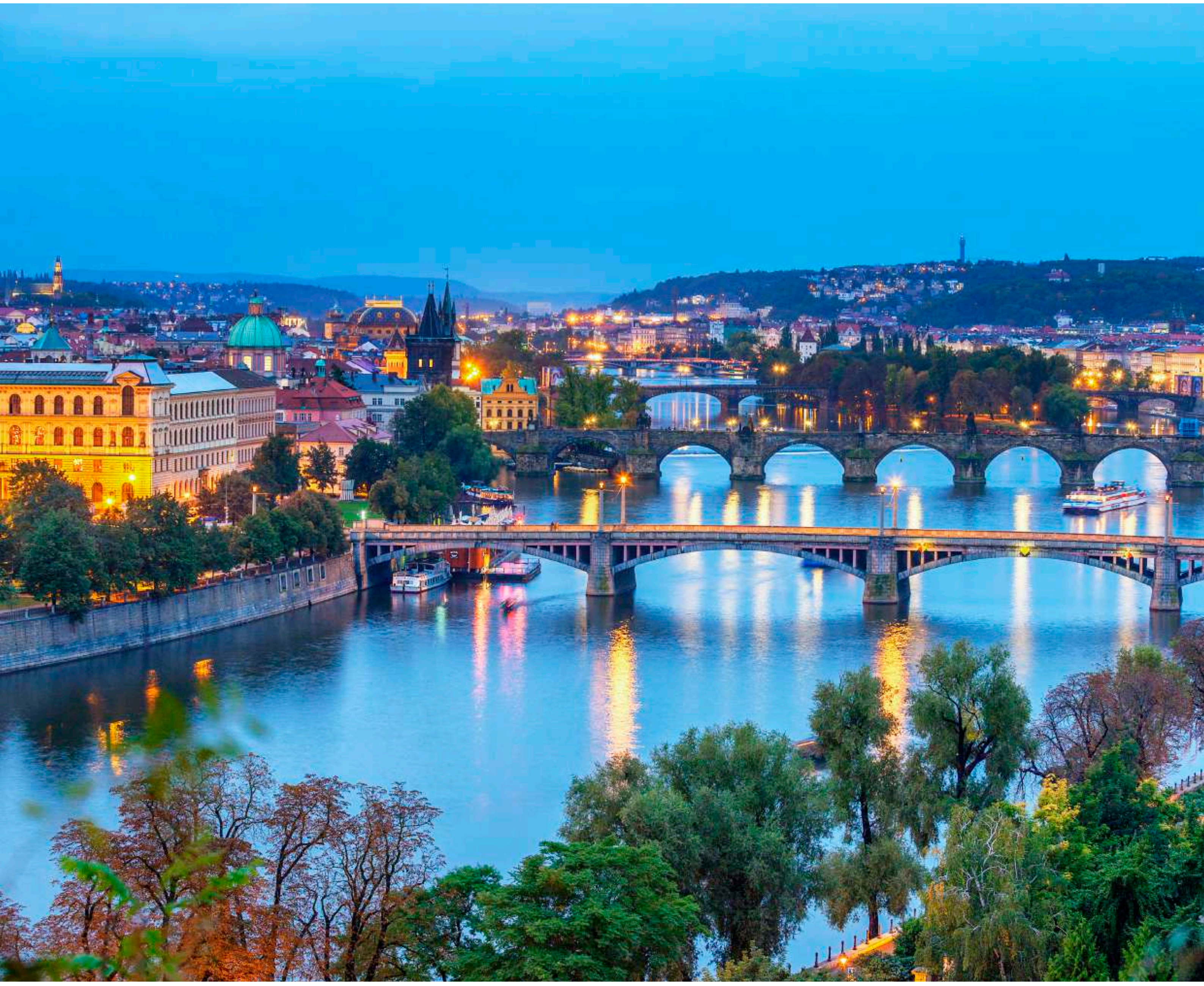
World Congress on

Polymer, Material Science & Renewable Energy

24-25 NOVEMBER 2025

PRAGUE, CZECH REPUBLIC



Venue: Panorama Hotel Prague
Milevska 1695/7, 140 63 Prague 4-Nusle, Czechia

Scientific Program

Day 1

November 24–25, 2025 | Prague, Czech Republic

Scientific Program

09:00 –09:15: Registrations

09:15 –09:30: Opening Ceremony

Keynote Presentations

09:30–10:10

Title: 30,000 Nano Implants in Human with No Failures...and Still Counting

Thomas J Webster

University of Pittsburgh, USA

10:10–10:50

Title: Physicochemical and Fire-Resistant Properties of Palm-Based Fire Retardant Composite

