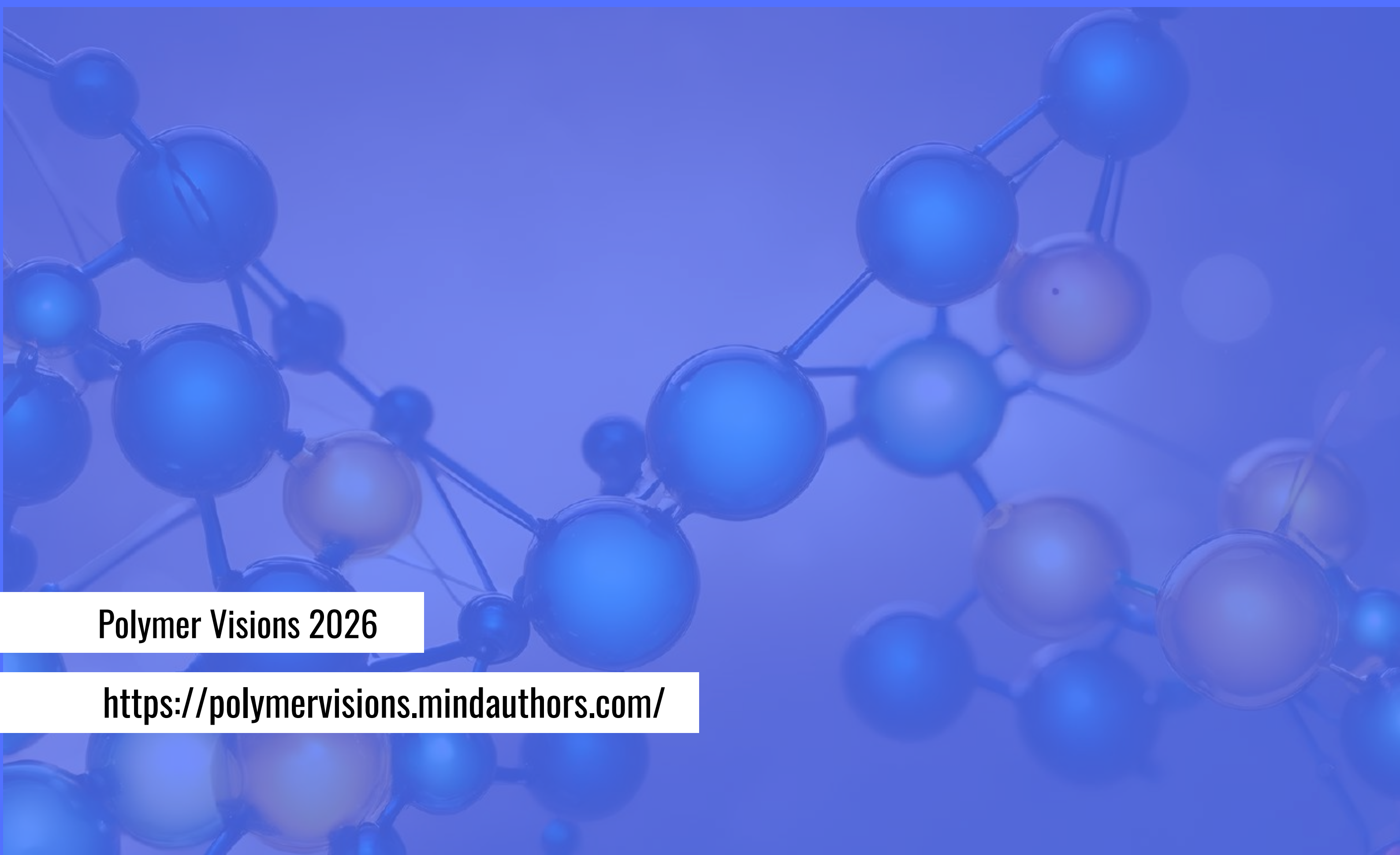
Theme:

"Advancing Emerging Innovations and Frontiers in Polymer Science and Engineering"

2nd International Conference on

POLYMER SCIENCE & ENGINEERING

June 15-16, 2026 | Fairfield by Marriott Bali Legian, Bali



Polymer Visions 2026

https://polymervisions.mindauthors.com/

DAY 1 Monday June 15 2026

09:00 - 09:30	Onsite Registration & Seating Arrangement	
09:30 - 10:00	Introduction & Open Ceremony	
Plenary Presentation		
10:00 - 10:30	**Prof. Md Mainul Islam** University of Southern Queensland, Australia	Sustainable Macadamia Nutshell-Based Particulate Composites: Unlocking Mechanical Performance and Structural Application Potential
10:30 - 11:00	**Prof. Koji Matsuoka** Saitama University, Japan	Synthetic Assembly of a Series of Glycopolymers for Evaluations of Lectin—Carbohydrate Interactions
11:00- 11:20 Refreshment and coffee		
Keynote Presentation		
11:20 - 11:45	**Prof. Dr Thomas Walther Schmidt** (Ms. Qingyu Yang) Huafeng New Material Co, Ltd., China	Sustainable HAPTIC 3D Textile Coatings
11:45 - 12:10	**Prof. Leelakrishna Reddy** University of Johannesburg, South Africa	Optimized UV-B and UV-A Emission in BaB_8O_{13} Compounds: Tailoring Gd^{3+} Doping With Pb^{2+}, Ce^{3+}, and Pr^{3+} for Phototherapy Applications
12:10 - 12:35	**Prof. Elisabeth Djurado** University Grenoble Alpes, France	Innovative Nanostructured Oxygen Electrodes for Solid Oxide Cells
12:35 - 13:00	**Professor Ir. Ts. Dr. Hamidah Mohd Saman** Universiti Teknologi MARA (UiTM), Selangor, Malaysia	Fire Resistance of Composite Insulated Strengthened Carbon Fibre Reinforced Polymer (CFRP) Reinforced Concrete (RC) Column
Memorable Group Photo & Selfie		
13:00 - 13:45 Tempting Buffet Lunch & Photo Session		
Oral Presentation		
13:45 - 14:05	**Dr Eva Scholtzova** Slovak Academy of Sciences, Slovakia	Small Pollutants Adsorbed by Defective Graphene
14:05 - 14:25	**Prof. Tao Yi** Donghua University, China	Activatable Nano Systems for Diagnosis and Treatment
14:25 - 14:45	**Dr. Yongsheng Chen** Nankai University, China	High Performance OPV Molecules and Devices
14:45 - 15:05	**Prof. Kimihisa Yamamoto** Institute of Science Tokyo, Japan	Synthesis of Multi-metallic Nanoparticles Using a Dendrimer Reactor
Slots available		
15:05 - 15:25 Refreshment and coffee		
Oral Presentation		
15:25 - 15:45	**Prof. Valeri Barsegov** University of Massachusetts, USA	Dynamic Force Spectroscopy in Silico: Exploring Strength, Deformability, Toughness and Mechanical Fatigue of Biological Nanoparticles
15:45 - 16:05	**Dr. Aleksandra Lobnik** University of Maribor, Slovenia	Nano Based Sensors
16:05 - 16:25	**Dr. Mohammad A Obeid** Ras Alkhaimah, UAE	Lipid Nanoparticles Formulations: from Bench Scale to Industrial Scale
16:25 - 16:45	**Prof. Katarzyna Falkowicz** Lublin University of Technology, Poland	Thermo-Mechanical Stability Analysis of Thin-Walled Composite Profiles With Selected Mechanical Couplings

*****End of Day 1 Conference*****

DAY 2 Tuesday June 16 2026

09:30 - 10:00	Onsite Registration & Seating Arrangement	
Plenary Presentation		
10:00 - 10:30	**Prof. Olivier Bonnaud** University of Rennes, France	The Need for Innovation in Nanotechnology Training to Meet The Future Energy and Sustainability Challenges of The Digital World.
Keynote Presentation		
10:30 - 10:55	**Dr.Xing-Jie Liang** National Center for Nanoscience and Technology of China, China	Nano Pharmaceutical Drug Carriers for Controllable Delivery and Release In Vivo
10:55 - 11:15 Refreshment and coffee		
Keynote Presentation Cont......		
11:15 - 11:40	**Prof. Tyson York Winarski** Arizona State University, USA	Strategic Protection of Nanotechnology with Intellectual Property
11:40 - 12:05	**Dr. Atsushi Kajiwara,** Nara University of Education, Japan	Clarification of Elementary Processes of Radical Polymerizations using Electron Spin Resonance (ESR/EPR) Spectroscopy in Various Media
12:05 - 12:30	**Prof. Isabel Gouveia** University of Beira Interior, Portugal	From Fossil to Biobased Nanofibers: The Role of Circular Bioeconomy in Transforming the Textile industry
12:30 - 12:55	**Prof. Annie K. Powell** Karlsruhe Institute of Technology (KIT), Germany	The Power, Beauty and Magic of Coordination Clusters for the Development of Materials Science
Memorable Group Photo & Selfie		
12:55 - 13:40 Tempting Buffet Lunch & Photo Session		
Oral Presentation		
13:40 - 14:00	**Prof. Martin Bolduc** Université du Québec à Trois-Rivières, Québec, Canada	Photonic Processing for Flexible Hybrid Electronics (FHE)
14:00 - 14:20	**Prof. Masahiro Furuya** Waseda University, Japan	From Industrial Disaster to Material Processing - Control Technology of Vapor Film
14:20 - 14:40	**Prof. Maria Giovanna Buonomenna** Ministero dell'Istruzione e della Ricerca Scientifica (MIUR), Italy	Nanostructured Polymer Membranes for Gas Separation
14:40 - 15:00	**Mr. M Qasim Khan** Aligarh Muslim University, India	Selective Delivery Employing Targeted Multifunctional Nanoparticles: Potential as a Possible Prophylactic Tool in Management of Fibrosarcoma in Model Animals
15:00 - 15:20	**Prof. Giada Gasparini** University of Bologna, Italy	Innovation in Structural Design Through Metal 3D Printed Lattice Elements

15:20- 15:40 Refreshment and coffee

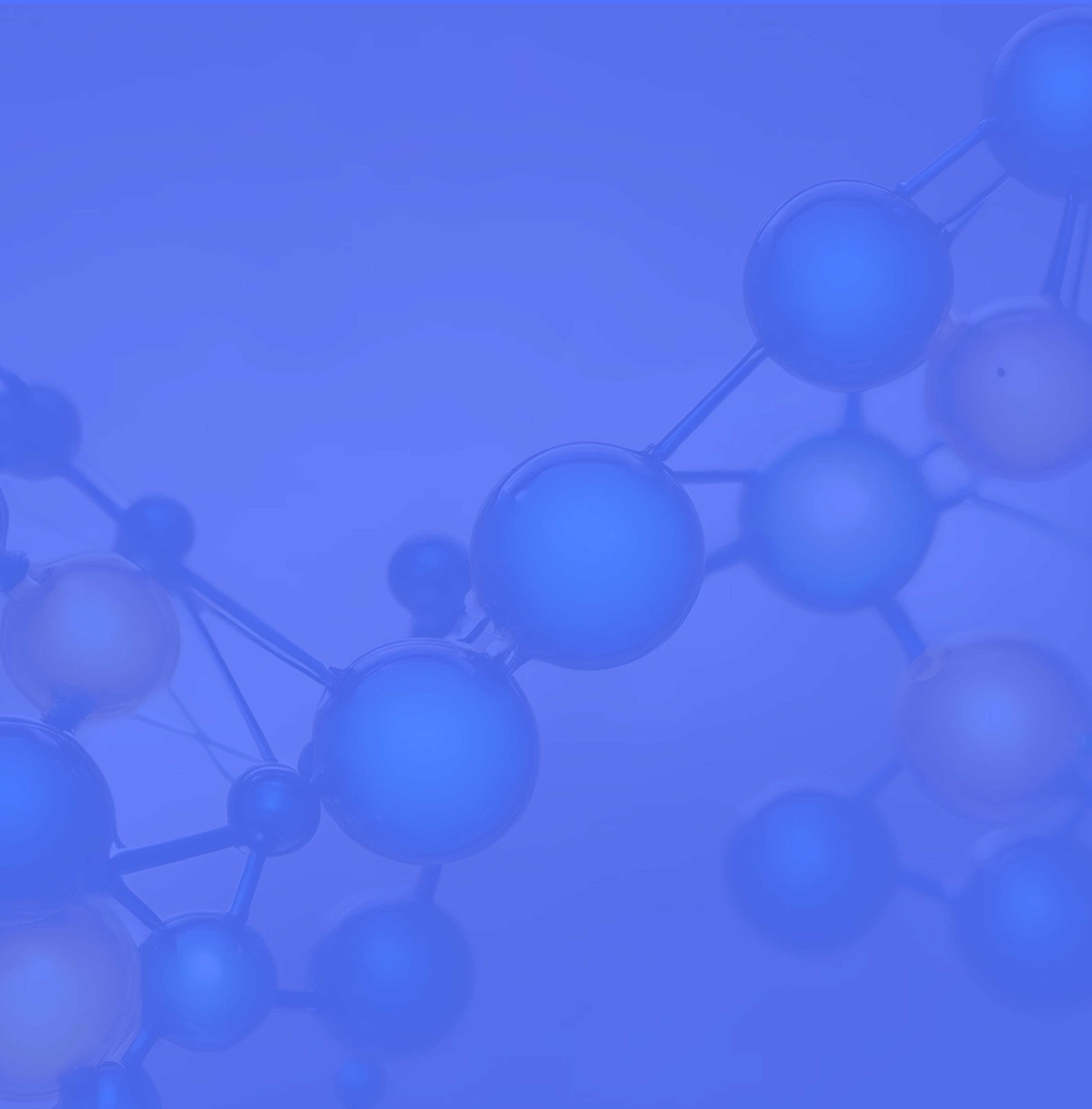
Poster Presentation (15:40 - 16:10)

