the problem solution of antibiotic-resistant microflora decontamination using technology based on fluorescent diagnostics and Photodynamic Inactivation (PDI). As nanocarriers, the photosensitizer ethosomes were used. Due to its neutral charge and spherical shape, the nanoparticles were able to penetrate through skin barrier and destroy pathogenic microorganisms.

70 patients were received PDI technology treatment of purulent wounds. Before and after irradiation, microflora composition and quantity were analyzed. The obtained data evidenced that local application of Photoran E6 and PDI technology inactivate both Gram-positive and Gram-negative bacteria. The use of photosensitizer nanocarriers led to obtain a quantitative decrease of bacterial growth in the wound of all patients and reduce the healing time of wounds.

PDI technology using application of photosensitizer nanocarriers showed high antimicrobial activity against antibiotic-resistant microflora of infected wounds in most clinical instances. The decontamination of microflora enabled to perform delayed reconstructive plastic surgery to close soft tissue defects and reduce hospitalization time of patients.

Audience Take Away Notes

- An improvement of patients treatment was the main aim of study. The obtained information could be used as a part technologists and doctors studying
- The results could help the audience in their job
- Other faculties to expand their researches or teachings could use this research
- This practical solution of the problem could simplify or make a designer's job more efficient
- It will improve the design accuracy and receive all other benefits

Biography

Moscow Medical University University in 1987 and obtained PhD in 1992. Then he continued work in P. A. Herzen Cancer Research Institute. He defended doctoral dissertation about oncology microsurgical reconstruction organs and tissues in 1998. Afterwards he relocated in Sechenov University in 2014. Nowadays he has the position of Director Institute cluster oncology from 2019. As a recognized leader of oncology treatment and rehabilitation, he joined the Russian Academy of Science in 2004 and became the RAS fellow in 2016. He has published more than 100 investigation articles in SCI(E) journals. Index Hi 26.

Mohammad Al Mamun[1,2]*, Yasmin Abdul Wahab[1], M. A. Motalib Hossain[1], Abu Hashem[1,3], Nor Aliya Hamizi[1], Zaira Zaman Chowdhury[1], Sharifah Fatmadiana Wan Muhamad Hattad[4], Irfan Anjum Badruddin[5], Sarfaraz Kamangar[5], Mohd Rafie Johan[1]

[1]Nanotechnology and Catalysis Research Centre, Institute for Advanced Studies, Universiti Malaya, 50603 Kuala Lumpur, Malaysia
[2]Department of Chemistry, Jagannath University, Dhaka-1100, Bangladesh
[3]Microbial Biotechnology Division, National Institute of Biotechnology, Ganakbari, Ashulia, Savar, Dhaka-1349, Bangladesh
[4]Department of Electrical Engineering, Faculty of Engineering, Universiti of Malaya, 50603, Malaysia
[5]Mechanical Engineering Department, College of Engineering, King Khalid University, Abha 61421, Saudi Arabia

Differential pulse voltammetric tuning of the screenprinted carbon electrode surface to enhance the electrochemical performance and multiplex detection

Screen-Printed Carbon Electrodes (SPCEs) have shown tremendous scope for the miniaturization and commercialization of low-cost electrochemical sensors and biosensor devices. But the commercial SPCEs have a narrow Potential Window (PW) that limits their applications for various analytes owing to the presence of some inherent redox peaks in the wider PW. In this exploration, the electrochemical performance of the SPCE surface has been significantly improved after DPV treatment, making it appropriate for use as a transducer in electrochemical analysis, mainly for the identification of biomolecules. After evaluating the condition of the untreated SPCEs surface, it was pre-cathodized using the DPV technique in KCl-tris buffer (pH = 8) from +2.0 V to -2.0 V vs Ag. The electrochemical performance of the DPV-tuned SPCE electrode was noticeably improved. Because the value of k0 increased from 2.89 x 10 - 6 cm s − 1 at the untuned SPCE to 3.92 x 10-6 cm s − 1 at the tuned SPCE in the presence of a model redox-couple, [Fe(CN)6]-3/-4. The electrochemical double layer Capacitance (Cdl) and the electroactive surface Area (A) of the electrode were enhanced by the factors of 20 and 52 times, respectively, after the DPV treatment. Moreover, the charge transfer resistance (Rct) of the treated SPCE surface decreased about 78 times compared to the fresh electrode. Excellent electrocatalytic performance and reproducibility were displayed by the DPV-tuned electrode towards the redox species [Fe(CN)6]-3/-4 which have been strongly supported by the calculated electrochemical parameters. Furthermore, this DPV treated electrode is greatly suitable to detect multiple analytes (such as Cd2+, Cu2+ and Hg2+) in a mixture with excellent reproducibility. However, this multiplex detection ability of the DPV tuned SPCE has created the opportunity for further research regarding the optimization of signal intensity intended for targeted analytes by the determination of various characteristic electrochemical parameters. Therefore, this study will introduce a reliable innovative platform for not only the pre-treatment of SPCEs but also enhance the electrocatalytic activity, reproducibility, electrode surface area, non-faradaic potential window, eliminating the interfering inherent peak of the electrode surface. It also creates a scope to analyze multiple targets simultaneously within the wide potential window, which may reduce the electroanalysis cost dramatically.

Audience Take Away Notes

- Screen-Printed Carbon Electrodes (SPCEs) demonstrate significant potential for downsizing and commercializing affordable electrochemical sensors and biosensor devices. However, the Potential Window (PW) of commercially available SPCEs is limited, restricting their use for a range of analytes due to inherent redox peaks present in a broader PW. From my presentation, the audiences could be able to learn first time how to eliminate those unexpected redox peaks from the SPCE by electrochemical tunning and apply precisely and successfully

- Here, I will describe an advanced and effective electrochemical method to modify the surface of Screen-Printed Carbon Electrodes (SPCEs) using Differential Pulse Voltammetry (DPV). This modification aimed to eliminate the inherent redox peaks that constrain the Potential Window (PW) of the electrodes. Subsequently, we assessed the electrochemical performance of the modified SPCEs, focusing on various parameters such as reproducibility. This assessment was conducted using Cyclic Voltammetry (CV), DPV, and Electrochemical Impedance Spectroscopy, employing $[Fe(CN)6]3-/4-$ as a model redox analyte. Additionally, we evaluated the modified electrode's capability for detecting multiple analytes by testing it in a mixture containing Cd2+ (cadmium), Cu2+ (copper), and Hg2+ (mercury) ions, using both CV and DPV techniques. The data from the electrochemical analysis reveals that following the DPV-based electrochemical treatment, the surface of the Screen-Printed Carbon Electrode (SPCE) demonstrates outstanding reproducibility and enhanced electrochemical efficiency within an expanded potential window
- I hope that this innovative Differential Pulse Voltammetry (DPV) tuning technique will overcome the intrinsic limitations of Screen-Printed Carbon Electrodes (SPCEs), thereby broadening their potential for accurate applications in diverse fields. The students and colleagues associated with the participants could also enhance their knowledge by having this information shared with them

Biography

Mohammad Al Mamun completed his B.Sc. (Hons.) in Chemistry in 1999 and M.Sc. in Physical-Inorganic Chemistry in 2001, both from the University of Dhaka, Bangladesh. He further pursued an M.Phil. in Physical Chemistry, which he obtained in 2008, also from the University of Dhaka. Expanding his academic horizons, he went on to earn an MS in Nanoscience and Nanotechnology in 2011 from the University of Rovira I. Virgili (URV), Spain. Since 2011, he has been serving as an Associate Professor of Chemistry at Jagannath University, Dhaka. Currently, he is pursuing his PhD at the NANOCAT (Nanotechnology and Catalysis Research Centre), part of the Institute for Advanced Studies (IAS) at the University of Malaya, Malaysia, under the guidance of Dr. Yasmin Abdul Wahab. Over the course of his career, Al Mamun has contributed significantly to his field with some international awards, authoring over 50 research articles, several book chapters, all published in various international journals.

Dr. Flora M. Yrad[1]*, Evangelyn C. Alocilja[2]
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Functionalization of dextrin-capped gold nanoparticles with oligodeoxynucleotides

Gold Nanoparticle (AuNP) is a colloidal zerovalent nanoscale gold core generally capped by organic layer and dispersed in a solvent. Their unique properties offer great potential applications in many fields including biosensing. DNA-functionalized AuNPs are popular in biosensors due to their ability to recognize and interact with target molecules through DNA recognition sequences. The objective of this study was to functionalize dextrin capped AuNP with DNA oligonucleotide to produce a functional Gold Nanoparticle/Reporter DNA (AuNP/rDNA) conjugate intended as reporter probe for a lateral flow biosensor for dengue RNA detection. Synthesized dextrin-capped AuNP was mixed with a 20-base long DNA oligonucleotide thiolated at the 5'-end for ligand exchange reaction through salt-aging process. DNA-functionalized AuNPs were characterized by color validation, UV-vis spectroscopy, and High-Resolution Transmission Electron Microscopy (HRTEM). The numbers of DNA strands attached to the AuNPs were quantified using AuNP decomposition by potassium cyanide and UV-vis spectroscopy measurements. The factors that affect functionalization were also determined. AuNPs with average core sizes of 7 and 10 nm were successfully functionalized with thiolated DNA molecules. Well-functionalized AuNP retained the characteristic AuNP red color, exhibited AuNP Surface Plasmon Resonance (SPR) bathochromic shift, and stable against aggregation at high salt concentrations. The DNA loading was found to be 9 ± 1 and 22 ± 2 DNA strands per particle of the 7 and 10 nm core sizes, respectively.Dextrin capped AuNPs were successfully functionalized with 5'-end thiolated oligodeoxynucleotide and produced stable AuNP/rDNA conjugates. Functionalization was affected by the stability, concentration, and sizes of the dextrin capped AuNPs.

Audience Take Away Notes

- The study reports that dextrin-capped gold nanoparticles can be successfully functionalized and produce stable AuNP/rDNA conjugates
- The study is helpful in the applications of gold nanoparticles as DNA reporter probes for lateral flow biosensor
- This research could be used by other faculty to expand their research or teaching on functionalization of dextrin capped gold nanoparticle and gain insights on the factors that affect DNA functionalization
- The study reports on the first attempt of quantifying the number of DNA strands attached to dextrin-capped gold nanoparticles

Biography

Dr. Flora M. Yrad studied Chemistry at Silliman University and the University of San Carlos, Philippines. She conducted her dissertation research at the Nano-Biosensors Lab, Department of Biosystems and Agricultural Engineering, Michigan State University, USA funded by the United States Agency for International Development (USAID) Advanced Research Scholarship and Silliman Faculty Development Committee (FADECO) Doctoral Scholarship. She had published her works on modified synthesis of dextrin- capped gold nanoparticles and dengue RNA detection using lateral flow biosensor. She graduated in 2019 with a PhD in Chemistry. She obtained the position of an Associate Professor at Silliman University, Dumaguete City, Philippines.

Dr. Naoki Azuma[1]*, Kenji Fukuzawa[1], Shintaro Itoh[1], Hedong Zhang[2]

[1]Department of Micro-Nano Mechanical Science and Engineering, Nagoya University, Nagoya, Japan
[2]Department of Complex Systems Science, Nagoya University, Nagoya, Japan

Manipulation and analysis of large DNA molecules using micro/nanogap structures

Analyzing the length of DNA molecules is one of the fundamental processes for analyzing DNA molecules of bacteria and viruses in the humanbodies and in the environment.For example, to identify the genotype of bacteria, analyzing the length distribution of DNA fragments is required after its genomic DNA is cut at the positions of specific base sequences using the restriction enzymes.To analyze the horizontal transmission of bacterial genes, analyzing the length distribution of multiple plasmid DNAs inthe bacteria is required as a pretreatment for gene analysis. These analyses have been used to identify the infection routes and the gene propagation pathways of dangerous bacteria such as drug-resistant bacteria, and require high-speed and high-sensitivity analysis. Gel electrophoresis, which uses the mesh structure of the gel as a molecular sieve matrix, has been usually used to analyze the length of DNA molecules. However, this method requires a large consumption of DNA samples and long analysis time. In particular, the length analysis of large DNA, which is larger than 10 kbp(base pairs), such as bacterial genomic DNA and plasmid DNA has required several days to be analyzed. This is because large DNA molecules have a random coil shape with a diameter of several micrometers and are greatly deformed when they migrate in the small mesh structure of a gel, requiring slow migration using a special electrophoresis method. The unique deformation of large DNA molecules is a difficulty in high-speed analysis. Therefore, we have developed the methods to analyze large DNA molecules by manipulating them using micro- and nano-scale gaps formed in a microfluidic channel. We have proposed the methods to control the Brownian motion of large DNA molecule using an array of microgap structures, to trap large DNA molecules using a nanoslit structurewith the depth of several tens of nanometers, and to stretch a single large DNA molecule. By manipulating large DNA molecules using these micro- and nano-gaps, fast length analysis of large DNA molecules at the tens of minutes level has been realized. In this presentation, we would like to introduce the principles, the experimental results, and impact of our micro/nanogap -based DNA analysis methods. If these methods can be put into practical use, we expect that there are various applications, not only for bacteria and viruses, but also for extracellular vesicles and environmental DNA, and so on.

Audience Take Away Notes

- Micro/Nanostructures fabrication using a micro-fabrication technique
- Migration Control of biomolecules using micro/nanostructures
- Understanding of methods of analysis of large DNA molecules

Biography

Dr. Naoki Azuma studied Micro-Nano Mechanical Science and Engineering at the Nagoya University, Japan and graduated as MS in 2016. He then joined the research group of Prof. Fukuzawa at the Nagoya University, Japan. He received his PhD degree in 2018. His current position is an assistant professor at the department of Micro-Nano Mechanical Science and Engineering, Nagoya University. His research interests includebiomolecule analysis, micro-nanofluidics, and micro-nano tribology. He has hadthe research funds and the research articles, and has received several awards, including the Young Outstanding Lecturing Fellow Award from the Japan Society of Mechanical Engineers.

Tshireletso M. Madumo[1,2]*, Sithembela A. Zikalala[1], Nozipho N. Gumbi[1], Shivani B. Mishra[3], Bulelwa Ntsendwana[4], Edward N. Nxumalo[1]

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[4]Nanotechnology Innovation Centre, Advanced Materials Division, Mintek, Private bag X3015,Randburg, Johannesburg 2125, South Africa

Development of nitrogen-doped graphene/MOF nanocomposites towards adsorptive removal of Cr (VI) from the wastewater of the herbert bickley treatment works

Industrial effluents laden with Cr (VI) pose considerable health risks to human and animal life if left untreated. Hence, in this work, metal–organic framework-5/nitrogen-doped graphene (MOF- 5/NGO) nanocomposites are fabricated. These materials were produced with increasing NGO loadings (0.05, 0.10 and 0.15 wt. %) to investigate the effect of the NGO content on the chemical and physical properties of the composites. The FTIR spectra show the nanocomposites be to be rich in surface –OH and –COOH functional groups. Raman spectroscopy confirmed bond formation between the MOF-5 and NGO through downshift of the G- and 2D-bands. XRD analysis showed the composites, MOF-5 and the NGO to be highly crystalline while thermogravimetric analysis indicated the thermal stabilities of the composites to be enhanced. SEM studies revealed the NGO flakes to be dispersed on the MOF-5 microstructures prior to adsorption and the disappearance of microstructures post adsorption. The as-synthesized nanocomposites exhibited BET surface area in the range 384.55–395.56 m2 .g– 1 which is a significant increase from that of MOF-5 261.00 m2. g– 1. The optimal conditions for maximum Cr(VI) adsorption were determined to be: pH = 2, contact time of 60 min, adsorbent dosage of 6 mg.L– 1,initial Cr(VI) concentration of 0.5 mg.L-1 and temperature of 30 ◦C. A maximum adsorption efficiency of 46.1 % was achieved by MOF-5/NGO (0.05 wt. %) and not significantly compromised by competing metal ions. The Cr (VI) removal on MOF-5/NGO nanocomposites is well described by the Langmuirisotherm, confirming a chemisorption process. In addition, the thermodynamic studies confirmed the adsorption process to be favorable, spontaneous and endothermic. The Cr(VI) removal % on MOF-5/NGO from real water is 52.1 %. Therefore, the novel MOF-5/NGO nanocomposite can be applied for efficient Cr(VI) removal from industrial wastewater due to synergistic surface characterized by better adsorption capacity not met by pristine materials.

Biography

Tshireletso Madumo is a Professional Natural Scientist in Chemical Sciences and a Researcher who possess 10 years of expertise as a Laboratory Scientist from Ekurhuleni Water Care Company: Scientific Services in South Africa in performing accredited chemical testing services on water and wastewater matrices to ensure consistent excellence in water care for Green Drop status compliance. Tshireletso holds a National Diploma in Analytical Chemistry, Bachelor of Technology degree in Chemistry from Tshwane University of Technology ,South Africa and a Master's Degree Chemical Engineering from the University of South Africa. Tshireletso published a paper titled "Development of nitrogen doped graphene/MOF nanocomposites towards adsorptive removal of Cr (VI) from the wastewater of the Herbert Bickley treatment works" in Febuary 2023.Tshireletso have a manuscript titled "Industrial Wastewater Treatment Past and Future Perspectives in Technological advances for Mitigation of Cr(VI) Pollutant accepted for publication in the Open Access book, "Wastewater Treatment - Past and Future Perspectives" in March 2024.Tshireletso is currently a PhD candidate at the University of Johannesburg, South Africa investigating innovative strategies to fabricate mixed matrix membranes for water treatment in alignment with the Sustainability Development Goals(SDGs) particularly SDG 6:Clean Water and Sanitation.

Yasuhiro Kimura
Department of Micro-Nano Mechanical Science and Engineering, Nagoya University, Nagoya, Aichi, Japan

Atomic migration-driven metal nanowire growth

Metallic nanowires, also called whiskers, are next-generation materials that are expected to revolutionize the functionality of materials by improving the performance of existing devices due to their unique physical properties at their own microscopic scale. The application of metallic nanowires is expected to include the development of high-strength structural materials that take advantage of the small number of crystal defects that reduce strength due to their extremely small size, their use as optical waveguides for optoelectronics that utilize surface plasmon propagation, and their application as metamaterials for realizing negative refractive indices. etc. are expected to be developed. Nevertheless, the application of metallic nanowires remains at the laboratory level. The essential technological issue that is slowing down industrial applications is the fact that the principle of creating pure metal nanowires has not yet been established. Noted that, for nanowire growth, the "growth driving force" of how to supply atoms and the formation of a "growth nucleus" as a singularity of how to eject atoms in only one dimension are important, but this is unclear for pure metals. The nanowires reported so far are semiconductors such as Si or metal oxides such as Fe2O3, and the principle of crystal growth by Chemical Vapor Deposition (CVD) is widely used. In this CVD approach, the growth driving force is given in the gas phase and controlled as partial pressure, and the growth nuclei are created by using metal catalysts. On the other hand, for pure metals with low vapor pressure, the CVD-based nanowire creation method used for semiconductors and metal oxides is not applicable, and the establishment of a novel growth technique has been required. This study introduces a knowledge for metal nanowire growth technique based on the atomic diffusion which is an atomic transportation phenomena due to the chemical potential gradient induced by electric, thermal, and stress field.

Audience Take Away Notes

- Learn where we stand in metallic nanomaterials research
- Learn the difference from general semiconductor nanowire growth methods
- Learn about the phenomenon of atomic diffusion as a new knowledge for nanowire growth

Biography

Dr. Kimura studied Mechanical Engineering at Tohoku University, Japan and graduated as MS in 2014. He joined the research group of Prof. Saka at the Tohoku University, Japan, and took part in the group of Prof. Cola at the Georgia Institute of Technology, US to learn the nanomaterial synthesis and device application as a visitor researcher for short term. From 2015-2017, he received the JSPS Research Fellowship for Young Scientists DC2. He received his PhD degree in 2017 at the Tohoku University. He obtained the position of an Assistant Professor at the same institution in 2017-2019, and at the Nagoya University in 2019-present. He has published more than 45 research articles.

Ashita Anand[1,2]*, Neeraj Dwivedi[1], Suneeti Singh[1], David M Cahill[2], Srikanth Mateti[3], Julie Mondon[2], Palash Kumar Manna[1]

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[2]Faculty of Science Engineering and Built Environment, Deakin University, Australia

[3]Institute of Frontier Materials, Deakin University, Australia

Development and characterization of controlled release nano-fertilizer

Slow-release nano-fertilizers are now utilized widely to enhance nutrient usage efficiency and limit nutrient loss to the environment, which is a major drawback associated with conventional fertilizer applications. In this study, we report the development of a slow- release, macronutrient-based nanofertilizer that uses nanozeolite as a carrier. The porous nanozeolite creates a 'barrier' that prevents the fertilizers from uncontrolled release into the soil. Additionally, the nanozeolite itself acts as a soil conditioner. Nanozeolites were synthesized using hydrothermal method followed by loading of (NH4)2SO4 as N-source. Transmission electron microscopy was used to identify average zeolite size ranging from 80- 90nm, with a somewhat cylindrical shape identified through SEM imaging. FT-IR Spectroscopy before and after loading confirmed the incorporation of nitrogen compounds in the nanozeolites. Comparative release studies showed that whilst N release from regular (NH4)2SO4 stopped within 48 hours, N release from the nanozeolite based fertilizer continued for 120 hours. Consequently the nano-sized zeolite has a 60% increase in nitrogen holding efficiency compared to regular N fertilizer, which effectively facilitates a gradual release in the soil or any other medium (e.g. hydroponics). The slow-release property of nanozeolites can be exploited to reduce the dosage of conventional nitrogen and other fertilizers and improve the soil health as an added benefit.

Audience Take Away Notes

- Site-targeted distribution of nano-fertilizers results in a regulated release of agrochemicals, decreased toxicity, and improved fertilizer nutrient use
- Nano-fertilizers can be used not only as nutrient suppliers but also as soil conditioners as they can replenish soil and have good water holding capacity thus improve quality parameters of crops and enhance soil fertility
- Laboratory analysis by various researchers have confirmed that nano-fertilizers are safe and non-toxic following tests on plant and animal cells, as well as impact on soil microorganisms
- Substituting traditional methods of fertilizer application with nano-fertilizers is an effective approach that releases nutrients into the soil both gradually and in a controlled way
- Nano and bio-fertilizers are among the modern blessings of nanotechnology by researchers to serve humanity as they are an effective solution that will increase agricultural production

Biography

Ms. Ashita Anand studied microbiology at University of Delhi in India and graduated as BSc (Hons) in 2017 and post-graduated as MSc. Applied Microbiology from VIT, Tamil Nadu, India in 2019. She then joined as a PhD Scholar at Teri Deakin Nanobiotechnology Center, Gurugram, India. It is an in-country research program allowing students to carry out research at the Teri Deakin nanobiotechnology center in India and obtain a higher degree by research at Deakin in Australia. She is now in the final year of her PhD and in the process of submitting her research articles.

MARCH
18-20

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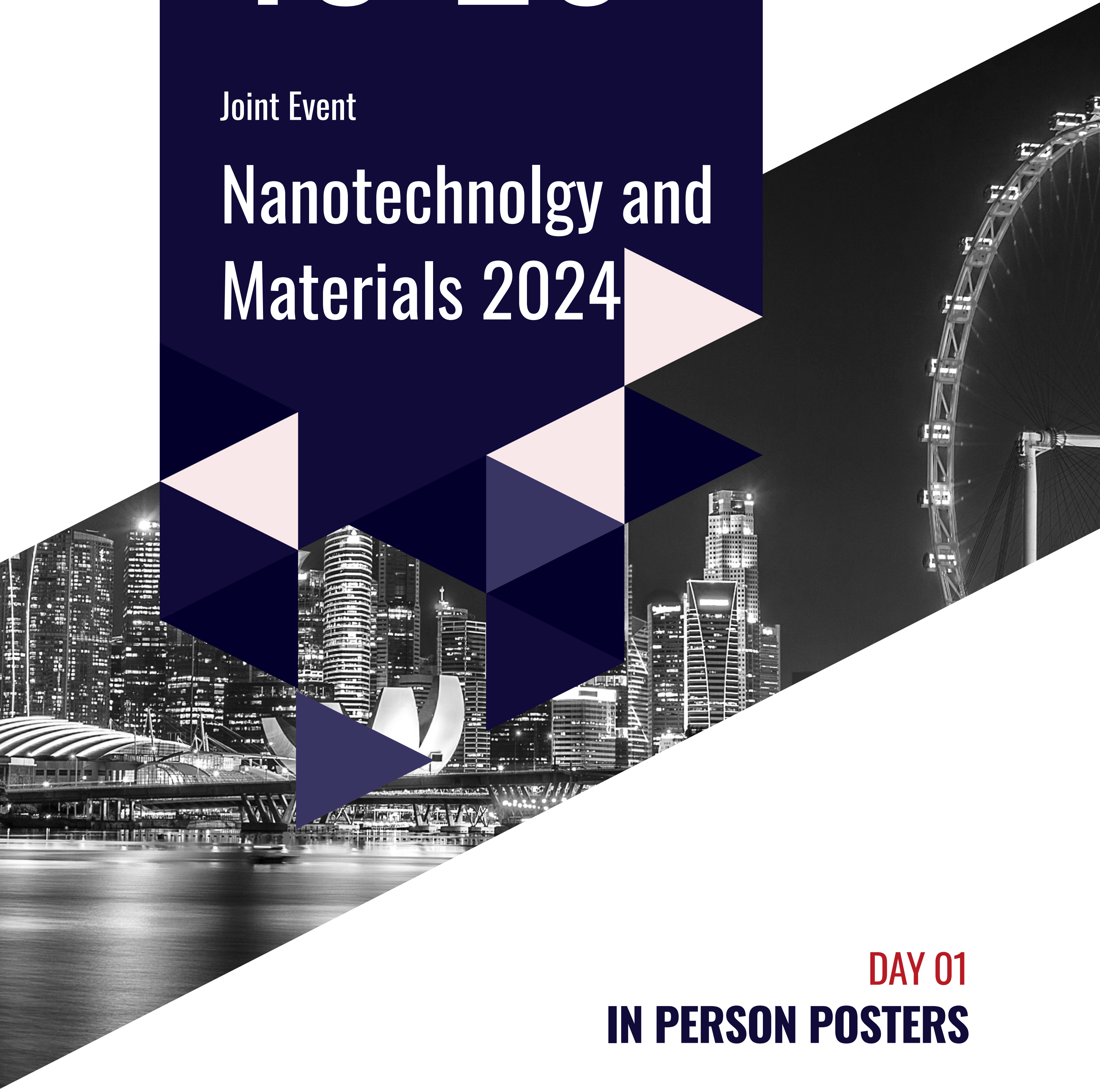

DAY 01
IN PERSON POSTERS

Vishakha Goswami*, Shashank Deep
Indian Institute of Technology, India

Nanocarriers for the delivery of quercetin to inhibit the UV-induced aggregation of γd-crystallin

Due to gradual environmental changes like ozone layer depletion and global warming, human eyes get exposed to UV light. Exposure to UV light can be a cause of cataract, one of the ocular diseases which may cause vision impairment. To date, lens replacement is the only treatment available for cataract. In our present study, we have carried out an extensive examination of polyphenols as inhibitors for UV-induced aggregation of γD-crystallin. On exposure to UV-C light, γD-crystallin forms fibrils instead of amorphous aggregates. Various polyphenols were tested as inhibitors, out of them quercetin, baicalein, and caffeic acid were found to be effective. As polyphenols are insoluble in water, nanoencapsulation was tried to enhance their bioavailability. CS-TPP and CS-PLGA encapsulating systems were considered as they form biodegradable nano-capsules. Out of three polyphenols (quercetin, baicalein, and caffeic acid), quercetin forms nanocarriers of smaller sizes, a must for crossing retinal barrier. Quercetin nanocarriers were considered as an effective system that could be used for therapeutic application. For these nanocarriers, encapsulation efficiency, and polyphenol release kinetics were studied. CS-PLGA NPs were found to have better loading efficiency for quercetin than CS-TPP NPs.

Audience Take Away Notes

- Thank you for providing me platform to show my research. Through my presentation in form of poster I will able to share potential nanocarriers which could inhibit aggregation of γD-crystallin (aggregation of γD-crystallin is cause of cataracts)
- These nanocarriers are perfect solution to cataracts. As only solution of cataracts is lens replacement which is not possible in many developing countries
- Biodegradable nanocarriers are perfect solution to for drug delivery

Biography

Ms. Vishakha Goswami studied Chemistry at the University of Delhi, New Delhi India and graduated as M.Sc in 2016. She then joined the research group of Prof. Shashank Deep at IIT Delhi. She has published 3 (2 published and 1 manuscript submitted) research articles in Langmuir journal, ACS.

Lu Zhou*, Dan Zhang, Xuanjun Zhang
Faculty of Health Sciences, University of Macau, China

Design of ion current and fluorescence dual-signal nanochannel sensors for effective and reliable detection

Nanochannel sensors show high sensitivity and are promising for the detection of toxic substance, biomolecules, and other analytes. However, ion current may be affected by many other factors, leading to false-positive signals. In contrast to the conventional passive reaction to analytes, here, we create a series of ion current and fluorescence dual-signal nanochannels for reliable detection. The spatially resolved fluorescence signal combined with ion current signal significantly improve the reliability of the sensing. Inspired by biological aquaporins, we developed an effective strategy to regulate the hydrophilic/hydrophobic balance by the controllable in situ assembly of Coordination Polymers (CPs) using BDC-NH2 on anodic Aluminum Oxide (AAO) nanochannels to promote HCHO detection. We found that the hydrophobic/hydrophilic balance in CP/AAO heterosomes plays significant roles in the effective detection of HCHO. The hydrophobic AAO barrier layer is necessary to support the confinement effect, while the hydrophilic CP surface is favorable for HCHO to access the channels and then condense with the responsive amine to generate a new imine. The optimized CP/AAO Janus device shows excellent performance in the quantitative analysis of HCHO over a wide range from 100 pM to 1 mM by monitoring the rectified ionic current. Inspired by light-activatable biological channelrhodopsin-2, photochromic spiropyran/anodic aluminium oxide nanochannel sensors are constructed to realize a light-controlled inert/active-switchable response to SO2 by ionic transport behaviour. We find that light can finely regulate the reactivity of spiropyran/anodic aluminium oxide nanochannels for the on-demand detection of SO2. After ultraviolet irradiation of the nanochannels, spiropyran isomerizes to merocyanine with a carbon–carbon double bond nucleophilic site, which can react with SO2 to generate a new hydrophilic adduct. Benefiting from increasing asymmetric wettability, the proposed spiropyran/anodic aluminium oxide nanochannel device exhibits a robust photoactivated detection performance in SO2 detection in the range from 10 nM to 1 mM achieved by monitoring the rectified current.

Keywords: Nanochannel Sensor, Fluorescence, Ion Current, Reversible, Light-Controlled Photochromism.

Biography

Lu Zhou studied pharmacy at Chongqing Medical University and received her master's degree in 2023. She then joined the lab of Prof. Xuanjun Zhang at the Faculty of Health Sciences of the University of Macau, where she studied for a PhD in Biomedicine.

Namhun Kwon[1,2]*, Myungsuk Kim[1,2]*, Seounguk Bae[1,3], Jaejin Sim[1], Soongju Oh[2], Dong Hyun Kim[1], Kyoung Tae Park[1], Jae Hong Shin[1]

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[2]Department of materials and science, Korea University, Seoul, South Korea
[3]Department of materials and science, Hanyang University, Ansan, South Korea

A study on highly efficient Ni-Fe alloy sulfuric acid leaching through anodize electrolysis process

The surging demand for nickel, driven by the proliferation of secondary batteries, has intensified the need for innovative approaches to secure a stable supply. However, the geographical constraints and export restrictions on nickel resources in certain regions have underscored the necessity to explore alternative methods of nickel extraction. To overcome these issues, various nations and institutions are actively engaged in research to refine nickel metal via the conversion of intermediate products such as Mixed Hydroxide Precipitate (MHP), Nickel Pig Iron (NPI), and Ferronickel (Fe-Ni) into high-purity nickel sulphate. The conventional atmospheric leaching process faces thermodynamic limitations, rendering the extraction of nickel from these intermediates unfeasible at ambient conditions. To circumvent this, the method of choice involves High-Pressure Acid Leaching (HPAL) conducted under elevated temperatures and pressures. However, the HPAL process can caused notable environmental and economic concerns due to using massive acids and equipment. To tackle these issues, this study introduces an innovative approach utilizing Ni-Fe alloy as an anode to intentionally induce overpotential, facilitating controlled oxidation while simultaneously transforming it into finely divided oxide particles. Through this intentional oxidation process, the Fe-Ni alloy is pulverized into fine particles, leading to a larger surface area compared to its bulk form. This increased surface area promotes efficient leaching of sulfuric acid. Furthermore, thermodynamically, reactions between oxides and sulfuric acid are more favourable than when metals are in their elemental state. Therefore, maximum leaching efficiency can be achieved. Consequently, the nickel leaching efficiency is substantially elevated, achieving a remarkable efficiency of up to 98% without the need for any additional additives. The optimization of grinding and leaching efficiency is systematically investigated under varied operating voltages. The obtained powders and leaching efficiency are corroborated through a comprehensive array of analytical techniques including Field Emission Scanning Electron Microscopy (FE-SEM), Contact Angle (CA) measurements, X-ray Fluorescence (XRF), and Inductively Coupled Plasma (ICP) analysis. This pioneering approach not only demonstrates the potential to revolutionize nickel extraction from traditionally challenging sources but also underscores the significance of leveraging electrochemical principles to enhance leaching processes. This study not only contributes to the sustainable supply of nickel, crucial for emerging technologies, but also offers a template for innovative, energy-efficient hydrometallurgical processes applicable to diverse metal recovery endeavours.

Audience Take Away Notes

- It can be applied not only to nickel, but also to various secondary battery raw materials industries that deal with LIB materials like cobalt or manganese
- The audience will discover new approaches to nickel refining, the primary ingredient of secondary batteries through the presentation

- By introducing a relatively straightforward nickel intermediate processing method that requires less extensive equipment and is simpler than conventional industrial processes, it is believed that a practical approach could be provided

Biography

Mr. Namhun Kwon received his Bachelor's and Master's degrees in Engineering from Dankook University, South Korea, in 2019 and 2021 respectively. He is currently pursuing his Ph.D. degree at Korea Institute of Industrial Technology, a government research institute, and Korea University. His current research focuses on molten salt electrolysis, secondary battery materials, refractory and rare metal refining and recycling.

Biography

Mr. Myungsuk Kim studied energy engineering at the Dankook University, South Korea, and graduated with an MS in 2023. He is currently pursuing his Ph.D. degree at Korea Institute of Industrial Technology, a government research institute, and Korea University. His current research focuses on pyro/hydrometallurgical processes for rare metal refining and recovery.

Dr. Cheng Jung Yao[1,2]*, Shu Jyuan Yang[1], Chung Huan Huang[1], Yuan Ting Chang[1], Chung Hao Wang[3], Ming Jium Shieh[1,4], Tai Horng Young[1]

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[3]Gene'e Tech Co., Ltd., 2nd Floor, No. 661, Bannan Road, Zhonghe District, New Taipei City 235, Taiwan
[4]Department of Oncology, National Taiwan University Hospital and College of Medicine, No. 7, Chung-Shan South Road, Taipei 100, Taiwan

The development of chitosan-based nano-carrier for highly antibiotic-resistant H. pylori eradication therapy

Helicobacter pylori infection usually causes gastrointestinal complications, including gastrointestinal bleeding or perforation, and serious infections may lead to gastric cancer. Amoxicillin is used to treat numerous bacterial infections but is easily decomposed in the gastric acid environment via the hydrolyzation of the β-lactam ring. In this study, we develop chitosan-based nanoparticles loaded with amoxicillin (CAANs) as an H. pylori eradication platform. The CAANs were bio- compatible and could retain the antibiotic activity of amoxicillin against H. pylori growth. The mu- coadhesive property of chitosan and alginate enabled the CAANs to adhere to the mucus layers and penetrate through these to release amoxicillin in the space between the layers and the gastric epi- thelium. The use of this nanoparticle could prolong the retention time and preserve the antibiotic activity of amoxicillin in the stomach and help enhance the eradication rate of H. pylori and reduce treatment time. These CAANs, therefore, show potential for the effective treatment of highly anti- biotic-resistant H. pylori infection using amoxicillin.

Audience Take Away Notes

- H. pylori infection causes long-lasting inflammation and further leads to certain types of gastric cancer, particularly gastric adenocarcinoma and gastric Mucosa-Associated Lymphoid Tissue (MALT) lymphoma. Because of its role in causing gastric cancer, in 1994 H. pylori was classified as a class 1 human carcinogen, by the World Health Organization's International Agency for Research on Cancer. Antibiotic resistance is the most important factor in treatment failure. One international multicentre prospective non-interventional registry starting in 2013 aimed to evaluate the decisions and outcomes in H. pylori management by European gastroenterologists and found resistance to clarithromycin, metronidazole and levofloxacin were 25%, 30% and 20%, respectively. Our study provided a non-toxic formulation for these drug resistant strain with single antibiotics and shorter duration (7 days), and this characteristic not only improved the patient compliance but also reduced the resistance of other antibiotics currently used in standard eradication therapy

Biography

Dr. Yao studied medicine at Taipei Medical University, Taiwan and graduated as a medical doctor in 1998. He then completed internal medicine and gastroenterology specialist training at the National Taiwan University Hospital and now serves in the gastroenterology department of Taipei Municipal Wanfang Hospital. In addition, Dr. Yao entered the doctoral program of the Institute of Medical Engineering of National Taiwan University in 2013, specializing in the study of the application of nanomedicines in the bactericidal treatment of Helicobacter pylori and cancer treatment.