Junidah Lamaming

Universiti Malaysia Sarawak, Malaysia

Group Photo | Coffee Break 10:50-11:10@ Foyer

Session Introduction

Tracks

Renewable Energy: Conversion and Storage | Waste Management | Biodiversity | Sustainable and Renewable Energy | Bio-based and Renewable Materials | Waste-to-Energy and Biorefineries | Polymer Science | Composite Materials | Polymer Chemistry | Polymer Engineering | Polymer Physics | Polymer Materials

Session Chair: Thomas J Webster, University of Pittsburgh, USA

Oral Presentations

11:10–11:40	**Title: Fiber–Matrix Interactions in Agricultural Biomass Fiber Composites: Role of Bio-Based Polymer as Matrix Phase** **Nurjannah Salim** Universiti Malaysia Pahang Al Sultan Abdullah, Malaysia
11:40–12:10	**Title: Multi-density Foam-cell Headrest Design using Fast-Aggressive** **Sungwook Cho** Kongju National University, Republic of Korea
12:10–12:40	**Title: Enhancing the Performance of Piecewise Integrated Composite Structures through Optimized Machine Learning Data Allocation** **Seungmin Ji** Kongju National University, Republic of Korea

Lunch Break 12:40-13:40

13:40–14:10	**Title: Deep-Learning-Based Prediction of Mechanical Properties of Woven Carbon Fiber Reinforced Plastic Considering Crimp Geometry and Weave Pattern** **Seung ho Kwon** Kongju National University, Republic of Korea
14:10–14:40	**Title: Multi-scale interface design for realizing highperformance conversion efficiency in Mg-based thermoelectric device** **Jing-Tai Zhao** Guilin University of Electronic Technology, China
14:40–15:10	**Title: Polysaccharides in Agriculture: Crosslinked Sodium Alginate-g-poly(Potassium Acrylate) for Extended Water and Urea Release** **Talha Genc** University of Montpellier, France
15:10–15:40	**Title: Solid Waste Management in Climate Change Context: A Systemic Review of Developing Countries** **Khadija Ouknine** Cadi Ayyad University, Morocco

Coffee Break 15:40-16:00@ Foyer

16:00–16:30	**Title: Adaptive Mechanisms of Argania spinosa under Harsh Environmental Conditions: A Mini-Review** **Dounia Azwaq** Cadi Ayyad University, Morocco

16:30–17:00	**Title: Enhancing Coal Fines through Innovative Sustainable Green Binders for Eco-Friendly Briquettes** **Tebogo Mashifana** University of South Africa, South Africa

Poster Presentation

17:00–17:30	**Title: Microstructure and Mechanical Behavior of High-Entropy Alloy Processed by Cyclic Extrusion Compression Method** **Marcin Madej** AGH University of Krakow, Poland

Panel Discussion & Certificate Falicitation

Day –1 Ends

Day 2

Scientific Program

Virtual Mode Zoom Meeting
(GMT+2) Time in Czech Republic

November 25, 2025 | Virtual

Keynote Presentation

09:00–09:40	**Title: Towards a Sustainable World** **Marta Balan** Mt Battery Unity in Diversity Trust, Australia

Oral Presentations

09:40–10:00	**Title: Aunified formula for the viscosity of polymer solution** **Ang-Yang Yu** School of Chemistry & Chemical Engineering of Guangxi University, China
10:00–10:20	**Title: Additive Engineering for Efficient and Stable Perovskite Solar Cells** **Teo Siow Hwa** Universiti Malaysia Sabah, Malaysia
10:20–10:40	**Title: Research on Microstructural and Compositional Changes in Degraded Perovskite Solar Cells** **Yung-kuan Tseng** National Yunlin University of Science and Technology, Taiwan
10:40–11:00	**Title: Superior Electrochemical Water Splitting Achieved by Incorporating Molybdenum in Self-standing NiSe2/CoSe2 Heterostructures** **Priyanka Aggarwal** Tantia University, India
11:00–11:20	**Title: Complex Metal Ions Role to Enhancing Conversion and Storage of Solar Energy using Reductant and Photosensitizer** **Bijendra Singh** Central University of Gujarat, India
11:20–12:00	**(Keynote) Title: Crystallographic Transformations and Energy Storage and Dissipation in Thermomechanical Processes in Shape Memory Alloys** **Osman Adiguzel** Firat University, Turkey
12:00–12:20	**Title: Prospective Investigation of Metal-Oxide Nanofilms for High Performance Devices** **Paulo Cesar de Morais** Catholic University of Brasilia, Brazil
12:20–12:40	**Title: Synthesis of biodegradable carboxymethylcellulose polymer hydrogels for water stress mitigation and controlled release of nitrogen and phosphate fertilizers.** **Lívia Valentim Sanches** Universidade Estadual Paulista, Brazil