MM01	**Prof. Hubert Debski** Lublin University of Technology, Poland	Numerical and Experimental Study of the Stability and Load-Carrying Capacity of the Compressed Composite Profiles With Closed Sross-Setctions
MM02	**Prof. Pawel Wysmulski** Lublin University of Technology, Poland	Influence of Central Hole on the Buckling and Post-Buckling Response of CFRP Laminate
MM03	**Dr. Laura Floroian** Transilvania University of Brasov, Romania	Functionalized Antimicrobial Films Based on Antibiotic Imbedded in Bioactive Glass Matrix for Implants Coating
PV01	**Dr. Bhavika Bhatia** Shiv Nadar Institution of Eminence, India	Energy-Efficient and Scalable Benzoxazine Polymeric Platform for Photocatalytic Hydrogen Peroxide Generation
PV02	**Ms. Viranchika Bijalwan** University of Petroleum and Energy Studies (UPES), Dehradun, India	Bio-Based Thiol-Acrylate Vitrimers For Light-Based 3D Printing of Soft Active Materials
MM04	**Prof. Dae-Woon Jeong** Changwon National University, Korea	Pore-Engineered Ni/Al_2O_3 Catalysts for High-Performance CO_2 Reforming
MM05	**Ms. Hamna Jameel** Aligarh Muslim University, India	Plant Extract Mediated Bio-Fabrication of Chromium-Manganese Nanocomposite and its Anti-Biofilm Potential Against Some Important Bacteria
MM06	**Dr. Swaleha Zubair** Aligarh Muslim University, India	Amphotericin B Nano-Assemblies Circumvent Intrinsic Toxicity and Ensure Superior Protection in Experimental Visceral Leishmaniasis with Feeble Toxic Manifestation`

*****End of Day 2 Conference*****

Notes:

9450 SW Gemini Dr
Suite 71868
Beaverton, Oregon 97008 US



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Plenary Presentation

DAY - 1

Sustainable Macadamia Nutshell-Based Particulate Composites: Unlocking Mechanical Performance and Structural Application Potential

Md Mainul Islam

School of Engineering and Centre for Future Materials, University of Southern Queensland, Toowoomba, QLD 4350, Australia

The quest for sustainable alternatives to conventional structural materials has become central to both engineering innovation and environmental stewardship. Among emerging bio-resources, the macadamia nutshell, a high-density, hard, and abundant agricultural by-product, offers unique promise as a reinforcing filler in polymer composites. In this plenary presentation, I will showcase our systematic investigation into macadamia nutshell (MNS)-based particulate composites fabricated with epoxy and vinyl ester matrices. Through comprehensive mechanical testing (compressive, tensile, flexural) and microstructural analysis, we demonstrate that composites containing 10–20 wt.% MNS achieve optimal strength-to-weight ratios, with flexural strength enhancements of up to 15% over neat resins. Beyond performance metrics, I will discuss how these composites embody principles of circular economy and resource efficiency, positioning them as competitive alternatives to timber and synthetic composites. The findings highlight scalable opportunities for eco-construction, green infrastructure, and next-generation structural applications. More broadly, this research underscores the transformative role of agricultural by-products in addressing global sustainability challenges, turning waste into value, and advancing the future of smart and sustainable composites.

Biography:

Associate Professor Dr Md Mainul Islam is an academic in Mechanical Engineering with specialisation in Composite Materials in the School of Engineering at the University of Southern Queensland (UniSQ), Australia. He also belongs to the Centre for Future Materials at UniSQ for conducting research. He completed his PhD in Mechanical Engineering at the University of Newcastle, Australia. He is a graduate and also former Assistant Professor in Mechanical Engineering of Khulna University of Engineering & Technology (KUET), Bangladesh. He got Master degree in Structural Engineering from Kyushu University, Japan. His current research interests are in the areas of smart and sustainable composites and shape memory polymeric materials especially for infrastructure and biomedical applications. He has over 170 research publications based on his research outcomes. He has been able to secure a total of over $1.5M research funding jointly and individually during his academic career so far. He has supervised over 15 PhD students to their completion. He possesses editorial roles in several renowned journals and chairs Technical Committees for several international conferences. He is a Fellow (FIEAust) and Chartered Professional Engineer (CPEng) of Engineers Australia and a Fellow of Materials Australia (CMatP). He is also a Higher Education Senior Fellow of Advance HE (SFHEA) based in UK.

Synthetic Assembly of a Series of Glycopolymers for Evaluations of Lectin—Carbohydrate Interactions

Koji Matsuoka

Division of Material Science, Graduate School of Science and Engineering; [2]Medical Innovation Research Unit (MiU), Advanced Institute of Innovative Technology (AIIT); [3]Health Sciences and Technology Research Area, Strategic Research Center, Saitama University, Sakura, Saitama 338-8570, Japan

Glycoproteins, glycolipids, and proteoglycans are known as glycoconjugates and these are generally existing on cell surfaces. In biological events, the glycoconjugates play roles not only as carriers of information in cell-cell interactions but as markers of cellular differentiation, aging, malignant alteration, and so on. The oligosaccharide chains of glycoconjugates are, therefore, the third chains of biomacromolecules next to nucleic acids and proteins. Since the saccharide chains have highly complex structures, functions of the glycoconjugates were not completely investigated.

Affinity of a monomeric saccharide chain against the appropriate protein, such as a carbohydrate-binding protein, a lectin and an enzyme, is not so high, usually in the mM range. In the 70’s, Lee reported remarkable enhancement of the binding affinity by means of multivalent-type sugar substrates, so-called “sugar clustering effect”.[1)] The clustering effect has been expanded to other bioactive substances.[2)]In this presentation, our recent progress on design, synthesis, and biological evaluation of our multivalent-type substances will be discussed.

1) Y.C. Lee, et al., J. Biol. Chem. 1983, 258, 199.
2) Y. Komano, et al., Biomacromol. 2025, 26, 3021.

Biography:

Dr. Koji Matsuoka is a Professor of Material Science, Graduate School of Science & Engineering, Saitama University (SU), Saitama, Japan.He received a bachelor’s degree from Seikei University in 1990 and a Ph.D. from Hokkaido University (with Prof. S.-I. Nishimura) in 1995. He did his postdoctoral research at RIKEN, Saitama, Japan. He joined the Department of Functional Materials Science, Faculty of Engineering, Saitama University in 1995 as an assistant professor and was promoted as an associate professor in 2001 and professor in 2011. He has published more than 150 research articles and book chapters in the fields of organic chemistry and polymer chemistry.

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Keynote Forum

DAY - 1

Sustainable HAPTIC 3D Textile Coatings

Thomas W. Schmidt & Qinyu Yang
Huafeng New Material Co, Ltd., Key Lab for Sport Shoes Upper Materials of Fujian Province

A new HAPTIC 3D textile coating technology will be presented. Amazing new surface effects for athletic footwear upper materials could be achieved while matching or exceeding all the harsh requirements of high performance footwear. Special attention will be put on the sustainability of resulting products and efficiency in production. With HAPTIC technology a significant change in supply chain could be achieved leading to more lean component manufacturing and traceable accountability. With the HAPTIC technology 3D printing could be transferred into mass production of many millions of shoes. New digital application technologies for printing waterborne PUD chemistry was developed. Beside of the actual technology a more general view on sustainability will be presented. The new concept of long and short term CO2 cycles will be discussed defining priorities for future developments. Instead of focusing of biodegradable or so called bio-materials it is suggested to focus on long term CO2 cycles and developing technologies for capturing CO2 and keeping it captured. The focus on climate change and CO2 emission will lead to a totally different point of view on sustainability and material and process development.

Biography:

Dr. Schmidt holds a PhD degree in Chemistry and Material Science from the University of Wuerzburg in Germany. After a postdoc in Durham, UK he started his industrial career at adidas in China. Later he developed his career at TIGER Coatings in Austria leading an international coatings and printing innovation team. His expert knowledge of coating chemistry and technology lead him back to the textile industry in China where he created the HAPTIC coating technology for athletic footwear. His interdisciplinary and multi-cultural approach to technical challenges lead to numerous patents and publications.

Optimized UV-B and UV-A Emission in BaB_8O_{13} compounds: Tailoring Gd^{3+} Doping with Pb^{2+}, Ce^{3+}, and Pr^{3+} for Phototherapy Applications

Prof Leelakrishna Reddy
Department of Physics, University of Johannesburg, Gauteng, South Africa

We present an intriguing scenario involving a wide band gap (4.3 to 4.5 eV) semiconducting material, BaB_8O_{13}, which serves as an ideal host for embedding rare-earth ions such as gadolinium (Gd^{3+}). Gd^{3+} ions typically require high excitation energy, generally above 250 nm, to transition from their ground state to a higher excited state. BaB_8O_{13} is particularly well-suited for this purpose as it can effectively absorb energy and transfer it to the embedded Gd^{3+} ions, resulting in emissions in the UV-B range around 311 nm. To further enhance emissions at approximately 311 nm, the host material can be co-doped with sensitizers such as Pb^{2+}, Ce^{3+}, and Pr^{3+}. These sensitizer ions absorb the excitation energy and transfer them non-radiatively to the Gd^{3+} ions, thereby amplifying the emissions in the UV-B range. This process controls the efficient energy transfer mechanisms between the host lattice and the embedded ions, which is crucial for maximizing the emission intensity. These UV-B and UV-A emissions are particularly significant for phototherapy, as they fall within the action spectrum for the treatment of various skin conditions such as psoriasis and vitiligo and many more. Additionally, the ability to fine-tune the emission properties through co-doping strategies with Gd^{3+} as a UV-B emitting source opens possibilities for optimizing the material for specific therapeutic applications. The development of such materials could lead to more efficient and targeted phototherapeutic treatments, reducing exposure times and improving patient outcomes.

Biography:

Prof. L. Reddy is a distinguished physicist who earned his PhD in Physics from the University of Johannesburg, South Africa. With a strong foundation in condensed matter physics, he has established himself as an authority in the fields of energy materials, gas sensing technologies, and perovskite-based systems. His early research focused on the magnetic properties of bulk materials, which later evolved into an exploration of the luminescent and electronic properties of nano-structured and perovskite materials. These investigations have significant implications for next-generation batteries, high-performance gas sensors, and advanced optoelectronic devices.

Prof. Reddy's research bridges fundamental physics with practical innovation, particularly in energy storage and conversion, photoluminescent materials, and nanoscale surface interactions. His scholarly excellence and impactful contributions have earned him recognition as an NRF-rated scientist in South Africa. A sought-after speaker at international conferences, he is frequently invited to deliver keynote and plenary lectures on emerging trends in nanotechnology and materials science. Recently, he was appointed as an Extraordinary Distinguished Professor of Physics at the University of the Western Cape, further cementing his role as a leading figure in advancing sustainable materials research and technology innovation.

Innovative Nanostructured Oxygen Electrodes for Solid Oxide Cells

Elisabeth Djurado
Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP, LEPMI, 38000 Grenoble, France

This talk aims to design novel optimized oxygen electrodes with improved mixedionic-electronic properties to be used as more efficient oxygen electrodes in SOCs operating at about 700°C. Indeed, it is of high importance to control the electrode microstructure and composition to obtain large surface areas. These properties are essential to increase the number of active sites for the ORR/OER and to enhance the ionic transfer at the electrode/electrolyte interface.

Recent advances in the design of the state-of-the-art $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$, $La_{2-x}Pr_xNiO_{4+\delta}$, with $0 \leq x \leq 2$, and PrOx oxygen electrodes are reported with grain size and porosity at the nanometer length scales. These active functional layers are fabricated using electrostatic spray deposition, a unique bottom-up method capable of depositing films with porous morphologies by a nano-texturing approach.

The latest electrochemical performance results of these innovative oxygen electrodes will be shown, investigating the role of the nanostructure and the electrode/electrolyte interface. The correlation between microstructure, composition, grain size, interfaces, and electrochemical properties is discussed in detail.

To conclude, the suitability of these mixed ionic and electronic conductors (MIEC) with innovative and controlled microstructure as durable air electrodes for SOECs has been proven to be promising.