MARCH

18-20

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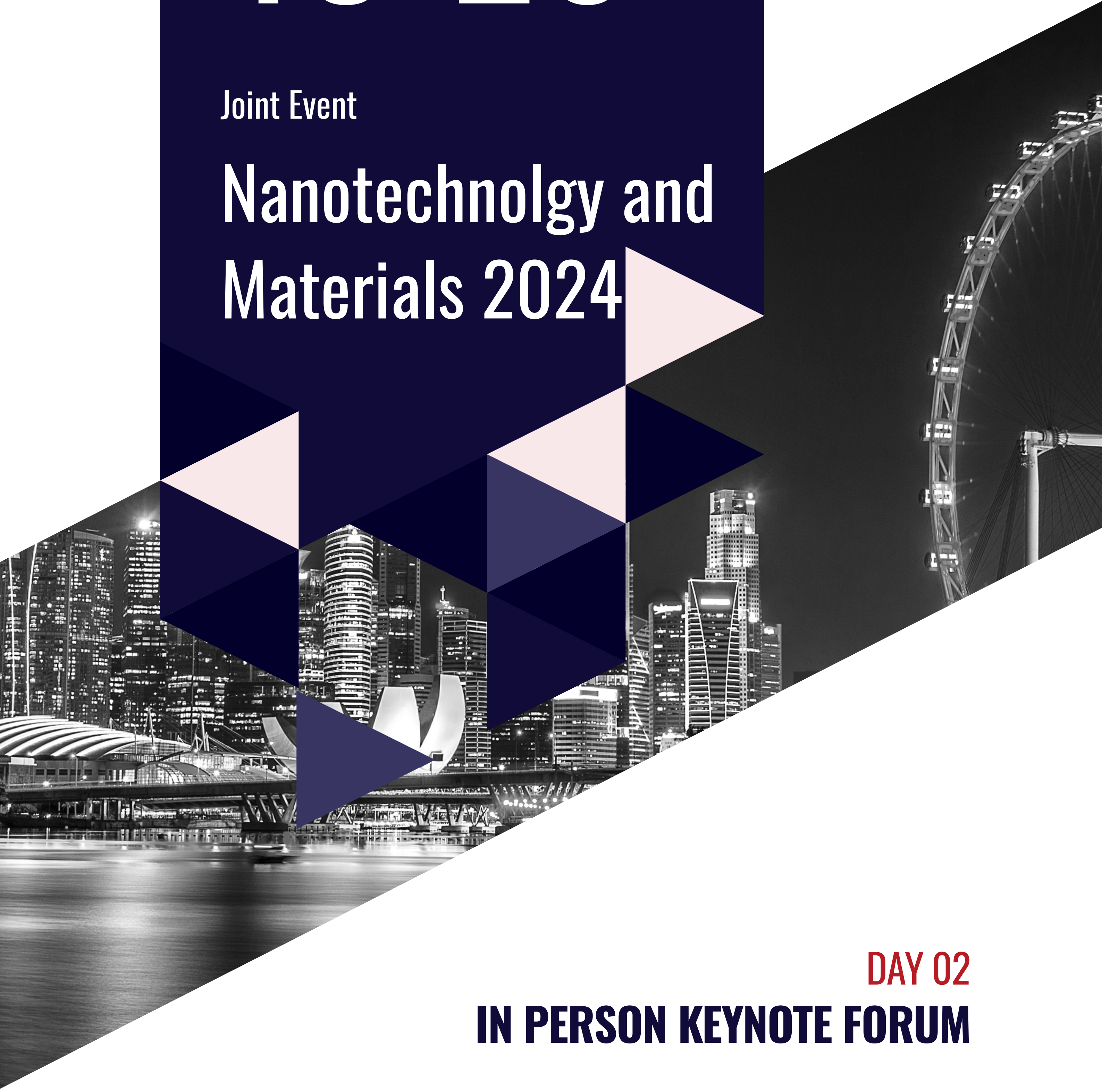

DAY 02

IN PERSON KEYNOTE FORUM

Enhancing strength and ductility in a near medium mn austenitic steel via multiple deformation mechanisms through nanoprecipitation

Prof. Mark Rainforth[1]*, J Gao[2]

[1]Department of Material Science and Engineering, The University of Sheffield, Mappin Street, Sheffield, S13JD United Kingdom

[2]Collaborative Innovation Center of Steel Technology, University of Science and Technology Beijing, China

There has been a significant effort to develop steels with sub-micron grain size, since they will possess high strength and toughness, which makes them promising candidates for light-weighting technologies and contribute to strategies for energy savings. However, there has been no industrial fabrication of true ultrafine-grained steels. The finest grain size steels have a microstructure that is developed through phase transformation with a limit on the grain size that can be developed to a few microns. Here, we present a new method to produce a copper bearing ultrafine-grained structured steel that can be manufactured through conventional manufacturing routes. The key to achieving a sub-micron grain size is to induce simultaneous recrystallization and copious quantities of intragranular nanoprecipitation. The rapid and plentiful nanoprecipitation prevents the growth of the fine freshly recrystallized grains, leading to an equiaxed ultrafine-grained structure. Precipitation is from fine, coherent, disordered Cu based precipitates throughout the structure. Importantly, the precipitates do not provide precipitation hardening, rather they exhibit weak interactions with dislocations, which is key to achieving high ductility. Sustained work hardening arises from twinning-induced plasticity, with the fine grain size and the presence of fine precipitates leading to the formation of extremely fine twins. This results in a large uniform ductility of 45% with tensile strengths of 2000 MPa. The current grain refinement concept can be easily extended to other alloy systems, and the manufacturing processes are compatible with existing industrial production lines.

Audience Take Away Notes

- Understand the latest state-of-the-art in steel
- Understand how microstructure can be manipulated by processing
- Understand the origins of high strength

Biography

Professor Mark Rainforth, FREng is POSCO Professor of Steel and former Head of the Materials Department at the University of Sheffield. He is currently Sheffield PI on the Future Steel Manufacturing Hub, SUSTAIN (£10.6m). Winner of the IOM3 Rosenhain and Verulam Medals and past President, Royal Microscopical Society, he is an elected Fellow of Royal Academy of Engineering. He is recognised for his work on the processing and characterisation of metal alloys. He has worked on steels for the last 40 years, including publishing papers on steel in Nature and Science. He has published ~400 refereed scientific papers, attracting over 900 citations per year.

Revolutionizing antenna technology: A comprehensive overview of electronically tunable material-based beam-steering structures

Nasimuddin and Michael Yan-Wah Chia

Institute for Infocomm Research, A*STAR, Singapore, nasimuddin@i2r.a-star.edu.sg

Biography

Dr.Nasimuddin (M'2003-SM'2009) received his B.Sc. in 1994 from JMI, India, and his M.Tech. and Ph.D. in 1998 and 2004, respectively, from DU, India. Dr.Nasimuddin has worked as a Senior Research Fellow (1999-2003) at DU, India. He has worked as an APD Research Fellow (2004-2006) at Macquarie University, Australia. Currently, he is working as a principal scientist at the Institute for Infocomm Research, A*STAR, Singapore. He has published 230 journal and conference papers on microstrip-based microwave antennas/components. He has edited two books and contributed a chapter. He has ranked in the top 2% of World Scientists in 2023.

In the ever-evolving landscape of wireless communication and connectivity, the advent of mmWave 5G technology has ushered in unprecedented demands for adaptable antennas with beam scanning and beam steering capabilities. This surge extends across various domains, including communication systems, radar applications, imaging technologies, and satellite systems. As these advanced systems continue to shape the future of connectivity, reconfigurable and beam-steering antenna structures emerge as pivotal components, offering the agility required to meet the challenges posed by the mmWave band.

The imperative for directive and high-gain antennas with reconfigurability from the essential role they play in the architecture of advanced communication systems. Their ability to adapt and steer beams becomes crucial for ensuring high data rates and compensating for the considerable path loss inherent in mmWave frequencies. Among the various contenders for achieving beam steering and reconfigurability, a standout candidate is the application of liquid crystal (LC) and other materials with electronically tunable dielectric properties. This innovation, facilitated by the application of an electric field, opens new frontiers in antenna technology for wireless systems.

Within the realm of beam steering, different antenna systems have showcased their capabilities, including mechanical, electronic, lens, metamaterial-based, leaky-wave, and grid antennas. Leveraging Liquid Crystal (LC) materials for beam steering in leaky-wave antennas (LWA) and antenna arrays proves promising. To enable beam steering at a fixed frequency, the integration of tunable materials or varactor diodes becomes imperative in the design of LWA and antenna arrays. LC materials present themselves as durable substitutes for phase change in beam steering and beamforming circuits, showcasing negligible material losses—especially critical at mmWave frequencies exceeding 10 GHz. Recent advancements have witnessed the successful design and implementation of various antenna structures featuring LC for beam scanning and reconfigurable applications.

This presentation aims to provide a comprehensive and detailed overview of electronically tunable material-based beam-steering antenna structures. By delving into the intricacies of this cutting-edge technology, we seek to unravel the potential of liquid crystals and similar materials in revolutionizing antenna design for advanced wireless systems. The exploration will span the theoretical foundations, practical implementations, and potential applications of these electronically tunable materials, shedding light on their transformative impact on the rapidly evolving landscape of mmWave communication, radar, imaging, and satellite systems. Through this discourse, hope to inspire a deeper understanding and appreciation for the role of tunable materials in shaping the future of antenna technology.

BOOK OF ABSTRACTS

MARCH

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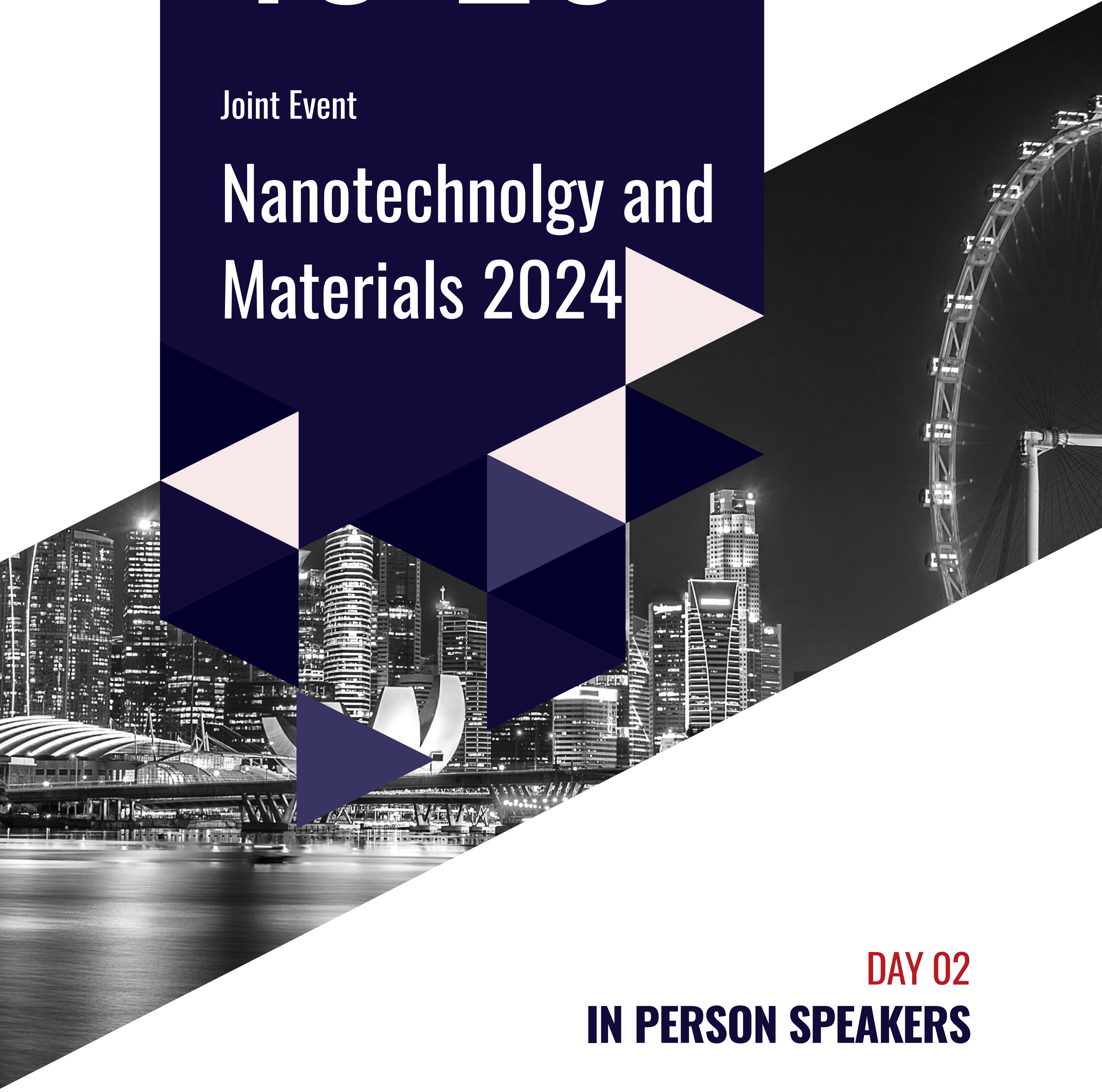

DAY 02

IN PERSON SPEAKERS

Prof. Milos Janecek[1]*, Kristina Bartha[1], Josef Strasky[1], A. Terynkova[1], Pere Bariobero Vila[2], Petr Dolezal[3]

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Phase transitions in metastable Ti15Mo alloy

Metastable beta titanium alloys are perspective candidates for the use in the aircraft industry and medicine due to their excellent strength, relatively low modulus of elasticity and enhanced biocompatibility. Thermomechanical treatments are often used to improve mechanical properties of these alloys due to the precipitation of different phases, namely the α- and ω-phase. It is also well-known that the α-phase precipitation is heterogeneous and preferentially occurs at lattice defects. Thus, a high density of grain boundaries and dislocations is needed for a homogeneous nucleation of the α-phase.

A Ti15Mo, which is a representative of a simple binary metastable beta Ti alloy, in a beta solution treated condition was subjected to Severe Plastic Deformation (SPD). Two most popular techniques of SPD – Equal Channel Angular Pressing (ECAP) and High Pressure Torsion (HPT) were employed to introduce a high density of lattice defects to the material. The material was subsequently subjected to several types of thermal treatments in order to examine the phase transformations occurring in the deformed material upon heating.

In order to optimize the parameters of the thermomechanical treatment of the alloy and to achieve a material with required mechanical properties, the effects of the grain boundaries, dislocations, induced strain, ω-phase and local chemical inhomogeneities on phase transformations were examined in-situ by electrical resistivity and synchrotron X-ray diffraction and complemented by post mortem detail investigation of the microstructure and lattice defects in characteristic conditions by scanning and transmission electron microscopy including advanced techniques of transmission Kikuchi diffraction and automated crystallographic orientation mapping, positron annihilation spectroscopy, and X-ray diffraction.

Lattice defects introduced by SPD significantly influence both the phase transformations and the morphology of the α-phase. Lattice defects, in particular dislocations and grain boundaries, act as preferential nucleation sites for α precipitation and form fast diffusion paths for solutes which results in enhancement of phase transformations in the severely deformed material. On the other hand, mechanical properties of heat treated samples are mainly influenced by of the hard and brittle ω-phase and this influence is superior to that of the strain imposed SPD.

Audience Take Away Notes

- The employment of synchrotron XRD for investigation of phase transitions in metastable alloys
- Efficient data processing from in-situ acquisition ofsXRD for the determination of phase composition
- Complex microstructure investigation by different techniques
- The design of big joint implants with tailored properties

Biography

Prof. Milos Janecek studied physics at the Charles University, Prague, Czech Republic and defended his PhD at 1992 at the same University. After a two-year post-doc fellowship at the University of Manitoba in Winnipeg, Canada and 1.5 year fellowship at the LTPCM INP Grenoble, France he obtained the position of the Associate Professor at the Charles University. In the years of 2003-2005 he worked as a visiting professor at the Clausthal Faculty of Technology, Clausthal, Germany. In 2017 he became a full professor at the Charles University. He has published more than 240 research articles in WOS journals.

Vladislav Kozhukhov*, GeorgiyBrovko, Elena Martynova
Department of Mathematics and Mechanics, Lomonosov Moscow State University, Moscow, Russia, elasticitytheory@yandex.ru

Recent advancements in A. A. Ilyushin's structural modeling method for non-classical continuum

The works of the famous Russian (Soviet) scientist A.A. Ilyushin, combining mechanical intuition, theoretical research and original experiments, continue to influence the mechanics of deformed solids. His groundbreaking work has advanced various fields, notably in modeling complex structures and media. Ilyushin's emphasis on describing complex continuumphenomenologically and analyzing internal particle interactions has set the stage for further research endeavors. This study builds on his methodologies, focusing on exploring novel models, particularly in investigating the natural vibrations of Cosserat-type structures, thus aligning with Ilyushin's enduring legacy and contributing to ongoing discussions on non-classical continuum models.

The investigation delves into the natural vibrations of a flat strip within an anisotropic two-dimensional Cosserat medium, assuming classical small deformations and no external forces or moments. Analysis reveals two distinct natural frequencies corresponding to each wave number. Lower frequency oscillations are characterized by inclusion rotations, which accompany longitudinal displacement, while higher frequency oscillations impede such displacements. These findings are supported by applying specific parameter values to the medium model.

Furthermore, we have visually represented the relationships between natural frequencies, phase velocities, and group velocities concerning wave numbers. These graphs elucidated key features, including their asymptotic behavior. Notably, when H2=0 (parameter of the model), certain regions on the graphs displayed the absence of dispersion curves passing through. Additionally, it was observed that the group velocity of the lower natural frequency tends towards zero at high values of the parameter k, a behavior distinct from the case when H2≠0.This graphical analysis enhances our understanding of the system's behavior and contributes to the broader discourse on non-classical media models.

Audience Take Away Notes

Understanding of Non-Classical Media Models

By delving into the natural vibrations of Cosserat-type structures and examining their behaviors under different conditions, the audience gains insight into the intricacies of non-classicalcontinuum models. This understanding can be applied in various engineering and scientific contexts where classical assumptions may not fully capture the complexities of the system.

Modeling Complex Structures

The study provides insights into modeling complex structures, particularly those exhibiting anisotropic and two-dimensional characteristics. Engineers and researchers working on the design and analysis of such structures can incorporate the findings to improve their modeling approaches and accurately predict system behaviors.

Optimization of Structural Designs

Understanding the natural frequencies and behaviors of structures under different conditions can aid in optimizing structural designs. By analyzing the effects of parameters such as inclusion rotations and external forces on vibration characteristics, engineers can refine designs to enhance structural performance and efficiency.

Development of Analytical Tools

The graphical representations of relationships between natural frequencies, phase velocities, and group velocities provide valuable analytical tools. Researchers can utilize these graphs to analyze and interpret data, identify trends, and make informed decisions in the design and analysis of complex systems.

Enhanced Understanding

Professionals in engineering, materials science, and related fields can deepen their understanding of non-classical media models and complex structural behavior. This comprehension enables them to approach their work with a more nuanced perspective, considering factors beyond traditional assumptions.

Improved Modeling Techniques

Engineers involved in structural analysis and design can utilize the methodologies presented in this study to refine their modeling techniques. By incorporating insights into natural vibrations and behaviors of Cosserat-type structures, they can develop more accurate and reliable models for predicting system responses.

Faculty members conducting research in fields related to solid mechanics, structural engineering, material science, and physics can leverage the findings and methodologies presented in this study to explore new avenues of inquiry. They can build upon the foundation laid by this research to investigate further aspects of non-classical media models, complex structural behaviors, or related phenomena. This could lead to the development of new theories, models, and experimental techniques, contributing to the advancement of knowledge in their respective fields.

Yes, this research provides practical solutions for designers by improving modeling accuracy, optimizing structural designs, expediting design iterations, and mitigating design risks. By understanding the behaviors of Cosserat-type structures, designers can make informed decisions, streamline processes, and achieve more efficient and effective design outcomes.

Yes, this research will likely improve the accuracy of designs and provide new information to assist in solving design problems. By delving into the natural vibrations and behaviors of Cosserat-type structures, the study offers insights that can enhance modeling accuracy and inform design decisions. Designers can utilize this new information to better understand structural responses, optimize designs, and address design challenges with greater precision and effectiveness.

- Other Benefits

1. Enhanced understanding of non-classical media models and complex structural behaviors.
2. Improved modeling techniques for more accurate predictions.
3. Optimized structural designs for enhanced performance.
4. Streamlined design iterations for faster progress.
5. Proactive risk mitigation to prevent failures and delays.
6. Enriched educational materials for further studies.
7. Fostered interdisciplinary collaboration among faculty members.
8. Applicability across various fields, promoting innovation and knowledge exchange.

Biography

Vladislav Kozhukhov graduated with a degree in Mathematics and Mechanicsfrom the Department of Theory of Elasticity at Lomonosov Moscow State University in 2022. He completed his studies under the supervision of Professor G.L.Brovko and Ass.ProfE.D.Martynova.

Leila Momenzadeh*, Irina V. Belova, Graeme E. Murch

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Molecular dynamics simulation of yttria-stabilized zirconia: Investigating the influence of yttria and oxygen vacancies concentration on physical properties

Yttria-Stabilized Zirconia (YSZ) is a pivotal material in energy conversion and storage applications. In this study, we employ Molecular Dynamics (MD) simulations to investigate the effects of different yttria concentrations on YSZ physical properties, while also exploring the influence of introducing and eliminating oxygen vacancies within the lattice at 1800 K.This researchreveals that enthalpy changes in YSZ are sensitive to yttria concentration. The dynamic nature of atomic interactions within the lattice is characterized by fluctuations in enthalpy, providing insights into the material's response to thermal and compositional variations. Additionally, the study considers the impact of oxygen vacancies on enthalpy, examining how defect concentrations contribute to the overall energetics of YSZ. The insights gained from this research contribute to a deeper understanding of the material's stability and behaviour, guiding the optimization of YSZ-based systems for enhanced performance in various applications.This research contributes valuable insights into the complex relationship between yttria concentration, oxygen vacancies, and the physical properties of YSZ, providing a foundation for the rational design and optimization of YSZ-based materials in emerging technologies.

Keywords: Yttria-Stabilized Zirconia, Molecular Dynamics Simulation, Oxygen Vacancies, Physical Properties.

Biography

Leila Momenzadehis a versatile and personable Mechanical Engineer with a strong background in research and teaching. He expertise spans mathematics, computer modelling, simulation, and thermodynamics of metals, alloys, and ceramics. Recognized for leadership and organizational skills, He has excel in developing and delivering engineering units, receiving recent accolades for teaching excellence. He currently serving as a Subject Matter Expert at Southern Cross University, he continue to contribute to academic and research endeavours.

Antonio Pantano

Department of Engineering, University of Palermo, 90128, Palermo, Italy

Natural fibers composites: Nanoparticles as reinforcing agent for improving performances

The use of biocomposites, materials generally obtained by reinforcing eco-sustainable or renewable matrices with natural fibers, is increasing sharply in many industrial sectors (automotive, construction, shipbuilding, etc.) since they allow the production of components, systems and machines to be adapted to increasingly stringent environmental protection regulations, while reducing production costs, weight and operating costs.Although natural fiber reinforced composites have promising mechanical and physical characteristics, they have some limitations such as moisture absorption and a limited level of adhesion to polymer matrices. These problems lead to ineffective stress transfer at the fiber-matrix interface of the produced composites. However, the incorporation of nanomaterials can help solve these problems. The high surface area of the nanofillers promotes a better bond with the polymer matrix, resulting in a greater reinforcing action. Natural fiber reinforced composites with nanoparticles are more environmentally friendly, with lower water absorption and better mechanical properties. Furthermore, the incorporation of specific nanomaterials into natural fiber polymer composites can provide additional benefits such as bacteria resistance, anti-odour properties and UV protection.

A numerical approach was developed to model the effects of dimensional characteristics, distribution and orientation, and volume fraction of fibers and nanoparticles on the main mechanical characteristics of a biocomposite reinforced by randomly distributed short natural fibers and nanoparticles.

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Audience Take Away Notes

- Participants will learn how the incorporation of specific nanomaterials into natural fiber polymer composites can provide significant benefits
- People from industry may be very interested since renewable matrices with natural fibers, since there is an increasing need of these in many industrial sectors (automotive, construction, shipbuilding, etc.) in order to comply with new stringent environmental protection regulations
- This research may be useful to other faculty to expand their research or teaching ongreen materials
- The experimental results and the numerical model presented here can help optimizing the manufacturing of new composites reinforced with natural fibers and nanoparticles

Biography

Antonio Pantano is full professor at the Engineering Department of the University of Palermo (Italy). He earned is M.S. (1999) and Ph.D. (2002) in Engineering Mechanics from Michigan State University. From 2002 to 2004 he was Postdoctoral Associate at the Massachusetts Institute of Technology working on carbon nanotube enabled materials. In 2004 he moved to the Department of Mechanics, University of Palermo, where he was professor "Rientro dei Cervelli", a position for outstanding scientist. From 2007 he is professor, first associate and later full, at the University of Palermo. He has published 9 books and more than 100 research articles.

Dr. Hitoshi Ozaki*, Ryoma Tsuda. Hiroshi Kawakami
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Dissimilar metal joining of magnesium alloy and aluminum alloy by laser roll welding

In recent years, a material hybrid structure has been proposed in which magnesium alloys and aluminum alloys are placed in the right places in order to reduce the weight of transportation equipment. However, when different metals are fusion-welded, the formation of brittle intermetallic compounds at the joint interface causes the problem of reduced joint strength. Therefore, in this study, we tried to apply the laser roll welding process – a method developed by Kutsuna et al., which is effective for joining dissimilar metals. At that time, welding was performed by changing the welding conditions, and the influence of the welding conditions on the joint strength and the structure formed at the joint interface was discussed.

The laser roll weldability of magnesium alloy JIS MP-AZ31B and aluminum alloy JIS A5052P was evaluated by changing the arrangement of the materials, laser power, and welding speed. Under the conditions which magnesium alloy was the upper sheet, welding was possible at a welding speed of 30 mm/s or less at a laser power of 1.5 kW and at a welding speed of 35 mm/s or less at 2 kW. On the other hand, under the conditions which aluminum alloy was the upper sheet, it was possible to join at a welding speed of 25 mm/s or less at a laser power of 1.5 kW and at 35 mm/s or less at 2 kW. The thickness of the upper sheet became thinner after welding. The decrease in the sheet thickness was more remarkable when the welding speed was low, and the thickness was thicker as the welding speed is high. The maximum tensile strength of the joint in this study is 72.6 N/mm. There were two types of fractures after the tensile test: interfacial fracture and fracture in the upper sheet of the weld. The strength was higher at the interface fracture.

Audience Take Away Notes

- Audience will understand the overview of laser roll welding, which is effective for joining dissimilar metals
- Audience will understand the laser roll weldability of magnesium alloy and aluminum alloy
- The adoption of dissimilar metal joints will increase the freedom of product design

Biography

Dr. Ozaki studied Material Science and Engineering at the Nagoya University inJapan. He received his bachelor's and master's degrees at the same University. He finished a PhD in engineering at Nagoya University in 2008.Then he obtained the position of an Assistant Professor of Department of Mechanical Engineering at the Mie University in Japan. His work focuses specifically on the laser welding and cutting of metallic material.

Michal Knapek[1]*, P. D. Ispanovity[2], D. Ugi[2], G. Péterffy[2], I. Groma[2], K. Mathis[1], F. Chmelik[1]

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In-situ insights into micron-scale plasticity

Elementary plastic deformation events (dislocation avalanches, mechanical, martensitic transformation, etc.) are typically concealed in the deformation curves as the curves provide only “average information”. This is due to the simultaneous plastic activity at a multitude of locations within the sample as well as due to the limited force and time resolution of deformation devices. On the other hand, supplementarytechniques such as high-resolution/ultra-fast imaging and acoustic emission, if implemented correctly, allow fordetailed characterization of the activity of deformation mechanisms. Here, we apply thesetechniques to characterize metallic materials at macro- down to micro-scales, where the deformation behavior becomes rather erratic. Using these techniques, spatial andtemporal patterns in seemingly random plastic events can be recognized by employing variousstatistical analyzes.

As a practicable example, we present compression experiments on micron-scale Zn specimens performedusing a unique experimental set-up capable of detecting weak acoustic “signatures” of dislocation slip. Robust correlationsare observed between theenergies of deformation events and the emitted acoustic signalsinducedby the collective dissipative motion of dislocations. Moreover, we show by statisticalanalyzes that despite fundamental differences in deformation mechanisms(and involvedlength- and time-scales), dislocation avalanches and earthquakes are essentially alike.

The obtained data contribute to the fundamental understanding of deformationdynamics in crystalline materials and can be utilized in designing future metallic materials as well as emerging micron-size mechanical devices.

Audience Take Away Notes

- The missing link between the properties of acoustic signals and the corresponding local deformation events is established for the first time
- Scale-free deformation dynamics is manifested across different scales and conditions using the acoustic emission technique
- The results contribute to the fundamental understanding of (inherently stochastic) deformation dynamics in crystalline materials

Biography

Dr. Michal Knapek studied Physics of Materials at the Constantine the Philosopher University in Nitra, Slovakia and graduated as MSc. in 2012. He then joined the research group of Prof. Chmelik at the Department of Physics of Materials, Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic where he received his PhD degree in 2016. After several short- and long-term fellowships he obtained the position of an Assistant Professorin 2022 at the same institution. He has published more than 60 research papers indexed in the Web of Science database.

Pramod Avti

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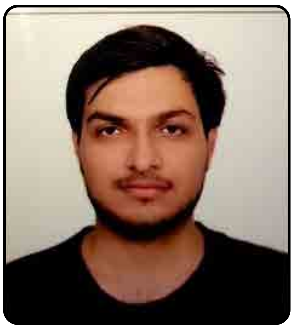
Advanced smart nanobiomaterials as emerging versatile platforms for healthcare systems

High quality materials in the nanosize and based-platforms have advantages over conventional methods due to feasibility of tailoring and tuning the desired properties to produce enhanced uniform distribution, targeted and localized delivery, sustained and controlled release, and enhanced therapeutic efficacy with fewer side effects. The synthetic articulation can be achieved in their shapes and sizes that modulates the unique physicochemical properties to achieve the desired properties for a variety of biomedical applications. A multitude of synthetically produced nanoparticles from inorganic/metallic nanoparticles (carbon, iron oxide and gold), organic (dendrimers, polymers) and inorganic/organic nanocomposites are explored in our group to build a biocompatible, biodegradable architecture for attaining multifunctional and multimodal approaches to suffice from targeting and delivery, tissue engineering and molecular bio-imaging. Most of these inorganic/metallic nanoparticles are stabilized with various synthetically articulated simple to complex organic ligands which hold the capacity for multifunctional groups for various applications such as physiological circulation and stealth, targeted delivery, molecular recognition and non-invasive multimodal approaches. This presentation highlights some of the properties of the nanomaterials and complex ligand designs and their structures using which the selective delivery systems, tissue engineering and multimodal imaging platforms are developed for effective diagnosis and therapy.

Biography

Pramod Avti is affiliated with India's Postgraduate Institute of Medical Education and Research (PGIMER). Leveraging his expertise, he contributes significantly to the institution's healthcare and academic initiatives. His role plays a pivotal part in advancing medical education and research at PGIME.



Piyush Verma*, Himanshu Ojha
Division of Radiological Nuclear and Imaging Sciences (RNAIS), Institute of Nuclear Medicine and Allied Sciences (INMAS), Defence Research and Development Organization (DRDO), New Delhi, Delhi, India

Luminescence insights to binding interactions of graphene oxide with pepsin: A spectroscopic and molecular docking approach

Graphene Oxide (GO) is wonder material yet a controversial in the biomedical field irrespective of its wide applications in drug delivery, wound healing, biosensors, etc. The interaction of GO with proteins is complex and depends basically upon the properties of GO. Pepsin is the gastric enzyme responsible for protein digestion. Pepsin is involved in the pathophysiology of several disease therefore the interaction of GO with pepsin may reveal insightful facts. In present study the interaction study of GO with pepsin is performed by various spectroscopic techniques as well molecular docking studies. The UV-Vis study revealed the hypsochromic shift indicative of formation of ground state complex. The fluorescence study revealed both static and dynamic nature of quenching. The thermodynamics studies further revealed the spontaneous nature of the interaction. Further the enzyme activity of pepsin was found to deceased significantly. The molecular docking results supports all the studies revealing that hydrogen bonding and pi-pi interaction dominates the interaction between GO and pepsin.

Audience Take Away Notes

- Formulation development for gastric delivery of GO
- Knowledge of Protein-ligand interaction with new drugs
- Secondary structure analysis of protein in presence of nanomaterial
- Protein corona analysis
- Audience will use this study to perform or design experiments with new drugs/nanomaterials
- For targeted drug delivery encompassing nanomaterials
- Understand molecular docking in order to find a lead for a particular disease model
- This research that other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- It improve the accuracy of a design, or provide new information to assist in a design problem
- Methodology can be optimized for designing new experiments
- Further this study can be used with other proteins

Biography

Mr. Piyush Vermais pursuing his Ph.D. studiesfrom INMAS, DRDO, India and post-graduated as M.Pharm in 2021. He then joined the research group of Dr. Himanshu Ojha (Sc. "F") at INMAS, DRDO, India. Hecompletedhis graduation degree in 2019 at Uttarakhand Technical University, India. He also received gold medal during his graduation and post-graduation studies. He also worked as a Young Professional (Pharma) at NPPA.He has published 11 research articles in SCI(E) journals.

Mukul Srivastava*, Sumit Basu

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Critical assessment of the multi-functionality of CNT reinforced CFRP composites

Carbon Fiber Reinforced Polymer (CFRP) composites possess attractive mechanical properties that make them the material of choice foraerospace applications.In order to improve their multi-functionality, Carbon Nanotubes (CNT)have long been used in the hope that these reinforcements will, withoutcompromising theexcellent mechanical and fracture properties of CFRPs, lead to betterthermal conductivity, Electromagnetic (EMI) shielding and weatheringresistance. In the present work,we critically compare four different types of composites with a viewto assessing their multi-functionality. To this end, we compare, conventional CFRP composites with, i. CF/modified epoxy where the epoxy resin is reinforced with CNTs,ii. grafted CF/epoxy where CNTs are grown on the carbon fibers insidea CVD reactor and iii. grafted CF/modified epoxy where both theprocesses in i. and ii are used. Our results show that, in terms ofboth Mode I and Mode II fracture toughness, CFRP < CF/modifies epoxy <grafted CF/epoxy <grafted CF/modified epoxy, though stiffness and strength of all fourtypes are close. Moreover, weathering resistance increasessignificantly with addition of CNTs tothe resin. The composite retains much of its toughness after 1000 hrsof weathering. Anisotropic thermal conductivity is measured through aningenuous technique involvingthermal imaging. But in spite of the fact that CNTs are highly conductive, thermal conductivity in all directions is onlymarginally affected by the addition of CNTs. The EMI shielding capabilities of an unidirectional conventional CFRPis high when the incident electric field is along thedirection of the fibers, which have good electrical conductivity. Whenthe incident field is perpendicular, shielding effectiveness is poor.However, addition of CNTs on eitherepoxy or grafting them on the carbon fibers do not necessarily lead tohigher EMI shielding characteristics though grafted carbon fibers themselvesare about 5 times moreconducting than conventional fibers. Unfortunately, the wettability of thesegrafted fibers are poorer and composites made from grafted fibers have a highervoid volume fraction thanconventional CFRPs. The increase in conductivity of the fibers isunfortunately offset by the presence of a large percentage ofmicrovoids. Finally, we identify possiblemodifications in the synthesis procedure for obtaining a bettercombination of favourable properties in CNT modified CFRP composites.

Audience Take Away Notes

- Multi functional CFRP composites are a long-standing technological goal. In this presentation, we will outline challenges and potential benefits of using CNT in conventional CFRPs in order to enhance their thermal, weather resisting and electromagnetic shielding properties

Biography

Mr. Mukul Srivastava completed his B.Tech in Mechanical Engineering at Uttar Pradesh Technical University, India, in 2014. Subsequently, he earned his M.Tech in Material Engineering from the Indian Institute of Technology, Roorkee, in 2016. Following his graduation, he joined the research group led by Prof. Sumit Basu in the Department of Mechanical Engineering at IIT Kanpur. Currently, he is working as a research scholar in the same department. He has published two research articles in SCI(E) journals.