12:40–13:20	(Keynote) Title: Microstructure and Mechanical Behavior of High-Entropy Alloy Processed by Cyclic Extrusion Compression Method **Paulo Cesar de Morais** Catholic University of Brasilia, Brazil
13:20–13:40	Title: Analyzing Heat Transfer in Solar-Powered Ventilation to Enhance Energy Efficiency in Buildings **Karla María Aguilar Castro, Carlos Enrique Torres Aguilar, Edgar Vicente Macias Melo** Universidad Juárez Autónoma de Tabasco, Mexico

Panel Discussion

World Congress on

Polymer, Material Science & Renewable Energy

November 24-25, 2025 | Prague, Czech Republic

HYBRID EVENT

KEYNOTE PRESENTATIONS
DAY 1

Thomas J. Webster
University of Pittsburgh, USA

30,000 Nano Implants in Human with No Failures...And Still Counting

Nanomedicine is the use of nanomaterials to improve disease prevention, detection, and treatment which has resulted in hundreds of FDA approved medical products. While nanomedicine has been around for several decades, new technological advances are pushing its boundaries. For example, this presentation will present an over 25 year journey of commercializing nano orthopedic implants now in over 30,000 patients to date showing no signs of failure. Current orthopedic implants face a failure rate of 5 – 10% and sometimes as high as 60% for bone cancer patients. Further, Artificial Intelligence (AI) has revolutionized numerous industries to date. However, its use in nanomedicine has remained few and far between. One area that AI has significantly improved nanomedicine is through implantable sensors and neurological applications. This talk will present research in which implantable sensors, using AI, can learn from patient's response to implants and predict future outcomes. Such implantable sensors not only incorporate AI, but also communicate to a handheld device, and can reverse AI predicted adverse events. Examples will be given in which AI implantable sensors have been used in neurology to inhibit implant infection and promote prolonged neural function. Moreover, in vitro and in vivo experiments will be provided that demonstrate how nanotechnology can be incorporated into neurology to help human health

Biography:

Thomas J. Webster's (H index: 130) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995; USA) and in biomedical engineering from RPI (Ph.D., 2000; USA). He has formed over a dozen companies who have numerous FDA approved medical products currently improving human health in over 30,000 patients. His technology is also being used in commercial products to improve sustainability and renewable energy. He is currently helping those companies and serves as a professor at Brown University, Saveetha University, Hebei University of Technology, UFPI, and others. Dr. Webster has numerous awards including: 2020, World Top 2% Scientist by Citations (PLOS); 2020, SCOPUS Highly Cited Research (Top 1% Materials Science and Mixed Fields); 2021, Clarivate Top 0.1% Most Influential Researchers (Pharmacology and Toxicology); 2022, Best Materials Science Scientist by Citations (Research.com); and is a fellow of over 8 societies. Prof. Webster is a former President of the U.S. Society for Biomaterials and has over 1,350 publications to his credit with over 55,000 citations. He was recently nominated for the Nobel Prize in Chemistry. Prof. Webster also recently formed a fund to support Nigerian student research opportunities in the U.S.

Junidah Lamaming
Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak

Physicochemical and Fire-Resistant Properties of Palm-Based Fire Retardant Composite

This study investigates the physicochemical characteristics and fire-resistant performance of a novel palm-based fire retardant composite developed from agricultural waste materials. The composite was formulated using palm biomass derivatives integrated with inorganic fire- retardant additives to enhance thermal stability and combustion resistance. Comprehensive characterization techniques, including FTIR, TGA, SEM, and XRD, were employed to analyze the material's chemical composition, thermal behavior, and structural properties. Fire resistance was evaluated through standardized flame retardancy tests such as the limiting oxygen index (LOI), vertical burning (UL-94), and cone calorimetry. The results revealed that the palm-based composite exhibited significant improvements in fire resistance, thermal stability, and structural integrity compared to untreated controls. These findings demonstrate the potential of palm-derived materials as sustainable and effective components in environmentally friendly fire-retardant systems for construction and industrial applications.

Keywords: Reinforced composite, fire resistant board, lignocellulosic biomass, characterization, mechanical properties

Biography:

Junidah Lamaming, Ph.D., is a senior lecturer at Universiti Malaysia Sarawak, Malaysia, specializing in nanocellulose, polymer composites, and sustainable biomaterials. An award-winning researcher and prolific author, she has published extensively and serves as a reviewer for numerous international journals.