Biography:

Elisabeth Djurado is a Full Professor of Materials Scienceat the Institute of Engineering Univ. Grenoble Alpes,France, since 1990. She studied Chemistry at the University of Clermont-Ferrand, France. Throughout her career, she was a research scholar at the University of Pennsylvania, US (1989-1990) in the domain of superconductors. Her main interests in Laboratoire d’Electrochimie et de Physico-chimie des Matériaux et des Interfaces include the elaboration and the structural/microstructural/electrochemical investigations of ceramics and interfaces for solid-state ionics and especially for solid oxide cells at intermediate temperature. She has published more than 130 papers in international peer-reviewed journals (h=33, Web of Science) and she has directed 20 PhD theses.

Fire Resistance of Composite Insulated Strengthened Carbon Fibre Reinforced Polymer (CFRP) Reinforced Concrete (RC) Column

Professor Ir. Ts. Dr. Hamidah Mohd. Saman and Afifudin Habulat

Low Carbon and Building Materials Research group (LoCBIM), Faculty of Civil Engineering, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor, MALAYSIA*

Faculty of Civil Engineering, Universiti tekbologi MARA, Cawangan Pulau Pinang, Permatang Pauh Campus, 13500, Pulau Pinang, MALAYSIA

This study investigates the fire performance of carbon fibre reinforced polymer (CFRP)-strengthened reinforced concrete (RC) columns insulated with a novel eco-friendly composite mortar. The The insulation, consisting of 20% expanded perlite aggregate (EPA) and 30% ground granulated blast furnace slag (GGBS), was applied in two configurations: CI1 and CI2, with CI2 additionally incorporating 0.5% polypropylene (PP) fibres to enhance fire resistance. Three full-scale RC column specimens (200 mm × 200 mm × 2640 mm) were tested under ASTM E119 standard fire conditions. The control specimen (C3) was strengthened with CFRP but without insulation, while specimens C4 and C5 were insulated with CI1 and CI2, respectively. Fire resistance times of 98 and 86 minutes were recorded for C4 and C5, respectively, compared to 78 minutes for the uninsulated control (C3). The insulated specimens exhibited significantly delayed heat penetration and improved thermal stability, with C5 showing a constant axial deformation for up to 20 minutes under sustained load. A finite element (FE) model was developed to simulate heat transfer and structural response, which showed strong agreement with the experimental results. The model also identified an optimal insulation thickness of 50 mm, offering effective thermal protection while maintaining constructability. The study demonstrates that the proposed insulation system, incorporating recycled and lightweight materials, offers a sustainable and practical solution for enhancing the fire resistance of CFRP-strengthened RC column, addressing a key limitation of CFRP materials in high-temperature conditions.

Biography:

Professor Ir. Ts. Dr. Hamidah Mohd. Saman is a Professor of Civil Engineering at Universiti Teknologi MARA (UiTM) and a Professional Engineer registered with Board of Engineers Malaysia (BEM). She holds a Ph.D. from the University of New South Wales, Australia. Her research focuses on concrete, polymer composite in construction, including high-performance concrete, self-healing and bio-concrete, and fire-resistant materials. She has published over 300 papers and secured over RM2 million in research funding. Actively involved in professional bodies, she has served in key roles within the Concrete Society of Malaysia and ACI Malaysia Chapter. She has supervised 30 Ph.D. candidates, with 22 having successfully graduated.

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Scientific Session

DAY - 1

Small Pollutants Adsorbed by Defective Graphene

Eva Scholtzova[1]*, Daniel Moreno-Rodríguez[2], Hirotomo Nishihara[3,4]

[1] Institute of Inorganic Chemistry, Slovak Academy of Science, Dúbravská cesta 9, 84536 Bratislava, Slovakia
[2] Dipartimento di Ingegneria Meccanica e Aerospaziale, Sapienza Università di Rome, 00184 Roma, Italy
[3] Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai, 980-8577, Japan
[4] Advanced Institute for Materials Research, Tohoku University, Sendai, 980-8577, Japan

In the technological processes, a lot of small pollutants like CO_2 and NH_3 appear, having a massive impact on our environment. Remediation requests effective adsorbents, which minimise the presence of these small structures in nature and our everyday life. Many carbon-based materials are utilised as highly effective materials in remediation processes. One of them, graphene, as a 2D material, is characterised by a single layer of sp^2-hybridized carbon atoms arranged in a honeycomb lattice. It offers remarkable physicochemical properties, making it suitable for effective adsorption. These properties can be changed or influenced, e.g., by intrinsic and extrinsic defects (e.g. vacancies, dislocations or grain boundaries), which inevitably arise during synthesis. The presented study explores how specific topological defects, e.g., formations of pentagonal, heptagonal, and octagonal rings, impact graphene’s electronic structure and adsorption behaviour regarding small molecules like CO_2 and NH_3.

The density functional theory (DFT) method was used for the study of the adsorption properties of pristine graphene and graphene with the presence of topological defects for the small molecules mentioned above. Theoretical modelling elucidated the influence of the examined defects and the mutual orientation of surface and adsorbed molecules on the adsorption effectiveness of this carbon-based material [1].

Acknowledgement: Funded by the EU Next Generation EU through the Recovery and Resilience Plan for Slovakia under project No. 09I03-03-V04-00009.

[1] D. Moreno Rodriguez, E. Scholtzova, H. Nishihara, Mater. Chem. Front., (2025)

Biography:

Dr. Eva Scholtzova has a PhD in physical chemistry. She works in the Department of Theoretical Chemistry at the Institute of Inorganic Chemistry, Slovak Academy of Sciences in Bratislava, Slovakia. Her group studies by molecular modelling and computational methods mainly inorganic layered structures (clay minerals, graphene, and the hybrid structures based on them) because the advanced materials prepared by modifying these structures are widely used for their unique properties applicable in green chemistry, wastewater and soil treatment, and drug carriers as effective adsorbents.

Activatable Nano Systems for Diagnosis and Treatment

Tao Yi*, Peng Wei, Linyan Liu, Chengcheng Wang

College of Chemistry and Chemical Engineering, Donghua University, Shanghai 201620, China

Malignant tumor (cancer) has become an important killer endangering national health. In the process of tumor treatment, there are widespread problems such as poor targeting and low concentration of drugs in the tumor area, which not only affect the therapeutic effect, but also bring great systemic toxic side effects. Therefore, how to improve the targeting property of nanodrugs toward tumor tissues and further enhance the concentration and residence time of nanodrugs at tumor sites are the key problems need to be solved. We proposed to construct nanoaggregation systems activated in situ by utilizing the high expression characteristics of reactive oxygen species (ROS) unique to tumor environment. After activation, mild covalent chemical crosslinking segment could be released to achieve specific enrichment of nanomaterials at tumor sites. Based on this strategy, responsive nanomaterials and prodrug systems that could be specifically activated by ROS in the tumor microenvironment were developed to achieve efficient targeted treatment of in-situ tumors and metastases. Since ROS has deep relationship with some biological metal ions such as copper and iron, which can generate immune stress, this activation strategy was also used to effectively treat other diseases related to the immune response, such as the immune rejection in skin allograft model and Wilson's disease.

Biography:

Tao Yi, Professor, Ph. D. (Peking University). She joined Kyoto University as a JSPS postdoctoral fellow in the period of 1999-2001 and worked as a research fellow in University of Tokyo and Paris University (XI) (CNRS) from 2002 to 2004. After that she joined Fudan University and became a full professor in 2007. From 2021, she became a research leader in college of chemistry and chemical engineering, Donghua University. Her research interests focus on stimulus responsive functional materials, biosensors, imaging and therapy. She has authored 250 peer reviewed publications with more than 16000 citation. Her h-index is 68.

High Performance OPV Molecules and Devices

Yongsheng Chen

Nankai University, College of Chemistry, Tianjin 300071, CHINA

Among the high demanded green energy technologies, efficient utilization of sunlight energy would probably be the most important one. In this talk, state of the art results for photovoltaic technology using organic solar cell will be presented, particularly for their application for wearable devices. Some thoughts about their current status and future directions will be also discussed.

Biography:

Dr. Yongsheng Chen (陈永胜) graduated from the University of Victoria with PhD in Chemistry in 1997 with Prof Reg Mitchell and joined Prof Robert Haddon/Peter Eklund and Prof Fred Wudl groups for Postdoc studies from 1997-1999. From 2004, he has been a Chair Professor at Nankai University, Director for the Center of Nanoscale of Science and Technology. His main research interests include: Multifunctional Materials Based on Carbon Nanotubes and Graphene; Organic and Polymeric Functional Materials; Green energy devices using Graphene and Nanotubes, including OPV and Supercapacitor, etc. He has been selected as the highly cited scientist by Thomson Reuters for last over ten years (2014-2025).

Synthesis of Multi-metallic Nanoparticles Using a Dendrimer Reactor

Kimihisa Yamamoto

Institute of Science Tokyo, 4259 Nagatsuta, Yokohama 226-8503, Japan

Dendrimers are highly branched organic macromolecules with successive layers or “generations” of branch units surrounding a central core. Organic inorganic hybrid versions have also been produced, by trapping metal ions or metal clusters within the voids of the dendrimers. Their unusual, tree-like topology endows these nanometer-sized macromolecules with a gradient in branch density from the interior to the exterior, which can be exploited to direct the transfer of charge and energy from the dendrimer periphery to its core.

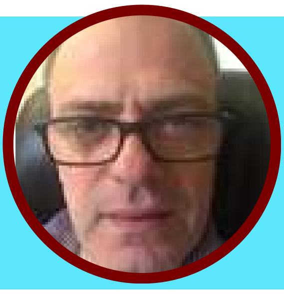
We show that $AuCl_3$, $SnCl_2$, $FeCl_3$, and so on complexes to the imines groups of a spherical polyphenylazomethine dendrimer in a stepwise fashion according to an electron gradient, with complexation in a more peripheral generation proceeding only after complexation in generations closer to the core has been completed. By attaching an electron-with drawing group to the dendrimer core, we are able to change the complexation pattern, so that the core imines are complexed last. By further extending this strategy, it should be possible to control the number and location of metal ions incorporated into dendrimer structures, which might and uses as tailored catalysts, building blocks, or fine-controlled clusters for advanced materials. The metal-assembly in a discrete dendrimer molecule can be converted to a size-regulated metal particle with a size smaller than 1 nm as a molecular reactor. Due to the well-defined number of metal clusters in the subnanometer region, its property is much different from that of bulk or general metal nanoparticles. The chemistry of nanocatalysts on the sub-nanometer scale is not yet well understood because precise multi-metallic nanoparticles are difficult to synthesize with control over size and composition. The template synthesis of multi-metallic sub-nanocalaysts is achieved using a phenylazomethine dendrimer as a macromolecular template.

REFERENCES

K. Yamamoto et al. Nature Rev. Chem., 5, 5, 338, 2021, Chem. Rev., 120, 2, 1397, 2020, Nature. Commun. 2018, 9, 3758, Nature. Commun. 2018, 9, 3873, Science Adv. 2017, 3, e1700101, Nature. Commun. 2017, 8, 688, Nature. Commun. 2017, 8, 749. Science Adv. 2016, 2, e1601414, Angew. Chem. Int. Ed. 2015, 54, 9810, Acc. Chem. Res., 2014, 47, 1127, Nature Commun., 2013, 4, 2581, J. Am. Chem. Soc., 2013, 135,13089, Angew. Chem. Int. Ed. 2013, 52, 7419, J. Am. Chem. Soc., 2012, 134, 8412, Nature Chem, 2009, 1, 397, Nature Nanotech., 2008, 2, 106., J. Am. Chem. Soc., 2007, 129, 9256., J. Am. Chem. Soc., 2005, 127(40), 13896., J. Am. Chem. Soc., 2005, 127(37), 13030., J. Am. Chem. Soc., 2004, 126(6), 1630., Nature, 2002, 415(6871), 509

Biography:

Kimihisa Yamamoto received PhD degrees from Waseda University in Polymer Chemistry in 1990. He joined the Department of Chemistry at Keio University from 1997 as professor. Currently, he is a professor in Tokyo Institute of Technology since 2010. His present research interests are in developing supra-metallomolecules for nanosynthesizers involving nanoparticles, subnanoparticles and superatoms.