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[5]Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China
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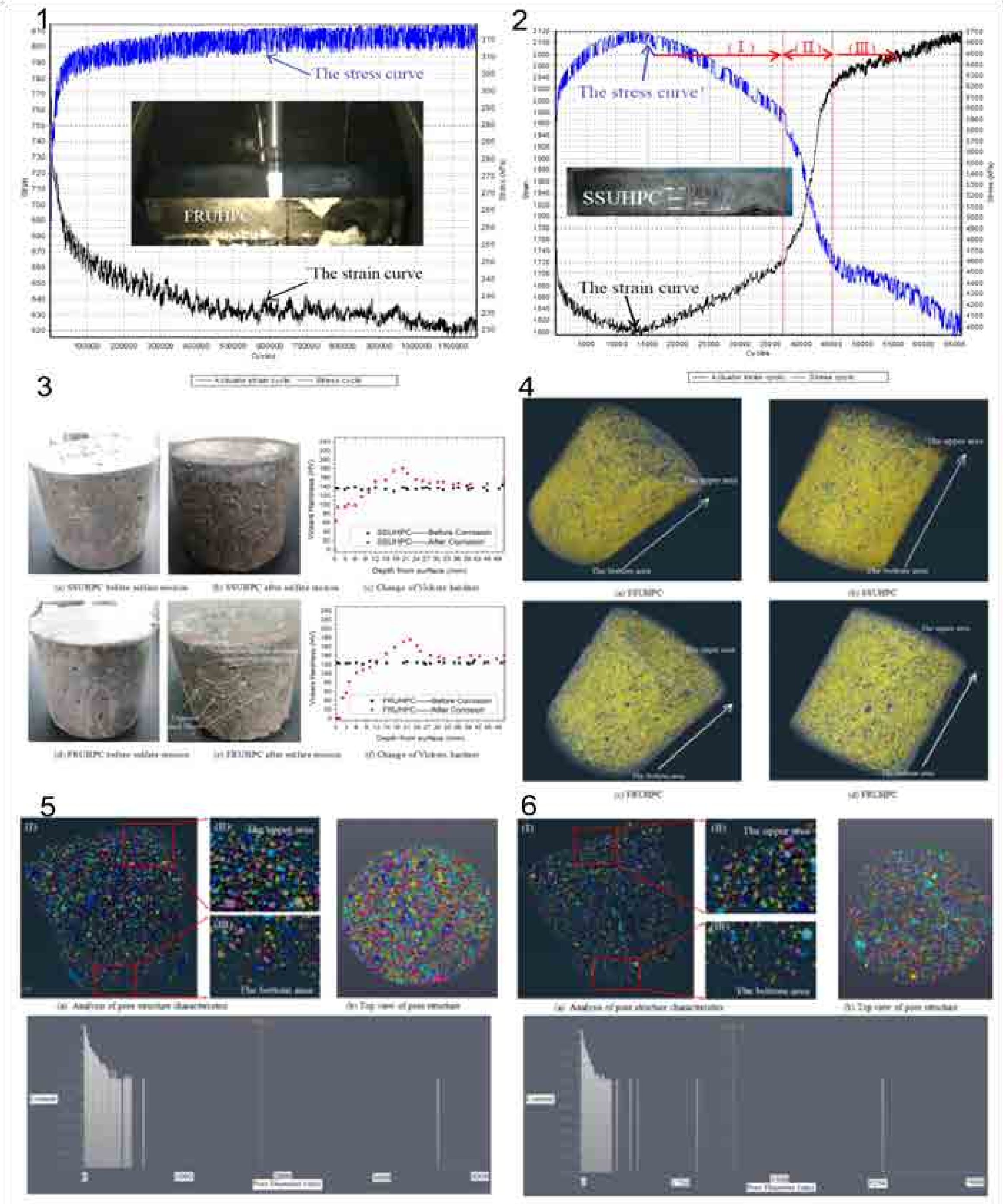
Resource utilization of sea sand-research and development of ultra-high performance cement-based materials

At present, river sand was the main source of sand for construction. But the supply of river sand was limited by resources and environmental impact, and cannot fully met the demand for construction. China's coastal areas were rich in sea sand resources, and the total amount of sea sand resources in China's offshore was about 67.96×1010 ~ 68.49×1010 m3. The mining of sand for construction has gradually shifted to the marine environment. The orderly development, research and utilization of abundant sea sand resources as construction aggregates has become an inevitable development trend. How to use sea sand to prepare innovative water conservancy construction materials with excellent mechanical and durable properties is an intense and urgent task.

Based on the preparation principle of UHPC, sea sand and artificial sea water were used to replace river sand and fresh water to prepare Seawater Sea-Sand Ultra High Performance Concrete (SSUHPC), and Freshwater River-Sand Ultra High Performance Concrete (FRUHPC) was prepared for comparative study. The compressive strength of SSUHPC and FRUHPC is 162.1 MPa and 173.3 MPa, respectively. Both SSUHPC and FRUHPC have high fatigue resistance characteristics, and SSUHPC takes the lead in stress failure in high stress fatigue test. Both SSUHPC and FRUHPC show excellent durability characteristics, while SSUHPC performs better. The microstructure characteristics of SSUHPC and FRUHPC were studied by SEM, XRD and MIP technology. The continuous section data were obtained by μX-CT technology, and the fibre and pore structure were reconstructed and established, so as to study the performance difference mechanism between SSUHPC and FRUHPC.

Hydration degree of mortar, characteristics of pore structure and dispersion of steel fibre were important factors on mechanical properties and durability of concrete materials. Excellent mechanics and durability of UHPC were guaranteed by uniformly dispersed steel fibre, hydrated cement mortar with mature structure and reasonable pore structure. Compared with FRUHPC, the mortar in SSUHPC has a higher degree of hydration, and the mortar with mature hydration structure and dense structure make the concrete material have higher corrosion resistance. Due to the uneven distribution of pore and steel fibre, the compressive strength and fatigue resistance of SSUHPC were inferior to that of UHPC prepared with freshwater river-sand. Firstly, this paper verifies the possibility of using seawater seasand to produce concrete with ultra high mechanical properties and durability. SSUHPC was slightly inferior to UHPC prepared from freshwater river-sand in mechanical properties, but it has more excellent durability characteristics. In view of these problems, the performance of SSUHPC can be further improved by improving the pore structure and fibre distribution.

The performance difference of mechanic properties and durability between SSUHPC and FRUHPC was systematically studied, and the mechanism of performance difference between the two kinds of concrete materials were revealed, which lay a solid theoretical foundation for the utilization of sea sand resources and the promotion of seawater seasand concrete.



Audience Take Away Notes

- In view of the problem of using seawater and seasand to prepare concrete, it is urgent to develop a new preparation method of corrosion resistant marine concrete with seawater and seasand, so as to prolong the life of buildings and better serve in the harsh Marine environment. The use of abundant seawater and seasand resources in coastal areas can prepare ultra-high performance Marine concrete with high erosion resistance, which has far-reaching economic and social benefits for reducing construction and maintenance costs, improving resource utilization efficiency and realizing sustainable development

- The introduction of this report can be used by relevant technical personnel in the manufacture and design of concrete materials for building materials and Marine engineering, and can also be used as a reference book for relevant professional research personnel in universities and colleges
- The traditional methods to solve the shortage of river sand include making machine-made sand, using it after desalting and using it mixed with machine-made sand. The use of sea sand has always been controversial, the most critical problem is that the damage caused by chloride ions in sea sand is unavoidable, and the mechanical properties and durability of sea sand concrete cannot be guaranteed. The advent of ultra-high performance concrete of seawater sand has injected a shot in the arm for the industry. The excellent performance of ultra-high performance concrete itself can ensure the ultra-high mechanical and durability characteristics when using seawater and sea sand as raw materials, which will have a positive academic impact in the industry and lay a solid theoretical foundation for the engineering application of sea sand

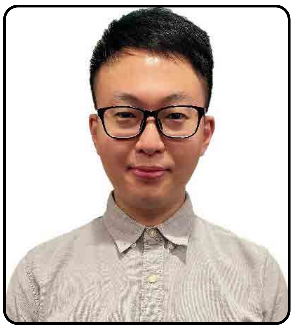
Fig. 1 500000 loading times of FRUHPC when the loading value was 10 kN; Fig. 2 500000 loading times of SSUHPC when the loading value was 10 kN; Fig. 3 Comparison of SSUHPC/FEUHPC before and after sulfate erosion; Fig. 4 Difference of UHPC prepared with seawater seasand and freshwater river-sand; Fig. 5 Reconstruction pore structure model of SSUHPC (above 200 μm); Fig. 6 Reconstruction pore structure model of FRUHPC (above 200 μm).

Biography

Dr. Li Tianyu, member of chinese national committee on large dams and supported by Jiangsu Funding Program for Excellent Postdoctoral Talent. He was graduated from Hohai University in 2022 under the guidance of Professor Surendra P.Shah, and joined Hohai University in the same year, obtained a lecturer position. He is mainly engaged in the development and performance deterioration mechanism of ultra-high performance cement-based materials, hydraulic building safety monitoring and intelligent water conservancy. He has Published more than 50 research articles with 20 articles included in SCI(E) journals, authorized more than 10 invention patents, and published 2 academic monographs.

Biography

Mr. Zhang Rujiu is currently a PhD candidate in the Department of Hydraulic Engineering at Tsinghua University, China. He received the BEng degree in Civil Engineering from Central South University, China, in 2021. He is mainly engaged in several engineering projects related to properties of rock materials in arch dams and tunnels, and have accumulated a wealth of experience. He has published more than 10 journal papers and 4 international conference papers, and authorized 5 patents and an academic monograph in related research fields. His current research interests include the mechanism, risk assessment, prediction, and control of rockburst and large squeezing deformation in rock materials.



Chien Fang Ding

Department of Biomechatronics Engineering, National Taiwan University, Taipei, Taiwan

Additive manufacturing of metallic structures by laser-induced forward transfer

The utilization of Laser-Induced Forward Transfer (LIFT) in additive manufacturing presents a promising avenue for the precise development of metallic structures on flexible substrates. Despite its notable advantages, including being a contactless and nozzle-free process facilitating the rapid fabrication of 3D structures, LIFT faces challenges such as shockwave generation, poor adhesion to receiver substrates, and issues with uniform depositions. This research addresses these limitations by proposing effective solutions for their mitigation. To enhance the LIFT process, receiver surface modifications and low-pressure conditions are introduced through Laser Surface Texturing (LST) coupled with a vacuum pump. Exploring various textures and orientations in LST aids in determining the optimal conditions for Copper (Cu) deposition. The innovative approach of utilizing the same laser system for both LST and LIFT contributes to the cost-effectiveness and efficiency of the manufacturing process. Beyond Copper (Cu) depositions, this research incorporates additive layers of Silver (Ag) and Platinum (Pt). The subsequent fabrication of Ag and Pt micropillars on their respective additive layers leads to the formation of Cu-Ag and Cu-Pt alloy structures. Electrical and material characterizations validate the potential applications of these structures, revealing enhanced adhesion with electrical properties for LST-based LIFT under low-pressure conditions. Finally, an in-depth energy analysis, employing theoretical and finite element methods (FEM), provides valuable insights into the mechanics of the LIFT process, further contributing to the understanding and advancement of this additive manufacturing technique.

Audience Take Away Notes

- **Optimizing Deposition Parameters:** The audience will learn about the investigation of various textures and orientations through Laser Surface Texturing (LST) to determine the optimal conditions for copper (Cu) deposition using Laser-Induced Forward Transfer (LIFT)
- **Diverse Alloy Structure Formation:** The audience will learn about the successful fabrication of Cu-Ag and Cu-Pt alloys structures by depositing additive layers of Silver (Ag) and Platinum (Pt) in addition to Copper (Cu) using the developed methodology
- **Enhanced Adhesion and Electrical Properties:** Experimental evidence demonstrating enhanced adhesion and improved electrical properties for LST-based LIFT under low-pressure conditions will be presented, providing valuable insights into the potential applications of the developed technique

Biography

Professor Chien-Fang Ding pursued his academic journey in mechanical engineering at National Taiwan University, Taiwan, earning his MS degree in 2014. Subsequently, he attained his PhD in 2019 from the same institution. Following a year-long postdoctoral fellowship under the guidance of Dr. Cheng-Tien Chiang at the Ultrafast Surface Science Laboratory, Institute of Atomic and Molecular Sciences, Academia Sinica, he secured the position of Assistant Professor at the Department of Biomechatronics Engineering, National Taiwan University in 2022. Prof. Ding's research is centered around laser manufacturing and its diverse applications, reflecting his commitment to advancing knowledge and innovation in this field.

Li. Liang[1]*, Wei Tong[2], Liangming Peng[1]

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[2]School of Mechanics and Optoelectronic Physics, Anhui University of Science and Technology, Huainan, Anhui, PR China

Achieving superplastic TWIP steel welded joint via vacuum electron beam welding

A crack-free high-Mn TWIP steel welding joint with comparable superplastic was obtained via vacuum Electron Beam Welding (VEBW) where the microstructural evolution, mechanical behaviors and strengthening mechanism of welding joint were investigated. The results indicated that the welding joint with a typical nail-shaped welding cross-section was divided into three zones including the base metal (BM), Heat-Affected Zone (HAZ) and Fusion Zone (FZ). Massive fine AlN-type precipitates with the hexagonal crystal structure were observed in welding join. The orientation relationship between the γ-austenite matrix and AlN precipitates was determined as [001]γ // [2110]AlN. In FZ, small-sized cellular grains or columnar grains with consistent growth directions were combined into large-sized columnar grains with obvious <001> preferential orientation. Compared with the base mantal, the yield strength, ultimate strength and elongation of the VEBWed specimen were slightly reduced by 6.03%, 4.7% and 13.23%, respectively. However, the impact toughness was obviously decreased from the 87.90 J to 68.97 J after the VEBW process, which was mainly attributed to the brittle AlN precipitates, inhomogeneous microstructure and back stress induced by the plastic mismatch between gradient grains. The strength contributions of different regions to overall strength including of BM, HAZ and FZ in welding joint were calculated. Here, the dislocation strengthening and precipitation strengthening were the dominant strengthening mechanisms of FZ, which was attributed to the high level of density and massive fine AlN precipitates induced by micro-elements segregations during the VEBW process.

Audience Take Away Notes

- Provides suitable welding process parameters for vacuum electron beam welding of TWIP steel
- Explained the mechanism of superplasticity of TWIP steel welded components
- Provides experimental and theoretical references for practical engineering applications of TWIP steel
- Provide additional engineering details

Biography

Mrs. Liang studied solid mechanics in the research group of Prof. L.M. Peng at the University of Science and Technology of China. She will compete her PhD degree from University of Science and Technology of China in June 2024. She has a background in advanced manufacturing of metallic materials, microstructural evolution, phase transition orientation relationships, and deformation mechanisms. Her related work has been published in journals such as Acta Mater, Int. J. Plast, Scr. Mater and Appl. Phys. Lett. If there have any postdoctoral position or cooperation needs, you can contact her.

Min Hsuan Lee
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The role of machine learning in organic solar cell research

Machine Learning (ML) and Artificial Intelligence (AI) methods are emerging as promising technologies for enhancing the performance of low-cost Photovoltaic (PV) cells in miniaturized electronic devices. Indeed, ML is set to significantly contribute to the development of more efficient and cost-effective solar cells. This systematic review offers an extensive analysis of recent ML techniques in designing novel solar cell materials and structures, highlighting their potential to transform the low-cost solar cell research and development landscape. In this presentation, a comprehensive view of the machine learning methods (e.g., Gaussian Process Regression (GPR), Bayesian Optimization (BO), and Deep Neural Networks (DNNs)) used for organic photovoltaic materials will be introduced. Basic steps to train ML models well be given. The research status with respect to the applications of machine learning in organic solar cells will be discussed. The presentation will conclude with insights on the challenges, prospects, and future directions of ML in low-cost solar cell research and development. Ultimately, the application of ML techniques in solar energy can revolutionize the industry and pave the way for a cleaner and more sustainable future.

Biography

Min-Hsuan, Lee is an Assistant Professor in Institute of Environmental and Occupational Health Sciences, NATIONAL YANG MING CHIAO TUNG UNIVERSITY, Assistant Professor (joint appointment), Institute of Environmental Engineering. He received his Ph.D. degree in Physics from Hong Kong Baptist University in 2016. From 2016 to 2023, He was a R&D engineer in Electronic and Optoelectronic System Research Laboratories, Industrial Technology Research Institute. His current research interests include printing fully solution-processed organic electronic devices (e.g., quantum dot- based light-emitting devices (QD-LEDs), solution-processed Organic Light-Emitting Diodes (OLEDs), Organic solar cells (OSCs), and wearable sensors) and the application of artificial intelligence in organic electronic technologies.

Anjan Sil[1]*, Bharat Verma[2]

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[2]Department of Metallurgical and Materials Engineering, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, India

Characterization of honeycomb structured carbonaceous anode material for sodium-ion battery application

MBecause of their low cost and abundant resources, sodium ion batteries (SIBs) have drawn attention of researchers in recent years for possible large-scale energy-storage application [1-3]. Sodium has similar chemical and physical properties with lithium. However, finding a suitable anode material is still a major challenge in realizing the practical utilization of sodium-ion battery as an energy storage device. Owing to its excellent electrochemical property, hard carbon has emerged as a potential anode material for sodium ion battery. Hard carbons are synthesized by pyrolysis of bio-waste materials [2-4]. Hard carbon can be obtained from environmentally friendly, inexpensive, and renewable bio-sources which represent a great advantage in terms of costs as well as large scale production and commercialization [5-6]. In this study, carbonaceous anode material has been synthesized for SIBs by carbonization of waste pea skins at different temperatures ranging from 750° to 1400°c. Due to its structure being honeycomb type with open pore channels, the pea skin carbonized at 750°c is reported to have highest reversible discharge capacity of over 250 mAhg-1 at 10 mAg-1 with stable cyclic performance. The post-cycled anodes were analyzed by scanning electron microscope (SEM), X-ray diffractometer (XRD), X-ray photoelectron spectroscope (XPS) and Raman spectrophotometer. The electrode kinetics was evaluated using electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV) method.

Keywords: Honeycomb Structure; Carbonization; Electrochemical Characteristics.

Audience Take Away Notes

- The audience will be able to learn battery cell technology specifically about the preparation and characterization of bio-waste derived hard carbon materials to be used as anode for sodium ion battery. They will be able to use such learning to their research, teaching and in industry
- As the presentation will discuss about the experimental techniques for materials synthesis and their characterization applicable to the electrode (anode) development of sodium ion battery, such studies and techniques involved are very much useful for industry application. Hence attending the presentation will be a great benefit for the target audience to seek job in the battery and relevant industries as well as use the idea in their job
- Other faculty members interested in this field of energy storage materials and battery technology could very well use this research to expand their research and / or teaching
- The research provides a practical solution to the development / preparation of hard carbon from environmentally friendly, inexpensive and renewable bio-sources which represent a great advantage in terms of costs as well as large scale production and commercialization. Moreover, the presentation will discuss about sodium storage mechanism in hard carbons. Thus, this research is expected to simplify or make a battery designer's job more efficient
- The research will provide new information to assist in the battery cell design problem by way of developing hard carbon based anode materials of superior electrochemical performance

- As this research addresses the development of sodium ion battery technology by preparing improved cost-effective hard carbon-based anode materials, it is expected to commercialize the materials. Moreover, sodium ion battery is expected to be a future potential substitute for lithium-ion battery technology. This is required for large scale application especially in bulk use such as batteries for electric vehicles

Biography

Dr. Anjan Sil is a professor at Indian Institute of Technology Roorkee, India. He received his PhD degree in 1991 at Banaras Hindu University, India. His teaching and research career span over 30 years in materials engineering with specialization in energy storage materials and functional ceramics. His research is focused currently on energy storage materials. He has supervised 16 PhDs. He has published about 100 research papers in reviewed journals and was granted with 4 patents. He has one book chapter in Graphene Science Handbook. He has completed several sponsored research projects. He had several international collaborations.

Yuanfeng Zhao, Peng Zhao, Dr. Yijun Zheng*
School of Physical Science and Technology, ShanghaiTech University, Shanghai, China

Fuel-driven transition from fibers to vesicles in dissipative self-assembly for drug delivery

Dissipative self-assembly refers to the phenomenon in which molecules or objects, operating under conditions far from equilibrium, organize themselves into structured arrangements or patterns by expending energy and generating waste. This process is prevalent in the natural world, particularly within biological systems like the creation of cellular frameworks and the process of cell division, both of which rely on dissipative self-assembly mechanisms. Furthermore, scientists have started to leverage the principles of dissipative self-assembly in the development of novel functional materials and intelligent systems within artificial materials and setups. Consequently, the exploration of dissipative self-assembly holds significant importance, as it aids in comprehending intricate phenomena in the natural realm and paves the way for the advancement of innovative materials and technologies. In this presentation, I will introduce an inventive design for a straightforward dissipative self-assembly system. This system possesses the capability to transition between two distinct assembly structures, namely fibers and vesicles, by introducing chemical fuels. I will also illustrate its practical applications in the delivery of hydrophobic drugs into cells.

Audience Take Away Notes

- The potential to revolutionize drug delivery methods, ultimately benefiting healthcare by providing more effective and targeted delivery of drugs, potentially leading to better patient outcomes and reduced side effects
- How utilizing dissipative self-assembly principles can improve the accuracy of designs in various fields. By harnessing this phenomenon, designers can create materials and systems with greater precision and control
- How this inventive system can provide a practical solution to problems related to drug delivery, simplifying the process and potentially making designers' jobs more efficient. It offers a novel approach to address drug solubility and targeting challenges

Biography

Dr. Zheng studied Chemistry at the Beijing Normal University, China and graduated as MS in 2006. She then joined the research group of Prof. Xinhua Wan at Peking University. She received her PhD degree in 2011 at the same institution. From 2011 to 2013, she conducted postdoctoral research supervised by Prof. Butt and Dr. Ikeda at the Max Planck Institute for Polymer Research in Germany, and from 2015 to 2019, she continued her postdoctoral research supervised by Prof. Arancha Del Campo at the Leibniz Institute for New Materials, also in Germany. She obtained the position of an Assistant Professor at ShanghaiTech Univerisity in China in 2019. She has published more than 40 research articles in SCI(E) journals.

MARCH

18-20

Joint Event

Nanotechnolgy and Materials 2024

DAY 02

VIRTUAL KEYNOTE FORUM

The influence of nanomorphology in biological assays

The presentation will be focused on exploring mathematical models which are suitable to describe cargo-delivery using Nanomaterials (NMs) while assessing information from in vitro assays. Presently, less than about 0.5% of the accumulated world's reports involving in vitro assays include a mathematical model, but this fraction is growing up steeply worldwide in recent years, signaling the recent trend in handling the biological data in a more comprehensive way. The starting mathematical model for in vitro assays is the Hill equation, herein described as a Hill-inspired approach, characterized by its Hill coefficient. In this case, the morphological parameters of the NMs are included into the original Hill coefficient, which is interpreted as the number of ligand sites in the MNM's surface which are available for binding to receptors onto the cell membrane.

Audience Take Away Notes

- Those producing and handling data from bioassays would be able to incorporate a more comprehensive analysis of the data
- The produced documents (reports, patents, papers)will incorporate a cutting edge approach, thus improving the technical and scientific standards
- From this knowledge, the efficiency and technical quality of previsionswill be enhanced

Paulo C. De Morais

Genomic Sciences and Biotechnology, Catholic University of Brasília, Brasília, DF, Brazil

Institute of Physics, University of Brasília, Brasília, DF, Brazil

Biography

Professor De Morais, PhD, was full Professor of Physics at University of Brasilia (UnB) – Brazil up to 2013, Appointed as: UnB's Emeritus Professor (2014); Visiting Professor at HUST – China (2012-2015); Distinguished Professor at AHU – China (2016-2019); Full Professor at Catholic University of Brasília – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-years (1987-1988) post-doc position with Bell Communications Research – USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais – Brazil. He has published about 500 papers (Web of Science).

Interaction between actin and quantum dots

Quantum Dots (QDs) are fluorescent nanoparticles with a broad emission range. As such, QDs are high sought after for optical-based biomedical applications. Recently, studies have shown the toxicity of quantum dots, which raised concerns regarding the use of QDs in biomedical technologies. In particular, there is still a lack of research on the cytotoxicity of quantum dots when exposed to cells due to random interactions with surrounding macromolecules. In our study, we investigated the direct interaction between QDs and a cytosolic protein to determine if modification of biomolecule upon interaction is one of the factors behind QDs' toxicity. Using Saccharomyces cerevisiae as a model organism, we performed Shotgun Proteomics to identify QD binding proteins. These identified proteins are associated with translation, mitochondria, vesicular trafficking, and the actin cytoskeleton. As our in vitro culture study showed that QDs caused abnormal actin cytoskeleton organization in yeast, we decided further to study the interaction between QDs and actin using a series of biochemical experiments. Through native polyacrylamide gel electrophoresis, we confirmed the binding of G-actin with QDs. Furthermore, we observed a temperature-dependent quenching of actin's intrinsic fluorescence by QDs, which suggests a static interaction. In addition, our data revealed an altered absorption spectrum in G-actin protein upon interaction with QDs. This further verifies the static interaction between G-actin and QDs as well as suggests actin-QDs complex formation. Using Circular Dichroism spectroscopy, we also found that QDs induced significant changes to the secondary structure of G-actin. Overall, our research characterized the interaction between QDs and G-actin, and proposed protein structure alteration resulting from direct interaction as a possible mechanism for QDs toxicity. The potential impact of QD binding to G-actin on actin polymerization and disassembly will be assessed.

Audience Take Away Notes

- Quantum dot chemical and physical properties
- Assessment of Quantum-dot interaction with proteins
- Assessment of QD-mediated protein assembly and disassembly
- Nanotoxicology is a relatively new field. Most of the nanotoxicology research focuses on assessing the phenotypes of cells undergoing cell apoptosis. Rather, our research aims to understand the molecular mechanism of nonapoptosis-mediateddamages occurring in the cells exposed to the environment with manufactured nanoparticles. The presented information via the abstract and the oral presentation will help understand this new approach of experiments and expand their research horizon in the future

Nhi Le, Abhishu Chand, Kyoungtae Kim*

Department of Biology, Missouri State University, Springfield, MO, United States

Biography

Dr. Kyoungtae Kim is a professor at Missouri State University (MSU) in Springfield, MO. He received his Ph.D. in Biology at Florida State University and completed his post-doc at Washington University in St. Louis, MO, where he studied cell biology and physiology. His current research focuses on cellular trafficking and nanomaterial-based nanotoxicology. His work has been published in the following international peer-reviewed journals: Cells, International Journal of Molecular Sciences, European Polymer Journal, FEMS Yeast Research, Cell Biology International, Biology of the Cell, European Journal of Cell Biology, Genes, Nanomaterials, and Biomolecules.Overall, his research results were disseminated in 241 presentations at internal and external scientific meetings, including many invited andkeynote presentations. It is noteworthy that he was invited to several international conferences to present the results of his research as a keynote speaker or main presenter. For example, at the sixteenth International Conference on the Science and Application of Nanotube held in Japan in 2015, he presented his results with the theme of

- In particular, as stated above, they can use the similar techniques presented by my presentation for testing their nanomaterials' impact on macromolecule binding
- At least, nanomaterial manufacturers will find the significance of random interaction between nanomaterials and proteins, which will motivate them to produce more environmentally friendly nanomaterials
- As stated above, we believe manufacturers will be aware of this problem and give an effort in producing less-toxic materials for biomedical approaches

"Carbon Nanomaterials Negatively Affect Cell Viability and Gene Expression". In 2018 two other topics "Membrane Trafficking" and "Quantum dot-mediated Cell Toxicity" were presented by him as a keynote speaker in Montreal, Canada. He also served as a conference session moderator at the American Society for Cell Biology and was invited to serve as the World Yeast Congress Organizing Committee and Worlds Yeast Congress Session Chair. In 2019, his research was presented at the German-American Science Slam held in St. Louis, MO with the title “What doesn't kill you makes you...develop acute health problems down the road”. In 2020, he was invited to give his research talk at the EFIGIE Talks held virtually in Brazil with the title “Study of Intracellular Traffics and Assessment of anticancer therapeutics and engineered nanoparticles on cells”.

Introducing nanoporous metallic capsules for improved stem cell delivery and function

Traditionally, polymer capsules have been used and proposed for stem cell delivery to the body to treat numerous diseases due to their ease of manufacturing, low expense, and relative acceptance in the body. However, polymer capsules used for stem cell delivery have proven problematic due to a lack of neovascularization bringing nutrients to the cells and removing cellular waste as well as promoting inflammation which clogs capsule pores necessary for the stem cells to live. This study introduces through-porous nano metals as improved stem cell delivery devices. Specifically, complete through nano-pores were created in several metals (such as Ti and stainless steel) which were shown to reduce inflammation, promote neovascularization, and selectively release analogs of insulin (for diabetes applications) while restricting the passage of IgG (which would initiate an inflammatory response). For some of the metallic membranes created, due to their nanoscale pore size, complete inhibition of IgG adsorption and infiltration was measured. Further modification of the surface of these metallic stem cell delivery devices to generate nanoscale roughness proved to inhibit inflammatory cell (such as macrophage) functions. Lastly, in vivo studies demonstrated greater neovascularization up to such metallic nanoporous membranes necessary to maintain encapsulated stem cell viability. In this manner, this in vitro and in vivo study introduced brand new unique through nanoporous metal stem cell delivery capsules that outperform existing polymers and, thus, may revolutionize the use of stem cell delivery for numerous diseases.

Audience Take Away Notes

- What is stem cell delivery
- How one can improve stem cell delivery through nanotechnology
- What is the future for the use of metallic nanoporous membranes in biomaterials and healthcare

Thomas J. Webster

School of Health Sciences and Biomedical Engineering, Hebei University of Technology, Tianjin, China

School of Engineering, Saveetha University, Chennai, India

Program in Materials Science, UFPI, Teresina, Brazil

Nanovault, Mansfield, MA, United States

Biography

Thomas J. Webster's (H index: 117; 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 is a former President of the U.S. Society for Biomaterials and has over 1,350 publications to his credit with over 53,000 citations. He was recently nominated for the Nobel Prize in Chemistry (2023).

Supramolecular materials integrating molecular machines and motors: Structure probed using scattering techniques (small-angle neutron and x-ray)

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

[1]Matiere et Systemes Complexes Laboratory, Universite Paris Cite, Physics Department, France

[2]Institute Charles Sadron, Strasbourg, France

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

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

Audience Take Away Notes

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

Biography

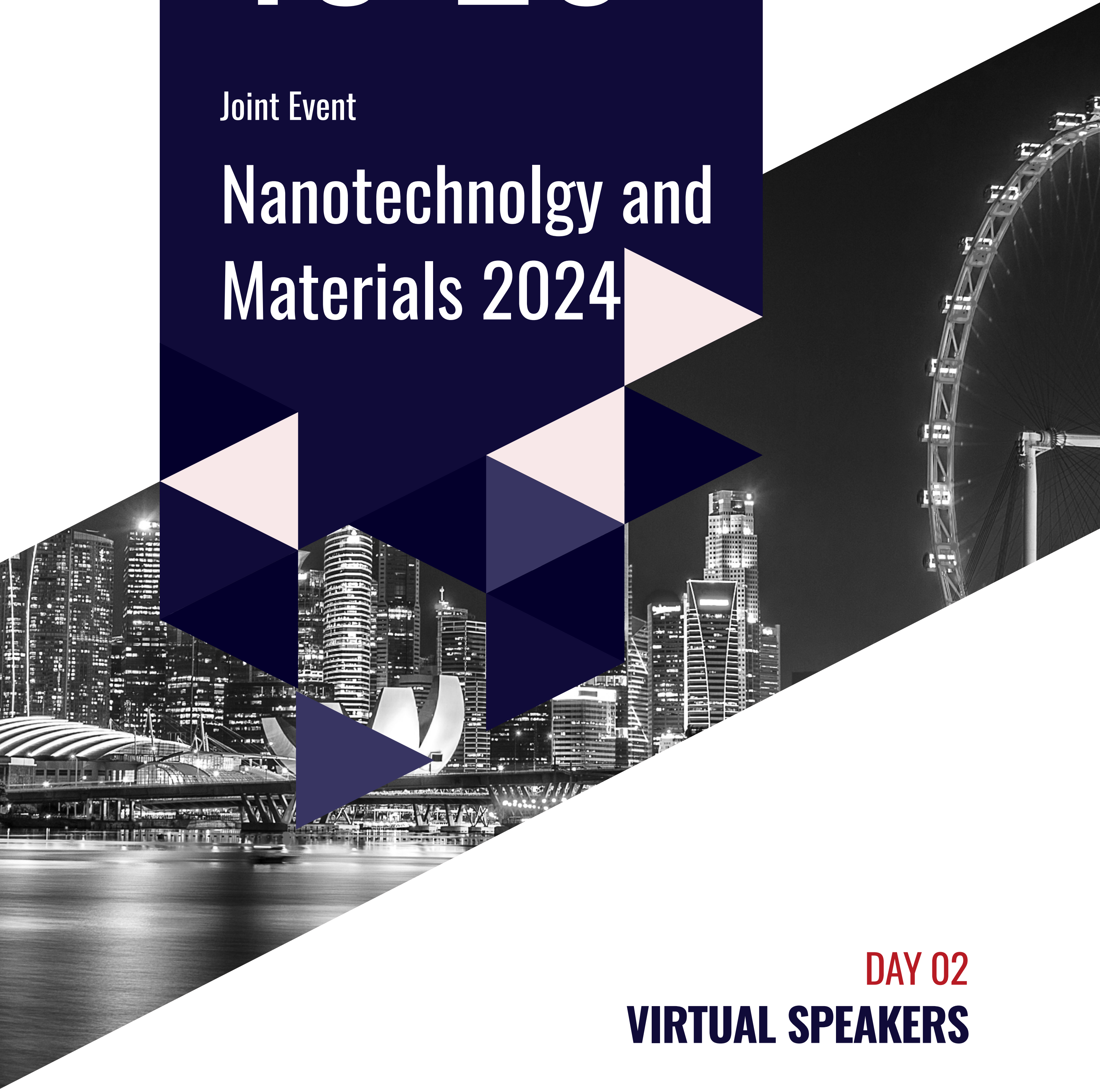
Eric Buhler currently holds a Full Professor position in soft condensed matter at Universite Paris Cite (France). In 1996, he received his Ph.D. degree in physics at the University of Strasbourg investigating the structural and dynamical properties of wormlike micelles. Prof. E. Buhler subsequently obtained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

MARCH

18-20

Joint Event

Nanotechnolgy and Materials 2024



DAY 02

VIRTUAL SPEAKERS

Yulai Zhao[1,2]*, Jing Zhang[1], Haoran Chen[1], Linxi Hou[1,2]
[1]College of Chemical Engineering, Fuzhou University, Fuzhou, Fujian, China
[2]Qingyuan Innovation Laboratory, Quanzhou, Fujian, China

Porous carbon based composites for energy storage via high internal phase emulsion template

HierarchicallyPorous Carbons (HPCs) are a class of highly interesting materials with wide applications. This presentation mainly reported the preparation of HPC based compositesowning enhanced energy storage capabilitywith the aid ofHigh Internal Phase Emulsion (HIPE) template. At first, a series of N-doped Porous Carbons (NPCs) are prepared via HIPE template, followed by growing polyaniline (PANI) arrays and subsequent carbonization/activation. The NPCs have interconnected hierarchical porous structures with abundant micro- and mesopores. The porous structures of NPCs can be tuned by changing aniline concentration and polymerization time, respectively. By tuning the conditions, the Specific Surface Area (SSA) of NPCs increases to 1768.6 m2/g. The specific capacitance of optimized NPC reaches up to 241.2 F/g at 1 A/g with a retention ratio of 97.8% after 10, 000 cycles at a high current density, proving its excellent energy storage capability and cycling stability. To further increase the SSA and performance, a novel strategy, namely internal phase-external phase coefficient high internal phase emulsion (IP-EP coHIPE) template, to prepare HPCs with notably enhanced porosity and SSA. In this strategy, sodium alginate (SA) solution which was employed as the internal phase was emulsified in external oil phase containing divinylbenzene (DVB) as monomer & crosslinker. HPCs were obtained by external phase polymerization, internal phase crosslinking and carbonization in sequence. Compared with conventional HIPE template, IP-EP coHIPE template can provide HPCs with enhanced porosity and increased SSA (high to 2280 m2/g) due to the utilization of the void space of the general HIPE-based HPCs via facile internal phase cross-linking. The porous architectures of HPCs can be adjusted by changing the concentration and volume fraction of SA solution internal phase. The specific capacitance of optimized HPC is 306 F g-1, much higher than 145 F g-1 of HPC from traditional HIPE template (HPC-b) at 1 A g-1. Furthermore, Co-doped Ni nanoparticles/oxygen-enriched HPCs (Co-Ni/OHPCs) by a modified IP-EP coHIPE templating. The OHPC framework provides high surface area and structural stability, meanwhile Co doping can significantly reinforce the electrochemical performance of the Co-Ni/OHPCs battery-type electrodes. By changing the ratio of N2+/Co2+, the optimized Co-Ni/OHPC electrodeexhibited excellent electrochemical performance of 498.5 F g-1 at 1 A g-1 and 817.3 F g-1 at 5 mV s-1, respectively. Furthermore, coupling with an activated porous carbon anode, the assembled hybrid supercapacitor possessed an appreciable energy density of 66.94 Wh kg-1 at 409.9 W kg-1 and a retention ratio of 73.9% after 5000 cycles, showing considerable application prospects.

Audience Take Away Notes

- The authors expect to offer the use for reference to prepare porous polymers or carbons with enhanced porosity and resultant performances via HIPE template method
- The audience may be inspired to prepare porous materials with desired porous architectures or to modify the porous walls

- The research expands the capability of HIPE template in preparing porous materials. The research may provide new strategy to prepare NPCs with interconnected porous structure
- It can provide some new information to the preparation of porous materials

Biography

Dr. Zhao studied Applied Chemistry at China University of Geosciences (CUG), China and graduated as BS in 2008. He then joined the research group of Prof. Wang at Polymer Chemistry at Zhejiang University (ZJU). Hereceived his PhD degree in 2014from ZJU and then obtained the position of a Lecture at Fuzhou University. Five years later, he achieved the title of Associate Professor at the same institution. He has published about 23 research articles in SCI(E) journals.