World Congress on

Polymer, Material Science & Renewable Energy

November 24-25, 2025 | Prague, Czech Republic

HYBRID EVENT

SPEAKER PRESENTATIONS

DAY 1

Nurjannah Salim
Universiti Malaysia Pahang Al Sultan Abdullah, Malaysia

Fiber–Matrix Interactions in Agricultural Biomass Fiber Composites: Role of Bio-Based Polymer as Matrix Phase

The growing demand for sustainable and high-performance materials has accelerated the development of bio-based polymer composites reinforced with agricultural biomass fibers. A central challenge in these systems is achieving strong interfacial adhesion between hydrophilic natural fibers and hydrophobic polymer matrices. This review explores the mechanisms of fiber–matrix interactions with a specific focus on bio-based polymer matrices such as lignin-derived polybenzoxazines, polylactic acid (PLA), and epoxidized vegetable oils. These polymers not only offer environmental benefits but also possess functional groups that can be engineered to enhance compatibility with lignocellulosic fibers. The review critically examines recent advances in fiber surface treatments, matrix modifications, and emerging processing technologies that aim to improve interfacial bonding and overall composite performance. Case studies from multiple agricultural fibers, including kenaf, flax, oil palm, and jute, are analyzed to illustrate how fiber–matrix compatibility affects mechanical, thermal, and morphological outcomes. The synthesis concludes with an evaluation of research gaps and outlines future directions toward optimizing fiber–matrix synergy through advanced bio-based resin design and processing innovation.

Keywords: Fiber–matrix interaction, Agricultural biomass fibers, Bio-based polymer matrix, Sustainable material

Biography:

Ts. Dr. Nurjannah Salim is a Senior lecturer in the Faculty of Industrial Science and Technology at Universiti Malaysia Pahang Al-Sultan Abdullah. Her research interest is in the field of Polymer Composite and Technology, specializing in polymer composite and properties of lignocellulosic based composites, properties of components of bioresources in relation to panel production and protective functional components of plant biomass. The key strategy in her research activities is to develop new composites from green material such as lignocellulose fiber. Her main current research interest deals with the development and application of lignocellulose plastic composite materials as alternatives material such as furniture, paneling and engineering products. The outcomes of her research have been presented and published in many article journals on materials study, polymer composite at various international and national refereed journals, symposiums, and conferences.

Sungwook Cho
Kongju National University, Republic of Korea

Multi-density Foam-cell Headrest Design using Fast-Aggressive Whale Optimization

This study presents a new Multi-density Foam-cell (MF) headrest designed to reduce neck injuries that occur during rear-end collisions, with a particular focus on protecting wheelchair users in wheelchair-accessible vehicles (WAVs). Neck injury severity, measured by the Neck Injury Criterion (NIC) and the Normalized Neck Injury Criterion (Nij), is highly influenced by the position of the headrest and the distribution of foam densities within it. To optimize these factors, we developed a modified version of the Whale Optimization Algorithm known as Fast Aggressive Whale Optimization (FA-WOA).

The proposed FA-WOA combines two key strategies. The first is an aggressive mechanism that improves convergence rate i.e., reducing computational time, by adaptively reducing the search domain, guided by parameters such as a modified search spread, a best candidate gradient, and an updated coefficient vector. The second strategy enhances diversity in the search process to avoid premature convergence and improve global accuracy.

We first validated the performance of FA-WOA using a wide range of benchmark functions. We then applied it to a rear-end collision simulation involving a Hybrid III dummy, a wheelchair, and its restraint system. The goal was to find the optimal headrest position and foam density configuration that would minimize NIC and Nij.

The results demonstrate that FA-WOA offers an effective and reliable solution for complex, high-dimensional engineering optimization problems in occupant safety design.

Keywords: Meta-heuristic algorithm, whale optimization algorithm, PU foam, rear-end collision analysis, finite element analysis

Biography:

Mr. Cho received his M.S. degree in 2024 from Kongju National University, South Korea, where he is currently pursuing a Ph.D. degree. His research interests include the optimal design of composite structures, machine learning, meta-heuristic algorithms, impact analysis, optimization of manufacturing processes, and quantum computing.

Seungmin Ji
Kongju National University, Republic of Korea

Enhancing the Performance of Piecewise Integrated Composite Structures through Optimized Machine Learning Data Allocation

Fiber-reinforced composite structures designed with a single stacking sequence have limitations in performance improvement. To address this issue, the Piecewise Integrated Composite (PIC) design method, in which stacking sequences are varied according to loading type, has been proposed. In previous studies, machine learning was employed to determine the stacking sequence for each loading type; however, insufficient training accuracy for specific loading type limited the effectiveness of the PIC design method. Therefore, in this study, a training data allocation strategy was established to enhance the prediction accuracy of machine learning. Data were grouped according to the absolute magnitude of each loading type, and combinations of these groups were constructed. Random samples were then drawn from each combination to train machine learning models. Through an analysis of the results with respect to different data allocations, criteria for effective data assignment were derived to achieve higher prediction accuracy. As a result, the improved prediction accuracy led to enhanced structural performance of a bumper beam designed using the PIC design method.

Keywords: Fiber reinforced composite, Piecewise integrated composite, Machine learning, Bumper beam

Biography:

Mr. Ji received his M.S. degree in 2023 from Kongju National University, South Korea, where he is currently pursuing a Ph.D. degree. His research interests include the optimal design of composite structures, machine learning, representative volume element of composite, impact analysis, optimization of manufacturing processes, and quantum computing.