Dynamic Force Spectroscopy in Silico: Exploring Strength, Deformability, Toughness and Mechanical Fatigue of Biological Nanoparticles

Valeri Barsegov
University of Massachusetts, Lowell, Massachusetts, USA

We outline new approaches to biomaterials structure modelling and high-, performance computing and present Fluctuating Nonlinear Spring model for describing mechanical deformation of biological nanoparticles. The model is applied to the protein nanoshells of bacteriophage P22, Human Adenovirus and Herpes Simplex viruses. These nanoshells are soft (~1-10-GPa elastic modulus) with low ~50-480-kPa toughness – a regime of material behavior that is not well understood, and with their strength increasing while their toughness decreasing with particle size. The nanoshells of bacteriophage P22, Human Adenovirus and Herpes Simplex virus are weakly ductile with deformations <10-20% of their size. Larger nanoparticles are more resilient and more plastic compared to smaller particles. A computational approach to “fatigue testing in silico” will be presented. This approach is applied to encapsulin nanocompartment, Cowpea Chlorotic Mottle Virus (CCMV) nanoshell, and microtubule (MT) filament to describe their damage-dependent biomechanics (strength, deformability, stiffness), thermodynamics (released and dissipated energies, enthalpy, entropy) and material properties (toughness). Thick CCMV and MT nanoparticles experience material fatigue due to slow recovery and damage accumulation, while thin encapsulin nanoshell shows little fatigue due to rapid remodeling and limited damage. The results challenge the existing paradigm: damage in biological nanoparticles is partially reversible; fatigue crack might heal; nanoparticles adapt to deformation amplitude and frequency to minimize the energy dissipated; and using crack size to quantitate damage is problematic as several cracks might form simultaneously. Fatigue testing in silico can be used to explore damage-induced changes in the material properties of other biological nanoparticles.

Biography:

Dr. Valeri Barsegov is Chemistry Professor at the University of Massachusetts, USA. He obtained his PhD degree from University of Texas at Austin in 2001. His research in material science contributed to the emergence of new fields of research: biomechanics of hemostasis/thrombosis [NPJ Biol Phys Mech, 2, 6 (2025); Acta Biomaterialia, 190, 329 (2024); PNAS 115, 8575 (2018); JACS 139, 16168 (2017)]; physical virology [Acta Biomaterialia, 122, 263-277 (2021); Biomacromol 17, 2522 (2016); JACS 136, 17036 (2014)]; and high-performance computing [Proteins 78, 2984 (2010); J Phys Chem B 115, 5278 (2011); J Comp Chem 37, 1537 (2016)].

Nano Based Sensors

A.Lobnik[1,2] , A. MABES RAJ[1,2], V. Valeriia Sliesarenko[2], Luka Popović[2],

(1) University of Maribor, Faculty for Mechanical Engineering, Smetanova 17, SI-2000 Maribor, Slovenia
(2) Institute for Environmental Protection and Sensors (IOS) Ltd, Beloruska 7, SI-2000 Maribor, Slovenia

Due to the extremely fascinating and useful chemical and physical properties, nano-materials exhibit an interest in many fields of applications such as photonics and sensor technology, biomedicine and biotechnology, environmental protection, production of paints and varnishes, textiles, footwear, packaging, electronics, aerospace and automotive, etc. Until today, nanotechnology has already contributed to the number of innovative products in various engineering disciplines. In the European market, many products containing nanomaterials, e.g., batteries, coatings, antibacterial textiles, cosmetics, food products, are already present.

Although nanomaterials, on the one hand, offer technical and commercial opportunities and challenges, on the other hand, they can pose a risk to the environment and raise concerns about the health and safety of humans and animals, as regulation of nanomaterials is debated and many questions related to the risks of exposure to nanomaterials are still unanswered.

This lecture will introduce some recent examples from our Research Group demonstrating the use and challenges that may be tackled by functional nanomaterials, and some risks will be briefly mentioned:

This lecture will introduce some recent examples from our Research Group demonstrating the use and challenges that may be tackled by functional nanomaterials, and some risks will be briefly mentioned:

(a) In the "Safety and protection" as an optical chemical sensor for food quality control, detection and protection against UV radiation, and toxic organophosphates and MeHg.

Optical chemical sensors based on mesoporous silica (SiO_2) and titania (TiO_2) nanomaterial became very widespread in the last decades and rely on the use of "sol-gel" materials, which include e.g. indicators, dyes and other additives.

Our group recently developed a variety of novel "sol-gel" materials in the form of spherical nanoparticles and thin films containing specific dyes which enable more reliable sensing of important parameters such as oxygen, temperature, pH, etc., which will be presented together with the sensing requirements of sensitivity, selectivity, stability, etc. [4, 5]

(b) In the "Health" as an optical chemical sensors for the detection of disease states in-vitro and in-vivo,

Furthermore, mesoporous silica (SiO_2) nanoparticles have attracted much attention the last decade in nanomedicine applications due to their biocompatibility, flexible functionalization, tunable pore size and diameter. In addition to the fine control of their size, shape, and pore structures, incorporation of drugs, dyes or indicators is important for their therapeutic applications.

Our recent results on the synthesis and functionalization of various types of superparamagnetic nanoparticles (“core-shell”) and mesoporous silica nanoparticles having different pore sizes, containing therapeutic agents and dyes, will be presented.

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Acknowledgements: *acknowledge the EU Horizon 2020 research and innovation program under the MSCA-FoodTraNet project (grant agreement no. 956265). A.L acknoweldge the Slovenian Research Agency (Research Programmes P2-0424, P2-0438 “Optisens”). G.J.M was in part supported by the project NanoFlow (project number FO999899045) kindly funded by the Austrian Research Promotion Agency (FFG).*

Lipid Nanoparticles Formulations: From Bench Scale to Industrial Scale

Prof. Dr. Mohammad A. Obeid

Faculty of pharmacy, Ras Alkhaimah medical and health sciences university, Ras Alkhaimah, UAE

Lipid nanoparticles are self-assembling vesicles obtained by hydrating a mixture of non-lipids and cholesterol and are suitable as carriers of drugs and biopharmaceuticals. It is desirable to be able to accurately control size and polydispersity of the vesicles as this can impact on biological outcomes. Moreover, its crucial to formulate these nanoparticles in a scalable method that can be used in industrial settings. One approach that has been successful for lipid-based systems is the use of microfluidic mixing which allows for the precise control of the generated nanoparticles. Microfluidic mixing has been compared with a traditional method such as thin film hydration method and heating method using niosomes as a model nanoparticle.

Niosomes are lipid bilayer vesicles that are composed of non-ionic surfactant. These nanoparticles were successfully prepared by microfluidic mixing which is a recently developed method used to prepare lipid-based nanoparticles and results in the production of small vesicles with efficient encapsulation of a therapeutic agent. To prepare niosomes using microfluidic mixing, specific volumes from each stock solution of the lipids components will be mixed together to prepare the lipid phase. The lipid phase will then be injected into the first inlet and the aqueous phase into the second inlet of the microfluidic microchannel, with the mixing temperature set above the phase transition ofthe lipids. The flow rate ratios (FRR) between the aqueous and organic phase and the total flow rates (TFR) of both phases are among the factors that control the particles production using this method.

The generated niosomes were compared with the niosomes that have the same components but prepared with different methods such as the thin film hydration method which usually will be followed by extrusion step for size reduction.

The size of niosomes produced by microfluidic mixing was controlled by altering the FRR and TFR in both the lipid and aqueous phases. In contrast, niosomes prepared by the TFH method and heating method were large, polydisperse, and required a post-manufacturing extrusion size reduction step (around 4μm ± 0.2 before extrusion). A stability study for the prepared niosomes at four temperatures (4, 25, 37 and 50°C) for 4 weeks indicates that the vesicles were shown to be stable in terms of size and polydispersity index (PDI).

The prepared particles were investigated for their ability to encapsulate and deliver several therapeutic agents such as doxorubicin, paclitaxel, cisplatin, nucleic acids, and many other hydrophilic and hydrophobic molecules.

Thermo-Mechanical Stability Analysis of Thin-Walled Composite Profiles with Selected Mechanical Couplings

Katarzyna Falkowicz[1*], Pawel Wysmulski[2], Hubert Debski[3]
[1-3]Lublin University of Technology, Poland, Europe

In recent years, composite materials have gained prominence in various engineering fields due to their exceptional properties such as high strength and stiffness coupled with lightweight, especially in aerospace, building industry or medicine. Among the numerous examples of contemporary applications of composite structures are wind turbine blades, pipelines, industrial tanks or chimney structures. In view of such a wide spectrum of applications, these structures can be subjected to different types of impacts, i.e. mechanical, chemical but also thermal loading, which is the focus of this paper. The influence of temperature can therefore be crucial for some structures and lead to effects such as: loss of stability, material degradation, degradation of elastic constants, delamination, reinforcement slippage, creep, thermal flow. It is also worth mentioning that already during the manufacturing process, composites are subjected to increased temperatures, and then cooled to ambient temperature, which can lead to residual stresses in the material.

The aim of the research was to analyze the stability of compression thin-walled composite columns with selected cross-section, subjected to axial load under various temperature conditions. The test samples were made of carbon-epoxy composite in symmetric and nonsymmetric layer arrangements. The selected configurations were characterized by resistance to thermal distortions resulting from the high-temperature curing process (HTCS laminates). Experimental tests were carried out using a universal testing machine, a thermal chamber and the optical ARAMIS system for measuring 3D deformations. A tangible effect of the conducted research was the determination of the influence of both temperature and the arrangement of composite layers with selected mechanical couplings on the stability of the structure. The novelty of this work is the use of interdisciplinary research techniques to determine the critical state of compressed thin-walled composite structures with selected cross-section in an nonsymmetric layer layouts and the influence of thermo-mechanical properties as well mechanical couplings on the stability and load-bearing capacity of thin-walled composite structures.

This research was conducted under project No. 2022/47/B/ST8/00600, financed by the National Science Centre, Poland. This research was funded in whole or in part by the National Science Centre, Poland [2022/47/B/ST8/00600].

Biography:

I work as an Associate Professor at LUT (Lublin University of Technology) at Department of Machine Design and Mechatronics. The subject of my research is related to the analysis of stability and the analysis of failure mechanisms of thin-walled composite structures made of fiber composites laminates, especially composites with nonsymmetrical configurations with mechanical couplings. Research are conducted in the area of experimental research on physical models of structures, as well as in the field of numerical simulations using the finite element method.
I am author of over 50 published publications (h-index in Scopus = 21).

2nd International Summit on

Polymer Science & Engineering

Theme:

"Advancing Emerging Innovations and Frontiers in Polymer Science and Engineering"

Dates:

June 15-16, 2026 (In-Person)

Venue:

Fairfield by Marriott Bali Legian, Bali

Plenary Presentation

DAY - 2

The Need for Innovation in Nanotechnology Training to Meet the Future Energy and Sustainability Challenges of the Digital World

Prof. Olivier Bonnaud
GIP-CNFM, France, University of Rennes, France

Digital applications in many areas of society are undergoing rapid development in today's world. This development seems very useful for most of our daily activities, but it also leads to a considerable increase in the amount of treated data, particularly in the current context of the very rapid development of AI tools. Given that all digital objects rely primarily on electronic equipment and tools based on microelectronic and nanoelectronic devices and systems, this evolution is leading to exponential growth in the consumption of electrical energy and natural mineral resources. In less than a decade, this could lead to a harmful impasse, with digital activity consuming all of the world's electrical energy production. In addition, current technologies use numerous natural mineral resources that are becoming scarce and/or expensive. Societal behaviors and technologies must evolve. To achieve this, new skills and expertise must be developed to stimulate innovation in the production of billions of connected objects each year. This corresponds to new jobs, mainly in the fields of microelectronics and nanotechnologies. Thus, this sector becoming a global priority, research centers are focusing on these challenges. Their recent findings predict that the energy consumption of all digital equipment could be reduced by a factor of more than 10 within a reasonable timeframe. By combining improvements in the technological processes of basic devices involving new materials, circuit architecture, and new packaging, we can hope to meet these challenges. This approach requires adapting training to acquire new skills and know-how for innovation in research and production. The French national network for higher education in microelectronics and nanotechnologies, a network of 12 French inter-university training centers, has adopted this strategy. Several examples of new technical approaches combined with training on innovative platforms relevant to the challenges ahead are presented.

Biography:

Prof. Bonnaud, student of the Ecole Normale Supérieure de Paris-Saclay, PhD in microelectronics, became full professor at the University of Rennes/Supelec in 1984 where he created a microelectronics research laboratory that he directed until 2010, as well as international master's and doctoral programs. He has supervised 43 PhDs, published or presented 550 papers including 100 international invited papers. Founding in 1985 the West Inter-university Microelectronics Center, he headed it until 2010, when he was appointed by the French Ministry as Executive Director of National Coordination for Higher Education to Microelectronics and Nanotechnologies (GIP-CNFM) which he still heads. He is currently coordinating a five-year project as part of France's 2030 strategy. Professor emeritus since 2013, he was selected by the Chinese government's “1000 Global Talents” program in 2014, and became guest professor at SEU (Nanjing-China). He received the Chinese government's Friendship Award in 2023.

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Keynote Forum

DAY - 2

Theme: “Advancing Emerging Innovations and Frontiers in Polymer Science and Engineering.”