Xuelian Chen[1], Qigu Huang[1]

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Significantly tunable foaming behavior of blowing agent for polyethylenefoam resin with a unique designed blowing agent system

The chemical blowing agent plays a crucial role in enhancing the performance of polyethylene (PE) foaming resin during the rotational foaming process. Previously, the conventional blowing agent of PE resin commonly used pure azodicarbonamide (AZ). It had the unavoidable drawbacks of releasing NH3 and exhibiting strong reactions during the rotational foaming process. Meantime, pure AZ had a relatively high decomposition temperature resulting in a sharp foaming process. To address the above issues, this work developed a unique designed blowing agent system. In this study, a novel blowing agent for PE resin was successfully synthesized by one-pot method. This blowing agent consisted of an activator and AZ, which exhibited a lower decomposition temperature and a milder decomposition rate than AZ. The activator was constituted of small-sized ammonium dihydrogen phosphate on AZ surface, which could be decomposed properly and deliver phosphoric acid and H2O during the foaming process. Then AZ reacted with H2O under phosphoric acid catalysis. And this reaction generated CO2 emission while reducing the emission of NH3 through recombination with phosphoric acid. Moreover, phosphoric acid catalysis caused a decrease in AZ decomposition temperature. Meantime, the thermal coupling appeared during the foaming process, which could further reduce the decomposition rate. Consequently, the small-sized activator played a key role in regulating cell formation and diffusion. Compared to AZ, the novel blowing agent system significantly reduced the cell diameter of PE foam resin and enhanced its flexural modulus by 50%. Furthermore, the novel blowing agent facilitated better demolding performance and improved surface morphology of PE foam product. This research provides a significant foaming behavior regulation for PE resin during industrial applications.

Audience Take Away Notes

- Explain why we choose this topic?
- Introduce our new creativity strategy
- Preparation and characterization of PAZ
- Thermal decomposition performance of PAZ
- Property of PE foaming product
- The mechanism of foaming behavior for PAZ

Biography

Dr. Xuelian CHEN studied Polymer Science at the Beijing University of Chemical Technology. He has been engaged in the research and development of rotational molding materials and industrial applications for a long time, and was named the best technical expert in rotational molding in China in 2015. He has owned more than 70 patents and more than 30 research articles.

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Chemical engineers' in the face of cosmetics, cosmeceuticals and nutraceuticals: An overview

Chemical engineers, working alongside chemists, toxicologists, and medical professionals, play a pivotal role in enhancing people's quality of life. The global pursuit of youthful looks drives millions. Cosmetic formulations incorporate elements like herbals, microalgae, and natural, semi-synthetic, and synthetic polymers. Due to pollution and climate change concerns, the use of non-woven smart tissues, biodegradable carriers, and eco-friendly biomaterials is vital. The COVID-19 pandemic underscored the importance of sustainable practices and safe products. Chemical engineers maintain the highest quality standards in cosmetic manufacturing, with ingredient selection being a critical factor in product properties.

Artificial Intelligence (AI) assumes a significant role in chemical engineering. AI leverages machine learning and data analytics to optimize chemical processes, enhancing efficiency, reducing waste, and boosting productivity. It aids in ingredient selection by analyzing chemical properties and interactions. AI-powered systems bolster quality control through real-time parameter monitoring, anomaly detection, and prompt corrective measures. AI enables personalized cosmetics by analyzing individual skin characteristics to create tailored formulations.

In summary, chemical engineers collaborate to develop sustainable technologies and uphold quality standards in the cosmetics industry. The integration of AI optimizes processes, improves ingredient selection, and enables personalized formulations. The combined efforts of chemical engineering and AI result in safer, more effective, and environmentally friendly cosmetic products.

Keywords: Cosmetics, Cosmeceuticals, Nutraceuticals, Sustainability, Biotechnology, Biomaterials, Nanotechnology.

Audience Take Away Notes

- The audience will gain insights into the evolving landscape of cosmetics, cosmeceuticals, and nutraceuticals, understanding industry progress, labeling overlaps, and potential health effects. They will learn how to critically evaluate product claims and the importance of clinical evidence
- Audiences can use this knowledge to make informed decisions about cosmetics and related products, ensuring safety and efficacy. They can also assess claims on products more discerningly, separating evidence-based claims from marketing hype
- This research equips professionals in the cosmetics industry with a deeper understanding of:
    - Regulatory needs
    - Safety concerns
    - The significance of clinical validation
- It empowers them to develop safer, more effective products and communicate their benefits more convincingly to consumers

- Faculty in related fields can use this research to expand their teaching materials, enhancing students' understanding of the cosmetics industry's complexities. It provides a foundation for discussions on regulation, product safety, and the role of evidence in claims
- The research emphasizes the need for uniform regulations, simplifying compliance for designers and manufacturers. This streamlines the product development process, reducing complexity, and ensuring adherence to safety standards
- By promoting evidence-based claims and safety standards, this research indirectly enhances the accuracy of product designs. It encourages designers to base their formulations on sound scientific principles, potentially leading to more effective products
- All other benefits
  - Consumer safety: Informed consumers can make safer choices
  - Industry credibility: Upholding quality and safety standards builds trust
  - Innovation: Encourages the development of products backed by evidence
  - Regulatory clarity: Supports policymakers in creating effective regulations.
  - Market competitiveness: Companies adhering to standards gain a competitive edge

Biography

Charles Ivan Salanga, a 21-year-old undergraduate Chemical Engineering student at Saint Louis University, excelled academically by publishing a research paper in the Scopus-indexed IOP Conference Series: Materials Science and Engineering.He was fortunate to have a mentor with impressive credentials, holding fellowships with the Philippine Institute of Chemical Engineers and the American Board of Preventive Medicine, Nutrition, and Sports Medicine, who guided his path. Charles recently presented his research at the Asia Pacific Confederation of Chemical Engineering (APCCHE) Congress 2023, highlighting his dedication to advancing the field.His clear goals included pioneering eco-friendly solutions to combat climate change, excelling in lab work, and enhancing global quality of life through technology, specializing in materials science and nanotechnology, and inspiring future chemical engineers with his achievements and ambitions. Beyond academics, he was a passionate learner and explorer, determined to leave a positive mark on the world.

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High sensitive biosensor based on topological darkness in hybrid thin film- graphene nanostructures

Plasmonic biosensing has emerged as the most sensitive label-free technique to detect various molecular species in solutions and has already proved crucial in drug discovery, food safety and studies of bio-reactions. This technique relies on surface plasmon resonances in ~50nm metallic films and the possibility to functionalize the surface of the metal in order to achieve selectivity. However, sensitivity of the most advanced plasmonic biosensors has fundamental limitation caused by losses in metals and/or geometry of biochips. Here, we introduce a new paradigm in optical biosensing associated with the phenomenon of topological darkness. Main feature of the nanostructures possessed Topological Darkness (TD) is the absence of reflection/transmission provided by spectral properties of optical constants of constituted materials and the positioning of the zero reflection/transmission surfaces. Importantly, the generation of TD in hybrid thin film-graphene nanostructures can lead to extreme singularities of phase of light, which can be used in phase interrogation schemes to improve the sensitivity of plasmonic label-free biosensors by several orders of magnitude. We create and utilise the TD using two different methods: (i) fabricate graphene- protected copper nanostructures with strong Surface Plasmon Resonance (SPR) and a jump of phase for reflection of p-polarized light under Kretschmann prism geometry and its strong response to variations of refractive index of the environment compared to amplitude parameters; (ii) the TD for both s- and p-polarizations of incident light can be realised in flat layered nanostructures with thinnest active metallic and graphene layers beyond the plasmonic metamaterials based on interference principle for enhancing of optical sensitivity and immobilization efficiency of label-free biosensors. In suggested biosensor the graphene works as a biomolecular recognition element for enhancing the surface adhesion and consequently improving the sensitivity of TD in hybrid thin film- graphene nanostructures and plays a dual role. First, graphene protects thin metal film from oxidation during biosensing which often requires liquid environment accelerating corrosion. Second, graphene is used as a bio-functionalized surface that also provides selectivity of biosensing.

In our studies it was shown that graphene-protected copper SPR exhibits great advantages on biosensing if use the phase which is more sensitive to the presence of DNA-like analytes at the sensor surface achieves the detection limit to 2.4pM (pico-mole). Such sensor sensitivity is compatible with the ones checked through current popular diagnoses. We have demonstrated a real- time, label-free, highly sensitive and relative cost-effective graphene-enhanced SPR sensor for malarial plasmodium parasite (malaria disease). The phase sensitivity of our graphene-enhanced SPR sensor exceeded by about two orders of magnitude of analogous optical biosensors and provides the detection limit of malaria hybridization probes at the level of 12 pM (100 pg/ ml). We have realised the Reichert Company protocol, which works fine for Au chips, and we found that amplitude (spectral) and phase sensitivities of our chips (Cu(Ag)@Graphene are 8 and 12 times, respectively, better than the conventional ones. Using graphene-protected copper SPR biosensors allows shedding light on the detection of important molecules in many different applications, such as human health, food and environmental safety.

Biography

Vasyl G. Kravets received his Ph.D. degree in physics (1990) from Taras Shevchenko University, Kiev, Ukraine. He worked in the Institute for Information Recording, NAS, Kiev, Ukraine, as a postdoctoral research scientist and later as a postdoctoral research fellow, University of York, UK, and an invited research scientist, University of Duisburg, Germany. He is currently a Research Fellow in the plasmonic group of Prof. A. Grigorenko in Department of Physics and Astronomy, the University of Manchester, UK. His current research interest focuses on development of hybrid plasmonic-two-dimensional nanostructures and their applications in biosensing, optoelectronic, and the solar photovoltaics field.

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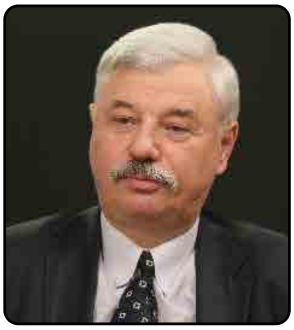
[2]Doctor of Medical Sciences, Professor
[3]Doctor of Legal Sciences, Professor

Application of nanotechnology for treatment of human bone joints with severe injuries

Using of nanotechnologies requires detailed analysis of existing obstacles to technology translation. Here we consider some bio nanotechnologiesfor the treatment of human bones, including its musculoskeletal system, experiencing the maximum load during the functioning of any living organism. We developed LitAr implantable material and itsapplication in some medical clinics and centers of Russian Samara city showed successful bone resorption and reduce scarring from surgical procedures.Here we discuss some details of LitAr technology application for these purposes by showingconcrete successful examples of medical treatmentfor severe mechanical deformation damages.We demonstrate time dynamics of X-ray images before and after suchapplication. Our results may used in thematic medical centers in cases of critical situations especially under emergency surgery.It would be logical to combine such technologies in those operating hospitals and clinics, that have already successfully applied them. It is especially difficult to organize for the Russian provincial doctors and the thematic scientists. We re-emphasize ways to accelerate the application of our method, as has been done previously.The implementation problemof our method is closely relatedwith financial support. But we hope that the scientific community efforts will help to change the attitude to our noticed innovations for the better in the interests of the whole humankind.

Biography

Alexander Valyaev, Leading Researcher, professor, doctor of Sciences, Division of Ecological Safety and Radiation Risk, Nuclear Safety Institute of Russian Academy of Sciences, Born on May 15, 1949 in Leninogorsk city, Republic of Kazakhstan. In 1972 he graduated with honours from the Tomsk Polytechnic Institute. In 1978 I successfully defended Ph.D. thesis in Russian Sverdlovsk city and In 1998 doctoral dissertation in Alma -Ata city of Republic of Kazakhstan. In 1994, I worked as the technical expert in USA and Canada according to international government contract. I participated with the thematic reports at many international thematic conferences and symposiums. From 2001-2011 I participated in 12 domestic and foreign events of NATO Program Scientific Committee. From 2017 to the present, I have been successfully collaborating with professors from Moscow and Russian Samara city on nanomedicine on development and application of prostheses for human organs.



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Prospects of carbon nanoenergy

The prospects of carbon nanoenergy, including hydrocarbon energy, the use of carbon nanotubes, and the energy of gas hydrates are considered. It is shown that the features of all types of carbon materials are determined at the nanoscale and that modern energy criteria determine the development of nanoenergy as one of the most important areas of application of nanotechnology in the global economy. he renewable nature of hydrocarbon resources due to the carbon cycle is noted.

There has been a great increase in interest in carbon energy in terms of its competition with renewable sources of alternative energy - wind, solar, and "green" (various algae). The question will probably be resolved as follows – which type of energy will be cheaper and provide technological needs. After all, a lower price per kilowatt-hour is not the only criterion of advantage – the ability to implement a forced engine operation mode and the possibility of delivering various types of energy carriers to the consumer (logistics) are also important.

The development of nanotechnology in the VI technological order is promising in the field of new environmental management, which means that new nanotechnology in use will be a commodity product of the VI technological order.

Modern energy criteria determine the development of carbon nanoenergy as one of the most important areas of application of nanotechnology in the global economy.

Oil, gas, coal, carbon nanotubes, gas hydrates are all carbon nanoobjects. Oil and gas consist of a number of nanocomponents, such as various gases, resins, and paraffins. It is the nanoscale features of these components of hydrocarbon energy carriers that determine the efficiency of their production and use both in energy processes and in petrochemical processes, allowing them to be used to produce petrochemical products, including for the manufacture of components of a number of equipment elements of renewable energy sources.

Methane gas hydrate (methanhydrate) It is also a nanoobject. The release of methane from methanhydrates requires about 15 times less energy than the thermal energy contained in the methane itself.

Nanotechnology allows us to propose new approaches to the development of gas hydrate deposits and shift the boundaries of the stability of methane gas hydrate up the temperature scale.

According to OPEC, by the end of 2020, oil consumption in the world was distributed by sectors as follows: 54% of consumption is accounted for by transport, 14% – by the chemical industry, 12% - by the agricultural industry, utilities and trade, 6% – by electricity generation, 14% – by other types industries. Even if it is possible to gradually completely switch transport, agriculture and electricity production to renewable sources, more than a third of oil consumption will still remain in other areas.

Many elements of the equipment for green energy are made using hydrocarbon products.

It is the symbiosis of engineering solutions in the oil and gas sector and in the "green" energy sector that oil and gas engineers are already starting to work in, gradually improving their skills, acquiring new knowledge and developing new technologies.

Audience Take Away Notes

- Components of carbon nanoenergy
- Carbon objects as nanoobjects
- The importance of hydrocarbon energy
- The use of carbon materials in green energy
- The carbon cycle in nature

Biography

Dr. Aleksandr Khavkin, graduated as specialist in 1975 Gubkin oil&gas University, Russia. He received the degree of Candidate of Technical Sciences in 1983. He received the degree of Doctor of Technical Sciences in 1987. Professor at Gubkin University since 1987, Professor at RUDN since 2022. Winner of the UNESCO Medal "Contribution to Development of Nanoscience and Nanotechnologies" in 2010. Participant of international conferences and exhibitions in Australia, England, Brazil, Hungary, Guyana, Denmark, Egypt, Spain, China, Norway, UAE, Russia, France, Japan. He has published more than 400 research articles.

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The importance of optimizing the synthesis conditions for obtaining pure ZnO-NP

As a result of the continuous development in the field of materials science, our life experience has changed significantly. Nanomaterials, due to their special properties at nano-scale, are increasingly used to improve the performance of various devices. Although we are witnessing to a tremendous development of the material chemical diversity, zinc oxide remainsan important multifunctional material. Due to its properties and its low toxicity, ZnO is widely used in different industrial applications such as: phosphor for photonic devices; catalyst for light conversion into useful chemical energy;nanostructured mixed-oxide for sensing of various pollutants or matrix for slow delivery of different drugs and pesticides.Along with the continuous demand for technologically valuable materials, simpler, inexpensive and environmentally friendly synthesis techniques are also needed.

In this respect,our research shows that the preparation of pure zinc oxide nanoparticles (ZnO-NP)is possible without any calcination stage using a facile precipitation route at room temperature. By changing different preparative conditions such as,reagents molar ratio and precipitation pH, our method was optimized to obtainpure ZnO-NP with sizes between 5-50 nm. On the other hand, by varying the volume of reactants, the reaction mechanism was significantly changed leading to completely different reaction products.

The changes of the morpho-structural and optical properties of samples were investigated by X-Ray diffraction, infrared spectroscopy, scanning electron microscopy, mineralogical optic microscopy, optical and photoluminescence spectroscopy. Depending on the synthesis conditions, three different crystalline phases were obtained: zinc oxide, zinc hydroxide and layered zinc acetate. Pure zinc oxide phase was obtained at pH values between 7-8 and fixed reagents molar ratio. A better understanding of the crystalline phasesformation was achieved using theoretical calculation (DFT) with a good match ofthe results with the experimental ones. Spherical nano-particles gathered in aggregates with various sizes were obtained for hexagonal ZnOstructureswhile sheet-like morphology was observed for the layered zinc acetate structures. Luminescent studies showed that the emission of ZnO-NP is in green spectral domain (~548 nm) due to VO → VB transitions whilethe blue emission of the layered acetate structures is much more complex due to Zni contributions.

Audience Take Away Notes

- About a facile, low-cost synthesis route for the preparation of ZnO-NP
- Role of pH on the formation of ZnO, Zn(OH)2 and layered ZnAc
- Correlation between molar ratio of reagents and morphology of the nano-particles
- Dependence of the luminescent emission on the lattice and defects type

Biography

Laura Elena Muresan studied chemistry - physics at Babes Bolyai University, Cluj Napoca, Romania, and after graduating, joined the inorganic research group at the Raluca Ripan Institute for Research in Chemistry, Romania, following in the same time the doctoral studies. She received the PhD degree in 2005 with the thesis entitled, Rare-earth doped luminescent materials. She currently works at the same institution, as senior researcher with more than 20 yearsexperience in material science. The main research field is focused on the synthesis and characterization of luminescent materials for different applications. The research activity is disseminated in various international journals (80 papers) and 6 patents.

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Combining electron channeling contrast and energy selected backscattered electron imaging to identifying defects in complex quantum dotssystems.

The microstructural characterization of semiconducting materials is essential to understand their physical properties, as well as device performance in various applications. Among the different techniques available, transmission electron microscopy (TEM) has been widely used for decades to reveal the defects in materials at nanoscale resolution. However, TEM has some limitations, such as the need for thin specimens, the difficulty of sample preparation, and the very small sample explored. Therefore, alternative or complementary techniques have been developed to overcome these challenges and provide more information about the materials of interest. One of these techniques is electron channelling contrast imaging (ECCI), which is based on the use of a scanning electron microscope (SEM) and a backscattered electron detector. ECCI exploits the phenomenon of electron channelling, which occurs when the incident electron beam is aligned with a crystallographic direction of the sample, resulting in enhanced or reduced backscattering depending on the orientation, and defect density, of the material. ECCI can provide high-resolution images of the surface and subsurface defects of materials, such as dislocations, stacking faults, and nano-motifs such as quantum dots, without the need for thinning or special sample preparation. For this reason, ECCI imaging of many heteroepitaxial structures has been reported, including subsurface quantum dots (QDs). However, the interpretation of image contrast can be hindered if an additional dot layer is deposited on the capping layer (CL) surface.

In this work, we present a novel approach to the study of defects and composition of InAs/GaAsBi QDs grown on GaAs substrates by means of two complementary scanning electron microscopy techniques: ECCI, using high primary beam energy (20 keV); and energy selective backscattered (EsB) electron detector imaging at low beam energies (2 keV). The latter enables a high sensitivity to small compositional changes and surface-sensitive spatial resolution. We obtain a comprehensive picture of the defect and compositional features of QDs and their correlation with growth conditions by combining both techniques. We demonstrate the effectiveness of our methodology by analysing different types of QD architectures where we implement GaAsBi capping of InAs QDs with different growth pauses.

We show that the wise use of both techniques and the subtraction of low voltage EsB in ECCI image allows us to enhance the contrast and visibility of the features. Results reveal the differences in defect types and distribution among the QD systems, as well as the variations in surface QD size, shape and/or the presence of Bi droplets. Our work provides a powerful tool for investigating and optimizing QD structures for various applications.

Audience Take Away Notes

- To know advantages of ECCI in terms of ease of use and reliable of the information obtained.
- Recognize opportunities of combine EECI and EsB techniques can be an advance in the study of more complex heteroepitaxial systems.

- To have knowledge of optimum parameters toenable reliable results.
- To know the effect of growth interruption approaches in the formation of InAs/GaAsBi quantum dots.

Biography

PhD Thesisrecognized by the Spanish Microscopy Society as the best thesis in thematerials category in the 2007 biannual call. Participation in 8 statal projects, 1 European integrated action, 4 regional projects, 9R&D and OTRI contracts with regional companies, 1 ITN network and 2 European projects. 65 JCR,1400 citations. More than 80 contributions to conferences. H index of 21.Co-director of 3 PhD Theses defended.
Excellence award 2019 in the Area of Materials Science and MetallurgicalEngineering from the University of Cadiz. Research lines: Characterization of semiconductors using HR, Z-contrast, EDX, EELS…).Engineering of III-Bi and III-Sb semiconductor alloys.

Shagufta Bi*, Rashi Srivastava
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Biogenic synthesis of nanoparticles and its antifungal and antibacterial applications

Science has changed due to the ability to manipulate matter at the molecular level. Materials having a minimum diameter of 1 to 100 nm are among the many materials referred to as nanoparticles. Combining organic and inorganic elements to produce microscopic structures is the large field of nanobiotechnology. The production of metal nanoparticles utilizing biological processes that are ecologically benign, sustainable, and bioinspired is one of the most fascinating features of modern nanoscience technology. With much effort, metal nanoparticles have been produced using various biological systems, including fungus, bacteria, and plant extracts. The geometric form, size, and stability of nanoparticles may be controlled by varying the quantity of metal salts and plant extracts, as well as the pH, temperature, and incubation duration. This work describes the synthesis of Palladium Nanoparticles (PdNPs) in an environmentally friendly, economical, quick, and simple manner utilizing Rosa damascena leaf as a capping and reducing agent. The synthesized PdNPs were characterized through UV-Vis Spectrophotometer, Fourier Transform Infrared Spectroscopy (FTIR), Transmission Electron Microscope (TEM), and Scanning Electron Microscope (SEM). UV studies confirmed the presence of PdNPs by their characteristic SPR peak at 364 nm. Synthesized PdNPs were spherical and polydisperse in shape where the size of nanoparticles was □ 20 nm. These green synthesized PdNPs exhibited significant activity against both antibacterial as well as antifungal species. The antibacterial activity of biosynthesized PdNPs from R.damascena leaf extract was investigated. The antibacterial activity was tested using the agar well diffusion method against the selected bacterial species of Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa. The antifungal activity of PdNPs from R.damascena leaf extract was tested using the agar well diffusion method against Candida ablicans, Aspergillus niger, and Aspergillus flavus.

Audience Take Away Notes

- Green synthesis of PdNPs by the Plant extract
- Antifungal activity against PdNPs
- Antibacterial activity against PdNPs

Biography

Miss Shagufta Bi works as a Senior Research Fellow (SRF) at IFTM University, Lodhipur Rajput, Delhi Road, Moradabad. Pin: 244102, Uttar Pradesh, India. Her current research is on the Green synthesis of Nanoparticles and In-vivo applications. She received the Global Academic Research Excellence Award for "Award for Excellence in Research" in life science in 2023. She attained and presented research papers at several national and international conferences. She was also invited for a short talk on her research work at an international conference at Mahatma Gandhi University in Kerala in 2022 and 2023. She has published several research Papers in reputed journals.

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Synthesis, characterization, and applications of carbon quantum dots

M Carbon Quantum Dots (CQDs), which are also referred to as Carbon Dots (CDs), are new nanomaterials based on fluorescent carbon that are zero-dimensional. The exceptional optical qualities of CQDs, along with their water solubility, biocompatibility, low toxicity, Eco-friendliness and straight forward synthesis routes. In this study, Carbon Quantum Dots (CQDs) extracted from cow milk and lime were synthesized in a single step using a novel hydrothermal process. The samples were characterized using a variety of methods, including transmission Electron Microscopy (TEM), Ultraviolet-Visible (UV-Vis), Fourier-Transform Infrared (FTIR), X-ray Photoelectron (XPS), and Photoluminescence (PL) spectroscopy. CQDs have quasi-spherical structures with an average particle diameter of 7 nm, according to TEM analysis. According to the XPS results, CQDs are primarily composed of carbon (67.36%), nitrogen (9.91%), and oxygen (22.73%). The high C and O content indicates that the particles have a lot of carboxyl groups on the surface. They have broad excitation-emission spectra, and excitation-dependent emission. This behavior could be attributed to the CQDs' varying sizes, random distribution, and the presence of various organic functional groups on their surfaces. At various temperatures, there is also an observed variation in the PL intensity of CQDs. The figures show that PL intensity decreases as temperature rises, and that this variation is constant across all wavelengths. This intensity drop could be the result of thermally activated non-radiative trapping increasing non-radiative relaxation at high temperatures. Despite being exposed to a lot of salt, UV light, and storage time, they stayed relatively stable. Since mechanisms for quenching fluorescence are selective and sensitive to Sn2+, they can be employed to create a nanosensor for detecting Sn2+.

Biography

Dr. Arvind K. Gathania is an Associate Professor in the Department of Physics & Photonics Science at the National Institute of Technology Hamirpur, Hamirpur-177005 India. He has over 25 years of experience in teaching and research. Optical materials for lighting, displays, and sensing applications are among his research interests. Over fifty of his research papers have been published in prestigious journals.

Dr. ABM Sharif Hossain*, Hassan Ahmed Alrudayni, Mohamed S. Aleissa

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Production and application of nanocellulose based nano-biopolymer derived from plant lignocellulose as tissue engineering biomaterials and drug delivery

The nanocellulose-basednanobiomaterials like nano-biofilm and nanocoating are appropriate to the medical, biomedical, cosmetics, and bioengineering industries. Biomaterial derived from plant sources like biopolymers is naturally organic and biodegradable. Potential applications of nanocellulose as nano-biomaterials in the fields of biosensors, wound healing, bone-cartilage regeneration, and dental applications as nanocellulose has great potential as a biomaterial for dental and oral applications. In addition, nanocellulose is promising to use in nanobiofilm and nanocoating for medicine (capsules and drugs), scaffolds for engineering of blood vessels, neural tissue, liver, adipose tissue, repairing connective tissue, congenital heart defects, nanobiomedicine, constructing contact lenses and protective barriers because of naturally organic and biodegradable.This study was carried out to investigate nanocellulose-basednanomaterialsand nanobiopolymers from ligno-cellulose-derived plant biomass coming after bioprocess technology. From the results, it was observed that nano celluloseorganic based nano-biomaterials were better than synthetic-basedmaterials for wound healing, bone-cartilage regeneration, and other applicationsdepending upon the different properties identified by ASTM (Americal standard for testing and materials) standard. Therefore, it can be concluded that organic (nanocellulose) based biodegradablenano-biomaterials may be used as biomedical and medical components in the field of tissue engineering, drug delivery as biomedical and medical components, and application in the pharmaceutical industry.

Keywords: Nanocellulose, Biopolymer, Biosensor, Wound Healing, Nanocoating.

Biography

Dr. ABM Sharif Hossain obtained his PhD in Plant and Industrial Biotechnology in 2006 at Ehime University, Japan. He holds a position as an Associate Professor of Biotechnology in the Department of Biology, Faculty of Science, Imam Mohammad Ibn Saud Islamic University KSA. Dr. Hossain has a total of 245 publications including patents, Journal papers, 15 books, and book chapters. He has more than 70 articles are Web of Sciences (ISI) and more than 80 have been published in Scopus Journal. He has a total of 55 Conference abstracts and proceedings. He achieved an h-index: of 28 and a total Google Scholar citation: of 3322. Dr. Hossain was the first scientist at Hail University and achieved the Vice Chancellor award at Hail University, KSA. Dr. Hossain supervised PhD: 6 (UM, UKM, Malaysia), MSc: 12, Undergraduate: 40 (University of Malaya, Kuala Lumpur and Hail University, KSA) students. He has completed 20 research projects. He is an Editorial member of 10 Journals. In addition, he is an External Examiner for PhD and MSc Thesis of 5 Universities. Dr. Hossain is expertise in Plant Biotechnology, Environmental Science and Biotechnology, Industrial Biotechnology, and Nanobiotechnology (nanomaterials) like nanocellulose and nano-starch crystal, nano-biofilm and nano-biosensor chip production using cellulose derived from plant biomass resources.

Ayad Al Thuwaynee
Department of Metallurgical Engineering, University of Babylon, College of Materials Engineering, Iraq

Outstanding flame approach for production Ferric Oxide (Fe2o3) nanoparticles

Synthesis of functional iron oxide nanoparticles (Fe_2O_3) has attracted considerable attention recently due to their potential diverse applications such as catalysis, optical magnetic recording, gas sensors, electronic devices and biomedical applications. The flame route establishes the science of the synthesis of functional iron oxide nanoparticles from premixed flamesby achieving nanoparticle sizes of less than 3 nm. Common methods for producing ferric oxide nanoparticles particularly sol-gel, hydrothermal, co-precipitation and microwave with comparative assessment for these methods, and the combustion synthesis of nanoparticles. Of all the methods, combustion based synthesis method was found to be the most appropriate due to significant advantagesover the wet chemical processes. In addition, recently it has been shown that combustion synthesis is the simplest and most economic method for nanoparticle production. Flame synthesis usually occurs as a single-step process, whereas wet chemical methods take multiple steps. Most importantly, combustion synthesis has proven to be an easily scalable process that can achieve high product yields and large, continuous production quantity.

Biography

Mr. Ayad Al Thuwaynee studied Master degree in Manufacturing System Engineering (MSE) at UPM, Malaysia and graduated in 2010. Then, he joined with Research and Development (R&D) department in ministry of industrial in Iraq. Currently, PhD student at Brighton University, UK. Undertaken study on the formation of the nanoparticle by combustion flame synthesis.

Modjadji R. Letsoalo[1], Steve R. Dima[1,2], Eric N. Maluta[1], Dr. Katekani Shingange[3,4]*

[1]Department of Physics, University of Venda, P/ Bag X 5050, Thohoyandou, 0950
[2]Next Generation Enterprises and Institutions Cluster, Council for Scientific and Industrial Research, Pretoria 001, South Africa
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Experimental and DFT calculations of ethylene detection performance of Co3O4

The morphology of Metal Oxide Semiconductors (MOS) significantly influences their gas detection abilities. Nanostructured forms, like hierarchical structures, exhibit superior gas detection capabilities compared to bulk materials. This is attributed to their larger surface area and enhanced reactivity, facilitating improved gas adsorption and diffusion, leading to amplified sensitivity and faster response/ recovery times. Cobalt dioxide (Co3O4), a typical p-type MOS, is commonly employed in gas sensing applications. Its sensing properties rely on surface catalytic properties, with sensors typically operating at temperatures exceeding 200°C. Understanding the morphology-dependent behavior of Co3O4 is crucial for optimizing its performance in gas sensing applications. This study investigates the gas detection capabilities of various cobalt oxide (Co3O4) structures, with a specific focus on Ethylene (C2H4) detection. The Co3O4 structures were synthesized by hydrothermal synthesis at different reaction duration times i.e., 6, 12, and 24 hours. X-ray Diffraction (XRD) revealed a strong crystallinity of the structures. Scanning Electron Microscopy (SEM) and Transmission Electron (TEM) revealed sheet-like morphology assembling to form hierarchical structures. The sheet-like structures demonstrated a decreasing surface area obtained through Brunauer Emmet-Teller (BET) with increasing duration time. The gas sensing performance studies revealed high selectivity towards C2H4 gas with the Co3O4_6hrs based sensor demonstrating the highest response of 49.6, with fast response and recovery time of 27/42 s at 100 °C. The sensing performance of the Co3O4_6hrs based sensor was attributed to the high surface area and high defects as revealed by BET and Photoluminescence (PL) analysis in comparison to the rest of the samples. To provide a deeper understanding of the gas-sensing mechanisms at play, Density Functional Theory (DFT) calculations were employed, offering valuable insights into the underlying processes driving the observed gas-sensing behavior.

Audience Take Away Notes

- Attendees will gain insights into the unique properties of Co3O4 and its suitability for ethylene sensing applications
- This research could serve as a foundation for other faculty members to expand their own research or incorporate related concepts into their teaching, fostering interdisciplinary collaboration
- The research may provide novel information that assists in solving design problems related to ethylene sensing, contributing to the advancement of technology in this field
- Beyond immediate applications, the presentation may have broader societal or environmental impacts by improving the efficiency of ethylene sensing, which is crucial in various industries, including agriculture, food storage, and environmental monitoring

Biography

Dr. Katekani Shingange is a scientist from the Advanced Materials Division at Mintek in South Africa. She holds a PhD (Physics) obtained from the University of the Free State (UFS). Her research focuses on the development of gas-sensors for the selective and sensitive detection of gas molecules biomarkers for application in food safety, environmental monitoring as well as disease diagnosis. So far, Dr. Shingange has made an impact in her field of study through contribution in the body of knowledge, and has published more than 18 peer-reviewed publications, and has an hindex of 13.

Prof. Vladimir G. Chigrinov
Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong
Nanjing Jingcui Optical Technology Co., LTD, Nanjing, China

Azodye photoaligned nanolayers for liquid crystals devices

Photoalignment and photopatterning has been proposed and studied for a long time. Light is responsible for the delivery of energy as well as phase and polarization information to materials systems. It was shown that photoalignment liquid crystals by azodye nanolayers could provide high quality alignment of molecules in a liquid crystal (LC) cell. Over the past years, a lot of improvements and variations of the photoalignment and photopatterning technology has been made for photonics applications. In particular, the application of this technology to active optical elements in optical signal processing and communications is currently a hot topic in photonics research. Sensors of external electric field, pressure and water and air velocity based on liquid crystal photonics devices can be very helpful for the indicators of the climate change.

We will demonstrate a physical model of photoalignment and photopatterning based on rotational diffusion in solid azodye nanolayers. We will also highlight the new applications of photoalignment and photopatterning in display and photonics such as:

1. Fast high resolution LC display devices, such as field sequential color ferroelectric LCD
2. LC sensors
3. LC lenses
4. LC E-paper devices, including electrically and optically rewritable LC E-paper
5. Photo induced semiconductor quantum rods alignment for new LC display applications
6. 100% polarizers based on photoalignment
7. LC smart windows based on photopatterned diffraction structures
8. LC antenna elements with a voltage controllable frequency

Biography

Professor Vladimir G. Chigrinov is Professor of Hong Kong University of Science and Technology since 1999. He is an Expert in Flat Panel Technology in Russia, recognized by the World Technology Evaluation Centre, 1994, and SID Fellow since 2008. He is an author of 6 books, 31 reviews and book chapters, about 317 journal papers, more than 668 Conference presentations, and 121 patents and patent applications including 36 US patents in the field of liquid crystals since 1974. He got Excellent Research Award of HKUST School of Engineering in 2012. He obtained Gold Medal and The Best Award in the Invention & Innovation Awards 2014 held at the Malaysia Technology Expo (MTE) 2014, which was hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014. He is a Member of EU Academy of Sciences (EUAS) since July 2017. He got A Slottow Owaki Prize of SID in 2018. He is 2019 Distinguished Fellow of IETI (International Engineering and Technology Institute). Since 2018 he works as Professor in the School of Physics and Optoelectronics Engineering in Foshan University, Foshan, China. 2020-2024 Vice President of Fellow of Institute of Data Science and Artificial Intelligence (IDSAI) Since 2021 distinguished Fellow of Institute of Data Science and Artificial Intelligence.

Dr. Elaheh Mohebbi[1]*, Eleonora Pavoni[1], Luca Pierantoni[2], Pierluigi Stipa[1], Emiliano Laudadio[1], Davide Mencarelli[2]

[1]Department of Science and Engineering of Matter, Environment and Urban Planning (SIMAU), Marche Polytechnic University, 60131 Ancona, Italy
[2]Information Engineering Department, Marche Polytechnic University, 60131 Ancona, Italy

Copper-based hot electrons and high-efficiency I(V) characteristics generated by VSe2 nanodiod

2D materials are growing at a rapid rate driven by the potential extraordinary electronic applications that they can offer. In parallel, Terahertz (THz) technologies have continued to receive a great attraction due to the many effective applications, however, it has continuously been hindered due to the low power and wide scale applicability of current THz source technologies. THz surface plasmonics is coming into the forefront as an area which can bridge these two emerging technologies and allow the necessary breakthrough that is needed in the so-called THz source gap region of 0.5 – 3 THz. By utilizing novel 2D materials based on Transition Metal Dichalcogenides (TMDs) with extraordinary electronic, optical, mobility and electrical properties, these limitations breaking results in terms of amplification in THz. Recently 2D vanadium diselenide (VSe2) has gained utmost attention stemming from its outstanding physical-chemical features with high performance applications in energy storage, pharmaceutical and broadband photodetection (visible to terahertz) areas. VSe2 is a typical TMD that exhibits metallic properties with zero band gap due to the strong electron coupling of V4+–V4+. This material shows an extreme electrical conductivity of 106 Sm−1, however, most previous reports are related to the responsivities, band structure and electromagnetic properties, while its optical and electrical properties in THz range are rarely reported.

Together with the high level of fabrication technology that has been reached experimentally, computer simulation in nanoscale becomes an indispensable tool for understanding the properties of devices and interfaces that meet ever increasing performance demands. Since, the size of modern electronic and optoelectronic devices continues to scale down, quantum mechanics approaches based on atomistic simulations are inevitable to account for the quantum mechanical phenomena that affect transport and optical properties of nanoscale materials and devices. In the present work, we have developed two kinds of modelling based on materials interfaces and devices as follow: i) The first one concerns materials interfaces linked into a supramolecular architecture in which we calculated the electronic and optical properties of total system using accurate simulation and methodology of the physics involved in THz range. ii) In the second part, self-consistent charge Density Functional Tight-Binding (DFTB) calculations have been performed to investigate the electrical properties and transport behavior of the VSe2/Cu nanodevices using different metallic electrodes. The implementation of novel 2D materials for plasmonicamplification of THz sources will be the needed gateway to open-up the current bottle-neck in RF applications beyond 1 THz frequency.