Seung ho Kwon
Kongju National University, Republic of Korea

Deep-Learning-Based Prediction of Mechanical Properties of Woven Carbon Fiber Reinforced Plastic Considering Crimp Geometry and Weave Pattern

Woven carbon-fiber reinforced plastic (CFRP) exhibits mechanical behavior that is strongly governed by weave architecture and yarn crimp. However, Classical Laminate Plate Theory (CLPT) and conventional RVE (Representative Volume Elements)-based finite element analyses (FEA) have limited fidelity in capturing non-uniform patterns and the continuity of crimp across unit boundaries. To address this gap, we propose a data-driven framework that predicts the effective properties of a 4×4 woven architecture from the properties of 2×2 meso scale RVEs augmented with descriptors of inter-unit crimp geometry. A micro–meso multiscale FEA was performed. At the mesoscale, we considered 4×4 woven with various weave types (plain, twill, and non-uniform patterns) assembled from 2×2 units with different connectivity conditions. All simulations employed periodic boundary conditions under tension, compression, and shear load cases. Experimental characterization was conducted for plain and twill weaves, and simulation results were validated against the measurements. The computed mechanical properties across weave patterns were curated into a database to train a deep neural network (DNN). The DNN inputs comprise the 2×2 units properties together with features describing the crimp geometry at inter-unit junctions; the outputs are the effective mechanical properties of the assembled 4×4 architecture. The trained model shows high agreement with FEA and correctly reflects property variations induced by connection-crimp effects, yielding robust predictions over diverse weave patterns and unit combinations.

Keywords: Woven composites, carbon fiber reinforced plastic, machine learning, composite structures

Biography:

Mr. Kwon is currently pursuing his M.S in Mechanical Engineering at Kongju National University. His research interests include the fiber reinforced plaistic, composite structural optimization, and machine learning.

Jing-Tai Zhao

Guilin University of Electronic Technology, China

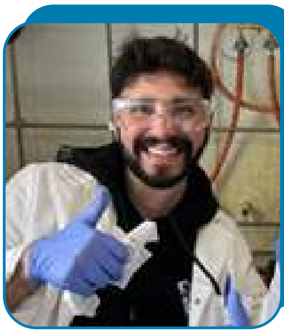
Multi-scale interface design for realizing high-performance conversion efficiency in Mg-based thermoelectric device

$Mg_3(Sb,Bi)_2$ alloys have emerged as a promising alternative to commercial Bi2Te3-based thermoelectrics, owing to its excellent thermoelectric performance, cost-effectiveness, and environmentally friendly nature. However, the average $_zT_{ave}$ of n-type $Mg_3(Sb,Bi)_2$ materials over a wide temperature range is significantly constrained by thermally-activated-conduction behaviors. In our work, an innovative and simple approach by leveraging the work function principle to design anti-barrier layers for electrons through metal-semiconductor contact engineering proposed. Specifically, nano-scale tungsten (W) and molybdenum (Mo) particles, which process a lower work function compared to the $Mg_3(Sb,Bi)_2$ matrix, were incorporated as composite materials. The $_zT_{ave}$ of the W-doped sample in 323 ~ 773 K range reaches 1.34, representing about 36.7% increase over the undoped sample, ranking among the highest for $Mg3(Sb,Bi)_2$ alloys. Based on the resulting samples, a segmented thermoelectric power-generation device utilizing p-type $(BST)_{97}(FeTe_2)_3$ and $(Ge_{0.91}Sb_{0.09}Te)_{0.99}(InSe)_{0.01}$ has been designed and prepared. When the relative current density (u) and the compatibility factor (s) are well-aligned, the system will operate approaching its maximum efficiency according to the COMSOL simulation results. In addition, the typical barrier layer materials, nickel (Ni) and titanium (Ti), were employed in the thermoelectric legs of the thermoelectric device, showing high interface stability and low interface resistivity. At $\triangle T = 440$ K, this device achieved a maximum conversion efficiency of 10.4% and a peak output power of 0.41 W. These results establish a solid foundation for the development of efficient thermoelectric material combinations.

Keywords: Thermoelectric conversion efficiency, Mg3(Sb,Bi)2, thermoelectric properties, Segmented thermoelectric device, Anti-barrier layers, Interface resistivity

Biography:

Prof. Dr. Jingtai Zhao, PhD from the University of Geneva (1991), Postoc (Ames Lab-USDOE,1991- 1994, USA). Returned to China (1994) and later became a full Professor of Materials Chemistry at Xiamen University (1997-1999) and later to Shanghai Institute of Ceramics – Chinese Academy of Sciences, Shanghai University and Guilin University of Electronic Technology. He had been visiting scholars at the Max-Planck Institute for Chemical Physics of Solids (1999-2002, Germany), Nanophotonic Center at Texas Tech University (2016-2018, USA) and Department of Physics of UC Davis (2018-2020,USA). Research interests focused on Inorganic Materials Chemistry and Physics, and development of energy-related materials and sensor devices, such as thermoelectrics, scintillators, luminescence and supercapacitor materials.