2nd International Summit on
Polymer Science and Engineering
15-16 June, 2026 | Bali

Nanopharmaceutical Drug Carriers for Controllable Delivery and Release In Vivo

Prof. Xing-Jie Liang
1．Laboratory of Controllable Nanopharmaceuticals, CAS Center for Excellence in Nanoscience and CAS Key Laboratory for Biological Effects of Nanomaterials and Nanosafety, National Center for Nanoscience and Technology, 100190 Beijing, P. R. China;
2. College of Nanoscience and Technology, University of Chinese Academy of Sciences, Beijing 100049, P. R. China

Compared to traditional drug delivery systems, To develop In Vivo Functional Nano-scale Delivery And Release （FUNDAR） Systems to improve efficacy in pharmaceutical research and development for better human health and life quality have greater potential in many areas, such as multiple targeting functionalization, combined drugs delivery, longer circulation time and systemic control release. FUNDAR incorporating stimulus-responsive biopolymer have remarkable properties which allow them to bypass biological barriers and achieve targeted intracellular drug delivery. FUNDAR can be employed for the efficient delivery of both peptide- and message RNA (mRNA)-based preventive or therapeutically vaccines. Herein, it is critical to clarify the characteristic features of nanostructure for the bio-/med- applications and their mechanisms with the aid of nanoparticles for the development of newer drug delivery systems to treat effective In Vivo.

Biography:

Dr. Xing-Jie Liang got Ph.D at National Key Laboratory of Biomacromolecules, Institute of Biophysics, Chinese Academy of Sciences. He finished his postdoc with Dr. Michael M. Gottesman, member of NAS and Deputy Director of NIH, for 5 years at Laboratory of Cell Biology, Center for Cancer Research, National Cancer Institute, National Institutes of Health. Then, he worked as a Research Fellow at Surgical Neurology Branch, NINDS, NIH. Dr. Liang currently is a principal investigator at Center for Excellence in Nanoscience, Chinese Academy of Sciences. As previous president of Chinese Association of Nanobiology, he is the Member of Academia Europaea (2023) and the elected Fellow of American Institute for Medical and Biological Engineering (AIMBE, 2020) and Faculty Member of F1000 Research (Pharmacology & Drug Delivery, 2012) and Hall of Fame (Advanced Materials, 2023). Dr. Liang has successfully developed “Injectable Nanomicelle Powder with Irinotecan” approved with CFDA and transferred NDA to pharmaceutical industry for clinical trials.

The Power, Beauty and Magic of Coordination Clusters for the development of Materials Science

Prof. Annie K. Powell
Karlsruhe Institute of Technology (KIT) Germany

The concept of the coordination cluster is an extension and enlargement of Werner’s ideas regarding coordination complexes. The compounds he first worked on to develop his theories were largely reliant on understanding single metal ion centres coordinated by a shell of ligands and mostly with coordination number 6. In our work we have enlarged this idea by using ligands and hydrolytic processes centred on metal ions to achieve the synthetic concept of the coordination cluster. After structural characterisation using Single Crystal X-ray diffraction we investigate their physical properties in the context of magnetic and optical experiments in addition to resonance spectroscopy including EPR, NMR and Mössbauer at a variety of applied fields. These plus some more exotic techniques help us both to understand their fundamental properties and to identify possible applications of these nanoscale coordination clusters. In some cases, the coordination clusters can be described as multitasking since they are able to show potential for different areas of application. They are thus “Magic” in many senses of the word. These endeavours will be described using a range of examples and an outlook for future directions in the field of coordination clusters will be presented.

Biography:

Prof Annie Powell studied Chemistry at Manchester University both as a Bachelor student and then a PhD student. She gained her PhD degree in1985 and then went to work with Prof Heinrich Vahrenkamp at Freiburg University as a postdoc working on organometallic chemistry. She returned to the UK as a temporary lecturer in 1988 (UKC) and then moved to UEA (Norwich) from 1989 to 1999 where she wss successively promoted to Professor. Since 1999 she has been back in Germany working in Karlsruhe at what is now known as the Karlsruhe Institute of Technology (KIT).

From Fossil to Biobased Nanofibers: The Role of Circular Bioeconomy in Transforming the Textile Industry

Prof. Isabel C. Gouveia
University of Beira Interior, Faculty of Engineering, (AEROG)-LAETA, Portugal

The textile industry is economically vital but remains one of the most environmentally impactful sectors worldwide. Large volumes of industrial waste—particularly wool remnants, hemp residues, agricultural by-products, and microbial biomass—contribute to pollution and resource depletion. Addressing this challenge requires innovative upcycling strategies that transform waste streams into high-value materials such as nanofibers and biocomposites, supporting more sustainable production models.

The Circular Bioeconomy (CBE), which integrates the principles of the Circular Economy and the Bioeconomy, offers a framework to reduce reliance on fossil-based resources while promoting regenerative and resource-efficient systems. This presentation is structured in two parts.

First, we present the results of an integrative literature review and documentary analysis of national and international strategies related to circular and bio-based transitions in the textile sector. The analysis identifies key synergies, policy gaps, and implementation challenges. Findings highlight the potential of bio-based materials, enzymatic recycling technologies, and supportive regulatory frameworks to enhance sustainability. However, significant barriers persist, including insufficient infrastructure, lack of regulatory harmonization, and limited consumer acceptance. The results emphasize the need for cross-sector collaboration, coherent policy support, and technological innovation to enable effective CBE implementation.

Second, we discuss recent research from our group demonstrating sustainable pathways for valorizing agricultural waste, textile waste, and microbial by-products. Through upcycling approaches, we have developed eco-friendly functional materials based on biobased nanofibers with potential applications in biomedical and industrial fields.

Overall, our work underscores that integrating technological innovation, public policy, and societal engagement is essential for accelerating the textile sector’s sustainable transformation. By advancing circular design strategies and bio-based material development, we contribute to reducing fossil dependency and minimizing waste generation within a Circular Bioeconomy framework.

Biography:

Isabel C. Gouveia is an Associate Professor in Textile Science and Technology at the University of Beira Interior, Portugal, and a researcher working at the crossroads of textile innovation, biotechnology, and sustainability. Holding a PhD in Textile Engineering (Textile Biotechnology), she develops circular bioeconomy pathways that transform agricultural, textile, and microbial waste into high-value biobased, antimicrobial, and bioactive materials. Her work bridges science, industry, and policy, integrating technological innovation with circular design and regulatory frameworks. Through interdisciplinary research and international collaboration, she contributes to shaping more resilient, low-impact, and regenerative futures for the materials sector.

Strategic Protection of Nanotechnology with Intellectual Property

Prof. Tyson York Winarski
Professor of Law, Patent Attorney, Sandra Day O’Connor College of Law, Arizona State University, Phoenix, Arizona USA

Nanotechnology sits at the frontier of innovation, enabling breakthroughs in medicine, energy, materials, and electronics. Yet the very qualities that make nanoscale science transformative, interdisciplinary nature, and rapid pace of development, also present unique challenges for intellectual property (IP) protection. This keynote will examine the evolving role of patents and other IP strategies in shaping the future of nanotechnology innovation and commercialization.

At the heart of the discussion lies the question of patentability. Defining novelty and non-obviousness at the nanoscale requires careful attention to measurement precision, reproducibility, and terminology. Claim drafting in nanotechnology often hinges on describing structures, compositions, and functions that operate at dimensions invisible to traditional frameworks, raising enablement and written description hurdles across global patent systems. By exploring leading cases and trends in the United States, Europe, China, Japan, and Southeast Asia, this address will highlight both convergences and divergences in nanotech patent practice.

Beyond patents, nanotechnology demands a holistic IP strategy. Manufacturing processes may be better protected through trade secrets, while defensive publishing and participation in international standards bodies can help mitigate risks of blocking patents. Meanwhile, regulatory oversight of safety and ethical considerations increasingly intersects with IP rights, influencing both enforcement and public acceptance.

Finally, this keynote will consider how innovators, universities, and enterprises can strategically leverage IP to secure investment, foster cross-border collaborations, and accelerate pathways from laboratory research to market applications. By positioning patents and IP as both shields and enablers, nanotechnology stakeholders can navigate the balance between protecting proprietary advances and advancing global progress.

In mapping this landscape, the address aims to provide practical insights for scientists, entrepreneurs, policymakers, and legal professionals committed to building a resilient and innovative nanotechnology ecosystem.

Biography:

Tyson Winarski is an Intellectual Property Law Professor and Patent Attorney with the Sandra Day O’Connor College of Law with Arizona State University. Tyson made the IAM Strategy 300: The World’s Leading IP Strategists for 2025. Tyson is also a technologist (BSME, MSEE) and inventor with over 52 patents in Artificial Intelligence (AI), blockchain, and nanotechnology. At ASU, Tyson teaches five graduate level courses on intellectual property law. Tyson has previously practiced law with Intellectual Ventures in Mountain View, California as well as Pillsbury Winthrop Shaw Pittman LLP and Steptoe and Johnson LLP in Washington, D.C.

Clarification of Elementary Processes of Radical Polymerizations using Electron Spin Resonance (ESR/EPR) Spectroscopy in Various Media

Atsushi Kajiwara
Nara University of Education, Takabatake-cho, Nara 630-8528, JAPAN

Electron spin resonance (ESR) spectroscopy has been used to study the fundamentals of radical polymerization. By optimizing the measurement conditions, radicals in polymerization reactions reactions can be directly detected, and well-resolved ESR spectra can be obtained. These spectra provide information on the structure, properties, and concentration of radicals, as well as the initiating and propagating (oligomeric and polymeric) radicals involved in radical polymerizations. Combining ESR with atom transfer radical polymerization (ATRP) has yielded significant new information about the properties of radical polymerizations. For example, it has revealed the dependency of propagating radical chain length, dynamics, and reactivity (e.g., hydrogen transfer). Time-resolved ESR (TR-ESR) is a technique for observing rapid radical reactions. It allows for the selective observation of the initiation process of radical polymerization, which cannot be observed by ordinary ESR (steady-state) measurements. Furthermore, TR-ESR provides information on the detailed structure and reaction kinetics of radical addition reactions by clearly observing the spectra of chain-initiating radicals in polymerization systems of various monomers. Traditionally, obtaining such information from ESR spectra during radical polymerization has been challenging, if not impossible. Recently, this technique has been applied to various media, such as organic solvents, water, and ionic liquids. Recent results will be reported.

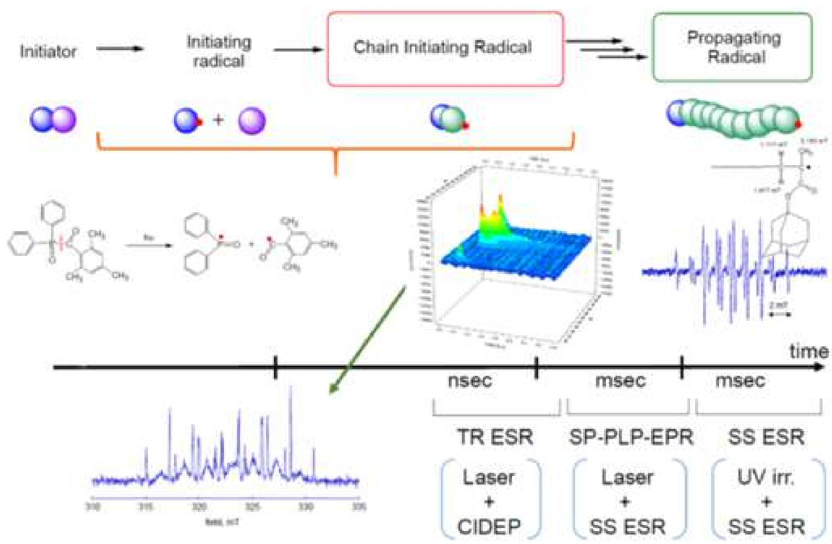

Figure 1 Elementary processes of conventional radical polymerizations and ESR/EPR technique with various time-resolusions.

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Education:
1983 B.S., Macromolecular Science, Osaka University, Osaka, JAPAN
1985 M.S., Macromolecular Science, Osaka University, Osaka, JAPAN
1990 Ph.D, Macromolecular Science, Osaka University, Osaka, JAPAN

1990-1998 Research Associate, Osaka University, Osaka JAPAN
1996-1997 Visiting Research Associate, Carnegie-Mellon University, Pittsburgh, PA
1998- 2014 Associate Professor, Nara University of Education, Nara, JAPAN
2014- Professor, Nara University of Education, Nara, JAPAN
2000-2001 Visiting Researcher, Peking University, China (JSPS Project)
2004-2005 Visiting Professor, Carnegie-Mellon University, Pittsburgh, PA (JSPS Project)

Present: Professor, Nara University of Education, Nara, JAPAN

Research interest: ESR spectroscopy on radical polymerizations and reactions
Development of teaching materials using ESR

Awards: 1995 SPSJ (Society of Polymer Science, Japan) Award for the Outstanding Paper in Polymer Journal: Radical Polymerization of 5-(4-Vinylphenyl)-10,15,20-triphenyl Porphyrin
2017 SPSJ (Society of Polymer Science, Japan) Award: Fundamental Research of Radical Polymerizations Using Electron Spin Resonance Spectroscopy.