Audience Take Away Notes

- Develop architectures which can find a solution for surface plasmons couple to the THz radiation
- Efficient nano-scale modelling to amplify THz waves based on surface plasmons in 2D materials
- High effective design of VSe2-based nanodiodes for plasmonic energy conversion

Biography

Dr. Elaheh Mohebbi studied Applied Chemistry at Teacher Training University of Tehran, Iran and graduated as MS in 2012 in Physical Chemistry from Applied Sciences University of Damghan, Iran. She then, in 2015, joined in the research group of Prof. Maurizio Casarin at the University of Padova, Italy and received her PhD degree in Molecular Science. Since 2019, she started the postdoctoral fellowship supervised by Prof. Mir Masoud seyedfakhrabadi in Department of Mechanical Engineering at University of Tehran, Iran. From 2021, she is researcher in Department of Science and Engineering of Matter, Environment and Urban Planning (SIMAU), Marche Polytechnic University, Italy. Her research focuses on first principles computational modelling, device design, electronic structure calculations, mechanical, optical properties, phononic and phase transitions, thermal conductions, IR, Raman and STM simulations. She has published extensively in these areas with more than 25 papers in archival journals and conference publications.

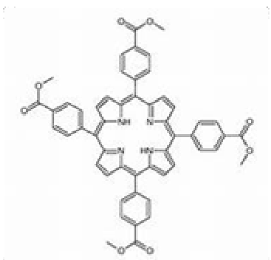
Prof. Raymond Jagessar

Department of Chemistry, Faculty of Natural Sciences, University of Guyana, Georgetown, Guyana

Porphyrin based nanomaterials

Porphyrins are terapyrrolic compounds that are usually synthesized by the condensation of aromatic aldehyde with pyrrole or the reaction of dipyrromethene with an aromatic aldehyde followed by oxidation with p-chloranil. Because of its highly conjugated nature and rich 22 p electron system, excellent chemical and physical properties, they have been used as versatile building blocks for the synthesis of nanomaterials with varying applicability, extreme molar absorption to near-infrared spectrum from the visible region, supreme oxygen quantum yields with singlet state, and chemical flexibility. Functionalized porphyrin-based nanocomposites offers various tunability modes in terms of optical, electronic, and magnetic properties and provide an efficient sensing platform to detect various analytes in the field of environment, health, and food. Porphyrin carbon nanocomposites can be used as nanosensors for the detection of toxic compounds and Volatile Organic Compounds (VOCs) generated during the deterioration of food. Porphyrins have demonstrated great potentials in visible-light photocatalytic applications, because of their electrical, optical and catalytic properties. This has found diverse application in the synthesis of selective nanomaterials with porphyrin like properties. The nanoparticles of porphyrin and its derivatives have been developed for drug delivery systems which are one of the popular fields in pharmaceutical chemistry. Porphyrin nanomaterials condensing to different drug delivery variables have been utilized to enhance delivery features due to the properties that allow immune tolerance, specific targeting, better hydrophilicity, and lengthy tissue lifetime.

Keywords: Porphyrin, Tetrapyrrolic Compounds, Porphyrin Based Nanomaterials, Porphyrin Based Nanocomposites.



Audience Take Away Notes

- Most of the audience are nanotechnologists and thus can incorporate part of my research in their work or apply them to their research work. However, the work must not be plagiarise
- The audience will be more knowledgeable at work in nanotechnology. This research faculty can use part of my research to expand their research. However, they must reference my work. It provides a practical solution toproblems that could simplify or make a nanotechnologist designer's job more efficient? Yes, it will improve the accuracy of a design, or provide new information to assist in a design problem? In addition, it will expand the scope of nanotechnologists

Biography

Prof. Raymond C. Jagessar obtained his BSc (distinction) in Chemistry/Biology from the University of Guyana (1991) and was assistant lecturer in the Department of Chemistry from (1991-1992). He obtained his PhD from the UK in 1995. He held three Post Doctoral Research Fellowships (PDF) at the University of South Carolina (USA), Wichita State University (USA) and the University of the West Indies during the period, 1996-1999. He has several international awards, amongst them are Chartered Chemist, CChem and Fellow of the Royal Society of Chemistry, FRSC, UK, Research Grants and recently, one of the awardees of the Guyana Innovation Prize, 2021. His research interests are broad, covering the spectrum of Pure and Applied Chemistry, Chemical Biology and Pharmaceutical Chemistry. He has published over 100 research articles, five book chapters, one book and presented at many conferences, locally and internationally. He is currently Professor in Chemistry (Organic and Inorganic) at the University of Guyana (South America), Fellow and President of the Caribbean Academy of Sciences.

Raymond Jagessar
Department of Chemistry, Faculty of Natural Sciences, University of Guyana

Nanotechnology, advancing material science and medicine

Nonotechnology has been a rapidly growing field of advanced science at the inception of this century. Nanotechnology of advanced materials, polymers, principally revolves around endeavours to plan materials at a sub-atomic level to accomplish alluring properties and applications at a naturally visible level. Nanotechnology can be used for the advancement of technologies, ranging from communication and information, health and medicine, future energy, environment and climate change to transport and cultural heritage, Personal Protective Equipment (PPE), fuels, fuel cells, biosensors, disease sensors etc. Nanomaterials will lead to a new approach to manufacturing materials and devices. Faster computers, advanced pharmaceuticals, controlled drug delivery, biocompatible materials, nerve and tissue repair, crackproof surface coatings, better skin care and protection, more efficient catalysts, better and smaller sensors, even more efficient telecommunication. For example, a low risk solution using antibody modified bismuth nanoparticle, in combination with an X-ray dose equivalent to a chest X-ray specifically, has been shown to kill the common bacterium Pseudomonas aeruginosa in a set up designed to resemble a deep wound in human tissue. Nanosized gold particle could catalyse the oxidation of carbon monoxide better than anything previously known. Heparin functionalized nanoparticles have been use for targeted delivery of anti-malarial drugs. Heparin is abundant and cheap, compared to treatments that involve antibodies, an important consideration, since malaria is most common in developing countries. A bone repairing nano-particle paste has been developed that promises faster repair of fractures and breakages. DNA containing two growth genes is encapsulated inside synthetic calcium phosphate nanoparticles. In a remarkable demonstration of the extreme limits of nanoscale engineering, researchers have used the tip of a scanning tunnelling microscope to cleave and form selected chemical bonds in a complex molecule. Many medicinal and industrial endeavours have seen the use of Nanotechnology. Nanoparticles can attach to SARS COV-2 viruses, disrupting their structure and so kill the virus. These and other more recent advances in nanotechnology will be presented at this conference.

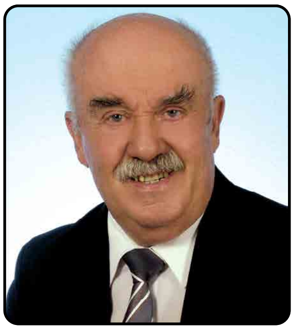
Keywords: Nanotechnology, Nanoparticles, Pseudomonas Aeruginosa, Heparin, Calcium Phosphate Nanoparticles, Scanning Tunnelling.

Audience Take Away Notes

- Most of the audience are nanotechnologists and thus can incorporate part of my research in their work or apply them to their research work. However, the work must not be plagiarise
- The audience will be more knowledgeable at work in nanotechnology. This research faculty can use part of my research to expand their research. However, they must reference my work. It provides a practical solution to problems that could simplify or make a nanotechnologist designer's job more efficient? Yes, it will improve the accuracy of a design, or provide new information to assist in a design problem? In addition, it will expand the scope of nanotechnologists

Biography

Prof. Raymond C. Jagessar obtained his BSc (distinction) in Chemistry/Biology from the University of Guyana (1991) and was assistant lecturer in the Department of Chemistry from (1991-1992). He obtained his PhD from the UK in 1995. He held three Post Doctoral Research Fellowships (PDF) at the University of South Carolina (USA), Wichita State University (USA) and the University of the West Indies during the period, 1996-1999. He has several international awards, amongst them are Chartered Chemist, CChem and Fellow of the Royal Society of Chemistry, FRSC, UK, Research Grants and recently, one of the awardees of the Guyana Innovation Prize, 2021. His research interests are broad, covering the spectrum of Pure and Applied Chemistry, Chemical Biology and Pharmaceutical Chemistry. He has published over 100 research articles, five book chapters, one book and presented at many conferences, locally and internationally. He is currently Professor in Chemistry (Organic and Inorganic) at the University of Guyana (South America), Fellow and President of the Caribbean Academy of Sciences.



Prof. Jerzy Kisilowski[1]*, Prof. Rafał Kowalik[2]*
[1]Retired, Poland
[2]Military University of Aviation, Dęblin, Poland

Wear and tear of turnout components and wheels of a rail vehicle moving at high speed (V>200 km/h)

Wear processes of turnout and wheel components will be presented based on the theory considering contact ellipses based on the work of Kalker, Chudzkiewicz. The Archard Model will not be used. Contact ellipses are determined based on the normal forces (perpendicular to the contact surface) from the vertical forces that arise during the passage of a rail vehicle through a turnout. The following assumptions are made: the Poisson's ratio of the wheel and rail in the turnout are the same; computer simulation is used in the analysis, taking into account Universal Mechanism software; at least 20000 passes of the rail vehicle through the turnout are performed in the simulation; the model of stiffness in the turnout is assumed to be variable as a function of the road (track elasticity constants are commonly assumed); simulations are carried out for rail vehicle speeds from 200 km/h to 350 km/h (in 50 km/h increments); rail vehicle movement takes place on the straight track of the turnout (it can also take place on the switch track at the turnout, but this type of research has not been carried out). The results are presented in the form of wear magnitudes of mating components.

Audience Take Away Notes

- The results of the work will allow the audience to get an idea of what kind of qualitative and quantitative character of wear and tear quantities arise in the process of movement of a rail vehicle along a turnout
- The results will allow railroad operating personnel to gain knowledge about the qualitative and quantitative nature of wear of turnout components and wheels
- The magnitudes of wear and tear will enable designers of operational processes to propose the possibility of wear and tear, which can cause wear and tear in the movement of a vehicle through a turnout
- The method of the proposed research can be used in design work on materials of both turnout elements and wheels of a rail vehicle

Biography

Professor Jerzy Kisilowski, PhD. DSc. Eng. Full professor at the Faculty of Transport and Electrical Engineering of the Kazimierz Pulaski UTH in Radom (to 2022). Head of doctoral studies (to 2021). He has promoted 30 PhD students. Author of 350 scientific publications in Polish, English, German and Russian. His scientific interests include dynamics of mechanical systems, theory of stochastic processes, theory of sensitivity, problems of diagnostics and reliability of mechanical and electronic systems. He was a member of the New York Academy of Sciences. While working at the university for 30 years, he actively participated in economic life.
Prof. Rafał Kowalik, PhD. DSc. Eng. Professor at the Faculty of Aviation of the Polish Military Academy in Dęblin. Author of 70 scientific publications in Polish and English. He obtained his master's degree in engineering from the Faculty of Transport and Electrical Engineering at the Radom and the Faculty of Electronics and Telecommunications at the Military University of Technology. He obtained his doctoral degree in 2016 at the Faculty of Transport and Electrical Engineering of the Kazimierz Pulaski UTH in Radom. His scientific interests include dynamics of means of transport, electronics and electrical engineering in means of transport.

Frederick H. Silver
Robert Wood Johnson Medical School, Rutgers University

Viscoelasticity of Synthetic Polymers and Soft Tissues Using VOCT

My lab has developed a new technique to noninvasively measure the elastic and viscous properties of synthetic and natural polymers using infrared light and acoustic sound applied transversely to the surface of materials. The technique termed vibrational optical coherence tomography (VOCT) measures the resonant frequencies of materials and calculates the elastic modulus from the deformation in-phase with the applied force. The viscous component is obtained from the ratio of the width of the deformation decay peak at the half-height divided by the peak height after the sample is unloaded. For silicone rubber, the viscous component of the viscoleastic behavior is much smaller then that of soft tissues including skin and cornea. The elastic modulus of both silicone, skin, and cornea are all about 2 MPs but skin and cornea have much higher viscous components (up to 65% of the elastic components) compared to silicone at strain rates of about 50 Hz. At strain rates of above 200 Hz silicone, skin, and cornea all behave almost purely elasticially with viscous components below about 5% of the elastic modulus. It is concluded that the high water content and viscoelasticity of skin and cornea help these tissues dissipate large amounts of energy at low loading frequencies preventing premature mechanical failure. The high value of viscous modulus of tissuesat low frequencies reflect water contents of up to 80% by volume. At low loading frequencies water is displaced form the spaces between collagen fibers in tissues dissipating some of the applied energy. At high strain rates, tissues behave almost purely elastically when water remains bound to the surface of the collagen fibers during loading. The ability to noninvasively measure the viscoelasticity of polymers and tissues provides a method to anlayze the effects of processing of implants and chnages that couur during disease.

Biography

Dr. Frederick H. Silver is a Professor of Pathology and Laboratory Medicine at Robert Wood Johnson Medical School, Rutgers, the State University of New Jersey. He did his Ph.D. in Polymer Science and Engineering at M.I.T. with Dr. Ioannis Yannas, the inventor of the Integra artificial skin, followed by a postdoctoral fellowship in Developmental Medicine at Mass General Hospital in Boston, MA with Dr. Robert L. Trelstad, a connective tissue pathologist. Dr. Silver invented a new technique termed vibrational optical coherence tomography (VOCT). US and European patents have been granted on VOCT to Rutgers.

Monika Walesa Chorab[1,2], Abdel Al Ahmad[1],Will Skene[1]*

[1]Institute Courtois, Department of Chemistry, Universite de Montreal, Montreal, QC, Canada

[2]Faculty of Chemistry, Adam Mickiewicz University in Poznan, Uniwersytetu Poznanskiego 8, 61-614 Poznan, Poland

Reversibly modifying the properties of sustainable devices through reversible covalent bonds

Smart windows are sustainable devices because theyreduce the cooling loads of buildings during hot and summer periods. As a result, the electricity consumedby a building for cooling with HVAC is much lower than buildings that do not use smart windows. Smart windows are enabled by a thin coating of an electrochromic material that reversibly changes its optical transmission with an applied potential. The electrochrome must therefore have a reversible redox behavior, change its optical transmission both consistently and reversibly with an applied potential, and filter the NIR region of the solar spectrum. While these properties can be designed into conjugated materials, the properties are locked into the conjugated framework owing to the robust covalent bonds. Converting the irreversible covalent bonds into reversible bonds opens the possibility of modulating the properties of the electrochrome after it has been integrating into smart windows. In the mid to long term, reversible bonds increase the usefulness of operating devices by regenerating the active materials as well as improving the recyclability of devices after their use. Within this context, it will be demonstrated that reversible bonds can be leveraged to reversibly change the properties of electrochromes. Specifically, multiple properties including redox potential, optical absorbance, fluorescence, and fluorescence intensity will be shown to be reversibly modulated by changing the conjugated framework courtesy of reversible covalent bonds. It will further be shown that the reversible bonds can be activated in solution and in the solid state for ultimately adjusting the properties of functioning devices.

Biography

The Skene research group focuses on using sustainable practices for developing sustainable devices. The team is interested in establishing accurate structure-property relationships of conjugated organic materials. Knowledge acquired from such studies is used in the rational design of materials whose properties can be adjusted to meet the requirements for a given application. The group also evaluates the performance of materials in solution, thin films and devices for improving the overall performance of devices.

Eknath Kole[a], Krishna Jadhav[b], Zia Khan[a], Rahul K. Verma[b], Jitendra Naik[a]***

[a]Department of Pharmaceutical Technology, University Institute of Chemical Technology,
KBC North Maharashtra University, Jalgaon M.S. 425001, India.
[b]Pharmaceutical Nanotechnology Lab, Institute of Nano Science and Technology, Sahibzada
Ajit Singh Nagar (Mohali), Punjab 140306, India.

Cross-linked Chitosan-Dextran Sulfate Nanoparticles for Vildagliptin Encapsulation: QbD Optimization and In Vitro Antidiabetic Efficacy

Vildagliptin (VLG), recognized for its antidiabetic properties, offers a potential remedy for this prevalent condition due to its notable characteristics, including high solubility and a brief elimination half-life. This study aims to develop sustained-release VLG-encapsulated crosslinked chitosan-dextran sulfate nanoparticles (VLG-CDNs) through microreactor-assisted synthesis. Employing a design of experiment (DoE) approach systematically optimized the fabrication process. The optimized VLG-CDNs exhibited a reduced particle size of 217.4 ± 12.3 nm and an encapsulation efficiency of 76.3 ± 3.0. Scanning electron microscopy revealed smooth spherical surfaces of the VLG-CDNs. Subsequently, spray drying technology was utilized for dehydration, and reconstitution ability was assessed. The in vitro release profile demonstrated sustained VLG release over 12 hours. In-vitro antidiabetic efficacy was evaluated through glucose uptake assays in the skeletal muscle L6 cell line, along with assessments of α-amylase and α-glucosidase enzyme activities. The results indicate that the optimized VLG-CDNs present a promising nanoformulation for effectively managing diabetes mellitus.

Audience Take Away Notes

- Nanoparticle synthesis using Microreactor.
- Characterization of Nanoparticles
- Evaluation of Nanoparticles

Biography

Mr. Eknath Kole studied M.S. Pharm at National Institute of Pharmaceutical Education and research Mohali (India), and Batchler of Pharmacy at Sant Gadage Baba Amravati University Amravati (India). Currently he has joined the research group of Prof. Jitendra Naik at Department of Pharmaceutical Technology, University Institute of Chemical Technology, Kavayitri Bahinabai Chaudhari North Maharashtra University Jalgaon. (M.S.). He has Published more than 10 research articles in SCI(E) Journals.

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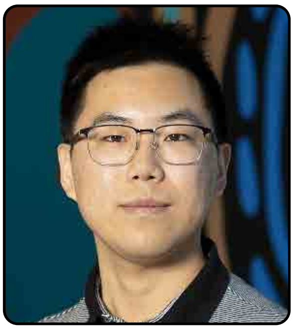


Liping Kevin Ge[1,2], Alessandro Tuniz[2,3], C. Martijn de Sterke[2,3], James M. Zavislan[4], Thomas G. Brown[4], Sascha Martin[5] and David Martinez-Martin[1,2]*

[1]School of Biomedical Engineering, Faculty of Engineering and IT, University of Sydney, NSW, 2006, Australia
[2]The University of Sydney Nano Institute, The University of Sydney, NSW, 2006, Australia
[3]Institute of Photonics and Optical Science (IPOS), School of Physics, Faculty of Science, University of Sydney, Sydney, NSW, 2006, Australia
[4]The Institute of Optics, University of Rochester, Rochester, New York, 14627, USA
[5]Department of Physics, University of Basel, Basel, 4056, Switzerland

Optimisation and artifacts of photothermal excitation of microresonators

The utilization of photothermal excitation for the precise activation of microresonators through focused, intensity-modulated light represents a burgeoning field of research with profound implications for atomic force microscopy (AFM) and related sensor technologies. This method's ability to induce accurate mechanical responses in microresonators without introducing distortions—even in challenging liquid environments—underscores its potential to drive significant advancements in high-resolution imaging and measurement techniques.

Despite the progress in enhancing the interaction between light and mechanical systems, notably through the development of specialized coatings aimed at improving light-to-mechanical conversion efficiency, substantial inefficiencies persist. The conversion process remains predominantly inefficient, with the mechanical movements of resonators confined to the scale of tens of nanometers, despite the application of milliwatts of optical power. This limitation not only underscores a pivotal challenge in maximizing photothermal excitation's effectiveness but also highlights the critical gap in our understanding of the photothermal process in liquid environment, particularly in terms of how efficiency is influenced by the microresonator's position relative to the photothermal beam's propagation axis.

To address these challenges, our study embarks on an in-depth exploration of photothermal efficiency across different environments—specifically, air and water—utilizing cantilever microresonators and a custom-engineered picobalance. This investigation reveals critical insights into the spatial dynamics of photothermal efficiency along the beam propagation axis, unveiling that factors such as far out-of-band laser emission can significantly impair the identification of the beam waist, leading to a dramatic reduction in photothermal efficiency by up to an order of magnitude.

Further, our research challenges prevailing assumptions about the beam waist's role in optimizing photothermal efficiency. Contrary to expectations, we discover that the beam waist does not invariably correspond to the peak position of photothermal efficiency. In fact, for silicon cantilevers with a trapezoidal cross-section, positioning at the beam waist can diminish photothermal efficiency by as much as 20%. These findings not only provide pivotal corrections to existing misconceptions but also offer a nuanced understanding of the complex interplay between light and mechanical motion in photothermal systems.

The implications of our study extend well beyond the immediate advancements in microresonator technology. By elucidating the intricate dependencies of photothermal efficiency on spatial positioning within the photothermal beam, this research lays the groundwork for more sophisticated and efficient photothermal excitation strategies. These insights hold the promise of enhancing the performance of

AFM and other microresonator-based technologies, potentially revolutionizing applications in material science, biology, and nanotechnology through improved sensitivity, precision, and adaptability in dynamic measurement environments.

In conclusion, our work not only addresses a critical gap in the photothermal excitation domain but also sets the stage for future research directions. By offering a detailed examination of the factors influencing photothermal efficiency, this study contributes to the broader endeavour of harnessing light for precise mechanical manipulation, paving the way for innovative advancements in the field of nanoscale measurement and imaging.

Audience Take Away Notes

- The foundation principles of photothermal excitation and its importance in microelectromechanical sensor technology
- The novel method developed for enhancing photothermal effects in sensors, including the technical approach and experimental validation
- The potential applications of enhanced photothermal excitation in improving sensitivity and reliability across various fields such as environmental science, medical diagnostics and industrial monitoring
- The broader implications of photothermal excitation enhancement for future research, including opportunities for interdisciplinary collaboration and innovation in sensor design and application

Biography

Liping Kevin Ge, a distinguished biomedical engineer and third-year Ph.D. candidate at The University of Sydney's School of Biomedical Engineering, specialised in instrumentation and nanotechnology. Leveraging a custom-built, cutting-edge tool, the picobalance, devised by his supervisor David Martinez-Martin and featured in Nature 2017, Kevin is dedicated to exploring its applications in determining single-cell mass. His ongoing Ph.D. thesis is a focused inquiry into utilising the picobalance for real-time analysis of distinctive patterns in cell death processes. Kevin's work reflects a commitment to advancing the field and contributing valuable insights to the academic community.

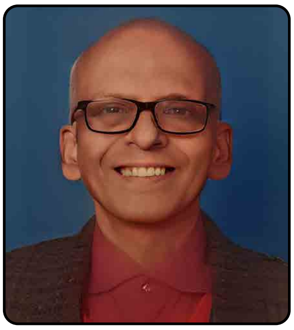
Anurag Kumar Pandey
IIT Kharagpur, India

Iodine-doped carbon dots as a nanocatalystfor degradation of cationic dye

Water pollution caused by industrial dyes or effluents has grown to be a serious global issue, especially in developing nations. Treatment of these environmental pollutants is essential because they pose a major threat to ecosystems, human health, and biodiversity all over the world. It has been found that using nanoparticles can be an effective way to purify water because of their low cost of manufacturing and environmentally friendly synthesis. Researchers are interested in Carbon Dots (CDs) because of their special qualities, which include minimal toxicity, excellent electron-donating capacity, high water solubility, and ease of manufacture. To facilitate the Fenton-like degradation of environmental pollutants in water, including Methylene Blue (MB) and Rhodamine-B (Rh-B) dye, we synthesized Iodine-doped Clove buds-derived Carbon Dots (I-CCDs). Multiple spectroscopic techniques have been employed to confirm the creation of I-CCDs. I-CCDs are proven to have exceptional antibacterial, optical, and cytocompatibility properties. Using NaBH4 as a reducing agent, it was discovered that the synthesized CDs are an efficient catalyst for the reduction of MB and Rh-B. UV-visible spectroscopy was utilized to create a comprehensive, step-by-step dye reduction method. As-prepared I-CCDs may prove to be a useful addition to systems for treating or purifying wastewater.

Biography

Anurag Kumar Pandeyis a Ph.D. student of “School of Nanoscience and Technology (SNST)”, IIT Kharagpur (West Bengal) working on topic “Carbon dots derived from natural precursors for biomedical and energy remediation applications”. I have completed my MTech degree in “Nanoscience and Nanotechnology” from SNST, Pondicherry university, Puducherry. I did B.Tech in “Electronics and communication engineering” from “Feroze Gandhi Institute of Engineering and Technology”, Raebareli, Uttar Pradesh.



Ravi Kikar Sinha
Unaffiliated Private Researcher, Patna, Bihar, India

Can we increase cruise and cargo ship's speed to 1000 knots with the use of portable electron positron contact based engines safely?

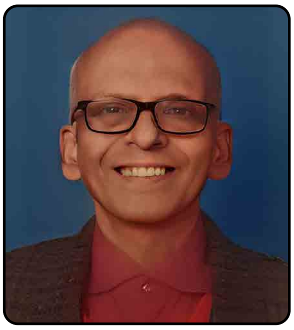
Suggest it may be possible to increase a cargo or cruise ship's speed from the usual 20-30 knots to 1000 knots, if we use portable electron positron contact based engines. In propelling the ships, so that they reach global distances within 24 hours. Source of electrons and positrons, may be derived from beta decay experiments. Collision of the antiparticles would result in release of desirable energy which can be used in propelling the ships. Some enzyme like physical agents might be involved in bringing the existance of antimatter to almost zero in most places in the universe.

Audience Take Away Note

- They can use nuclear physics tools to produce a hierarchi of portable engines with ability to propel a ship to greater and greater speed
- If single portable nuclear engines do not serve the purpose, they can use multiple nuclear portable engines to propel the ship
- They can get a job in automobile industry

Biography

The author graduated from Bihar university, L.S. College, Muzaffarpur, Bihar in 1973 in the biology (botany honours) section. He then went to Swansea to study genetics. (1974-75) he has published a note on design and speed of nuclear powered submarines in material science journal (2023,) USA; also published on mushroom in the same journal. His presentations have been accepted in 5 international conferences.



Ravi Kikar Sinha
Unaffiliated Indian Researcher, India

Use of vast coastal sea surface in harvesting electrical energy through floating large photovoltaic solar panels on them

Solar cell comprises a pn junction diode it generates EMF (Electromotive Force) when sunlight falls on the pn junction it functions on the principal of photo voltaic effect as the photodiode a p type semiconductor is obtained, when si or ge is doped with al, b, etc. Like impurities. A "n" type semicondoctor is obtained by doping si or ge with a pentavalent element like as,"p". The aim of discussion is not to give state of the art of the structure of pv solar panel. It only advocates use of sea surface in harvest of electrical energy by placing the best type of solar panels on sun drenched sea surface upto many gigavolts.

Audience Take Away Notes

- They can use semiconductor physics in teaching
- They can use this research in making policy to coastal govts

Biography

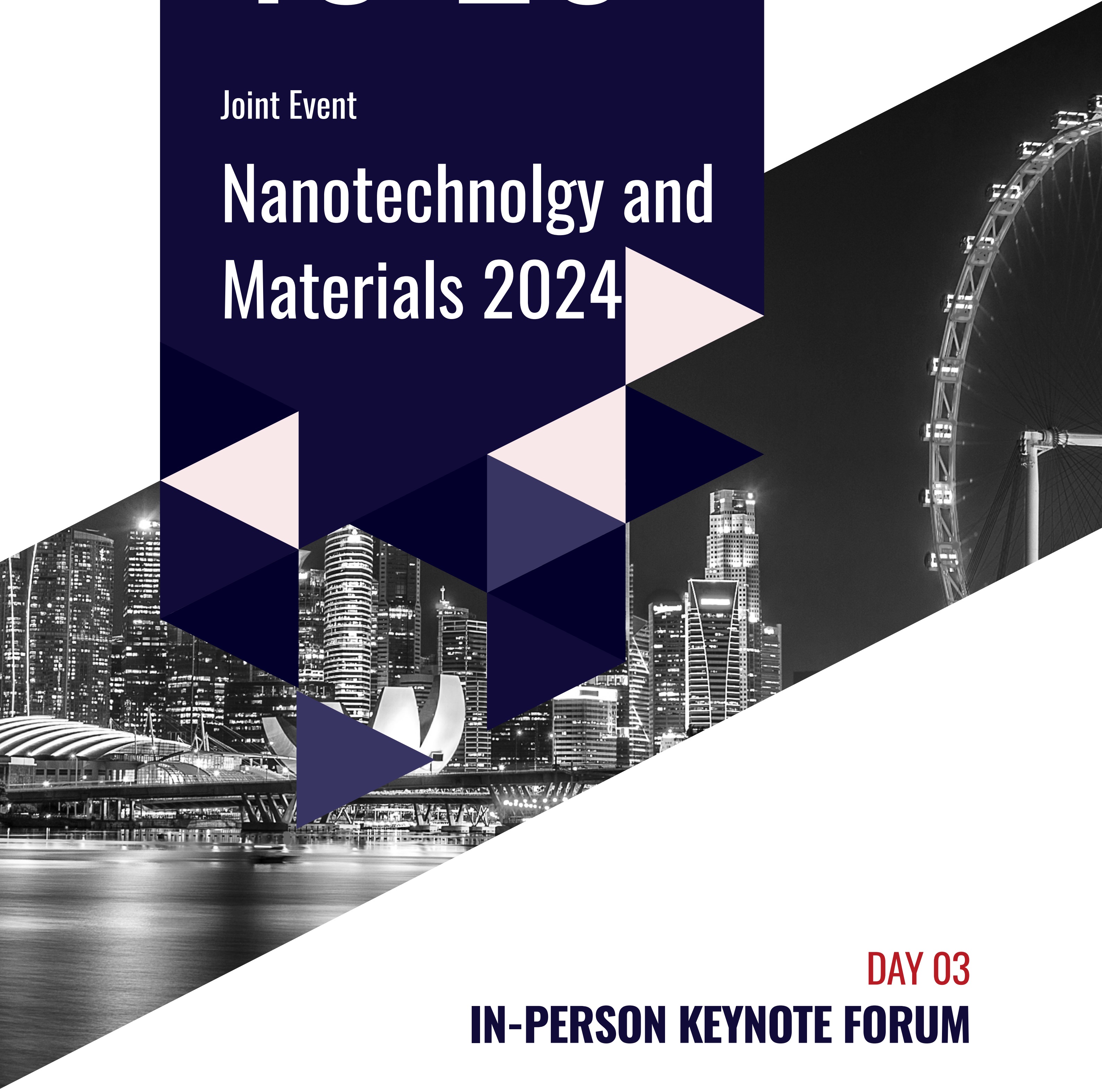
The author graduated from Bihar university, L.S. College, Muzaffarpur, Bihar in 1973 in the biology (botany honours) section. He then went to Swansea to study genetics. (1974-75) he has published a note on design and speed of nuclear powered submarines in material science journal (2023,) USA; also published on mushroom in the same journal. His presentations have been accepted in 5 international conferences.

MARCH

18-20

Joint Event

Nanotechnolgy and Materials 2024



DAY 03

IN-PERSON KEYNOTE FORUM

Waterproofing materials for ammonium nitrate

This study explores the possibility of overcoming the problem of hygroscopicity of ammonium nitrate by coating the particles with selected waterproofing materials.Gravimetric analysis of the samples of ammonium nitrate coated with eight different waterproofing materials, vis-a-vis,uncoated ammonium nitrate were conducted at different relative humidity and exposure time.The results indicate that mineral jelly is the promising waterproofing material for ammonium nitrate among the materials tested,viz.calcium stearate, dioctyl phthalate,kaoline,diethylphthalate, dinitrotoluene,shellac varnish and beeswax.Attempts were made to confirm the waterproofing ability of mineral jelly to ammonium nitrate using differential thermal analysis and x-ray diffraction patterns as an experimental tool.Suitability of mineral jelly as an additive for the gun propellant was also assessed on the basis of theoretical calculations using 'THERM' program.

Keywords: Hygroscopicity, Phase Transition, Waterproofing Ability, Mineral Jelly, Ammonium Nitrate, High Energy Materials, Coating Materials.

Audience Take Away Notes

- A suitable, easy and convenient method for waterproofing of ammonium nitrate
- It will establish a low cost,easily available and eco-friendly oxidizer to propulsion community
- This research will serve as an alternative pathway to the production of phase stabilized ammonium nitrate.
- This method of production of ammonium nitrate coated with mineral jelly will overcome the problem of formation of caking. Caking of ammonium nitrate is highly undesirable phenomenon as far as the use of ammonium nitrate in solid propellant is concerned.This is because it affects the structural integrity,energetic and ballistic regularity of the propellant.Thus it will provide a practical solution to the application of ammonium nitrate for future gun propellants
- Ammonium nitrate can be evolved as an eco-friendly oxidized for the application of future high energy materials

Dr. Ramdas Sawleram-Damse

Retd. Scientist, HEMRL, Sutarwadi, Pune -411021, India

Biography

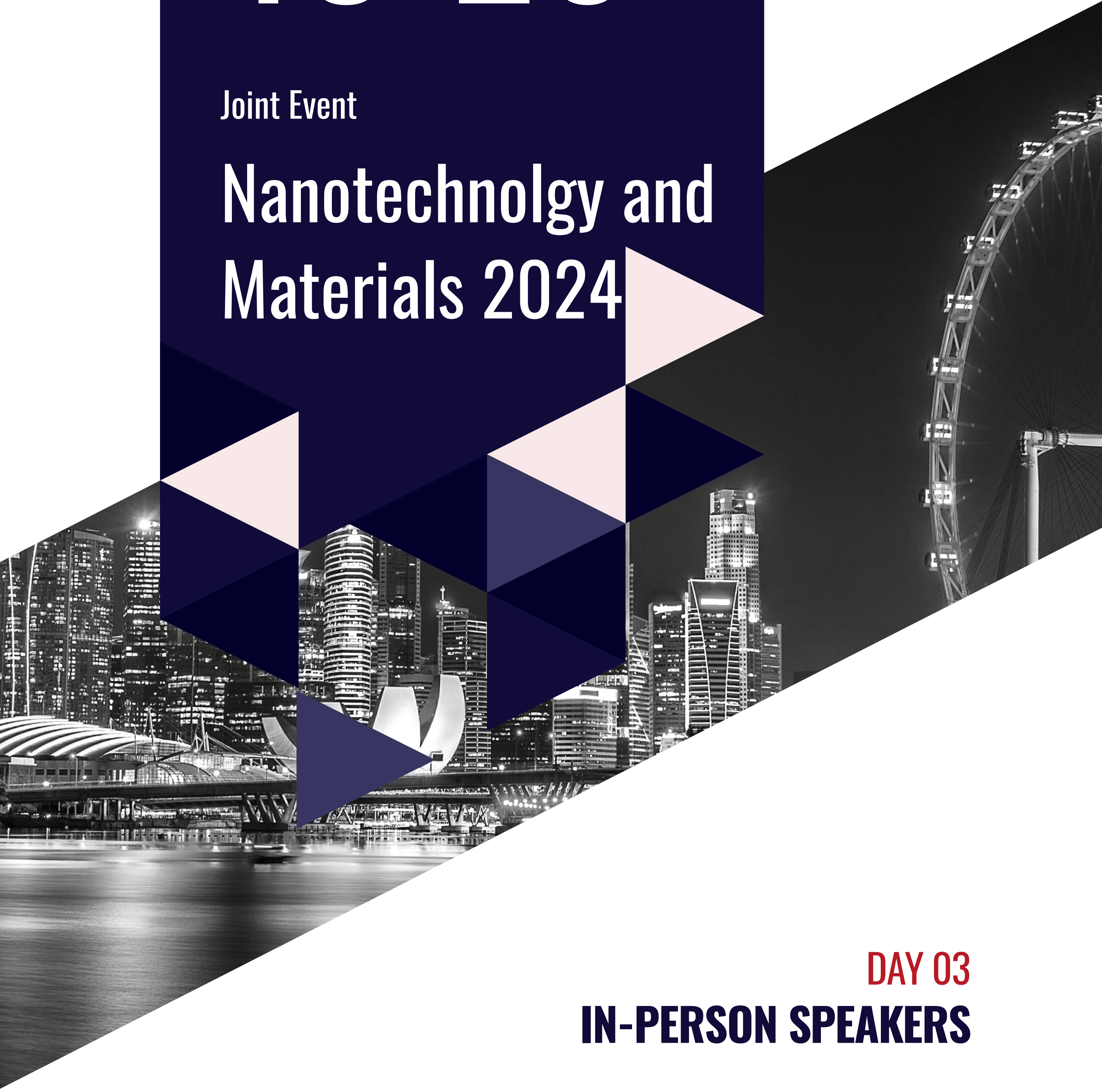
Dr.Ramdas SawleramDamsestudied MSc (Organic chemistry) fromSavitribai Phule University, Pune in 1983.Worked as Scientific Assistant in CSIR at NCL Pune from1983 to 1985and Scientist in DRDO at HEMRL Pune from 1985 to 2018.Awarded with Ph.D degree on the topic 'Studieson RDX-GAP based high energy gun propellants' in 2001 from Savitribai Phule University, Pune. Contributed significantly towards the successful completion of several R&D projects in the field of high energy materials. Presented several research papers in various international seminars/ workshops and published about sixty research papers in the reputed national/international journals and received several international awards/recognitions including International Scientist of Year award in 2007.The author is a recognized guide of Ph.Dfrom the Savitribai Phule University of Pune.