Talha Genca
University of Montpellier, France

Polysaccharides in agriculture: Crosslinked Sodium Alginate-g-poly(Potassium Acrylate) for extended water and urea release

Here we present the synthesis and characterization of a crosslinked sodium alginate-g-poly(potassium acrylate) hydrogel designed for extended release applications in agriculture. The hydrogel was synthesized via graft copolymerization of potassium acrylate onto sodium alginate using N,N'-methylenebisacrylamide as a crosslinker and ammonium persulfate as an initiator in aqueous solution. The physical, chemical, structural, and morphological characteristics of the hydrogel were thoroughly investigated using solid-state 13C-nuclear magnetic resonance (NMR), attenuated total reflectance fourier-transform infrared spectroscopy (ATR-FTIR), thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), scanning electron microscopy (SEM), and energy dispersive x-ray analysis (EDX). Swelling and deswelling ratios were evaluated to characterize the water absorption and release behavior of the superabsorbent hydrogel. Compression tests were performed on samples allowed to swell for varying durations in order to assess their mechanical stability and resistance to deformation under simulated soil pressure conditions. Furthermore, the hydrogel's interaction with urea was examined by evaluating its swelling capacity in urea-containing media and monitoring the controlled release of urea over time using ultraviolet spectroscopy (UV), demonstrating its potential as a nutrient delivery system in agricultural applications. This multifunctional material has potential applications in agriculture together with active substances such as fertilizers or soil conditioners, offering enhanced efficiency and environmental sustainability.

Biography:

Talha Genç earned a Bachelor's degree in Chemistry from Yildiz Technical University, completing an exchange year at Brno University of Technology and graduating with honors. He obtained a Master's in Advanced Cosmetic Sciences from the University of Bologna with 110/110 cum laude. Currently, he is a Marie Skłodowska-Curie Doctoral Researcher in the ESPERANTO project at the University of Montpellier.

Khadija OUKNINE
Cadi Ayyad University, Morocco

Solid Waste Management in Climate Change Context: A Systemic Review of Developing Countries

Solid waste management presents significant environmental and climate challenges due to increasing waste production, poor disposal practices, and inadequate infrastructure in developing countries. The effects of poor management are examined in this chapter, including pollution, loss of biodiversity, and greenhouse emissions from burning and landfills assainissement of uncontrolled landfills. Key difficulties include the lack of effective recycling programs, poor legislative frameworks, insufficient public awareness, and a scarcity of financial and technical resources. These issues frequently result in inefficient systems that fail to ensure sustainable waste management. The chapter then delves into potential solutions, including investments in waste treatment infrastructure, stricter enforcement of environmental regulations, and public involvement techniques. The article also discusses trash to energy technology and the need to integrate informal waste workers into formal systems. By addressing these aspects, this review provides insights into effective waste management strategies to mitigate climate impacts, protect ecosystems and promote a circular economy that reduces waste and maximizes resource use.

Biography:

Khadija Ouknine, 25, is a first-year PhD student in Environmental Sciences, focusing on waste management. She holds a Master's degree in Quality, Health, Safety, and Environment Management, and a Bachelor's degree in Biology with a specialization in Environmental Management. Passionate about sustainability and scientific research, she is currently working on a literature review related to her field of study.

Dounia Azwaq

Cadi Ayyad University (UCA), Essaouira Higher School of Technology, Interdisciplinary Laboratory for Research in Environment, Morocco

Adaptive Mechanisms of *Argania spinosa* under Harsh Environmental Conditions: A Mini-review

The argan tree [Argania spinosa (L) Skeels], native to the arid and semi-arid regions of the center-west of Morocco, is ecologically significant and contributes greatly to the local economy. Known for its resilience against desertification and role in preventing soil erosion, the tree also helps stabilize coastlines and mountainous areas. However, the increasing environmental challenges posed by climate change, such as water scarcity and salinity, are threatening these habitats. This review aims to explore the effects of drought and salinity on the morphological, ecophysiological, and biochemical traits of A. spinosa, focusing on the mechanisms that enable the tree to endure harsh conditions. It examines how these environmental stressors may affect the sustainability of A. spinosa populations and the livelihoods dependent on them. By synthesizing current research, this review aims to enhance our understanding of Argania spinosa's adaptation strategies, providing crucial information for conservation, sustainable managementand enhancing its role in carbon sequestration in the context of climate challenges.

Keywords: Argania spinosa, climate change, drought stress, salinity, adaptation, ecophysiological mechanisms.