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Scientific Session

DAY - 2

Photonic Processing for Flexible Hybrid Electronics (FHE)

Prof. Martin Bolduc

Department of Mechanical Engineering, Université du Québec à Trois-Rivières, Québec, Canada

Photonic processing has importance for future high-speed manufacturing of printable materials and sensors. This technology may enable the development of low-cost, eco-friendly, and flexible sensors. In addition, Photonic Laser and Intense Pulsed Light sintering processes involve the use of high-power nanosecond or microsecond pulse light to heat the functional ink layer in milliseconds beyond the maximum working temperature of the flexible polymer or paper substrate. The thermal penetration from a nanosecond laser irradiation is in the micrometer range estimated using COMSOL simulation. This process allows for the rapid and intense thermal penetration waves to occur, which leads to the sintering of nanoparticles and grains growth in the crystalline structure. In a first step the heat applied during photon irradiation volatilizes vehicle components in the printable ink formulation, then followed functional nanoparticles to contact each other. This technology is advantageous for flexible substrates having a low glass transition temperature. The study also highlights the potential of photonic technologies integration onto high-speed printing systems, which can potentially transform the field of microelectronics.

Biography:

Professor Martin Bolduc (INRS, PhD'04) holds a Research Chair in Intelligent Manufacturing at the Université du Québec à Trois-Rivières (UQTR), where his work focuses on advanced Printed Electronic (PE) and Flexible Hybrid Electronics (FHE) technologies. He joined UQTR in December 2020, following an industrial research career. He completed postdoctoral fellowships (2004–2006) at the State University of New York (SUNY) and at the Massachusetts Institute of Technology (MIT), working on perovskite-based photonic sensors and spintronic semiconductors, which led to a first patent and a highly cited article in Physical Review B (over 400 citations). From 2007 to 2020, he worked in the aerospace and military sectors with companies such as Tekna, INO, and Varitron, developing microfabrication processes for infrared and terahertz photonic sensors. In 2012, he began work in flexible electronics and later earned a Master's degree in the field (CalPoly, 2015), acquiring expertise in eco-friendly additive manufacturing for printable photonic sensors and flexible hybrid circuits. He is a scientific committee member of the Canadian IntelliFLEX Alliance and the author/co-author of more than 80 publications/patents with 2 technology transfers to startup companies. Currently, he supervises 2 postdoctoral fellows and 6 PhD and 2 master students, which research is focused on high-resolution laser processing for printable sensors.

From Industrial Disaster to Material Processing - Control Technology of Vapor Film

Masahiro Furuya
Waseda University, 3-4-1, Okubo, Shinjuku-Ku, Tokyo

The paper presents a groundbreaking persp-ective on harnessing the potential of vapor explosion, which has traditionally been associated with industrial disasters, for advanced material processing. By reimagining vapor explosion as a valuable tool rather than a hazard, a paradigm shift can be achieved, leading to revolutionary advancements in industrial applications. Vapor explosion generates catastrophic mechanical energy due to the rapid vaporization of a volatile cold liquid (e.g., water) upon contact with a hot liquid (e.g., molten alloy). This paper explores the innovative utilization of the vapor explosion phenomenon in functional material processing, as depicted in

Figure 1, highlighting its transformative capabilities in terms of superior cooling rate and atomizing performance. The author has named this process CANOPUS (Cooling and Atomizing based on NOvel Process Utilizing Steam explosion). The method employs a small-scale vapor explosion phenomenon by controlling the vapor film that separates water and molten alloy, enabling efficient cooling and atomization of molten alloys or highly viscous fluids.

Figure 2 shows the estimated cooling rates in terms of particle diameter for various cooling methods. The cooling rates were estimated basedon the measured secondary dendrite arm spacing at the centerof each particle cross-section (Matyjaet al., 1968). Endo et al. (1999)estimated the cooling rate in the SWAP method to be up to $5.2 \cdot 10^{5}$ K/s, which is considered the most efficient cooling method thus far. On the other hand, the cooling rate in the CANOPUS method (Furuya and Kinoshita, 2001) was $1.5 \cdot 10^{8}$ K/s, exceeding that of the SWAP method by over 280 times. To enable the practical use of amorphous materials, the required cooling ratemust exceed 10^{6} K/s. In the last decades, most research has focused on reducing the required cooling rate for amorphization by adding a certain amount of noble metals. However, by utilizing the sufficiently high cooling rate achievable with the CANOPUS method, it is possible to produce amorphous powder of practical composition without the need for noble metals.

Figure 3 shows a seriesof frames illustrating the successive stages of the CANOPUSmethod (Furuya, 2002) for molten tin dropletsinjected into a water stream flow from a round nozzle. The diameter of the dropletwas 2.3 mm, and the subcooling and flow rate of the water stream were 85 K and 5.5 l/min, respectively. Figure 3(a) was captured when the initial molten tin temperature was 400 °C. Fragmentation commenced immediately after the tin dropletimpinged onto the water streamsurface due to vapor explosionand lasted for 10 ms. Subsequently, the fragments moved toward the center of the water stream

Figure 3(b) was taken when the initial molten tin temperature was 700 °C. The tin temperature was so high that a stable vapor film prevented the tin droplet from coming into contact with the surrounding water for approximately 16 ms. As the droplet moved toward the center of the water stream, an energetic vapor explosion occurred. The rate of change of the interfacial area concentration at 700 °C was significantly higher than that at 40 °C.

Figure 4 depicts the morphology of a mora slug quenched in a water pool of a coal gasification pilot plant. The glassy slug consisted mainly of Al_2O_3 (53 wt%) and SiO_2 (27 wt%). The needle-shaped slug on the left side of Figure 4 becomes industrial waste because it is difficult to handle from the morphological point of view. Atomizing such highly viscous slugs at a nozzle or in a mill is difficult. To obtain spherical particles, the molten slug was released into a polyethylene glycol aqueous solution with a concentration of 200 wppm. The average molecular weight of polyethylene glycol was $1{\cdot}10^6$. The subcooling of the solution was 85 K, and the release height was 150 mm. The initial molten slug temperature was 1700 °C. The 4 mm spherical particles obtained in the top right corner of Figure 4 can be used as lightweight aggregates in concrete applications (Kanazu et al., 1996). The deviation from sphericity was adequately small, as the cloudy-point phenomenon stabilized the vapor film (Furuya and Kinoshita, 2001). To obtain powders, the CANOPUS method was successfully applied by releasing the molten slug into a pool of 25 wt% calcium chloride aqueous solution. The author reported that adding neutralsalt to water promotedvapor explosion at a relatively high temperature (Furuya,2002). The initial molten slug temperature and solution subcooling were 1700 °C and 85 K, respectively. The release height was 150 mm.

The bottom right of Figure 4 shows 25-63 μm powders obtained through the CANOPUS method. These powders can be used to reclaim one of the raw materials of cement (Kanazu et al., 1996) using the CANOPUS method. This method is suitable for producing fine powders by atomizing highly viscous fluids.

In conclusion, superlative cooling and atomization performance can be achieved through vapor explosion when there is a sufficient volumeand subcooling of the coolant,following the suppression of a stable vapor film. Similarly, a highly viscous coal gasification slug was atomized into 30 μm powder, which can be utilized as a raw material for cement. The cooling rate of Al-Si was $1.5{\cdot}10^8$ K/s, exceeding that of the previously employed method by over 280 times.

Acknowledgments

The experimental campaign was conducted while the author was affiliated with CRIEPI. The author would like to express gratitude to Mr. Kouji Suzuki, Mr. Takeo Yoshioka, and Mr. Tsutomu Sakuma of Electric Power Engineering Systems Co. Ltd. for their valuable assistance during these experiments. The author is also thankful to Dr. Kazuyoshi Ichikawa and Dr. Takahiro Arai of CRIEPI for their insightful suggestions and constructive feedback.

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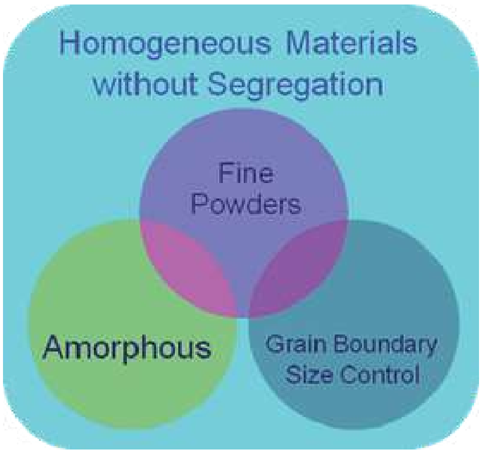

Fig. 1. Functionality of rapidly quenched materials

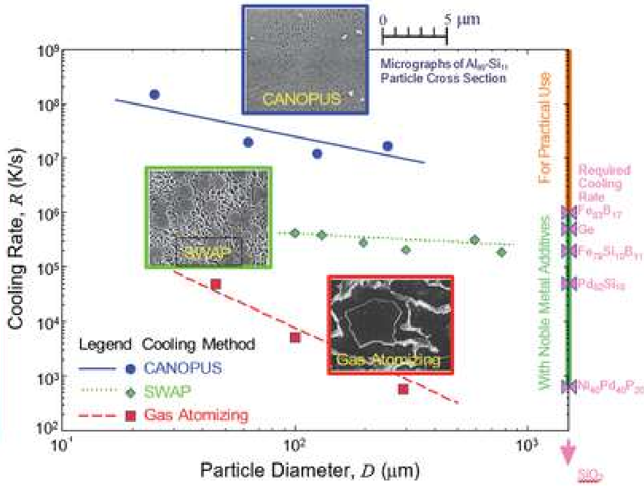

Fig. 2. Cooling rate of CANOPUS method with conventional ones

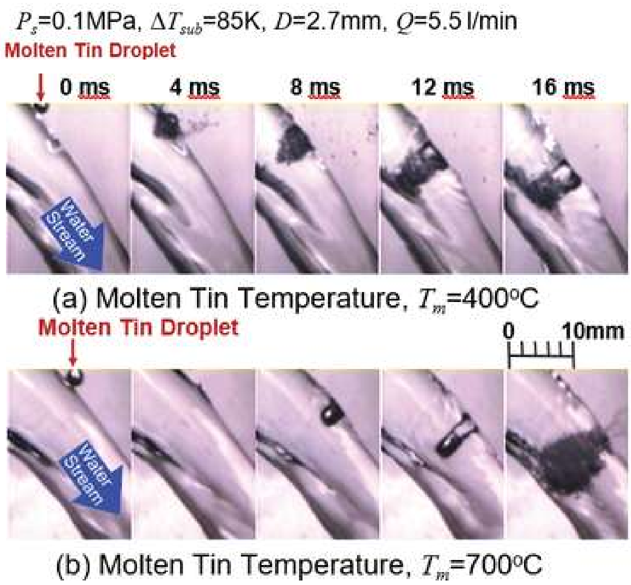

Fig. 3. Successive stagesof CANOPUS Process

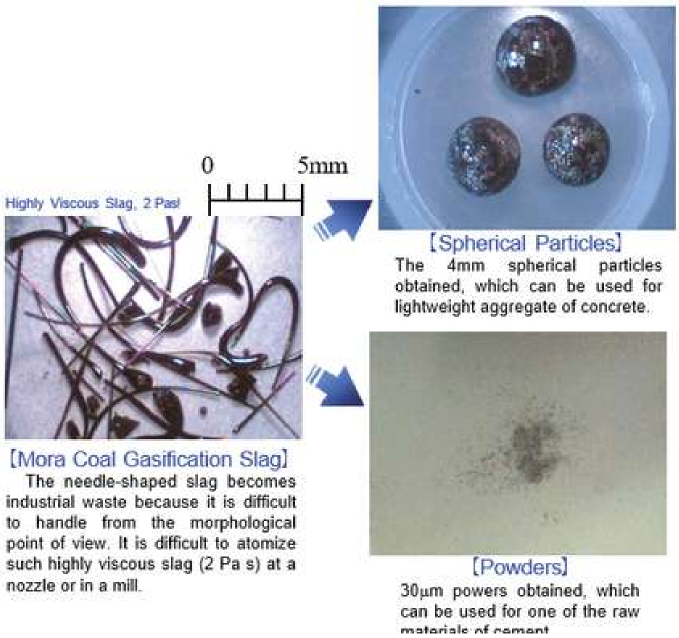

Fig. 4. Morphology in reference to vapor film controllability

Nanostructured Polymer Membranes for Gas Separation

Maria Giovanna Buonomenna

Ordine Regionale dei Chimici e Fisici della Campania (OCF) and Ministero dell'Istruzione e della Ricerca Scientifica (MIUR), Italy

The key parameters for gas separations employing membranes are the permeability of a specific component of the gas mixture and the selectivity. Membrane gas separation employing polymeric membranes has been commercially used since the 1970s generating a significant amount of academic and industrial research activity. It was recognized that an empirical upper limit (the well-known "upper bound") for the combined selectivity and permeability exists: the selectivity generally decreases with increasing permebility of the more permeable gas component. Molecular sieve membranes with well-defined uniform pore structure would be considered to be the true upper bound limit for polymeric membranes. Recently this upper bound has been updated for relevant gas separations by microporous rigid polymeric membranes.