MARCH

18-20

Joint Event

Nanotechnolgy and Materials 2024



DAY 03

IN-PERSON SPEAKERS

Prof. Ge Wang*, HongyiGao, Zhimeng Liu, Jing Lin, Linmeng Wang

Beijing Advanced Innovation Center for Materials Genome Engineering, Beijing Key Laboratory of Function Materials for Molecule & Structure Construction, School of Materials Science and Engineering, University of Science and Technology Beijing, Beijing, PR China

Calculation and data-driven strategies for accelerated MOFs design and synthesis

Metal-Organic Framework (MOF) is a new class of nanoporous material that is widely used in catalytic field due to their large specific surface area, high porosity and tunable pore size. Its excellent chemical tunability provides a wide material space, in which tens of thousands of MOF have been synthesized. However, it is impossible to explore such a vast chemical space through trial-and-error methods, making it difficult to achieve custom design of high-performance MOF for specific applications. Through introducing Density Functional Theory (DFT) calculation and Machine Learning (ML) approach, we discovered descriptor-based approach for designing high-performance MOF, and explored optimal synthesis strategies in large chemical space. Through DFT and data techniques (correlation analysis, genetic algorithm, crystal graph convolutional neural network), exploring the correlation between catalytic activity with metal active site composition and local chemical environment. By using the multi-objective optimization approach with a small number of iterations of experiments, providing a methodology for the co-optimization of defects and stability of Ce-MOF, guiding the optimization to improve the existing Pareto frontiers and enabling the optimal design of MOF catalyst with the best overall performance.

Audience Take Away Notes

- Explain how the audience will be able to use calculation and data-driven strategies in material science
- Give some typical examples for using DFT and data techniques to rational design and intelligent synthesis of MOFs
- Provide guidance for calculation and data-assisted Materials research

Biography

Prof. Ge Wang studied Chemistry at Northeast Normal University and graduated as MS in 1995. She received her Ph.D. in Chemistry from the Michigan Technological University in 2002. Currently she is a professor in the School of Material Science and Engineering at the University of Science and Technology Beijing. In 2012, she became a Yangtze River Scholar Distinguished Professor endowed by the Chang Jiang Scholars Program of the Ministry of Education. Her research interests focus on rational design and precise synthesis of Metal Organic Frameworks (MOFs) driven by high-throughput computational screening and machine learning, optimizing their catalytic and energy storage performance and understanding the underlying reaction mechanisms. She has published more than 300 research articles in SCI(E) journals.

B K Behera

Focus incubation centre for 3D weaving and structural composites, Department of Textile & Fibre Engineering, Indian Institute of Technology Delhi, India

Advanced multifunctional textile structural polymeric composites and applications

Novel materials with unique properties compared to conventional materials are named as advanced materials that help modern industries to drive technological innovations and optimise the cost and efficiency of existing traditional materials and products. These materials include biomaterials, smart materials, nano-engineered materials, auxetic materials, smart composites for structural health monitoring, structural power composites, and a large variety of advanced textile structural composite materials. This paper presents development of textile structural polymeric composites as a new class of high-performance functional materials in the Focus incubation centre of IIT Delhi where the emphasis is given to produce innovative fibre architecture in manufacturing of tough, net shape, damage resistance, ductile, light weight multifunctional structural composites. The toughening and strengthening of polymer, metal, and ceramic matrix composites through the use of 3-D fibre architecture is demonstrated with experimental evidence. Number of experimental investigations revealed the potential of 3D textile structural polymeric composites to be used in automotives, aerospace, marine, wind energy and civil engineering applications. Techniques for the modelling of textile structural composite for their mechanical performance are also illustrated with examples in specific applications. Engineering design and manufacturing of woven auxetic composites, metal matrix fibre reinforced composites, multifunctional structural power composite, metal laminates/sandwich materials, woven structural composite radome and several 3D woven structure based composites are discussed with experimental results of their structural and non-structural functions. Majority of the developments in focus incubation centre were carried out to promote the textile structural polymeric composites for advanced load-bearing applications in automotives, marine, aerospace, railway and wind energy mainly due to the huge potential for weight saving and fuel economy. It is established that these composites can achieve a weight reduction of as high as up to 35% compared to aluminium and 60% compared to steel and the overall weight of a vehicle can be reduced up to 10%.

Biography

Dr B. K. Behera is working as professor in the Department of Textile and Fibre Engineering , Indian Institute of Technology Delhi. His area of specialization includes Fabric manufacturing, 3D weaving and Braiding, Fabric Hand, Auxetic Textiles, Textile Structural Composites and Concretes and Mechanics of Textile Structure. His Current research interest includes Design and manufacturing of Textile structural composites and concretes, Green composites, 3D weaving, Auxetic Weaving and Composites, and Protective Clothing. Prof Behera has authored more than 350 peer-reviewed papers and delivered more than 350 talks in various international conferences and symposia including 70 plenary and invited speech in international conferences. He has authored , co-authored and chapter contributions in 15 books relating to Textile structural Mechanics, Soft computing in Textiles and Weaving Technology. Prof. Behera has supervised more than 100 PhD and Master thesis . He has six patents to his credit. Prof. Behera has successfully completed 25 sponsored research projects and more than 75 industrial consultancy projects as principal investigator. At present he is heading a Focus Incubation Centre in 3D weaving and Structural composites supported by Ministry of Textiles, Govt. of India. He has also worked as visiting professor in Shinshu university Japan, Technical university of Liberec, Czech Republic and University of Sao Paul , Brazil and Usak university Turkey. He has been an invited speaker in many foreign universities and institutions which includes Shinshu University Japan, Technical university Liberec, VUTS research centre Czech Republic, Promatech Machinery Research centre Italy, Composite research institute Budapest, Sao Paulo university Brazil. Prof. Behera is member of governing council of several reputed Textile institutions and member of Board of studies in five Technical universities . Prof. Behera has a very strong interaction with several reputed textile industries in India in the capacity of a consultant. He is also member of Board of Directors of three reputed textile companies in India. At present Prof. Behera has 4000 citation with 35 h-index.

Praveen Kumar Mudavath, Ashutosh Kumar, Brahma Raju Golla*
Metallurgical and Materials Engineering Department, National Institute of Technology, Warangal, 506 004, India

A very low temperature green processing for developing high dielectric Al2O3, SrTiO3 ceramic composites

Processing of ceramics and its composites either by conventional or advanced processing techniques necessitates very high sintering temperature (>1000oC) and moderate to long duration of time. On the other hand, the Cold Sintering Process (CSP) is a low temperature green technology proven a significant lowering in sintering temperature and time for a wide range of oxide ceramics. This energy-efficient method facilitates enhanced integration with different materials and even with polymers as well. The present work demonstrates the advantage of CSP in the processing of monolith ceramics (Al2O3, SrTiO3) at extremely low temperature of 300oC. Also Al2O3-(20-30 wt.%) HDPE composites are successfully processed at extremely low temperature of 120oC. High dielectric constant (ε') of 11.73 and low dielectric loss (tanδ) of ~ 0.0076 observed for CSPed- Al2O3-20HDPE and a little low ε' of 9.13 and low tanδ of 0.0066 was evident for Al2O3-30HDPE at 1MHz. Such dielectric behavior of Al2O3 composites are related to crystallite size, dangling bond density and decrease in microstrain. It was also observed that the dielectric constant of monolithic Al2O3 is around 90 at 20MHz. In case of SrTiO3, it was observed that the dielectric constant and loss decreased (up to 8MHz) from 275 and 0.75 to 118 and 0.05, respectively. Thiswork reveals the advantage of cold sintering in densifying and enhancing dielectric properties ofceramics.

Keywords: Al2O3, SrTiO3, Cold Sintering, Dielectric Properties, Microstructural Characterization.

Biography

Dr. Brahma Raju Golla is currently working as Associate Professor at Department of Metallurgical and Materials Engineering, National Institute of Technology (NIT) Warangal, India. He has more than 15 years of research and teaching experience. Before joining NIT Warangal, Golla worked as Assistant Professor for a semester at Malaviya National Institute of Technology (MNIT) Jaipur, India and as an Invited Scientist in Engineering Ceramics Research Group at Korea Institute of Materials Science (KIMS) South Korea for more than 2 years. Golla pursued his postdoctoral research for 2 years on drying characterization of ceramic films in Nonmetallic-Inorganic Materials Group, Technical University (TU) Darmstadt, Germany soon after completion of PhD. Dr. Golla earned his doctorate in Materials and Metallurgical Engineering under the supervision of Prof. BikramjitBasu from IIT Kanpur, India in 2009. His research focuses on processing-structure-property correlation of Ultra High Temperature Ceramics, Advanced Materials Processing, and Tribology of Materials. He has supervised 4 PhDs, 20 Masters (M. Tech) and 38 Undergraduate (B. Tech) Students. So far Dr. Golla contributed 3 book chapters in Ceramic Handbooks, edited 1 Conference Proceedings and is author/co-author of more than 55 archival research papers in peer reviewed international journals.

Krishnateja Challa, Kiranchand G R, Prof. N. Narasaiah*

Department of Metallurgical and Materials Engineering, National Institute of Technology Warangal, Telangana, India

Creep Fatigue Crack Growth (CFCG) studies on P91 steel

Components operating under elevated temperature are often subjected to cyclic type of loading, rendering crack growth due to creep–fatigue conditions, a significant concern during the design and service life-cycle of the component. An exhaustive comprehension of creep-fatigue crack growth behaviour is mandatory for quantifying and predicting the extent and scope of long-term failure in power stations. P91 steel finds widespread use in conventional power plant components. The American Society for Testing and Materials (ASTM) has in recent years come up with a novel standard for Creep-Fatigue Crack Growth (CFCG) testing, E 2760-19, wherein, compact testing specimens, C(T), are subjected to trapezoidal load-controlled conditions. The behaviour of P91 steel under CFCG conditions has been extensively studied under different force ratios: 0.1, 0.5, 0.8 and dwell times: 10s, 60s and 600s at a temperature of 600oC. The CFCG data has been analysed by means of stress intensity factor range parameter, ΔK and (Ct)avg parameter along with C* and (Ct)SSC. The variation in (Ct)avg, (Ct)SSC and C* with respect to number of cycles, for different force ratios and dwell times has been evaluated. The evaluation of load-line displacement reveals that P91 steel is a creep-ductile material. The crack tunnelling phenomenon has been extensively evaluated and discussed, along with quantification of the propagation of crack growth fronts. Wherever the specimen is subjected to higher dwell times, the rate of crack growth (da/dt)avg is subdued, when compared to the specimens subjected to lower dwell periods. Fractography was performed on the fracture surface; total CFCG portion is divided into 3 equidistant parts. Crack growth in the first portion during the initial part of crack propagation takes up a majority (60-90%) of the total life-cycle of the sample.

Audience Take Away Notes

- The audience would learn how to conduct Creep Fatigue Crack Growth tests as per ASTM 2760 to evaluate the real-time lifecycle of components
- This work would help the audience understand different aspects of determining crack growth rates via DCPD and fractographic analysis
- In-depth information regarding the calculation and evaluation of various crack growth parameters and determining the creep ductile and creep brittle nature of specimens is provided
- It will help in understanding the CFCG behavior of weld and base metals of P91

Biography

Prof. N. Narasaiah obtained a Ph.D. (2004) from the Indian Institute of Technology, Kharagpur, India, in the area of Fatigue and Fracture Mechanics. After obtaining Ph.D, he joined as Scientist in the CSIR – National Metallurgical Laboratory, Jamshedpur. After serving the CSIR-NML up until 2012, Dr. Narasaiah joined as a faculty member in the Department of Metallurgical and Materials Engineering, National Institute of Technology (NIT) – Warangal. He works in the area of Fatigue, Fracture mechanics, Deformation behaviour of materials. His other interests include failure analysis, creep-fatigue crack growth behaviour, remaining life assessment and component integrity evaluation. He is the recipient of the BOYSCAST fellowship for the year 2007-2008 from the Ministry of Science and Technology, India.

He has published around 80 publications in reputed journals. He has guided 8 Ph.Ds and 5 are going on. He has carried out more than 30 research projects worth of Rs. 30.0 Crore. He served as Head of Department of Metallurgical and Materials Engineering, Professor In-charge of Center for Advanced Materials, Associate Dean (Planning & Development) at NIT Warangal.

Kristian Michael Hai Xiong Tan, Dr. Wenting Li*, Oh Yi Hong, Kai Soon Fong

Institute of Manufacturing Technology (SIMTech), Agency for Science, Technology and Research (A*STAR), Singapore, 138634

Development of advanced robotic incremental sheet metal forming processes

Rapid prototyping has become increasingly indispensable in the iterative development of novel products across a spectrum of industries, including aerospace, automotive, construction, and biomedical sectors. Besides the prevalent 3D additive manufacturing technologies, robotic incremental sheet forming processes have emerged as versatile tools for fabricating customized and small-batch products, offering inherent advantages in flexibility, efficiency, and cost-effectiveness. This versatility is particularly pronounced when addressing the intricate requirements of large-sized sheet metal components.One persistent challenge encountered in incremental sheet forming process is the emergence of pillow defect at the sheet centre, a phenomenon known to compromise the formability of components and elevate the forming load. In response, this research systematically explores the impact of various factors, such as bend severity, forming wall angle, forming strategy, tool shape, and stepdown size, on the occurrence of the pillow defect during the incremental sheet forming process. Notably, the investigation culminates in the successful formation of a complex trihedral component devoid of the pillow defect through incremental sheet forming technology.However, the conventional incremental sheet forming process proves impractical when applied to the shaping of thicker and stronger parts, primarily due to the increasing forming loads involved. In response to this limitation, the research introduces an innovative ultrasonic-based double-side incremental sheet forming process, demonstrating a significant reduction in forming load accompanied by an impressive enhancement in geometric accuracy. The findings reveal a remarkable 56% reduction in the maximum average forming force and a noteworthy 72% improvement in surface accuracy.By advancing our understanding of the intricate mechanisms underlying the formation of the pillow defect in metal sheets, this research not only contributes to the scientific understanding of incremental sheet forming but also propels the frontiers of ultrasonic-based double-side incremental forming technology. This development holds promise for future applications, particularly in the realm of efficient, cost-effective, and precise manufacturing processes for complex sheet metal components.

Audience Take Away Notes

- Audience engaging with this presentation will acquire a comprehensive understanding of the pivotal role that rapid prototyping, particularly through robotic incremental sheet forming processes, plays in the development of new products across diverse industries, including aerospace, automotive, construction, and biomedical sectors. The narrative delves into the inherent advantages of ISF, such as flexibility, efficiency, and cost-effectiveness, especially when dealing with the fabrication of large-sized sheet metal components
- A key takeaway lies in the recognition of a persistent challenge within the incremental sheet forming process—the emergence of pillow defect at the sheet center. The audience will gain insights into the multifaceted factors influencing the formation of this defect, including bend severity, forming wall

angle, forming strategy, tool shape, and stepdown size. The research successfully navigates and addresses this challenge, leading to the formation of a complex trihedral component devoid of the pillow defect through incremental sheet forming technology

- Furthermore, the narrative highlights a practical limitation of the conventional incremental sheet forming process when applied to shaping thicker and stronger parts due to substantial forming loads. The introduction of an innovative ultrasonic-based double-side incremental sheet forming process emerges as a solution, showcasing a substantial reduction in forming load and a remarkable enhancement in geometric accuracy. Audience will learn about the impressive 56% reduction in the maximum average forming force and a noteworthy 72% improvement in surface accuracy, showcasing the potential for more efficient, cost-effective, and precise manufacturing processes for complex sheet metal components
- In essence, the audience gains valuable insights into the challenges, advancements, and potential applications within the field of incremental sheet forming, particularly with a focus on mitigating defects, reducing forming loads, and improving geometric accuracy through innovative technologies

Biography

Dr. Wenting Li is a Scientist from SIMTech, A*STAR. Her areas of interest include developing robotic incremental sheet forming techniques, innovative honeycomb-based lightweight structures, microforming processes, and other cutting-edge manufacturing technologies for metal sheets. She has successfully developed robotic incremental sheet metal forming process to fabricate highly customized façade panels for design structure to replace manual hammering, as well as an advanced progressive forming process to fabricate the novel semi-reentrant honeycomb core with a zero Poisson's ratio and reentrant honeycomb core with a negative Poisson's ratio. She is an expert in predicting failure or fracture in metal plastic forming.

Lajpreet Kaur[1*], Prasanjeet Kaur[2], Rashmi Pandey[3], Mallika Pathak[4], Himanshu Ojha

[1]Division of RNAIS, Institute of Nuclear Medicine and Allied Sciences, DRDO, Timarpur,Delhi-110054, India
[2]Kusuma School of Biological Sciences, Indian Institute of Technology, Hauz Khas, Delhi-110016, India
[3]Guru Gobind Singh Indraprastha University (University School of Biotechnology), Delhi,110078, India

[4]Department of chemistry, Miranda House, University of Delhi, Delhi-110007, India

Synthesis and physicochemical characterization of tannic acid encapsulated BSA Nanoparticles: From structural analysis to bioactivity assessment for enhanced drug delivery

BSA-NPs offer a beneficial strategy for targeted drug delivery. These NPs improve the drug effectiveness by increasing its availability and distribution. At the same time, these NPs reduce the body tendency to develop resistance towards drugs. Tannic Acid (TA), a naturally-occurring polyphenolic compound, exhibits strong antioxidant property and it has been tested for its anticancer property against different types of cancer. In present study, BSA nanoparticles encapsulated Tannic acids (TA-BSA-NPs) were synthesized and characterized using FE-SEM, FT-IR and UV-Vis spectroscopy. The TA-BSA nanoparticles, about 300 nm in diameter with a surface zeta potential of □-37 mV, and encapsulation efficiency of 78%, have shown sustained release of TA up to 75% during in vitro studies. Cellular uptake investigations demonstrated that more than 80% of MDA-MB-231 cells i.e., human breast carcinoma cell line uptake TA-BSA NPs. The present study also narrows down the research gap by investigating the conformational changes in BSA-NPs after TA encapsulation via FT- IR. The critical findings indicate % increase in β-sheet content 56 % in BSA NPs and it decreased by 33.7 % for TA-BSA NPs. In summary, these findings suggested significant improvement in TA delivery after encapsulation in sustained manner. The outcomes of the chemical morphology analysis and in vitro release experiments suggest that these nanoparticles hold promise as vehicles for delivering drugs in biological settings where a release of TA is needed.

Audience Take Away Notes

- My lecture will specifically help researchers in the field of biochemistry to design new drug delivery agents and how to test their efficacy
- My research is noble as I have explained for the first time the changes in the secondary structure of BSA when BSA changes to BSA nanoparticle
- In our study we have optimized the procedure for interlinking tannic acid with BSA nanoparticle
- Finally we have tested the drug delivery efficacy of drug loaded BSA nanoparticle

Biography

Miss Lajpreet Kaur received her post graduation degree in Biosciences from Banasthali Vidyapith in 2018. Thereafter, She joined the Institute of nuclear medicine and allied sciences, DRDO as Junior research scholar. She is currently pursuing her Ph.D degree from the same institute. She has published 13 articles in scopus indexed journals.

Sagar Gomad, Saurabh Singh, Akhil PS, Uma Maheswara Rao Seelam*

Department of Metallurgical and Materials Engineering, National Institute of Technology, Warangal, TS 506004, India

Machine learning assisted prediction of solid solubility limits in binary metallic alloys through hume-rothery approach

The solid solubility of metallic alloys is a critical factor in designing the materials with tailored properties. Hume-Rothery rules qualitatively predict the Solid Solubility Limits (SSL) in the binary metallic alloys. In recent years, Machine Learning (ML) approach hasbecomean alternative to predict SSLquantitatively. In the present work, the Random Forest (RF) and Artificial Neural Networks (ANN) ML algorithms wereapplied to 2798 binary metallic alloy systems and the solid solubility limits were predicted. The study primarily utilized a set of four featuresbased on the Hume-Rothery rules- namely: atomic size, electronegativity, valence, and crystal structure. It also considered an additional set of four features, based on three physical parameters: atomic weight, density, melting point, and one thermodynamic parameter: heat of mixing.In order to quantify the crystal structurefactor, a 'Crystal Structure Weightage Factor' (CSWF) wasdevisedand implemented. In the feature extraction step, the features valence, atomic weight and density were excluded while retaining the five features. After processing, the resulting accuracies of the training and test were98% and 84% respectively by RF regression, and 99% and 82% respectively by ANN regression. Among the Hume-Rothery features, theatomic size and crystal structure were calculated to have a feature importance of 21 & 20% respectively. Similarly, in the additionalfeatures, the heat of mixing and melting pointshowed the feature importance of22%&15%respectively. In addition, the data visualization and correlation matrix provide key insights into the solid solubility, which will presented. This study can also be extended to the multicomponent systems such as the high entropy alloys and the bulk metallic glasses.

Key words: Solid solubility limits; Hume-Rothery rules; Binary metallic alloys; Machine learning; Melting points

Biography

Dr. Seelam is an assistant professor in the Department of Metallurgical and Materials Engineering at the National Institute of Technology (NIT) Warangal, India. He received his B.Tech from Indian Institute of Metals (2002), M.Tech from the Department of Metallurgical Engineering at IIT(BHU), Varanasi (2004) and PhD from the Department of Materials Science and Engineering at the University of Central Florida, Orlando, Florida, USA (2010). After working briefly in TriQuint Semiconductor Company in Florida, USA, he moved to the National Institute for Materials Science (NIMS), Tsukuba, Japan for his post-doctoral fellowship in 2012. He spent 3 years at NIMS working on the rare-earth permanent magnets. He returned to the US in 2016 as a Specialist at EAG Labs at Syracuse, New York. He joined NIT Warangal as a regular faculty in April 2018. His research interests are rare-earth permanent magnets, nonequilibrium processing, multi-scale correlative characterization of materials and recently, machine learning in physical metallurgy.

Dr. Ajoy Kumar Pandey
Department of Metallurgical & Materials Engineering, National Institute of Technology Warangal, Telangana-506004, India

Zirconia based bio-ceramics – New additives

Zirconia ceramic shows the best mechanical properties in terms of fracture toughness as it undergoes transformation toughening that occurs during the propagation of a crack inside the matrix. To exhibit transformation toughening, higher temperature phases (i.e., cubic or tetragonal) need to be stabilized at room temperature. For this purpose, additives like CaO, MgO, Y2O3, etc., are normally used as stabilizers. Among these additives, yttria is the most popular for stabilization purposes but it suffers from Low-Temperature Degradation (LTD).

To overcome LTD issue, Ceria Stabilized Zirconia (CSZ) was tried first as Ceria, having isomolecular formula to that of zirconia, does not create any vacancies upon substitution. Hardness up to 945 HV10 with an average grain size of 4.3 μm was found for CSZ systems. It is noteworthy that the rate of phase transformation (during ageing) is significantly reduced for ceria-containing specimens.

However, Ceria-Stabilized Tetragonal Zirconia (CSZ) possess poor mechanical properties like hardness and strength compared to yttria-stabilized tetragonal zirconia (3YSZ). The poor mechanical properties of CSZ are due to its large grain size. The grain growth of CSZ is due to the need for high temperatures and longer times for sintering and lack of proper grain growth restriction mechanism (segregation) like in 3YSZ. To overcome this issue, co-doping of Nb2O5 and Sm2O3 was attempted in recent days.

It is observed that Nb2O5 helped in decreasing the sintering temperature of CSZ, and Sm2O3 suppressed the grain growth by segregating at the grain boundaries of CSZ. The two-step sintering process refined the microstructure in both systems. The improved grain size of 1.57 μm, along with a hardness of 1175 HV10 and optimum fracture toughness of 6.2 MPa m1/2 achieved for 1 mol % niobia doped ceria stabilized zirconia. The fine grain size of 0.64 μm with a high hardness of 1288 HV10 along with an optimum fracture toughness of 5.37 MPa m1/2 is observed for Samaria doped ceria stabilized zirconia.

Audience Take Away Notes

- Zirconia was highlighted as a ceramic biomaterial for load bearing orthopedics and dental applications
- In-vivo failure issues with yttria stabilized zirconia were discussed
- CeO2, Nb2O5 and Sm2O3 as an alternate of Y2O3, as a stabilizer to zirconia were investigated and results are highlighted

Biography

Dr. Ajoy Kumar Pandeycompleted his master's degree in Materials Engineering in 2007, he joined the Indian Institute of Technology Kharagpur, to pursue PhD. On completion of PhD degree in 2013, he joined the National Institute of Technology Warangal, INDIA, and currently working as an Associate Professor. He has published more than 30 research articles in SCI(E) journals and guided 4 Ph.D students. He has executed more than Rupees 11 crore worth of sponsored research projects and 180 lakh worth of projects are ongoing. Received Indian National Academy of Engineers fellowship under the "INAE Mentoring of Engineering Teachers" Scheme in the year 2014.

Dr. Waqas Ul Arifee*, Tae Jo Ko
School of Mechanical Engineering, Yeungnam University, Gyeongbuk, Gyeongsan, South Korea

Novel method for fabrication of separator/electrolyte for lithium metal batteries

A two-step process was adapted to prepare the separator/electrolyte for lithium metal batteries. In the 1st step electrospinning process was used and in the 2nd step solution casting method was adapted to cast on the electrospun membrane. This dual step process of fabrication technique provides the co-existence of semi-crystalline structure in the separator/electrolyte membrane. The surface morphology of the membrane was analyzed with the help of SEM. The mechanical strength and thermal stability of the membrane was outstanding for the separator/electrolyte membrane. The mechanical strength test was performed by universal testing machine using the ASTM standard for the preparation of sample. The membrane showed both the elastic and plastic behavior in the stress strain curve and hence the membrane was ductile in nature. The thermal stability showed that the membrane was thermally stable up to 300 °C. The membrane was assembled in the coin cell to check out the electrochemical behavior. The membrane was compared with the commercial Celgard separator. The membrane outperformed in the ionic conductivity and lithium-ion transference number. The membrane showed wide electrochemical stability window and uniform lithium plating stripping behavior in the various current rates. When compared with commercial Celgard separator, the coin cell assembled with prepared membrane exhibits better rate capability and excellent cycling performance.

Audience Take Away Notes

- The audience will be able to learn novel techniques of membrane fabrication, and advanced characterization techniques
- The research is a step forward to prepare safe and explosion free batteries
- The research is a practical solution to prepare separator/electrolyte for solid-state batteries
- The liquid electrolyte creates explosion and internal short circuiting, so this research could be a step forward for replacing the liquid electrolyte with solid electrolyte membrane

Biography

Dr. Waqas Ul Arifeen studied Industrial and Manufacturing Engineering at University of Engineering and Technology Lahore, Pakistan and graduated as BS in Engineering in 2015. He joined the research group of Professor Tae Jo Ko at Yeungnam University, South Korea. He received his PhD degree in Mechanical Engineering in 2020. He is currently an International Research Professor in School of Mechanical Engineering, Yeungnam University, South Korea. He has published more than 30 research articles in SCIE Journals in the field of energy storage devices applications specifically in lithium-ion, lithium metal, solid-state batteries and supercapacitors.

Lianjie Zhu*, Tao Li, Xiaokun Zhou, Deyou Chen, Yanmiao Yu

School of Chemistry & Chemical Engineering, Tianjin Key Laboratory of Organic Solar Cells and Photochemical Conversion, Tianjin University of Technology, Tianjin 300384, PR China

Designable synthesis of TiO2 nanostructures/composites and photocatalytic applications

TiO2 is a promising photocatalyst for H2 production and photodegradation of organic dyes. The photocatalytic activity of the TiO2 nanomaterial is closely related to its structure and composition. Thus, tuning its structure and composition is significant to enhance photocatalytic activity of the TiO2 nanomaterials. Series of TiO2 nanomaterials have been designed and synthesized, including well aligned Ti3+, N co-doped TiO2 Nanotube Array (NTA) films, Pd (or Au/Ag) loading TiO2 NTAs, TiO2 hollow spheres, Pd-CQDs co-decorated TiO2 nanosheets, Pd-cations co-modified TiO2 nanosheets, sulfide modified TiO2 composites. They exhibited excellent photocatalytic H2 productions and photodegradations on organic dyes. The influencing factors to activities have been explored and the photocatalytic reaction mechanisms have been proposed and discussed. The results show that the Hydrogen Evolution Rate (HER) over the Pd-CQDs co-loading TiO2 nanosheets could be 901 times higher than that of the pure TiO2, which could be attributed to the synergistic effect of Pd and CQDs. Introducing small amount of alkali salt (0.5 g L□1) solution in the preparation process of the TiO2 or in the photocatalytic reaction medium (1 g L□1) can also increase the HER rates distinctly.

Audience Take Away Notes

- Series of TiO2 nanostructures and composites have been designed and prepared. A few strategies were discussed to increase the photoctalytic activities (H2 production and photodegradation of dyes) of the TiO2 nanomaterials
- The TiO2 NTAs film catalyst is easy to be reclaimed from the dye solution after photo-degradation reactions, which is meaningful for practice application
- CQD was found helpful to photoreduction of Pd2+ to Pd metal nanoparticles on the TiO2, which is beneficial to enhancement of photocatalytic H2 production efficiency on the TiO2 composites and the utilization rate of Pd source. This may offer an idea to designer for synthesis of more efficient photocatalysts
- Ti3+,N co-doping, metal cation doping, noble metal loading, sulfide co-catalysts can all enhance the photocatalytic activities of the TiO2 nanomaterials to different extent. To maximize the activity, more than one strategy may be taken according to requirement

Biography

Prof. Dr. Zhu received her BSc. and MSc. degrees at Jilin University in 1994 and 2001, respectively. She gained her doctorate in physical chemistry at the Delft University of Technology (Netherlands) in 2005. As a post doctorate, she joined the Chemistry Institute of the University of Copenhagen in 2006. Since 2007, she worked in Tianjin University of Technology, where she obtained a professor position in 2013. Her current research interest is functional nanomaterials for photocatalysis, gas sensing and antibacterial. She has published more than 50 research articles in SCI(E) journals that were cited more than 1000 times.

Shinyoung Lee[1]*, Jimi Kim[1], Kyung Jin Lee[1], Woo Jin Song[1,2,3]

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Advanced non-woven separator membrane by syringeless electrospinning for high-performance lithium-ion energy device

Separators play a critical role in determining the electrochemical performance and safety of Lithium-Ion Batteries (LIBs). Developing separators to meet the various requirements of next-generation LIBs is quite challenging because it is extremely difficult to simultaneously meet safety issues and high performance, resulting in a technical contradiction. In general, an electrospun nonwoven membrane is one of thepromising candidates fornext-generation LIBs separators, but sufficiently thin electrospun-based nonwoven webs cannot be commercialized as separators due to their poor mechanical strength and excessively large porosity, which fail to withstand dendrite growth.In order to overcome these shortcomings, we used a syringeless colloidal electrospinning method to fabricate a composite nonwoven separator using Polyvinylidene Fluoride (PVDF) and lithium lanthanum zirconium oxide (Li6.4La3Zr2Al0.2O12, LLZO) particles. By evaluating the electrochemical performance of cells assembled with NCM622/graphite at a high C-rate, we have successfully demonstrated the feasibility of our separator membrane for use in high-power and high-energy LIBs.The assembled cell containing our separator membrane exhibited an outstanding specific capacity of 115 mAh·g-1 with 97 % capacity retention after 100 cycles, even at 3 C. Additionally, a lithium metal cell with our PVDF/LLZO separator showed improved stable cycle life and achieved capacity retention of 86 % after 250 cycles at 0.5 C.

Audience Take Away Notes

- The syringeless electrospinning method enables mass production at a fast production speed and is cost-effective
- The syringeless electrospinning method can produce multifunctional separators by applying various polymer materials and additives, which enables research on next-generation batteries
- Syringeless electrospinning, a new process in which multiple probe rods simultaneously compose nanofibers, can overcome the limitations of conventional electrospinning with a single needle

Biography

Shinyoung Lee studied organic materials at Chungnam National University, Republic of Korea. She earned a bachelor's degree in Organic Materials Engineering in 2023 and she is currently a M.S. student at Chungnam National University. She joined Prof. Song's research group, Advanced Soft Energy Materials (ASEM) Laboratory. She is interested in functional separators for energy storage systems. She won the Best Oral Presentation Award at the Society of Adhesion and Interface, Korea in 2023.

Yurim Lee[1]*, Dolly Yadav[2], Jung Hwan Jung[2], Jaewoo Kim[2], Woo Jin Song[1,3,4]

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[4]Department of Organic Materials Engineering, College of Engineering, Chungnam National University, 99 Daehak-ro (st), Yuseong-gu, Daejeon 305-764, Republic of Korea

Development of boron nitride nanotube-based additives to improve ionic conductivity and thermal stability for high-performance li-ion batteries

Electrolyte additives have been widely used to improve the long-term cycling performance of Lithium-Ion Batteries (LIBs) by preventing electrolyte decomposition at the electrodes.Currently, various electrolyte additives are being researched, and among them, additives that improve high-temperature stability to prevent ignition of the battery are under development. However, while these electrolyte additives improve the safety of the battery, they can also degrade the performance of the electrolyte and increase costs due to the additional additives. Therefore, there is a need for a new type of functional electrolyte material that overcomes the main limitations of the existing carbonate-based electrolyte system and is compatible with various electrolyte/electrode materials.

In this study, we propose Boron Nitride Nanotubes (BNNT) as a multifunctional electrolyte additive to improve the performance of conventional LIBs, demonstrating high lithium transference numbers (~0.68) and increased ionic conductivity by up to 30% (~0.87 mS/cm), thereby proving excellent cycle stability. When BNNT is dispersed in the electrolyte, the confinement effect of anions at defect sites is enhanced and $Li^+$is strongly coordinated with the solvent molecules. Also, the Lewis acid interaction between the anions/solvent and BNNT promotes the dissociation of Li^+ and accelerates Li^+ transport, resulting in a high Li^+ transference number.

Remarkably, BNNT-based electrolytes achieved stable capacity performance under various temperature conditions (-10 to 60 °C). It indicates that the design of these electrolytes can solve the low performance of LIBs at low or high-temperature conditions. Furthermore, the BNNT electrolytes also show stable and enhanced electrochemical cycle performance for varied cathode (NCM622, LCO) and anode materials (graphite, lithium metal) emphasizing upon its compatibility for different secondary storage devices. Electrochemical tests of NCM622//graphite full cells exhibit the highest reversible capacities of 153 mAh/g at 1C, and excellent cyclic retention after 500 cycles at high 10C with a specific capacity of 71.5 mAh/g with a Coulombic efficiency of 99.6%. Overall, we suggest BNNT as an excellent electrolyte additive to conventional carbonate-based electrolytes and could bring multifunctional benefits to LIB.

Audience Take Away Notes

- The audience including researchers, engineers, and battery manufacturers can learn various types of electrolyte additives to optimize the performance of Li-Ion batteries. By incorporating these additives into battery designs, they can enhance ionic conductivity, leading to faster charging and discharging rates. Moreover, improved thermal stability can prevent overheating issues and enhance the safety of Li-Ion batteries, which is most important in various applications, including electric vehicles and portable electronics

- The development of BNNT based electrolyte additives represents a novel approach to enhancing battery performance. BNNT has been explored as a protective coating to the separators to reduce the cell short circuit as well as enhance thermal stability and Li^+ conductivity. However, by demonstrating the feasibility of applying BNNT as electrolyte additives, other faculty members can build upon their research by conducting further studies, exploring different variations of BNNT additives, or investigating their applicability in other energy storage systems

Biography

Yurim Lee studied chemical engineering at the Chungnam National University, Republic of Korea, and received her B.S. degree in 2022. She then joined the research group of Prof. Song at the Advanced Soft Energy Materials, battery lab. She is currently in a master’s course and her research interests include electrolyte additives and synthesis of polymer materials for LIBs. She actively participates in various domestic conferences and presents her research on batteries.

Zhouyi Zheng[1], Qiuhe Wang[1], Zhiqi Dai[1], Ru-Yue Yuan[1], Zhibin Yu1, Yue Gong[1], Fujun Hou[1], Jun Ding[1], Wen Zhang[2], Yue Jiang[3], William Jia[1,4]*, and Jiang Xu[1,4]*

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Capsule coffee-inspired customizable mRNA vaccine production using a rapid on-sitemicrofluidicassembly(ROMA) technology

The emergence of mRNA vaccine has been profoundly addressing global infectious disease challenges andrevolutionizing cancer therapy and gene-editing. However, current mRNA vaccine remains distant fromcustomizablesupplyandarefraughtwithhurdlesofthermo-instabilityandinfrastructuredependence. Drawinginspirationfromtheefficiencyofcapsulecoffeemachines,weintroducearapidon-sitemicrofluidicassembly(ROMA)prototypecapableofgeneratingready-to-injectmRNAvaccinesatathroughput of 180 doses/hour (~100 μg mRNA/dose). Analogous to the varied flavors of capsule coffee, ourROMA prototype offers personalized options for mRNA vaccines, including lipid nanoparticle (LNP) sizes,compositions,mRNAtypes,anddosagestailoredtoindividualneeds.Divergingfromtraditionalmechanism of directly assembling mRNA and lipids into mRNA-LNPs, ROMA technology utilizes mRNAand pre-made empty LNPs to form mRNA-LNPs. Nevertheless, ROMA mRNA vaccine exhibits equivalentphysiochemical parameters and in-vivo expressions compared to conventional ones, with a benefit of lowertoxicity.Crucially,ROMAmRNAvaccine,immediatelydeployablewithouttheneedforstorage,fundamentally avoids the thermal instability and degradation risks associated with conventional mRNAvaccines. This transformative ROMA technology offers unparalleled user-end convenience, unlocking thepotential for personalized mRNA vaccines and treatments, thereby significantly expanding the scope ofmRNAand nucleicacid therapeutics.