Biography:

Dounia Azwaq, I am 25 years old and currently a first-year PhD student in Environmental Sciences at Cadi Ayyad University. My research focuses on carbon sequestration and the sustainable development of the argan forest in the Essaouira province. I am affiliated with the Higher School of Technology in Essaouira. I hold a specialized Master's degree in Environmental Management and Sustainable Development. I have skills in environmental performance, GIS, and ecosystem management. Passionate about climate issues and biodiversity, I actively contribute to projects related to sustainability and the preservation of natural ecosystems.

Tebogo Mashifana
University of South Africa, South Africa

Enhancing Coal Fines through Innovative Sustainable Green Binders for Eco-Friendly Briquettes

The coal industry is vital for its economy and energy production, but the generation of coal fines during processing poses environmental and health challenges. Coal briquetting offers a promising solution by converting coal fines into denser briquettes. This study investigates the use of cactus gel, an unconventional binder, to enhance the properties of coal fines briquettes and reduce emissions during combustion. Coal fines were mixed with cactus gel to improve compressibility and durability, with various solid-to-liquid mixing ratios tested. The mixture was shaped into briquettes using a 50x50x50 mm^3 mold and cured for analysis of compressive strength. The results indicated that the briquettes failed to maintain structure, disintegrating into a liquid-like substance and achieving only 95% of the minimum Water Resistance Index (WRI). However, the 40:60 solid-to-liquid ratio produced briquettes with the highest calorific value of 26.57 MJ/kg and a compressive strength of 0.375 MPa, meeting the requirements for fuel briquettes and demonstrating superior water resistance compared to lower ratios. Cactus gel proved to be an effective natural binding agent, significantly enhancing the structural integrity and energy content of coal fines briquettes. The 40:60 ratio emerged as optimal for achieving both high calorific value and compressive strength. These findings suggest a pathway toward more sustainable coal processing methods.

Biography:

Tebogo Mashifana is an educator and researcher specializing in circular economy, with over a decade in academia. Holding a DPhil in engineering, she has significantly contributed to sustainable resource management. Her expertise includes waste reduction strategies, the green economy, and resource efficiency across various sectors. An accomplished author, Mashifana, has published numerous journal articles, offering insights into environmental engineering and circular economy principles. Her commitment to advancing sustainable development practices through research continues to inspire positive change and promote a more sustainable future.

World Congress on

Polymer, Material Science & Renewable Energy

November 24-25, 2025 | Prague, Czech Republic

HYBRID EVENT

POSTER PRESENTATION

Marcin Madej

AGH University of Krakow, Poland

Microstructure and Mechanical Behavior of High-Entropy Alloy Processed by Cyclic Extrusion Compression Method

High-entropy alloys (HEAs) represent an innovative family of materials, notable for their remarkable microstructural stability, impressive mechanical strength, and suitability for demanding applications. Among these, the equiatomic CoCrFeMnNi system—widely known as the Cantor alloy—distinguishes itself with outstanding corrosion resistance and high ductility. This research focuses on evaluating the effects of cyclic extrusion and compression (CEC), a severe plastic deformation (SPD) technique, on the microstructure and mechanical properties of this alloy. During the CEC process, consolidation of powder is achieved by applying alternating compressive and tensile stresses. Specimens were processed through one, two, and three cycles of channel pressing, followed by thorough microstructural observation. To further enhance the properties, samples after multiple cycles were subjected to intermediate annealing at 900°C for 1 hour, enabling additional CEC passes. The findings show that three cycles result in a hardness of approximately 260 HV1—an increase of about 80 units compared to annealed material, with some residual porosity. Subsequent cycles after annealing raise the hardness above 300 HV1 and reduce porosity to nearly 1%. Scanning electron microscopy reveals progressive microstructure uniformity with each stage of CEC, while two series of three cycles yield strongly bonded powder grains with minimal porosity. The CEC procedure does not alter the elemental distribution, confirming a homogeneous alloy structure.

Acknowledgements: Research project supported by program Excellence initiative – research university" for the AGH University of Krakow" No 10651

Biography:

Marcin MADEJ, DSc, PhD, Eng., is a professor at AGH University of Krakow and works at the Faculty of Metals Engineering and Industrial Computer Science. His primary areas of expertise include metal matrix composites reinforced with ceramic particles, heat treatment, ferrous and non-ferrous metals and alloys produced by PM methods, tribological properties and surface engineering. He has authored and co-authored approximately 170 articles published in international and national scientific journals. Additionally, he is a member of the Polish Society for Composites Materials and Polish Tribology Society.