In this contribution, an analysis of recent findings for industrially relevant gas pairs, such as CO_2/CH_4, CO_2/N_2 is given.

Biography:

M. G. Buonomenna (1975), graduated in Chemistry in 1998 (110/110), obtained the license and status of Professional Chemist in 1999 (100/100) and a PhD in Chemical Engineering and Materials in 2005.
In 2014 and for the second time in 2018 she obtained the qualification of Associate Professor in Chemical Fundamentals of Technologies from MIUR. Her research activities relate to membrane science and technology for sustainable processes. She is author of more than70 scientific papers in peer-reviewed international journals, more than 90 contributions published in conferences proceedings, 10 chapters of scientific books, guest-editor of many Special Issues in peer-reviewed international journals, and member of the Editorial Boards for a number of international peer reviewed journals.

Innovation in Structural Design Through Metal 3D Printed Lattice Elements

Vittoria Laghi, Giada Gasparini and Tomaso Trombetti

DICAM – Department of Civil, Chemical, Environmental and Materials Engineering, University of Bologna, Italy

Metal Additive Manufacturing (AM), and in particular Wire-and-Arc Additive Manufacturing (WAAM)offers a promising solution to realize new sustainable and optimized steel structures. Lattice structures are characterized by high efficiency (in terms of high stiffness and minimized material use), however their application at the scale of the single element (“meso-scale”), such as beams and columns, is still hampered by the issue of the connection at nodes (in terms of geometry complexity, assembly and production cost). The ambition of this work is to propose a new class of efficient structural elements by exploiting the efficiency of lattice structures at the meso-scale through the adoption of WAAM production technology. The increased efficiency of lattice structures is provided by their high structural performances and reduced environmental impact, through the adoption of digital fabrication and optimization techniques for construction. The present work proposes an investigation on the computational design and fabrication of a new class of lattice steel structural elements fabricated with WAAM technology with different geometrical features. The geometry is varied in terms of cross-section (i.e. number of points in the lattice for the base cross-section) and relative local slenderness (i.e. maximum distance of the intersecting points of the lattice). The study investigates in particular the mechanical behavior of the different geometries of lattice columns under compressive action. In detail, the influence of the different geometries on the secondary bending moments coming from the outward thrust due to the absence of horizontal hoops at the control sections is quantified through experimental tests and numerical simulations.

Biography:

Prof. Giada Gasaparini is Associate Professor in Construction Design since 2019 and she has been a Researcher (Assistant Professor) in Construction Design (SSD ICAR/09) since 2008, in the Department DICAM, Faculty of Architecture of the University of Bologna. She holds the chairs of “Laboratory of Construction in Architecture IIA” and “Construction Design” at the Faculty of Architecture of the University of Bologna. In June 2001 she graduates with distinction in Civil Engineering at University of Bologna, where in 2005 he becomes PhD Doctor in “Structural Mechanics”. Since 2001 she's been active in the field of seismic engineering, with specific reference to the following research topics: (1) analysis of the torsional effects induced by the seismic action, (2) optimal damper insertion of viscous dampers into structures, (3) structural reliability analyses. She published more than 200 scientific papers, some of them on the most relevant international journals.

2nd International Summit on

Polymer Science & Engineering

Theme:

"Advancing Emerging Innovations and Frontiers in Polymer Science and Engineering"

Dates:

June 15-16, 2026 (In-Person)

Venue:

Fairfield by Marriott Bali Legian, Bali

Poster Presentation

DAY - 2

Numerical and Experimental Study of the Stability and Load-Carrying Capacity of the Compressed Composite Profiles with Closed Sross-Setctions

Hubert Debski[1*], Patryk Rozylo[2], Katarzyna Falkowicz[3], Pawel Wysmulski[4]

[1-4]Lublin University of Technology, Poland, Europe

Thin-walled composite profiles with open and closed cross-sections are used as stiffening elements for thin coverings in aircraft or automotive structures. They are load-carrying elements that usually ensure the stiffness and strength of thin-walled structures. Such structures are usually made of a carbon-epoxy composite material (CFRP) and one of their characteristics is buckling. This phenomenon is a behavior in which a structural component undergoes deformation under load. In general, the occurrence of buckling is undesirable in the operation of thin-walled structures subjected to compression. However, in most cases, thin-walled structures made of composite materials can continue to carry loads that are even several times beyond the critical limit. As previous studies have demonstrated, the structural performance of a thin-walled structural component in buckling state can be safe, provided that the buckling mode is elastic and that the post-buckling equilibrium path of the structure remains stable. The objective of this study was to investigate the stability and load-carrying capacity of thin-walled composite columns with closed cross-sections under axial compression. Interdisciplinary research methods were employed in the study. Experiments were conducted on a universal testing machine, using various testing techniques such as acoustic emission, optical deformation measurement and digital microscopy. In parallel to the experiments, numerical analyses were performed by the finite element method. In the FEA simulations (using ABAQUS® software), original numerical models were developed based on the known models of composite material failure. Both the experiments and the FEM simulations involved performing an in-depth analysis of buckling and post-buckling states, considering the failure phase of the composite material. Obtained experimental and numerical results provided insight into the stability and load-carrying capacity of composite profiles under compression over the full load range up to failure.

Biography:

I work as a Professor at Lublin University of Technology at Department of Machine Design and Mechatronics. The subject of my research is related to the analysis of stability and the analysis of failure mechanisms of thin-walled composite structures made of fiber composites laminates. Research are conducted in the area of experimental research on physical models of structures, as well as in the field of numerical simulations using the finite element method.

Pawel Wysmulski

Theme: “Advancing Emerging Innovations and Frontiers in Polymer Science and Engineering.”

2nd International Summit on

Polymer Science and Engineering

15-16 June, 2026 | Bali

Influence of Central Hole on the Buckling and Post-Buckling Response of CFRP Laminate

Pawel Wysmulski[1*], Katarzyna Falkowicz[2], Hubert Debski[3]

[1-3]Lublin University of Technology, Poland, Europe

The stability of composite laminates with geometric discontinuities is of central importance in the design of lightweight structures, where local weakening may significantly reduce load-carrying capacity. This study investigates the effect of a central circular hole on the stability of axially compressed plates made of carbon–epoxy composite.

The research was carried out in two stages. First, experimental tests were performed on CFRP specimens manufactured with an autoclave process to ensure high structural quality. Axial compression tests were conducted until instability occurred, and the load–displacement paths were recorded using a universal testing machine. The critical force was identified through approximation of the postcritical characteristic, enabling an accurate evaluation of the buckling. These measurements provided a reliable experimental baseline for model validation.

In the second stage, the numerical model of the plate was developed by finite element method in the system ABAQUS®. Linear eigenvalue analysis was performed to determine the bifurcation load, taking into account the anisotropic material properties ofthe laminate and realistic boundary conditions. The obtained bifurcation loads were then directly compared with the experimental critical loads. The comparison revealed a high level of consistency, thereby confirming the adequacy of the FEM model in reproducing the buckling behavior of CFRP plates with hole.

The results demonstrate that even relatively small openings cause a reduction in the critical load, highlighting the necessity of careful design when introducing hole in thin-walled composite structures. The combined experimental–numerical methodology employed in this study not only validates the FEM approach but also provides a foundation for future investigations into the post-buckling state and failure composite structure. These findings are of practical relevance to aerospace and automotive applications, where weight reduction must be balanced with structural safety and reliability.

Biography:

In October 2014, I began working as a researcher in the Department of Mechanical Design and Mechatronics at the Lublin University of Technology (POLAND), where I have been employed until now. The area of my research work focuses on the issue of stability of thin-walled structures made of modern layered composite materials, as well as in the field of numerical simulations using the finite element method. My scientific output currently includes 49 scientific publications (the current Hirsch index according to the Scopus database is 21). I presented 30 scientific papers at scientific conferences of international and national scope.

Functionalized Antimicrobial Films Based on Antibiotic Imbedded in Bioactive Glass Matrix for Implants Coating

Laura Floroian*[1], Liviu D. Dogar[1], Cristina Galbau[1], Daniel Cristea[1], Alin Pop[1], N. Mihailescu[2]

[1]Transilvania University of Brasov, Romania, Europe

[2]National Institute for Laser, Plasma & Radiation Physics, Bucharest, Romania, Europe

In this study we investigated the possibility to use in implantology of a new composite made from antibiotic imbedded in bioactive glass matrix onto polymer layer, with goal to merge the mechanical advantages of the metallic substrate with the excellent corrosion protection of the polymer and antimicrobial effect of the antibiotics. Furthermore, the addition of small quantity of bioactive glass allows the antibiotic release and hastens the osteointegration. Mechanical properties of coated implant were evaluated. The behaviour of bioactive glass + antibiotic / polymer / stainless steel structure in condition which simulates the physiological environment was evaluated in vitro by complementary techniques. The bioactivity and the release of the antibiotic were assessed by immersion into simulated body fluid and monitoring by FTIR and UV-VIS spectrometry and electrochemical measurements involving corrosion and EIS studies were carried out in order to investigate the corrosion resistance. The biological properties were tested including the microbial viability using Gram - and Gram + bacterial strains, the microbial adherence and the cytotoxicity on eukariotic cells.

Biography:

Dr. Floroian studied Physics at the University of Bucharest, Romania in 1995 and she is currently Associate Professor at Transilvania University of Brasov, Romania. Her current research interests cover biomaterials fields, optical sensor for cell detection, biosensors for biological compounds and toxic compounds, advanced techniques for thin films deposition and advanced techniques for surface characterization. Dr. Floroian is a member of many scientific societies: SRF – Romanian Society of Physics, Romanian Society of Automation and Technical Informatics (SRAIT), National Society for Medical Engineering and Biological Technology (SNMITB) and International Association of Online Engineering (IAOE).

Energy-Efficient and Scalable Benzoxazine Polymeric Platform for Photocatalytic Hydrogen Peroxide Generation

Bhavika Bhatia,Prashansa Gupta, and Bimlesh Lochab*

Materials Chemistry Laboratory, Department of Chemistry, School of NaturalSciences, Shiv Nadar Institution of Eminence, Delhi-NCR, Uttar Pradesh 201314, India.

The development of photocatalysts that combine scalable synthesis, mechanistic selectivity, and high catalytic performance is crucial for advancing artificial photosynthesis technologies. Herein, we report a metal-free polymeric photocatalyst, P-Tris(apm), which can be synthesized through a rapid, greener, and low-energy-intensive process, enabling gram-scale production within minutes. This facile and sustainable synthetic approach highlights the potential of the material for practical and large-scale applications.

Mechanistic investigations reveal that P-Tris(apm) selectively drives the two-electron oxygen reduction reaction ($2e^-$ ORR) under visible-light irradiation, enabling controlled reduction of molecular oxygen to hydrogen peroxide (H2O2) while effectively suppressing competing multi-electron pathways and H2O2 decomposition. The favorable electronic structure of the polymer facilitates efficient charge separation and selective oxygen activation, resulting in high reaction specificity. Efficient photon utilization is further evidenced by an apparent quantum yield (AQY) of 17% and a solar-to-chemical conversion (SCC) efficiency of 2.8%, both achieved within 1 h of light irradiation.

As a result of these features, P-Tris(apm) exhibits outstanding photocatalytic performance for H2O2 production from water and molecularoxygen under ambientconditions. The polymerachieves a high H2O2 formation rate of 3250 μmol g^{-1} h^{-1} and accumulates 34 mM H2O2 over24 h of continuous irradiation, while maintaining excellent photochemical and structural stability. The synergistic combination of scalablegreen synthesis, selective $2e^-$ ORR pathway, and high photocatalytic efficiency positions P-Tris(apm) as a promising polymeric platform for sustainable and decentralized hydrogen peroxide production.

Biography:

Bhavika Bhatia received her BSc (Hons.) degree in Chemistry from St. Xavier’s University, Mumbai, followed by an MSc degree in Chemistry from Shiv Nadar Institution of Eminence, Greater Noida. She is currently pursuing her PhD in Chemistry under the supervision of Prof. Bimlesh Lochab in the School of Natural Sciences. Her doctoral researchis centered on the design and synthesis of sustainable polymeric materials, with a strong emphasis on light-mediated processes. Her work explores the use of light as a versatile and energy-efficient tool for applications such as photocatalysis, additivemanufacturing (3D printing), and controlled polymer degradation. Throughher research, she aims to develop environmentally benign polymer systems that address challenges in sustainability, circular materials, and green chemical technologies. Her broader interests lie at the intersection of polymer chemistry, photochemistry, and materials science, with a focus on translating fundamental insights into practical and scalable solutions.

Bio-Based Thiol-Acrylate Vitrimers for Light-Based 3D Printing of Soft Active Materials

Viranchika Bijalwan[1]*, Sandra Schlögl[23], Sravendra Rana[1]

[1] UPES, School of Engineering, Energy Acres, Bidholi, Dehradun 248007, India.