Audience Take Away Notes

- ROMA prototype realizes small quantity but highly variable mRNA vaccine production of aGMP level at bedside, and thus circumvents the inherent thermal instability andsusceptibilityto degradationassociated with conventionalmRNAvaccines
- We believe that the ROMA technology can harmoniously meet urgent needs of basicresearchandemergentpublichealth,greatlyshortenturnovertimeofpersonalizedvaccineand bedside therapy, and broadly benefit fields like personalized tumor vaccines, proteinreplacementtherapyandgenetherapy
- The ROMA prototype represents a first-in-class platform for portable, customizable, and on-demandvaccine productionat theuser-end, by reducingthemanufacturingcycle ofconventionalmRNAvaccines fromseveral daysto amatterofminutes

Biography

Dr. Jiang Xu has served as a senior scientist at Virogin Biotech since 2021, leading the microfluidics group.Prior to this, he worked at Harvard Medical School as a postdoctoral and held a PI scientist position atBoston Molecules Inc. Dr. Xu earned his cotutelle Ph.D. in Physical Chemistry from the University ofBordeaux and Ph.D. in Chemical Engineering from the University of Waterloo. He has won a series ofprestigious funding and awards, including Harvard Catalyst Fellowship (2021), European Erasmus MundusFellowship (2012, Ph.D.), NIH Rapid Acceleration of Diagnostics (RADx®) grant (2020, PI), and ShanghaiRising-Starprogram (2023, PI).

Jinshun Bi[1,2]* and Linjie Fan[2]
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Nanoscale air channel devices for emerging IC applications

This talk will focus on a novel device named nanoscale air channel device (NACD), which has potentialapplicationsin ICs. Our work firstly focused on fabricating sub-10-nm air channel devices with ultra-low operating voltage, which can be utilized as an electrical element in high-speed and low-power ICs. The devices were fabricated with the aid of photolithography and focused ion beam (FIB) etching technology. On account of the extremely shrinking of nano-gap, record-high emission currents of 355.6 μA at 1 V were realized in air with a threshold voltage as low as 0.588 V. Then, based on the similar processes, nanoscale air channel Hall sensors were proposed and fabricated. Hall measurements were performed showed the linearity error was less than 5%, and the voltage-related sensitivity was 0.28 V/VT. The performance of the sensor was similar to that of the common micron-sized Hall sensor, but with the benefits of small size and easy integration.Lastly, the radiation hardness property of the NACD was demonstrated for future in-space applications. TID and SEE effects of the NACD were studied by using X-ray as the TID radiation source and a pulse laser as the SEE radiation source to simulate the radiation environment in space. No significant performance degradation was observed when the total dose of X-ray reached 1 Mrad (Si), and slight alterations were attributed to the accumulation of positive charge in the oxide. Furthermore, the SET and SEL phenomena were not detected under pulse laser energy up to 5 nJ, due to the SEEs-immune structure of NACD. Our work paves the way for the integration of NACDs, which in turn provides the possibility for NACDs to be applied in high-speed, low-power, and extreme environments.

The NACD shows high temperature stability and resistance to radiation effects , which can adapt to extreme working environments and is competitive in military and aerospace devices. Only electron emission was used to obtain complementary logic structures with functions similar to CMOS, and the NACD's use in logic circuits was demonstrated . More detailed results and discussion will be elaborated in the talk.

Audience Take Away Notes

- Novel nanoelectronics devices, nanoscale air channel device (NACD)
- Fabrication technologies and characteristics of NACD
- The potential application of NACD towards space exploration

Biography

Prof. Jinshun Bi received his B.S. degree in Microelectronics Department of Nankai University in China. He obtained the PhD degree in 2008 in Institute of Microelectronics, Chinese Academy of Sciences (IMECAS). He is now the Dean of School of Integrated Circuit, Guizhou Normal University. Prof. JinshunBi isleading andjoiningmorethan 20research-programs. Hehasauthored and co-authored more than 200 academic papers and 4 books while holding 46 granted patents. His research interests include emerging memory, radiation effects, reliability, nanoelectronics and bio-sensors. HeisaseniormemberofIEEEandChinaelectronics society. He served as a committee member and session chairs in internationalconferenceslikeIEDM,ESREF,NSREC,RADECSWorkshop.

Likhi Dhruv*; Deepak K. K. Kori; Apurba K. Das
Department of Chemistry, Indian Institute of Technology Indore, Khandwa Road, Indore 453552, India

Sodium Alginate-CuS nanostructures synthesized at the Gel-Liquid Interface: An efficient photocatalyst for redox reaction and water remediation

Gels are an excellent reaction medium for the synthesis of nanomaterials because they represent thetransitionphasethatexistsbetweensolidsandliquids.Inthisstudy,CuSnanostructuresaregrown atthegel-liquid interface using an environmentally sustainable sodium alginate gel as a reaction media. Themorphology of the CuS nanostructures is tailored by controlling the pH of the reaction media. CuSnanoflakesobtainedatapHof7.4,transformedintonanocubes at10, anddeformedatapHof13.

Powder X-ray diffractograms show that the CuS nanostructures are organized in a hexagonal crystalsystem. The +2 and -2 oxidation states of the Cu and S ions, respectively, are verified by the high-resolution XPS spectra. A huge proportion of greenhouse CO2 gas was physisorbed by the CuSnanoflakes.CuSnanoflakes developed at a pH of 7.4 had a lower bandgap than CuS nanostructures developed at pH10 and 13, resulting in a faster photocatalytic degradation of 95% crystal violet and ght. Additionally, thesodium alginate-CuSnanoflakes exhibit outstanding performance in photo-redox processes to convertferricyanide into ferrocyanideShort Description of what will be discussed during the presentation 98%methylene blue in aqueous dye solutions, respectively, in 60 and 90 minutes when illuminated with bluelight.

Audience Take Away Notes

- In my presentation, the audience will gain a comprehensive understanding of two critical aspects of myresearch: photocatalytic water remediation and the redox reaction involving ferricyanide to ferrocyanideconversion,with a focuson photocatalysis.
    1. PhotocatalyticWaterRemediation:Iwillexplainthesignificanceofthisprocessinaddressingwaterpollution challenges. The audience will learn how photocatalysis can harness the power of light tobreak down pollutants in water, making it safer for consumption and the environment. I'll delve intothemechanisms and specifictechniques employedin this context.
    2. Redox Reaction: I will elucidate the importance of redox reactions in various chemical processes. Theaudiencewilldiscoverhowferricyanidetoferrocyanideconversionplaysapivotalroleincertainchemical transformations, with potential applications beyond water remediation. I'll provide insightsintothe underlying chemistry and its relevance
    3. Photocatalysis: I will present the practical applications and outcomes of my photocatalysis research.Theaudiencewilllearnaboutthespecificchallengesl'veaddressed,methodologiesemployed,and theresultsachieved.Thismayincludeimprovedefficiency,reducedenvironmentalimpact,ornovelinsightsinto photocatalytic processes.
- Overall, my presentation will provide a concise but informative overview of these complex topics, allowingthe audience to grasp the significance of my research in advancing photocatalysis and its role in addressingenvironmentalconcerns through dyedegradation and redox reactions.

Biography

A Delhi native, I hold B.Sc. and M.Sc. degrees from the prestigious University of Delhi. Currently, I'm on anacademic journey, pursuing a PhD at IIT Indore. My passion for chemistry led me to become an activememberoftheACScommunity,whereIengagewithlike-mindedindividuals.Inarecentmilestone,IproudlyparticipatedintheACSFall2023event. AsIcontinuemyeducationalpursuitsandresearchendeavors,Iaimto make meaningful contributions to the field of chemistry, representing the intellectual richness anddiversityof Delhi, India.

Dr. Ncediwe Tsolekile[1]*, Mangaka Matoetoe[1], Sandile Songca[2], Oluwatobi Oluwafemi[3]

[1]VChemistry Department, Cape Peninsula University of Technology, South Africa
[2]Chemistry Department, University of Kwazulu Natal, South Africa
[3]Department of Chemical Sciences, University of Johannesburg, South Africa

Novel synthesis of quaternary Zn-Cu-In-S/ZnS QDs-mTHPP porphyrin conjugate for photodynamic therapy and antibacterial activities

Photodynamic Therapy (PDT) is a non-invasive therapeutic approach that eliminates improperly developing cells and bacteria. Porphyrins are utilized in PDT as photosensitizers; nonetheless, their clinical applicability has been restricted due to their poor dispersity, which causes aggregation and low yields of reactive oxygen species. We present here the conjugation of (Zn)CuInS/ZnS Quantum Dots (QDs) to 5, 10, 15, 20-tetrakis(3-hydroxyphenyl)porphyrin (mTHPP) to overcome these restrictions and boost PDT efficacy. The best circumstances for QDs-porphyrin conjugation production were thoroughly investigated. The bactericidal and PDT effectiveness of the produced (Zn)CuInS/ZnS - mTHPP conjugates were also evaluated in this study. The PDT effectiveness of mTHPP, QDs, and conjugate against the murine metastatic melanoma (B16 F10 Nex2) cell line was investigated with and without LED illumination. The conjugate had the greatest loss in cell viability after LED irradiation (72%) compared to the mTHPP (1%) and bare QDs (19%). Antimicrobial experiments on Escherichia coli (E. coli) revealed that the conjugation had a greater antibacterial impact than bare QDs, even in the absence of light. According to the findings, conjugate is a potential class of materials for anti-cancer and antibacterial PDT.

Audience Take Away Notes

- The audience will learn about a novel method for improving the efficacy of Photodynamic Therapy (PDT) by using conjugated Quantum Dots (QDs) and porphyrins. This understanding can be used in the treatment of cancer as well as bacterial infections. It provides a viable option for improving PDT efficacy, resulting in more successful outcomes in removing abnormally growing cells and microorganisms. This development has the potential to improve patient care and treatment alternatives. Related faculty members might utilize this study to expand their own investigations or include it in their teaching materials. The findings might pave the way for further research in photodynamic therapy, nanomedicine, and antibacterial therapies. This study offers a feasible remedy to the limits of utilizing porphyrins in PDT. The conjugation of QDs with porphyrins overcomes difficulties such as poor dispersity and low quantum yields, which may be used to simplify and improve the PDT process. This advancement has the potential to simplify the design and implementation of PDT protocols. The coupling of QDs with porphyrins also has led to more precise and efficient PDT treatment designs. It offers new insights on overcoming problems that were previously impeding PDT's efficacy leading to improved cancer cell and bacterial targeting and eradication
- All Other Benefits
  - o Enhanced efficacy in Photodynamic Therapy (PDT) thus improving treatment outcomes in cancer and bacterial infections
  - o Simplification and optimization of PDT protocols
  - o Potential for reducing side effects and increasing patient comfort

- o Expansion of knowledge in the fields of nanomedicine and antimicrobial treatments
- o Basis for further research and development in related areas
- o Integration into medical education and training programs

Biography

Dr. N Tsolekile earned her PhD in Chemistry from the University of Johannesburg, South Africa in 2020. She began her scientific career as a Scientist at the South African Medical Research Council. She joined Cape Peninsula University of Technology in 2014 as a Senior Lecturer and co-founded the Bio-Nanotech and Electrochemistry Research group. Her research area of interest is in the application of nanomaterials in theragnostics. She has published more than 25 research articles in international journals and has presented her work at both national and international conferences.

MARCH

18-20

Joint Event

Nanotechnolgy and Materials 2024

DAY 03

VIRTUAL KEYNOTE FORUM

The influence of nanomorphology in biological assays

The presentation will be focused on exploring mathematical models which are suitable to describe cargo-delivery using Nanomaterials (NMs) while assessing information from in vitro assays. Presently, less than about 0.5% of the accumulated world's reports involving in vitro assays include a mathematical model, but this fraction is growing up steeply worldwide in recent years, signaling the recent trend in handling the biological data in a more comprehensive way. The starting mathematical model for in vitro assays is the Hill equation, herein described as a Hill-inspired approach, characterized by its Hill coefficient. In this case, the morphological parameters of the NMs are included into the original Hill coefficient, which is interpreted as the number of ligand sites in the MNM's surface which are available for binding to receptors onto the cell membrane.

Audience Take Away Notes

- Those producing and handling data from bioassays would be able to incorporate a more comprehensive analysis of the data
- The produced documents (reports, patents, papers) will incorporate a cutting edge approach, thus improving the technical and scientific standards
- From this knowledge, the efficiency and technical quality of previsions will be enhanced

Paulo C. De Morais

Genomic Sciences and Biotechnology, Catholic University of Brasília, Brasília, DF, Brazil

Institute of Physics, University of Brasília, Brasília, DF, Brazil

Biography

Professor De Morais, PhD, was full Professor of Physics at University of Brasilia (UnB) – Brazil up to 2013, Appointed as: UnB's Emeritus Professor (2014); Visiting Professor at HUST – China (2012-2015); Distinguished Professor at AHU – China (2016-2019); Full Professor at Catholic University of Brasília – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-years (1987-1988) post-doc position with Bell Communications Research – USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais – Brazil. He has published about 500 papers (Web of Science).

Combined moisture and stress effects on durability of composites

The potentially high durability of fiber reinforced polymer matrix composites makes them extremely attractive for use in primary structural applications in harsh and changing environments. While significant research has been conducted on the effect of moisture and humidity there is very little information as related to the combined effects of stress and moisture. This research focuses on this aspect over a range of immersion temperatures and levels of sustained strain and results are correlated using both mechanical performance and dynamic mechanical analytical characteristics to determine mechanisms of deterioration, effects of synergistic interaction of the two drivers, and prediction of long-term durability. The results are also used to suggest thresholds for operating envelopes.

Audience Take Away Notes

- Effect of synergy between moisture and sustained levels of stress/strain.
- How to determine long-term durability and design thresholds
- Durability characteristics of FRP composites
- More effective and efficient design of FRP structures

Prof. Vistasp M. Karbhari

Department of Civil Engineering & Department of Mechanical and Aerospace Engineering, University of Texas Arlington, United States

Biography

Vistasp M. Karbhari is a Professor at the University of Texas - Arlington, and is known internationally for his research in the areas of mechanics and manufacturing of composites, durability of materials, infrastructure rehabilitation and multi-threat mitigation. He has published extensively in these areas with more than 400 papers in archival journals and conference publications. He has been recognized as a fellow of numerous professional organizations including the National Academy of Inventors, AAAS, ASCE, ASM, IIFC, ISHMII, SEI and is an elected member of the European Academy of Science and Arts.

Analytical modeling occupies a special place in reliability-physics predictive modeling in materials-science-and-engineering

Analytical ("mathematical") predictive modeling [1-4] occupies a special place in the reliability-physics modeling effort. Such modeling enables obtaining relationships that clearly indicate "what affects what", but, more importantly, can often explain the physics of phenomena and particularly various paradoxical situations better than the finite-element-analysis (FEA), or even experimentation, can [3,4]. FEA modeling, initially implemented in the mid-1950s of the last century in the areas of engineering where structures of complicated geometry were employed (aerospace, maritime, some civil engineering structures), has become shortly the major modeling tool in electronics and photonics engineering and reliability physics as well: powerful and flexible FEA computer programs enable obtaining, within a reasonable time, a solution to almost any stress-strain related problem. Analytical solutions in reliability physics problems are, however, still important: simple, easy-to-use and physically meaningful analytical relationships provide clear and compact information of the role of various factors affecting the phenomenon or the behavior and performance of a material or a device of interest. A crucial requirement for an effective analytical model is simplicity and clear physical meaning, and, as Einstein has put it, "external justification and internal perfection". A good analytical model should be based on physically meaningful considerations and produce simple and easy-to-use relationships, clearly indicating the role of the major factors affecting the phenomenon, the object or the structure of interest. One authority in applied physics remarked, perhaps only partly in jest, that the degree of understanding a physical phenomenon is inversely proportional to the number of variables used for its description and that "a formula longer than two inches is most likely wrong". Hooke's law (1678) in structural analysis, Newton's second law (1687) in mechanics, Lorentz's factor (1892) in the relativity theory (establishing the transformation from a coordinate frame in space-time to another frame moving at a constant velocity relative to the former one) and Einstein's famous relationship (1905) in nuclear physics are, probably, the best illustrations to this statement. Empirical relationships, such as, e.g., the Coffin-Manson's one in the reliability of solder-joint interconnections in electronic and photonic packaging, are useful, but their structure and particularly their non-integer exponents clearly indicate on the lack of understanding of the underlying physics of failure. It is imperative that predictive modeling is always conducted prior to and often even during the actual accelerated testing, particularly of the Failure-Oriented-Accelerated-Testing (FOAT) type [5], which is the experimental foundation of the Probabilistic Design-For-Reliability

Ephraim Suhir

Bell Laboratories, Murray Hill, NJ (ret), Portland State University, Portland, OR, and ERS Co., Los Altos, CA, USA; and Bordeaux Univ., Bordeaux, France

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

(PDfR) effort at the design stage (see, e.g. [6]) of an electronic or a photonic product, and that analytical ("mathematical") modeling complements computer simulations. These modeling tools are based on different assumptions and use different computation techniques, and if the output data obtained using these tools are in agreement, then there is a good reason to believe that these data are sufficiently accurate and, hence, trustworthy.

Bell Laboratories Distinguished Member of Technical Staff (DMTS) Award (for developing effective methods for predicting the reliability of complex structures used in AT&T and Lucent Technologies products), and 2004 ASME Worcester Read Warner Medal (for outstanding contributions to the permanent literature of engineering and laying the foundation of a new discipline “Structural Analysis of Electronic Systems”). Ephraim is the third “Russian American”, after S. Timoshenko and I. Sikorsky, who received this prestigious award. His most recent awards are 2019 IEEE Electronic Packaging Society (EPS) Field award for seminal contributions to mechanical reliability engineering and modeling of electronic and photonic packages and systems and 2019 Int. Microelectronic Packaging Society’s (IMAPS) Lifetime Achievement award for making exceptional, visible, and sustained impact on the microelectronics packaging industry and technology.

The Merging of Artificial Intelligence (AI) and biomaterials: The future of personalized health solutions

Artificial intelligence (AI) has revolutionized many fields by identifying patterns and optimizing processes. Despite the use of AI across numerous industries, its use in biomaterials is relatively absent. Here, in this invited talk, a review of the promise for the use of AI in biomaterials will be presented with a focus on using AI to optimize tissue growth, inhibit infection, and limit inflammation based on biomaterial properties. Specifically, here, in vivo studies were used in which biomaterial properties (such as surface, mechanical, electrical, etc. properties) were systematically changed and correlated using AI to modulations in tissue growth, infection, and inflammation. In one application, AI was used to optimize biomaterial properties specifically for orthopedic applications in which an optimal set of properties was identified for promoting bone growth while inhibiting infection and inflammation. The AI optimized biomaterial was confirmed using well established in vivo assays. In this manner, this presentation represents one of the few in which AI was integrated into biomaterial design to create new and improved orthopedic materials.

Audience Take Away Notes

- What is Artificial Intelligence (AI)
- How AI is being used in biomaterials to improve device performance
- What is the future for the use of AI in biomaterials and healthcare

Thomas J. Webster

School of Health Sciences and Biomedical Engineering, Hebei University of Technology, Tianjin, China

School of Engineering, Saveetha University, Chennai, India

Program in Materials Science, UFPI, Teresina, Brazil

Interstellar Therapeutics, Mansfield, MA USA

Biography

Thomas J. Webster's (H index: 117; 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 is a former President of the U.S. Society for Biomaterials and has over 1,350 publications to his credit with over 53,000 citations. He was recently nominated for the Nobel Prize in Chemistry (2023).

Nanotransporters for the release of bioactive molecules

In this study, the nanoformulation of plant extracts in phospholipid vesicles was performed to improve phytochemicals' applicability in potential skin products. In recent years, the scientific community and pharmaceutical and cosmetic industries gave much attention to plant-derived products with active ingredients. The antioxidant, antibacterial, wound healing, anti-aging, sun protection, and anti- inflammatory activities are some of their properties highlighted for topical application. Despite this, plant compounds present some drawbacks related to their poor solubility, instability, reduced skin permeation, and low skin retention time, which strongly restrict their topical application.

Nanotechnology Emerges as an Innovative Strategy to Tackle These Limitations:By manipulating materials and reducing their size at the nanometer scale, new structures able to incorporate different active molecules are produced. Nanocarrier-based delivery preserves biomolecules from degradation and increases their bioavailability, at the same time.

In this research, the plant material was obtained through alcoholic extractions of different parts of some common plants. Their incorporation in phospholipid vesicles was carried out by a simple sonication of extracts and phospholipids in dispersant solutions.

To verify that the nanoformulations had optimal features for skin delivery, a deep characterization was performed, in terms of size, surface charge, sample homogeneity, shape, degree of lamellarity, and entrapment efficiency of the main compounds characteristic of each extract.

Their biocompatibility was assayed with different skin cell lines as well as their antioxidant potential. Our results suggest that phospholipid vesicles incorporating plant extracts could be good candidates for topical delivery.

Audience Take Away Notes

- Taking advantage of the nano-sized structures, nanocarriers help poorly soluble molecules to become more bioavailable and protect them from degradation
- The modifiable surfaces of nanocarriers extend their usability in different biomedical applications, especially in targeted therapy: their modification not only stabilizes but also functionalizes them to be responsive to different stimuli
- Liposomes have attractive biological properties, including biocompatibility, biodegradability, low toxicity, small size, and different cargo transportability, that increase their application area from drug and gene delivery to the diagnostic sector, and cosmetics, food, and chemical industries

Prof. Antonio Vassallo

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85100 Potenza, ItalySchool of Engineering, Saveetha University, Chennai, India

Program in Materials Science, UFPI, Teresina, Brazil

Nanovault, Mansfield, MA, United States

Biography

Prof. Antonio Vassallo graduated as MS on Pharmacy in 2002 at the Salerno University, Italy, in 2005 he obtained his Specialization in Hospital Pharmacy. He received his PhD degree in 2010 at the same institution. In 2010 he won a position as Assistant Professor at the University of Basilicata, Italy and now he works in the Pharmaceutical and technological application division at University of Basilicata, from 2022 Associate Professor. Research objectives: Studies of formulation, preparation and control of synthetic or biologically active compounds in conventional and innovative dosage forms. He has published more than 70 research articles in SCI(E) journals.

BOOK OF ABSTRACTS

MARCH

18-20

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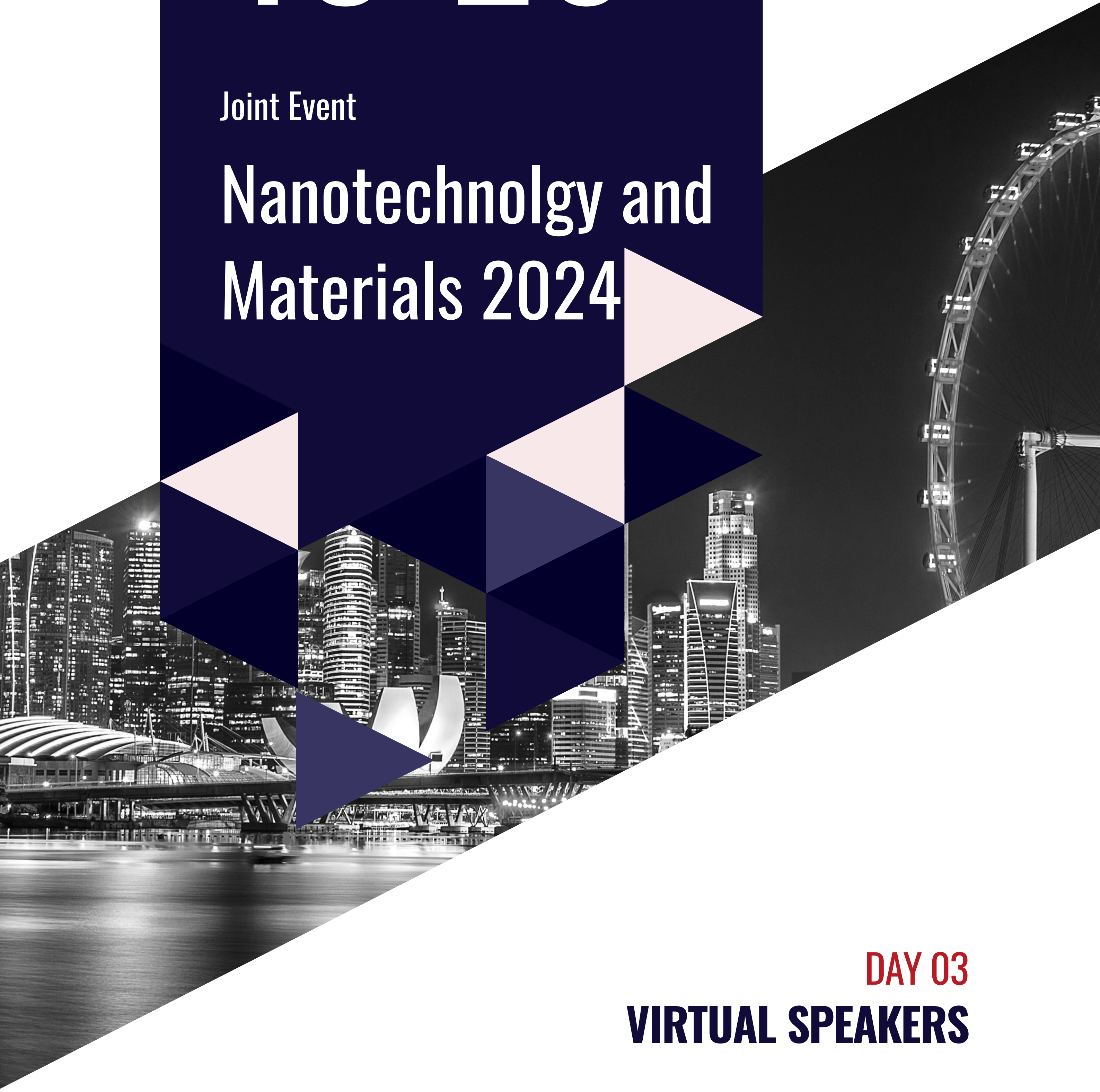
Nanotechnolgy and Materials 2024



DAY 03

VIRTUAL SPEAKERS

Prof. Hui Li[1,2,4]*, Yichen Deng[1], Zelin Li[1], Qingkai Han[1], Xiangping Wang[2], Jin Zhou[3], Zhongwei Guan[4]

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Analytic modeling and analysis of impact characteristics of composite cylindrical shells with an auxetic honeycomb core subjected to high-velocity internal projectile impact

An analytical model is developed to investigate the impact characteristics of composite cylindrical shells with two Fiber Reinforced Polymer (FRP) skins and an Auxetic Honeycomb Core (AHC) subjected to high-velocity internal projectile impact. A strain rate fitting function method is proposed to accurately simulate the dynamic behavior of materials under high-velocity impact loading by updating the elastic moduli. Reddy's higher-order shear deformation theory is utilized to define the structural displacement components, and an improved Gibson theory is applied to determine the equivalent elastic moduli and Poisson's ratios of AHC. The delamination and fracture energy absorption mechanisms of the FRP skins and the core are studied, and the dominant failure modes such as fiber tension, fiber compression, matrix tension, matrix compression, and compression-shear failure of AHC are identified using a 3D Hashin criterion for the skins and a compression-shear coupling failure criterion for the core. The model is roughly validated by comparing the predicted high-velocity impact parameters with literature and ABAQUS simulation results. Furthermore, a high-velocity impact experimental system for penetrating impact tests of such shell specimens is established to obtain the residual velocity, specific energy absorption, ballistic limit, and damage areas on the inner and outer skins of the specimens, with the measured data being employed to give a solid validation of the proposed model. A comprehensive error analysis is also discussed, highlighting the error sources and their impact on the accuracy of such an analytical model.

Audience Take Away Notes

- A novel composite cylindrical shell with two FRP skins and an AHC is fabricated
- An analytical model of such a shell is established to predict the impact parameters subjected to the internal impact of a high-velocity projectile
- The proposed model is validated through the comparison of literature, ABAQUS simulation, and experimental results

Biography

Hui Li is a professor at Northeastern University, China. He has published more than more than 70 research articles in SCI/ EI journals and 60 Chinese invention patents, including 45 top-level SCI papers in Compos Sci Technol, Compos. B. Eng, Mech Syst Signal Process, Nonlinear Dyn. etc. He once was a vibration engineer in Shenyang Machine Tool Co, Ltd, a postdoctoral fellow at Shenyang Engine Research Institute, and a visiting scholar at Liverpool University in the UK and Hanyang University in South Korea. His research interest includes nonlinear vibration, vibration and impact modeling, dynamic thermal evaluation of porous, hybrid and multifunctional composite materials and structures.

Dr. Yuting Liu[1,2]*, Albert Lee[3], Kun Qian[1,4], Peng Zhang[3], Zhihua Xiao[1,10], Haoran He[3], Zheyu Ren[1,4], Shun Kong Cheung[1], Ruizi Liu[1,4], Yaoyin Li[2], Xu Zhang[1], Zichao Ma[1], Jianyuan Zhao[2], Weiwei Zhao[2], Guoqiang Yu[7], Xin Wang[8], Junwei Liu[4,6], Zhongrui Wang[5], Kang L. Wang[3], Qiming Shao[1,4,6,9,10]

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Cryogenic in-memory computing using giant and tunable anomalous hall effect in magnetic topological insulators

Cryogenic in-memory computing holds the promise of energy-efficient hardware implementation for machine learning algorithms, particularly for crucial quantum computation tasks like quantum error correction and quantum control. However, achieving this requires the development of energy-efficient memristors that can operate at deep cryogenic temperatures, specifically at or below the temperature of liquid helium (4.2 K), a challenge that has yet to be overcome. Magnetic topological insulators are promising candidates due to their tunable magnetic order by electrical currents with high energy efficiency. Here, we build magnetic topological memristors and introduce a cryogenic in-memory computing scheme based on the coexistence of the chiral edge state and the topological surface state. We achieve high accuracy in a proof-of-concept classification task using four magnetic topological memristors. Furthermore, our algorithm-level and circuit-level simulations of large-scale neural networks based on magnetic topological memristors demonstrate a software-level accuracy and lower energy consumption for image recognition and quantum state preparation compared with existing magnetic memristor and CMOS technologies. Our results not only showcase a new application of chiral edge states besides their applications in topological quantum computing, resistance standards, and dissipationless interconnects, but also may inspire further topological quantum physics-based novel computing schemes.

Audience Take Away Notes

- The audience will gain insights into the potential of cryogenic in-memory computing and magnetic topological memristors for energy-efficient hardware implementation, particularly in the context of machine learning and quantum computation tasks. They will learn about the challenges and solutions associated with developing memristors that operate at deep cryogenic temperatures. This knowledge can be applied by researchers, engineers, and developers in the field of quantum computing and hardware design to explore and develop more energy-efficient computing solutions for various applications
- For researchers and engineers working in quantum computing and hardware development, this research provides valuable information on the use of cryogenic in-memory computing and magnetic topological memristors. It can help them make informed decisions when designing and implementing hardware for quantum error correction, quantum control, and other machine learning tasks. Additionally, the insights on lower energy consumption and software-level accuracy can guide professionals in optimizing their computing solutions for improved performance and efficiency
- This research has the potential to benefit other faculty members in academia. It introduces a novel approach to computing using magnetic topological memristors and cryogenic techniques. Other researchers and educators can use this work as a foundation for expanding their own research in the fields of quantum computing, materials science, and hardware development. It can also be used as educational material to teach students about emerging technologies and their applications in quantum physics-based computing schemes. The research may inspire further exploration and innovation in these areas

Biography

Dr. Yuting Liu studied Physics at the University of Paris-Sacalay, France and obtained his PhD degree in 2018. He then joined the research group of Prof. Martin Aeschliman at the Technical University of Kaiserslautern, Germany as a post-doc for one year. Subsequently, he did another post-doc at the group of Prof. Qiming Shao at Hong Kong University of Science and Technology. Now, he is an assistant researcher of Harbin Institute of Technology Shenzhen. His research focuses on developing novel spintronic devices for emerging computing architectures. He has published 11 research articles as the first author in high-impact journals, such as ACS nano, Phy. Rev. Appl. And Appl. Phys. Lett.

Tzu Hou Hsu
Department of Research and Development, Cheng Yieu Development Machinery Co., Ltd., Tainan City, Taiwan

Investigation of the composition and morphology of hardfacing welding powder

Hardfacing is a welding process used to apply a protective layer of wear-resistant material onto the surface of a metal component. This process is employed to extend the life of industrial equipment and machinery that is subjected to abrasive or erosive wear, impact, and corrosion. Common hardfacing materials include alloys containing chromium, tungsten carbide, cobalt, nickel, or a combination of these. One significant disadvantage of hardfacing welding is its limited coverage and thickness capabilities. Hardfacing is typically applied as a relatively thin layer to specific areas of a component that are prone to wear or corrosion. This means that not all parts of the component receive the protective hardfacing layer, leaving some vulnerable to damage. Additionally, the thickness of the hardfaced layer is restricted, making it unsuitable for applications requiring substantial material buildup. For very thick layers, multiple passes may be necessary, leading to increased costs, potential distortion of the component, and limitations in its effectiveness. These constraints can make hardfacing less suitable for scenarios where comprehensive protection or significant material reinforcement is needed. In our research, we conducted a thorough analysis of tungsten carbide-based hardfacing welding materials, commonly applied in creating a protective coating for plastic extruder dies. Our investigation encompassed both the powder composition and the properties of the welded section, utilizing techniques like SEM, EDS, and X-ray analysis. Our goal was to understand the material's behavior during the hardfacing welding procedure and to explore the potential of substituting this traditional method with a laser-based additive manufacturing technique, aiming to produce a more robust and thicker protective layer.

Audience Take Away Notes

- This study shows a comprehensive material characterization on the metal powder used in hardfacing welding process
- This study uncovers the detailed composition and structure of the hardfacing material utilized in creating the protective coating for the die of a plastic extruder
- This study suggests substituting the conventional hardfacing welding approach with an innovative additive manufacturing process

Biography

Mr. Hsu studied Materials Science at the National Tsing Hua University and graduated at MS in 2018. He studied another Master Degree in Mechanical Engineering Department at UC Berkeley and graduated in 2022. As a double master's degree holder in both mechanical and material engineering, he specializes in mechanical design, metallic materials, and additive manufacturing. Solid design skills in 3D CAD & Finite Element Analysis, and profound understanding in materials analysis & mechanical testing. Leading several projects, and have published 7 SCI Journals and 1 Patent.

Li Ma*, Ying Ji
Research Institute for Intelligent Wearable Systems, The Hong Kong Polytechnic University

Personalized nanofiber-based strategy for smart regulation of diabetic wounds

Different from normal wounds, wound management for patients with diabetes and metabolic disorders is challenged by spatiotemporally dynamic wound microenvironment. However, diabetes-specific wound care is not sufficiently explored and diabetic wounds are challenged by poor healing outcomes and high recurrence rates. Therefore, a tailor-designed wound dressing is important for diabetes-specific wound care. Utilizing in situ electrospinning with portability and flexibility, the study aims to develop personalized wound dressings based on the pathophysiological characteristics and time course of diabetic wounds. Different from traditional pre-fabricated wound dressings, the personalized nanofiber-based wound care strategy enables the delivery of versatile formulations to adapt to the dynamic and heterogeneous wound microenvironment at different healing phases. The custom-designed and dynamic wound dressing could provide an effective therapeutic strategy to enhance the response rate and accelerate the healing of diabetic wounds.

Arginine metabolism is essential in shaping immune regulation for diabetic wound healing. Nitric Oxide (NO) derived by arginine via the inducible Nitric Oxide Synthase (iNOS) pathway is critical for orchestrating the immune regulation in diabetic wounds. Meanwhile, arginine metabolized via the Arginase pathway contributes to collagen synthesis and cell proliferation. In this research, a class of arginine-based pseudo-protein polymers is developed and provides the regulatory potential to direct wound healing. Utilizing portable electrospinning technology, the as-developed polymers directly deposit as nanofibrous wound dressing onto the diabetic wounds. The study emphasizes the structure-process-property relationship for the design and development of customized formulations, as well as the diabetes-specific considerations to provide dynamic and spatiotemporal regulations of wound microenvironment, to promote diabetic wound healing.

Audience Take Away Notes

- The development of personalized wound care is important to improve the healing outcomes for patients. The various wound types, infections, as well as the complexity of patients' medical history, ages and health status, requires highly divergent wound care strategies, which could not be addressed by pre-fabricated wound dressings. Personalized and portable wound care could reduce the clinical visits of patients, minimize the risk of hospital-acquired infections, optimize the time and cost for curations, etc., which will positively impact both the physiological and financial aspects of patients to enhance their life quality. In the longer term, personalized and portable wound treatment could implement the smart wound care system towards future healthcare development

Biography

Ms. Li Ma is a Ph.D. candidate at the Hong Kong Polytechnic University. She received her bachelor's degree and master degree from Sichuan University. Ms. Ma is working on the ethanol-water-based portable electrospinning of various polymers to develop personalized functional materials including personalized wound dressings, personalized tissue engineering biomaterials, etc.

Chiara Marchionni
Department of Civil, Construction-Architecture, Environmental Engineering, University of L'Aquila, Italy

Green and sustainable materials in the built environment reuse

Today the construction sector is considered the largest contributor to climate change, producing about 39% of carbon dioxide emissions and 25% of solid waste globally. This happens because the construction industry still predominantly adopts a linear economic model, based on resource withdrawal - use - waste.

The difficult environmental situation, therefore, requires the construction industry to identify design solutions capable of reducing resource consumption and waste generation with the assumption of the time horizon of the whole life cycle. It is essential to move to a circular economic (CE) model, that promotes a sustainable built environment with increased efficiency for construction resources and waste minimization at construction stage and end of life.