[2] Polymer Competence Center Leoben GmbH, Sauraugasse 1, Leoben, Austria

[3] Institute of Chemistry of Polymeric Materials, Technical University of Leoben, Otto Glöckel-Strasse 2, Leoben, Austria

Dynamic covalent polymer networks have have emerged as a powerful platform for creating adaptive, reprocessable, and self-healing materials, particularly when combined with sustainable, bio-based precursors. Here, we report the development of bio-based thiol-acrylate vitrimer systems tailored for light-based 3D printing of soft, functional structures. The photopolymerizable resin formulations are based on acrylated epoxidized soybean oil (AESBO), a glycerol-derived reactive diluent, and thiol crosslinkers with varying functionalities, enabling precise control over network architecture and viscoelastic behaviour. The thiol-acrylate networks contain dynamic hydroxyl and ester functionalities that facilitate vitrimer behaviour through thermally activated transesterification reactions catalyzed by a tin-based catalyst ($Sn(Oct)_2$). Notably, $Sn(Oct)_2$ plays a dual role by promoting efficient bond exchange at elevated temperatures while also improving resin shelf stability by suppressing premature gelation. Digital Light Processing (DLP) 3D printing was used to fabricate soft structures with high resolution and shape fidelity. Dynamic mechanical analysis revealed that both AESBO content and thiol crosslinker functionality significantly influence the glass transition temperature, mechanical properties, and dynamic adaptability of the networks. Stress relaxation experiments demonstrated rapid network rearrangement, with up to 63% stress dissipation achieved within 2.6-3.6 minutes at temperatures between 180 and 200 °C, while substantially slower relaxation was observed at lower temperatures. The printed vitrimers exhibit efficient self-healing, reprocessability, chemical recyclability, degradability, and advanced shape-memory behaviour, making them ideal for soft active devices and soft robotics applications.

Biography:

Viranchika Bijalwan, a CSIR- Direct Senior Research Fellow, is a PhD student at the School of Engineering, University of Petroleum and Energy Studies (UPES), Dehradun, India. Her research interest is in the field of polymers, particularly photopolymers, self-healable materials, nanocomposites, and fiber reinforced composites. She has previously worked on a DST/SERB sponsored research project for the development of carbon fiber reinforced vitrimer composites, for aerospace applications. Currently, her work at UPES is focused on 3D- printing of photopolymerizable bio-derived vitrimers for potential in soft robotics and soft actuators.

Pore-Engineered Ni/Al_2O_3 Catalysts for High-Performance CO_2 Reforming

Dae-Woon Jeong[1]* and Beom-Su Cheon[1]
[1]Changwon National University, Republic of Korea

Carbon dioxide reforming (CDR) of CH_4 is a promising process for hydrogen production and greenhouse gas reduction. However, catalyst deactivation through carbon deposition and sintering limits its commercialization. In this study, Ni/Al_2O_3 catalysts were prepared by different methods to investigate the effects of pore properties and Ni-support interaction on catalytic performance. Mesoporous and bimodal porous structures were synthesized to clarify the relationship between pore characteristics and activity, while Ni addition was controlled to evaluate its influence on Ni–Al_2O_3 interaction. Among the catalysts tested at 700 °C with a CH_4/CO_2 ratio of 1.0 and a GHSV of 900,000 mL·g^{-1}·h^{-1}, the bimodal Ni/Al_2O_3 catalyst with Ni introduced after calcination showed the highest performance. This was attributed to enhanced mass transfer and optimized metal–support interaction, emphasizing the significance of pore structure control and Ni addition strategy in developing active and stable catalysts for CDR.

Biography:

Dr. Dae-Woon Jeong is a Professor in the Department of Environmental and Energy Engineering at Changwon National University, Republic of Korea. He earned his B.S. and Ph.D. degrees in Environmental Engineering from Yonsei University and completed postdoctoral research at the University of Toronto, Canada. Since joining Changwon National University in 2016, he has published about 100 SCIE-indexed papers and achieved technology transfers worth approximately 1.1 million USD. His research focuses on catalyst design and reaction engineering for hydrogen production, CO_2 reforming, and waste-to-energy conversion, aiming to develop efficient and sustainable energy technologies.

Plant Extract Mediated Bio-Fabrication of Chromium Manganese Nanocomposite and its Anti-Biofilm Potential Against Some Important Bacteria

Jameel H[1], Widad J[2], Mohammad Owais[3]

[1]Deptt. Of Biochemistry, Aligarh Muslim University, Aligarh -2
[2]Kasturba Medical College, Manipal-1
[3]Inter., Biotechnology Unit, -2

In the present study, we have used a green method for the synthesis of chromium manganese nanocomposites (Cr-MnNCs) employing the aqueous extract of Hibiscus rosa sinensis flower extract. The physicochemical characterization of the as-synthesised Cr-Mn-NCs was done by UV-Visible spectroscopy, DLS, zeta potential, FTIRspectroscopy, and electron microscopy (TEM and SEM) etc. The as-synthesized nanocomposites had a size range of 80-150 nm with polydispersity index of 0.398. The zeta potential of -17.7 mV reflected good stability of the Cr-Mn-NCs. Energy-dispersive X-ray spectroscopy (EDX) revealed that there were no discernible impurities in the Cr-Mn-NCs. The element analysis suggested the presence of chromium (2.17%), manganese (2.17%), carbon (54.44%), and oxygen (41.22%). The disc diffusion assay established superior anti-microbial potential of chromiummanganese nano-composite as compared to single metal nanoparticles and conventional antibiotics. The Cr-Mn-NCs successfully inhibited biofilms of the Gram-positive (Streptococcus mutans and Listeria monocytogenes), and the Gram-negative (Pseudomonas aeruginosa and Escherichia coli) bacterial strains. Additionally, Cr-Mn-NCs induced a significant elevation in reactive oxygen species (ROS) levels thereby highlighting their potential to disrupt target microbial membranes. The data of the present study emphasize the potential of the as-synthesized Cr-Mn NCs as a potent antimicrobial agent that kill less sensitive bacterial strains with great propensity.

Biography:

Hamna Jameel is a graduate student in the Department of Biochemistry, Aligarh Muslim University, India. Her research interests span nanotechnology-based drug and antigen delivery systems, with a strong focus on designing innovative therapeutic strategies for complex and multi-factorial diseases.

She has gained hands-on research experience through her involvement in several project, led by Professor Mohammad Owais, on selective delivery using targeted multifunctional nanoparticles. She developed lipid nanoparticles for treatment of fibrosarcoma and breast cancer in model animals. She has in several patents focusing on development of metal nanoparticles to her credit

She participated in several international seminars and symposiums. She also organized several scientific outreach programs such as AMR awareness sessions for the benefit of public health.

Amphotericin B Nano-Assemblies Circumvent Intrinsic Toxicity and Ensure Superior Protection in Experimental Visceral Leishmaniasis with Feeble Toxic Manifestation

Swaleha Zubair[1], Jameel H[2], Widad J[3], Mohammad Owais[4]

[1]Deptt. Of Computer Science, Aligarh Muslim University, Aligarh-2
[2]Deptt. Of Biochemistry, Aligarh Muslim University, Aligarh-2
[3]Kasturba Medical College, Manipal-1
[4]Inter., Biotechnology Unit, Aligarh Muslim University, Aligarh-2

In spite of its high effectiveness in the treatment of both leishmaniasis as well as various types of fungal infections, the free form of the polyene antibiotic amphotericin B (AmB) does not entertain the status of the most preferred drug of choice in clinical settings. The high intrinsic toxicity of the principal drug could be considered the main impedance in the frequent medicinal use of this otherwisevery effective antimicrobial agent. Taking into consideration this fact, the pharma industry has introduced many novel dosage forms of AmB to alleviate its toxicity issues. However, the limited production, high cost, requirement for a strict cold chain, and need for parenteral administration are some of the limitations that explicitly compel professionals to look for the development of an alternate dosage form of this important drug. Considering the fact that the nano-size dimensions of drug formulation play an important role in increasing the efficacy of the core drug, we employed a green method for the development of nano-assemblies of AmB (AmB-NA). The as-synthesized AmB-NA manifests desirable pharmacokinetics in the treated animals. The possible mechanistic insight suggested that as-synthesized AmB-NAinducesnecrosis-mediatedcelldeathandseveremitochondrialdy sfunction inL. donovanipromastigotes by triggering depolarization of mitochondrial membrane potential. In vivo studies demonstrate a noticeable decline in parasite burden in the spleen, liver, and bone marrow of the experimental BALB/c mice host. In addition to successfully suppressing the Leishmania donovani, the as-formed AmB-NA formulation also modulates the host immune system.

Biography:

Presently working as a Professor in the Department of Computer Science, Aligarh Muslim University, Aligarh. Besides active involvement in teaching she has successfully established a small but active research group with a focus on Bioinformatics, Data mining, Big data Analytics, andMachine Learning as a tool to unravel intricate mysteries of biological events. The amalgamation of computer-assisted algorithms with biologically relevant bigdata involving bio-macro-molecules such as DNA/RNA and proteins provides insight into the functioning of drug molecules at the molecular level. She has also exploited bioinformatics-related tools to identify potent antigens that can function as a candidate vaccine. The bioinformatics-based algorithms developed in Dr. Swaleha’s group, not only helped in the development of subunit vaccines, however, resulted in robust protection against various relevant pathogens such as Mycobacterium tuberculosis, Brucella abortifaciens, and Listeria monocytogenes, etc. She has also extensively worked on the exploitation of machine learning in deciphering various complicated biological events. Her research endeavors has made a revolutionary impact in the prognosis, treatment, and prevention of various important diseases of global importance. She has published (82) research articles in peer-reviewed journals of international repute.

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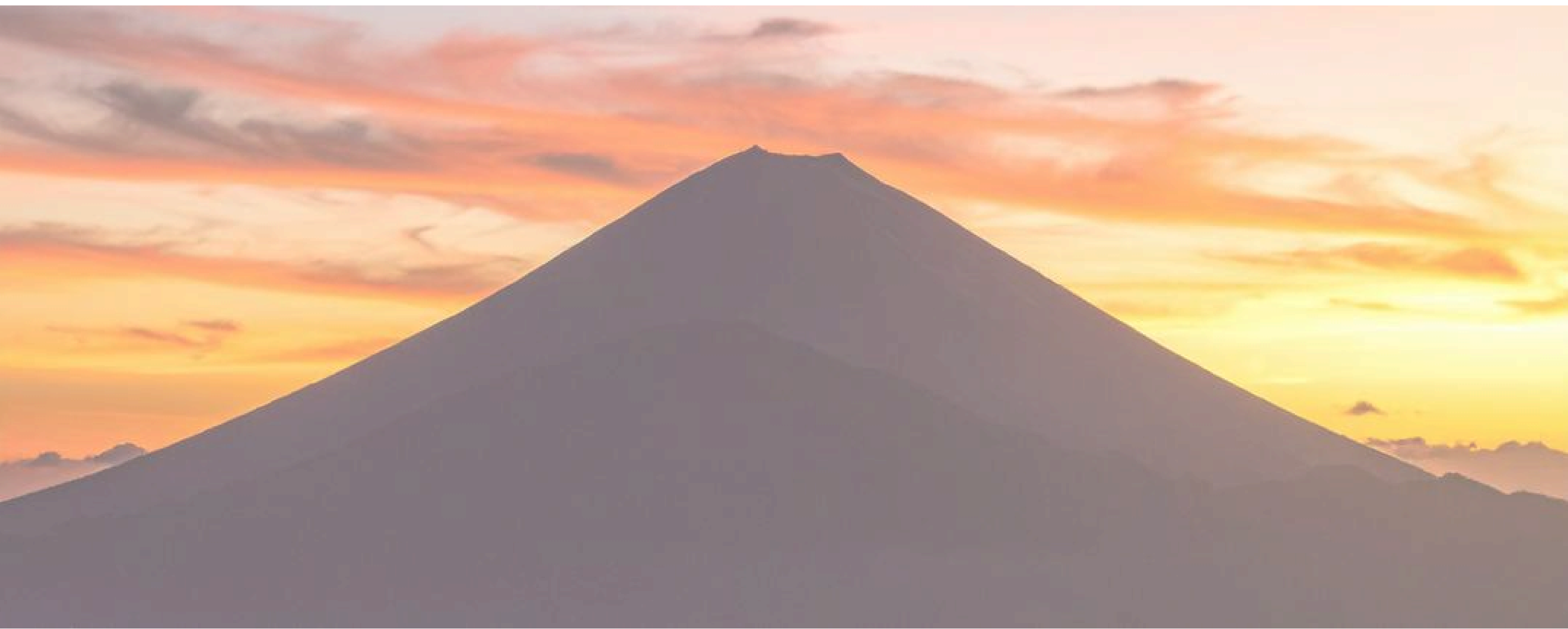

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9450 SW Gemini Dr
Suite 71868
Beaverton, Oregon 97008
US