This paper investigates these issues, proposing the sustainable and efficient reuse of the valuable built environment of the Italian territory through the use of dry construction systems and that of wood as a material to be integrated with existing structures.

The advantages of using wood in rehabilitation interventions are not only structural and executive, but also environmental: in fact, it is a living material and can store CO2, reducing emissions. In addition, comparison with other production cycles reveals the low gray energy of this material, which also offers the advantage of renewability, being a biodegradable material that can be completely recycled at the end of its use.

The paper presents a series of case studies related to minor historic centers located in the inland area of the Abruzzo Region, in central Italy.

Audience Take Away Notes

- The research links the theme of environmental sustainability to that of rehabilitation of the built environment, providing the international scientific community with design strategy to better intervene in valuable contexts
- The paper delves into the properties of wood as a material with multiple environmentally sustainable properties, investigating its various use scenarios
- The proposed design strategies are to support the shift toward a circular economy and the concepts of reuse and recycling, in the optics of achieving the global goals of decarbonization and energy conservation

Biography

Chiara Marchionni studied Construction Engineering-Architecture at University of L'Aquila, Italy, and graduated with honors in 2010. She received her Ph.D. in “Recovery, Design and Protection in Settlement and Territorial Contexts of High Environmental and Landscape Value” in 2015 at the same institution. After a lot of collaborations, in 2023 she obtained the position of young Researcher at Department DICEAA of University of L’Aquila. Her research has focused on development of methodologies and protocols from a sustainability perspective and life-cycle approaches to reduce product/process environmental impacts, including of building elements and components. During her research career, she published over of forty papers and participated in several conferences.

Prof. Michael I. Tribelsky
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Peculiarities of subwavelength field pattern at resonant light scattering by nanoparticles

Resonant light scattering by nanoparticles provides a unique opportunity to concentrate a high-amplitude electromagnetic field in a subwavelength area of space as well as to tailor and control its pattern. In addition to purely academic interest, this is extremely important for numerous applications ranging from medicine and biology to telecommunication and data processing. Despite more than a hundred years of extensive study, the problem is still far from completion. A review of new results in this field is presented in this contribution. In many cases, despite the smallness of the scattering particles, their light scattering has very little in common with the conventional Rayleigh case. New, counterintuitive effects, especially those related to violating the quasi-static description of the scattering occurring at the action of (ultra)short laser pulses, are pointed out, inspected, discussed, and classified.

Keywords: Nanoparticles, Light Scattering; Resonances, Filed Concentration, Controlled Field Patterns.

Biography

Prof. Tribelsky received his MS from Lomonosov Moscow State University in 1973, a PhD from Moscow Institute of Physics and Technology in 1976, and a Dr. of Sci. (habilitation) from Landau Institute in 1985. He received numerous national and international awards: Leninsky Komsomol Prize (1979); COE Professorship, the University of Tokyo (2006, 2008) and Kyushu University (2007), Japan; Honorary PhD, Yamaguchi University, Japan (2016), etc. Presently, his interest lies in subwavelength optics. He is the author of several books, book chapters, review articles, and more than 100 research papers.

Dr. Vladyslav Cheranovskii*, E.V.Ezerskaya,S.E.Kononenko
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The decorated spin ladder systems: Peculiarities of the energy spectrum and magnetization profile

Over the past few decades the one-dimensional mixed-spin lattice models like spin chains and spin ladders have attracted big interest due to numerous advances in targeted design of nanostructured magnetic materials.

In this work we studied analytically and numerically the energy spectrum and magnetic properties of the mixed spin-system formed by three-spin unit cells. This system can be considered as the two-leg spin 1/2 ladder model with additional spins   inside the ladder rungs (decorated spin ladder model). For the model with dominant spin coupling in ladder rungs the detailed analysis of the energy spectrum is given on the base of perturbation theory. It is shown, that despite the singlet ground state, the above spin ladder may have intermediate plateau in low-temperature magnetization profile. The existence of similar plateau was shown also in the case of some intermediate values of coupling parameters by means of exact diagonalization study of small ladder clusters and by the density-matrix renormalization group calculations. We also found, that the Ising type of interactions in ladder rungs may leads to the disappearance of the above intermediate magnetization plateaufor the corresponding isotropic spin ladder.

Audience Take Away Notes

- It is shown, that the theoretical approach based on spin formalism of valence bond method of quantum chemistry is of interest for the explanation of the relationship between chemical structure and magnetic properties of nanomaterials
- The results of above study will be useful for targeted design of the new magnetic materials on the base of transition metal complexes for needs of molecular spintronics
- In particular, sensitivity of the low-temperaturemagnetization profile of the proposed model nanomagnets to the chemical surrounding can be used for the design of new chemosencors

Biography

Vladyslav Cheranovskii completed his Doctor of Sciences in the year 1994 at the age of 38 years from Institute for Single Crystal, National Academy of Sciences of Ukraine. He is a Professor of V.N.Karazin Kharkiv National University, department of Chemistry. He has published 64 papers recognized by Scopus database. He is working in field of solid state physics and quantum chemistry. Main subject of interest: strongly correlated electron systems, theoretical simulation of electron structure and thermodynamics of nanomagnets.

Dr. Osman Adiguzel
Department of Physics, Firat University, Elazig, Turkey

Shape reversibility and fundamental characterization of shape memory alloys

A series of alloy systems take place in a class of functional materials with stimulus response to external effect. Shape memory alloys take place in this group by exhibiting a peculiar property called shape memory effect. These alloys have dual characteristics, shape memory effect and superelasticity, from viewpoint of reversibility. These phenomena are characterized by the recoverability of two certain shapes of material at different conditions. Shape memory effect is initiated with thermomechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of material cycle between original and deformed shape in reversible way. Therefore- this behavior can be called Thermal Memory or Thermoelasticity.This phenomenon is result of successive thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movements of atoms by means of lattice invariant shears in <110 > -type directions on the {110} - type planes of austenite matrix, along with lattice twinning reaction and ordered parent phase structures turn into the twinned martensite structures. The twinned structures turn into the detwinned martensite structures by means of stress induced martensitic transformation, with deformation in the martensitic condition. Shape memory alloys become noticeable as smart materials in mechanical applications in many fields of industry. These alloys exhibit another property called superelasticity, which is performed with stressing and releasing material in elasticity limit at a constant temperature in parent phase region, and shape recovery is performed simultaneously upon releasing the applied stress. Superelasticity is performed in non-linear way; stressing and releasing paths are different in the stress-strain diagram, and hysteresis loop refers to energy dissipation. These alloys are functional materials with these properties and used as shape memory elements in many fields from biomedical to the building and aviation industries as an energy absorber. Superelasticity is also result of stress induced martensitic transformation and ordered parent phase structures turn into detwinned martensite structure with stressing in the parent phase region.

Noble metal copper- based alloys exhibit this property in metastable β-phase region. Lattice invariant shear and twinning is not uniform in these alloys and gives rise to the formation of complex layered structures. The layered structures can be described by different unit cells as 3R, 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice. The unit cell and periodicity are completed through 18 layers in direction z, in case of 18R martensite in ternary copper-based shape memory alloys, and unit cells are not periodic in short range in direction z.

In the present contribution, x-ray diffraction and Transmission Electron Microscopy (TEM) studies were carried out on two copper- based CuAlMn and CuZnAl alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections, inherited from the parent phase structures, due to the diffusionless character of transformations. Critical transformation temperatures of these alloys are over the room temperature and specimens were aged at room temperature. A series of x-ray diffractograms were taken in a long-time interval, and these diffractograms show that diffraction angles and intensities of diffraction peaks change with the aging duration at room temperature. This result refers to the rearrangement of atoms in diffusive manner.

Keywords: Shape Memory Effect, Martensitic Transformation, Thermoelasticity, Superelasticity, Lattice Twinning, Detwinning.

Audience Take Away Notes

- Shape memory effect is a multidisciplinary subject and shape memory alloys are functional materials and used in many fields from biomedical to the building industry with dual characterization, thermoelasticity and superelasticity. Therefore, usually I introduce the basic terms and definitions at the beginning of my talk, so that the audience can gain elementary knowledge about the shape memory phenomena. After that I introduce the experimental results performed on the used alloy samples

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 were focused on shape memory effect in shape memory alloys. His academic life started following graduation by attending an assistant to Dicle University in January 1975. He became professor in 1996 at Firat University in Turkey, and retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He supervised 5 PhD- theses and 3 M. Sc- theses and published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international level with contribution. He served the program chair or conference chair/co-chair in some of these activities. Also, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Additionally, he joined over 120 online conferences in the same way in pandemic period of 2020-2022. Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data).

Dr. Ram Sambhar Shukla

Inorganic Materials and Catalysis Division, Council of Scientific and Industrial Research (CSIR)-Central Salt and Marine Chemicals Research Institute (CSMCRI), G. B. Marg, Bhavnagar – 364 002, Gujarat, India

MCM-41 as a potential mesoporous reference material for characterizing multi textural properties

Mobil Composition of Matter, MCM-41, associated with large Surface Area (SA) and mesopore-scale pore sizes,finds extensive applications in catalysis, adsorption,separation,sensor,hybrid optics,biomedical devicesand drug delivery etc. Simple structure and elegant synthesis procedureof MCM-41offers it as the most suitable model mesoporous adsorbent available for studying the fundamental features of adsorption such as the effects of pore size, hysteresis, etc., owing to its relatively uniform cylindrical/hexagonal pore channels. The cylindrical pore structure and high degree of pore symmetry associated with MCM-41 merit it as a representative mesoporous material. It is observed that the mesopores of the mesoporous materialsused as support in heterogeneous catalyst have potential to act effectively as nanophase reactors,permitting free ingress of reactants and egress of products that have cross-sections smaller than the diameter of the pores. These specific mesoporous concerns of MCM-41 led us to carry out investigations on it for developingit's standard reference material.There are very few reference materials for analysing the textural properties of the mesoporous material like, activated nanoporous carbons with BET surface area of 550±5 m2/g and 1396±24 m2/g. The BAM is the producers and suppliers of reference standard for pore size analysis. However to the best of our knowledge there is no reference material available/ developedwith a potential to analyze multi-properties like SA, Pore Volume (PV), Pore Diameter (PD) and Wall Thickness (WT) by using a single reference material standard. Investigations for the first time were performed by us towards the development of a standard of MCM-41 material associated with high SA, as a reference material to analyze multi-textural properties like SA, PV, PD and WT by using a single reference material of MCM41.Surface area and pore size analyzer need standard reference materials for calibration. MCM41 was elegantly synthesised and thoroughly characterised and subjected for regular time interval analysis of the textural and structural characteristics by nitrogen sorption and PXRD techniques respectively. MCM-41was stored (i) in the glove box and (ii) at ambient atmospheric conditions. The samples stored both ways, demonstrated that this high surface area material is effectively durable and stable for the long analyzed period of one year. The performance of the durability and stability of MCM-41 being almost identical for the samples stored in above two conditions suggested that the storing conditions donot have much effect provided the atmosphere over the sample is dry. No significant change in the values ofSA,PV, PD and WT occurred during the long time analysis of one year. This high surface area mesoporous material MCM-41 has shown its promising potential to act effectively as being single reference material to analyse multi textural properties. In line of above the present talk will discourse the findings of the investigations on the development of MCM41 as potential reference material, focussing on its durability,stability, characterisation and associated applications.

Biography

Dr. Ram Sambhar Shukla received B.Sc. (1975), M.Sc. (1977), Ph.D. (1981) degrees and PDF of CSIR (1981-83) from University of Allahabad, India and joined Inorganic Materials and Catalysis Division of CSIR- Central Salt and Marine Chemicals Research Institute, Bhavnagar, India as research scientist since 1983. His specializations include catalyst materials, green organic transformations of O_2, CO_2, CO, H_2 and CH_4, high temperature-pressure material and catalysis. He is Life Member of National Academy of Sciences-India, Allahabad and Catalysis Society ofIndia,Madras. He was Member of Indian Reference Materials, Delhi and was Chairman (Alternate), Inorganic Materials Sectional Committee of Bureau of Indian Standard, Delhi. As Bilateral Exchange of Scientists awardees visited France (CNRS,1993) and Korea (KOSEF, 2002) for collaborative research on C-H and CO_2 respectively. Awarded brain pool scientist (2011) and researched in Korea on utilization of CO_2 as soft oxidant. Performed as faculty Professor for Ph.D. course, of Academy of Scientific and Innovative Research (AcSIR), and of Bhavnagar University.He is reviewer for reputed journals for materials and catalysis and Ph.D. examiner for Indian universities. He credited: 100 papers, 5 patents, 2 reviews, 4 book/chapters, 52 invited lectures: 21 international and 71 national conferences,17 students guidance and 20 research projects.

Prof. Sivasubramanian Palanisamy*, D. Thresh kumar

Department of Mechanical Engineering, P T R College of Engineering and Technology, Madurai, Tamil Nadu, India

Evaluate the mechanical characteristics of hybrid natural fiber composites comprising ramie and flax under various conditions

The study focused on utilizing a hybrid ramie/flax natural fiber reinforcement in conjunction with epoxy resin as the matrix material. The fabrication method employed was compression molding. Among various combinations tested, the hybrid composition with 40 wt.% of 1 cm fiber length exhibited superior tensile strength at 32.67 MPa. Optimal compatibility between fiber/matrix phases and improved stress transfer behavior, as well as enhanced elastic deformation, were achieved with hybrid fiber combinations ranging from 30 to 40 wt.%. The addition of fibers, varying in length up to 40 wt.% and 0.5 cm, led to a significant improvement in flexural strength, increasing from 43.75 to 52.47 MPa. Moreover, the impact strength of the hybrid combinations also saw a notable enhancement, ranging from 10.23 to 15.97 kJ/m2. Notably, a 5% NaOH treatment had a substantial impact on tensile properties, ranging from 28.42 to 32.67 MPa, surpassing both untreated and 8% surface-treated fibers. Alkali treatment resulted in flexural strengths ranging from 49.83 to 52.47 MPa and 49.12 to 49.99 MPa. The study identified that the maximum tensile strength of 33.46 MPa was achieved under specific conditions, namely 120°C temperature, 12 MPa pressure, and 7 minutes duration. It was observed that excessively high pressure, elevated operating temperatures, and prolonged processing times led to a decline in the mechanical properties of the polymer composites. SEM analysis further corroborated these findings, indicating that the hybrid composition with 40 wt.% natural fiber exhibited superior fiber distribution, thereby contributing to the overall improved properties. It is worth noting that research efforts in the domain of natural fiber incorporation, fabrication conditions, and surface treatments are scarce, making this study a valuable contribution to the field.

Biography

Sivasubramanian Palanisamy currently serves as an Assistant Professor in the Department of Mechanical Engineering at P T R College of Engineering and Technology, located in Madurai, Tamil Nadu, India. He holds a Ph.D. in the field of Mechanical Engineering from Kalasalingam Academy of Research and Education (KARE) situated in Krishnankovil, Srivilliputhur, Tamil Nadu, India. Dr. Sivasubramanian Palanisamy's research expertise encompasses a wide range of areas, including biocomposite materials, the characterization of fibers, fiber-reinforced polymer composites, hybrid composites, fiber-reinforced elastomer composites, the study of tribological behavior in composite materials, and 3D printing. He has an impressive publication record, having authored over 25 research papers in renowned international journals and contributed to 10 book chapters. Additionally, he has delivered 12 keynote or invited talks in his specialized research domains. In recognition of his expertise, Dr. Sivasubramanian Palanisamy serves as a referee for numerous esteemed journals, including but not limited to Fibers, Biomass Conversion and Biorefinery, Engineering Science and Technology—an International Journal, Applied Science and Engineering Progress, Tribology in Industry, Buildings, Processes, Sustainability, and Energies.

Sivasubramanian Palanisamy[1]*, Murugesan Palaniappan[2]

[1]Department of Mechanical Engineering, P T R College of Engineering and Technology, Madurai, Tamil Nadu, India

[2]Department of Mechanical Engineering, College of Engineering, Imam Mohammed Ibn Saud Islamic University, Riyadh 11432, Saudi Arabia

Influence of Fiber Content and Length on the Mechanical Characteristics of Biocomposites Comprising Natural Rubber Reinforced with Sansevieria Cylindrica Fibers.

Utilized Sansevieria cylindrica fibers as a reinforcing component within a natural rubber matrix. It is crafted various biocomposite samples with differing fiber lengths and loadings, employing a compression molding process and vulcanizing technique while maintaining a temperature of approximately 150 °C. The results revealed notable mechanical properties for the optimal composite sample, characterized by a tensile strength of 10.44 MPa, a modulus elongation at break of 2.36 MPa, a tear strength of 627.59%, and a maximum hardness of 76.85 Shore A. These exceptional properties were achieved when using 6 mm fibers at a loading of 20 wt% within the composite. The improved properties can be attributed to the robust interfacial adhesion established between the Sansevieria cylindrica fibers and the natural rubber matrix. We further examined and analyzed the failure mechanisms at the interfaces of these biocomposites using scanning electron microscopy (SEM). The SEM images confirmed that the Sansevieria cylindrica fibers were enveloped by a larger amount of natural rubber, facilitating strong interfacial bonding between the fiber and matrix. The optimal composites developed in this study hold great potential for applications in general-purpose abrasion-resistant conveyor belts.

Biography

Sivasubramanian Palanisamy currently serves as an Assistant Professor in the Department of Mechanical Engineering at P T R College of Engineering and Technology, located in Madurai, Tamil Nadu, India. He holds a Ph.D. in the field of Mechanical Engineering from Kalasalingam Academy of Research and Education (KARE) situated in Krishnankovil, Srivilliputhur, Tamil Nadu, India. Dr. SivasubraPalanisamy's research expertise encompasses a wide range of areas, including biocomposite materials, the characterization of fibers, fiber-reinforced polymer composites, hybrid composites, fiber-reinforced elastomer composites, the study of tribological behavior in composite materials, and 3D printing. He has an impressive publication record, having authored over 25 research papers in renowned international journals and contributed to 10 book chapters. Additionally, he has delivered 12 keynote or invited talks in his specialized research domains. In recognition of his expertise, Dr. Sivasubramanian Palanisamy serves as a referee for numerous esteemed journals, including but not limited to Fibers, Biomass Conversion and Biorefinery, Engineering Science and Technology—an International Journal, Applied Science and Engineering Progress, Tribology in Industry, Buildings, Processes, Sustainability, and Energies.

Prof. Dr. Yarub Al Douri

Department of Applied Physics and Astronomy, College of Sciences, University of Sharjah, Sharjah, United Arab Emirates

How to solve the energy crisis by Nanotechnology?

Nanotechnology could deliver world-altering changes in the ways we create, transmit, store, and use energy. The scientists are working to develop super-efficient batteries, low-resistance transmission lines, and cheaper solar cells. However, the likelihood and time frame of these developments is unknown for the moment. The next generation of solar cells is thin film solar cells—flexible sheets of solar panels—that are easier to produce and install, use less material, and are cheaper to manufacture. These sheets can be incorporated into a briefcase that charges your laptop, woven into wearable fabrics that charge your cell phone and iPod, or incorporated into windows that can supply power to high-rise buildings.

In different parts of the world, the people do not have access to safe drinking water. But the new nanofiber water filters can remove bacteria, viruses, heavy metals and organic materials from water. They are re relatively inexpensive and easy to use, so the nanofilter could be widely employed easily. Providing pure drinking water would help prevent disease in many parts of the world, but it would not resolve many basic inequalities.

The nanotechnology has unique properties. The electrical properties, durability, strength and activity of nanomaterials are enhanced and engineered to obtain desired features through nanotechnology. Nanotechnology focusses on solar, hydrogen and biomass energy. The nanostructured catalysts are used to increase the efficiency of fuel cells while porous nanomaterials are used for hydrogen storage. The quantum dots and carbon nanotubes increase the energy absorption properties of solar cells. The development of cost-effective renewable energy systems will contribute to the urgent energy goals of our world and reduce the destructive effect of human activities.

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

Biography

Prof. Dr. Yarub Al-Douri is one of the Middle-East, North of Africa, Malaysia and Southeast Asia's most renowned scientists known for his contributions in Nanotechnology and renewable energy. He has PhD in Materials Science. Al-Douri has initiated Nanotechnology Engineering MSc Program and Nano Computing Laboratory, the first in Malaysia and Southeast Asia, in addition to founding Applied Materials Laboratory in Algeria. Also, Head of Department of Nanomaterials and Department of International Networking and Collaboration, additionally to Secretary of Department of Physics. He has received 72 national and international prizes and awards from USA, Austria, Japan, China, Iraq, UK, Malaysia Italy and others. He has more than 817 publications, US$ 5.1M research grants. Al-Douri has notable citations ≈ 10000, h-index = 53& i10-index = 225. He is Associate Editor of Nano-Micro Letters (Springer, Q1, IF= 23.655), Editor-in-Chief of Experimental and Theoretical Nanotechnology, Editor-in-Chief of World Journal of Nano Science and Engineering, His research field focuses on nanotechnology, renewable energy, nanoelectronics, nanomaterials, modelling and simulation, semiconductors, optical studies. Finally, Al-Douri is a public figure at international media in the UK, Singapore, Malaysia, Qatar and UAE.

Dr. Zakia Guezzen[1]*, Zakia Hammou[2], Aicha Boussoufi[1], Zouaoui Sereir[1], Mohamed Larbi Bennegadi[1]

[1]Composite Structures and Innovative Materials Laboratory, Mechanical Engineering Faculty, University of Science and 2Technology of Oran, BP 1505 El M'naouer, USTO, Oran, Algeria
Physical chemistry Department, Chemistry Faculty, University of Science and Technology of Oran, USTO, Oran, Algeria.

Effect of natural fibers on the natural frequencies of cylindrical biosourced shells

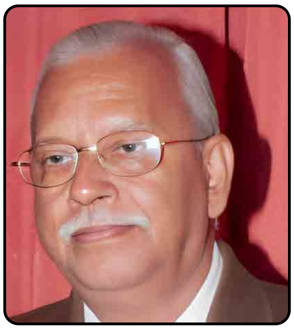
In the present article, the analysis of the free vibration of partially biosourced Cylindrical Shallow Shells (CSS) is presented with a focus on the effect of fiber contents and curvature. Initially, an experimental study is conducted to manufacture shells with varying Alfa fiber contents (Wf = 5%, 10% and 15%) impregnated with Medapoxy STR resin. The damping coefficients, frequencies, and mode shapes are predicted using free vibration testing with a hammer, with consideration of Mass Fraction (Wf) and cylinder curvature (k) of the Cylindrical Shallow Shells. Then, a numerical model is developed using ANSYS software to calculate the natural frequencies and the corresponding shapes, which are then compared to the experimental results. The results indicate good agreement between the natural frequencies obtained through experimental testing and those predicted analytically.

Audience Take Away Notes

- The audience will be able to use this work as a reference data for their numerical simulations and experimental tests of the free vibration of shells
- The audience may take this work as a data in their jobs of using biosourced materials
- This research provides a solution for the vibration problem with high amplitude by varying the mass fraction of s fiber of composites
- Our study is based on the effects of the mass fraction of the natural fiber on the natural frequencies of the shell reinforced by short natural fibers
- It has been shown that the increase in curvature of shells leads to an increase in natural frequencies and an increase in fiber content produces an increase in natural frequency

Biography

Dr. Zakia Guezzenstudied computer science at the Oran University, Algeria and graduated as engineering degree in 1990 and the magister degree in 2002. She then joined the research group of Prof. SEREIR at the Composite Structures and Innovative Materials Laboratory, Mechanical Engineering Faculty, University of Science and Technology of Oran. She received her PhD degree in 2023 at the same institution. She has published 3 research articles.



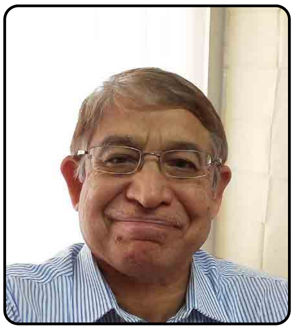
Prof. Suresh C. Ameta
Department of Chemistry, Paher University, Udaipur-313024, India

Photocatalysis: A promising technology

The whole world is facing two major problems. These are water & air pollutions and scarcity of energy resources. Both these problems can be resolved to a greater extent by using an emerging material, a photocatalyst. The problem of water pollution can be solved by photocatalytic material as an oxidant while energy crisis can be solved using it as a reductant. This material has a beauty that it can act as an oxidant as well as a reductant using electron-hole pair generated by its exposure to light. Majority of organic pollutants can be oxidised to small harmless or non-toxic products, while carbon dioxide in the air can be reduced to some synthetic fuels like formic acid, formaldehyde, methanol and methane. The photocatalytic activity of material can be enhanced by doping, composite formation, sensitization, use of co-catalyst, Z-scheme, etc.

Biography

Prof. Suresh C. Ameta obtained his Masters Degree from University of Udaipur and was awarded Gold Medal-1970. He obtained Ph.D. degree from Vikram University in 1980. He has served as Professor and Head, Department of Chemistry, North Gujarat University Patan (1994) and M. L. Sukhadia University, Udaipur (2002-2005) & Head, Department of Polymer Science (2005-2008). He also served as Dean, P.G. Studies for a period of four years (2004-2008) in M. L. Sukhadia University, Udaipur and Dean, Faculty of Science, PAHER University. Now, he is serving as, Professor of Eminence (Distinguished Professor), Faculty of Science, PAHER University, Udaipur. Prof. Ameta has an experience of around 50 years of Teaching and Research. He has successfully guided 102 students for Ph. D. Prof. Ameta has occupied the prestigious position of President, Indian Chemical Society, Kolkata (2000-2001) and is now lifelong Advisor. He was awarded a number of prizes during his career like National prize twice for writing Chemistry books in Hindi, Prof. M. N. Desai Award, Prof. W. U. Malik Award, Scientist of the Year Award, National Teacher Award, Prof. G. V. Bakore Award and above all, the Life Time Achievement Awards by Indian Chemical Society (2011), Kolkata Indian Council of Chemists, Agra (2015) and Association of Chemistry Teachers, Mumbai (2018). Dr. Ameta has more than 400 research papers and 36 books to his credit. He has contributed Chapters in Books published by Trans-Tech, Switzerland, Nova Science, Taylor & Francis, Elsevier, Springer, and Apple Academic Press, USA. He has twelve books to his credit; including Green Chemistry, Microwave Assisted Organic Synthesis and Solar Energy Conversion & Storage, Group Theory, Photocatalysis, Solar Energy Conversion & Storage, Advanced Oxidation Processes for Waste Water Treatment and Sonochemistry all from International Publishers, USA. Indian Chemical Society, Kolkata has published a Special issue of the Journal of Indian Chemical Society on his Sixtieth Birthday in 2008 and also instituted a National Prize in his honor as Prof. Suresh C. Ameta Award to be given to a Senior Scientist of the country from 2003 onwards.



Asif Zaidi
University of Waterloo, Canada

Hydrogen molecule: Estimation of ground and excited electronic states

Considering electron Compton wavelength associated with the mass of an electron as a basic unit of length for atomic and molecular systems one can estimate electronic energy levels of atomic and molecular systems by simple consideration of the atomic or molecular bound state as a standing wave. This investigation is about the calculation of both ground and excited electronic energy levels of hydrogen molecules accurately without complex quantum mechanical calculations based on the particle model. Predicted molecular electronic energy levels are obtained by a simple multiple of atomic ground state number of Compton waves. As hydrogen is now part of environmentally safe fuel research, simple and accurate investigation of its ground and excited states is useful. This paper establishes molecular energy level calculations using well-known corresponding atomic parameters.

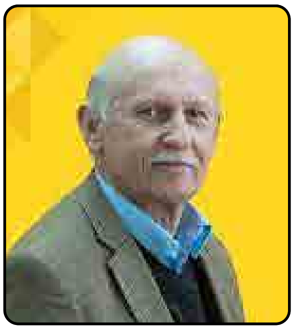
Audience Take Away Notes

- Compton wavelength of an electron is a natural unit of length for the scale of atomic and molecular systems.
- Bohr-like molecular electronic energy levels can be calculated for hydrogen molecule in a close form.
- The fine structure constant $'\alpha'$ emerges naturally as a ratio of electron Compton wavelength and de Broglie wavelength of an electron in the same orbit.

$$\alpha = \frac{\lambda_e}{\lambda_D} = \frac{1}{137}$$

Biography

Dr. Asif Zaidi studied Laser Science at the Physics department of the University of Waterloo in Canada. He completed his Ph.D. in 2010. His Doctoral research involved studying Laser-Matter interactions of carbon-based materials and resulting polyyne formation. He published a chemical reaction mechanism in the laser field for polyyne formation in 2019 as a conclusion of experimental studies. He also worked on laser Ablation of sold materials as a post-doctoral researcher. He taught Physics after his post-doctoral study while keeping research contact with his Laser Laboratory at the University of Waterloo as an Adjunct Faculty. His present work is theoretical about the electronic energy estimation of hydrogen and hydrogen-like molecules. This is an effort to simplify difficult quantum mechanical molecular calculations using a particle wave approach. Using Compton electron wavelength, he published his ground state calculations for the first group of elements. This topic was published in the Journal of Material Science and Engineering in 2023. Dr. Zaidi is a distinguished professional and academic associated with the University of Waterloo, based in Canada. With a profound commitment to excellence in both research and education.



Dr. Carlos Camurri*, Yasmin Maril

Department of Materials Engineering, University of Concepcion, Concepcion, Chile

Superficial grain refinement of 316l stainless steel by rolling with rough rolls

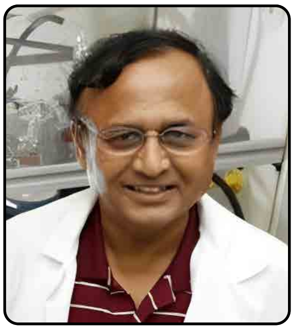
This study presents a novel approach to producing superficial micro- and nanostructures using a cold rolling process with rough rolls, followed by low-temperature annealing. The proposed technique attempts to recreate the superficial deformation occurring in the sandblasting process. It allows for the generation of an inhomogeneous network, or tangle, of high-deformation zones on the material's surface that act as nucleation centers during the subsequent annealing process. However, the proposed method has a significant advantage over sandblasting: it is a continuous process with high productivity. An austenitic stainless steel sheet, previously normalized, was used as the raw material. The samples were cold rolled using rough rolls (rhombic-based pyramids of 2.08 mm, 1.04 mm, and 1.5 mm in length, wide, and height, respectively) and annealed at temperatures between 200°C and 400°C for one hour. An optical and electronic microstructure analysis showed the presence of small, heterogeneously distributed surface grains of 200–300 nm in diameter. Finite element analysis revealed significant deformation that was inhomogeneous and likely responsible for the uneven distribution of the recrystallized grains. Additionally, surface nanohardness results showed a 20% increase with respect to the central zone of the material. Finally, wear tests of the treated samples showed lower wear than samples rolled with conventional rolls.

Audience Take Away Notes

- This work can be useful for others researchers who are working on the subject
- Provide an new alternative that could make a designer's job more efficient
- Improve the accuracy of a design and provide new process and information to assist in a design problem

Biography

Carlos Camurri is aMetallurgical Engineer, Master and Doctor Science in Metallurgy by University of Concepcion, Chile. Full Professor and former Director of PhD Program in Materials Science and Engineering and of the Materials Engineering Department at the Faculty of Engineering of the University of Concepcion.His research are related to mechanical characterization of materials and metal forming. He has 70 publications, 130 participations in congress, two books (Solids Mechanics and Metal Forming) and two patents (a process to improve working life of lead base anodes for copper electrowinning and a new method to determine H2 content on steel). He was Director of the Chilean Society of Materials and Metallurgy and a member of ANID, organization of the Chilean government in charge of founds for research grants.



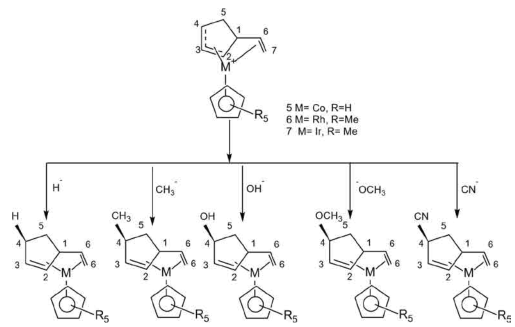
Dr. A. K. Fazlur Rahman[1,2]*, Martin A. Bennett[1], Zaheer Masood[2], BinWang[2]

[1]Research School of Chemistry, The Australian National University Canberra, A.C.T. 2601, Australia

[2]Department of Chemical, Biological and Material Engineering, University of Oklahoma, Norman, Ok 73019

Nucleophilic addition reactions to d9 metal (Co, Rh, Ir) stabilized carbocations: Reactions of [M(η5-C5R5) (η2vinyl -η3cyclopentenyl)]+ with Nu- (OH-, CN-, OMe-, CH3-)

Nucleophilic addition reactions to metal stabilized carbo-cations, such as, [(η5 -C5R5) (η2vinyl η3-cyclopentenyl)] +salts with various nucleophiles such as LiAlH4, MeLi, KCN, NaOMe, exclusively yields functionalized η2-vinyl η2-cyclopentene complexes, as the addition products in 70-80% yield. These neutral nucleophilic addition products complexes are readily soluble in cyclohexane and ether. Nucleophilic addition reactions to cationic [(η5 -C5R5) (η2-vinyl η3-cyclopentenyl)]+ are regio-selective and preferentially attacked the π-allyl unit not the π-vinyl unit of the carbocation fragment, seemingly followed the Davis, Green, Mingos rule, with a decrease by one unit of the hapticity of the ligand for example: η3 -allyl to η2 -olefin. The position of hydride attack was identified by reaction with LiBD4 and the Nu- appears exclusively to add in C4 carbon of the allylic unit with an exo attack with respect to the metal center suggesting a charge control pathway. DFT calculations were used to compare the nucleophilic reactivity of the coordinated vinyl cyclopentenyl cations coordinated to d9 metals going from 3d Co, 4d Rh and 5d Ir. All systems prefer exo attack at C4 position of the allylic cation, where the nucleophile prefers an attack to the allylic carbocation, from the opposite site of the metal fragment to minimize steric hindrance.



8a M= Co, R=H 8 b M= Co, R=H 8 c M= Co, R=H 8d M= Co, R=H 8 e M= Co, R=H

9 a M= Rh, R=Me 9 b M= Rh, R=Me 9c M= Rh, R=Me 9d M= Rh, R=Me 9e M= Rh, R=Me

10a M= Ir, R= Me 10b M= Ir, R= Me 10c M= Ir, R= Me 10 d M= Ir, R= Me 10e M= Ir, R= Me

Biography

Dr. Fazlur Rahman did his MA in Chemistry from Brandeis university and a Ph.D. from the Australian National University in Canberra, Australia. He did his post-doctoral works at the university of Tasmania, Australia, at the Ames National Laboratory, USA and at the University of Oklahoma, USA. Dr. Rahman is the recipient of Southwest ACS regional Award in 2009, and the Oklahoma Chemist award in 2015. Dr. Rahman held visiting faculty positions at Texas A&M, University of Rochester, Cal-Tech, UC Berkeley, Free University of Berlin and Fried Schiller University, Rutgers University and at the Columbia University in NYC. He currently holds an endowed professorship and Sharkey's Energy Foundation Chair in Chemistry at the Oklahoma School of Science and Mathematics. Rahman also worked as an affiliated Professor of Chemistry and Chemical Engineering at the with the University of Oklahoma where he teaches Organic chemistry as an adjunct Professor.

Prof. Zakaria Boumerzoug
Department of Mechanical Engineering, LMSM, University of Biskra, Biskra, Algeria

Friction welding of dissimilar metallic materials

Welding is an essential assembly process in the manufacturing industry. Friction welding is a process that is becoming more and more widely used because it is an environmental process. This process is based on friction between the parts to be welded. Likewise, this process is divided into three types of welding and which are linear friction welding, rotational friction welding and friction stir welding. One of the advantages of this process is that it is used in joining dissimilar metals such as welding steel with an aluminum alloy. Despite the number of dissimilar metals welded by friction, it was noted that this number remains limited because certain challenges remain to be overcome to achieve a weld joint with good mechanical properties. This is why several research projects are being carried out to answer all the questions that require solutions.

Audience Take Away Notes

- The public will be able to know this type of welding
- Engineers can know the types of friction welding which is a modern welding process
- Research in the field of friction welding of dissimilar metals is current. Moreover, it can be taught in the course related to metal welding
- Friction welding solves the problem of welding dissimilar metals using conventional methods such as electric arc
- Friction welding is an environmental process because it does not emit smoke like arc welding. In addition, the friction welded joint for certain dissimilar metals has good mechanical properties compared to the arc welded joint

Biography

Zakaria Boumerzoug is a professor at the Department of Mechanical Engineering at the University of Biskra. He was the head of the mechanical engineering department at the University of Biskra from 1998 to 2004 and head of the metallurgy department at the University of Biskra from 2004 to 2009. Teacher at the University of Biskra, from 1992 until our days. It has organized one international conference and 11 national conferences and workshops. He is responsible for doctoral training in metallurgy. He supervised more than 30 doctoral students. He has published more than 90 research articles, one book (Metallic materials and their industrial applications), two book chapters, and edited one book (Advanced Materials Design and Mechanics) in the field of materials science. He has a patent. He led 10 national scientific projects and one international project with the University of Mons (Belgium). He has been a member and guest editor of some international conferences. He has participated in more than fifty international conferences as a participant (with poster and oral presentations) and also as guest speaker. He is guest editor of the special issue on surface treatments.

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We wish to meet you again at our upcoming events in 2024...”

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