inovine
Scientific Meetings

World Congress on

Polymer, Material Science & Renewable Energy

November 24-25, 2025 | Prague, Czech Republic

HYBRID EVENT

Zoom Meeting (GMT+2) Time Prague, Czech Republic

VIRTUAL PRESENTATIONS

DAY 2

Marta Balan
Mt Battery Unity in Diversity Trust, Australia

Towards a Sustainable World

A brief update on climate change in the world and an overview of international agreements on combating climate change is presented, focusing at the role of humans in the programs. Apart from the adaptation to facts of climate change, the impact of the integrity of humans in the roots of climate change is analysed through the framework of teachings of faith traditions on shared values and their scientific correlates, postulating the unity of environmental and social sustainability. A new platform is proposed to expand the programs and policies drawn mainly by LiFE in the G20: Community Education in Eco-social Sustainability, for motivating communities and individuals to make sustainable choices, to develop a sustainable lifestyle and to contribute to character building of future generations for maintaining a lasting eco-social sustainability of the world.

The Community Education in Eco-social Sustainability Model is to be carried out in a multi purpose communal setting utilising a unique architectural structure, a Buckminster-Fuller dome, where a comprehensive innovative content is taught applying innovative methodology. Apart from climate information, the content is mainly human values and arts of cultures in programs of mini events designed to trigger attitude changes by the experience of facilitated active involvement in a communal interaction. Classical educational methods are also applied, such as lectures and workshops on combating climate change. The setting is designed to serve a practical application of eco-social sustainability principles: as headquarters of citizens' climate action initiatives, for promotion of a sustainable lifestyle, a display of green chemistry applications in farming and a place for collaboration between climate activists, cultural influencers, research and educational institutions, media, government and non-governmental organisations. This cost effective communal setting is a non-permanent removable structure fitting on small lots of crown land or on unused spaces of government properties and is applicable in various societies.

Key words: Eco-social Sustainability, Community Education, Values

Biography:

An academic in Transpersonal Psychology from Australia, Marta applied her multifaceted skills in pioneer volunteer community work since 1995. For fostering harmony and inclusiveness she initiated interfaith networking, founded the Unity in Diversity Events with annual concerts of traditional multi-faith music, the Victorian Shared Values Symposiums, the Victorian Interfaith Networks Annual Conferences and the multicultural WE ARE THE WORLD! Bring a bell! Concerts. Her research on unity of social and environmental sustainability she ploughed into the Victorian Sustainability-Well-being Expo in 2013. She utilises her expertise in community education on eco social sustainability through the Mt Battery Unity in Diversity Trust.

Ang-YangYu
Guangxi University, China

A unified formula for the viscosity of polymer solution

The concept of viscosity is one of the central themes in rheology. There are many factors, including temperature T, pressure P, shear velocity •, mass of polymer M and branching, which have great impacts on the shear viscosity of polymer solution. Based on the analysis and principle of each factor's influence on the viscosity of polymer solution, a unified expression for the viscosity of polymer solution is put forward in this work. This new formula has two adjustable parameters (A and B), as well as three polymer constants (M , n, C M), where M ismass of polymer, n stands for the non-Newtonian index and polymer. C M is threshold mass for chain entanglememt of

Keywords: Viscosity; Rheology; Polymer solution; Unified expression

Biography:

Angyang Yu studied physics at Dalian University of Technology (China) and obtained his B.Sc. in 2003. He received his M.Sc. in 2006 after conducting his master thesis on molecular reaction dynamics in Dalian Institute of Chemical Physics, Chinese Academy of Sciences. After obtaining his Ph.D. degree at Jilin University in China, he was awarded a Postdoctor's Fellowship to study titanium alloys' oxidation at Institute of Metal Research, Chinese Academy of Sciences. His research interests include calculations of molecular spectra, chemical kinetics, molecular excited states, molecular reaction dynamics and engineering alloy design

Teo Siow Hwa
Universiti Malaysia Sabah, Malaysia

Additive Engineering for Efficient and Stable Perovskite Solar Cells

The performance of high-efficiency inverted perovskite solar cells (PSCs) heavily depends on the quality of the hole transporting layer (HTL) and its interfaces. This study explores how incorporating lanthanum (La) into the NiOx matrix affects defect passivation, ultimately enhancing charge extraction capabilities and stability without sacrificing power conversion efficiency. The introduction of La results in a noticeable improvement in the quality of the La–NiOx layer, eliminating the formation of pinholes. Furthermore, La incorporation modifies the energy band alignment, which enhances hole transport and increases the open circuit voltage (Voc) beyond 1 V compared to pure NiOx. The advantageous impact of La is further confirmed through photoluminescence measurements, demonstrating effective passivation of trap states. Significantly, PSCs utilizing La–NiOx as the HTL exhibit a 21% increase in efficiency and superior stability compared to those with pristine NiOx. Remarkably, solar cells doped with 3 mole% La maintained 95% of their efficiency after 50 days of storage in a moisture-free desiccator, and 98% efficiency retention was observed for cells stored in a glovebox, substantially outperforming pristine counterparts. The positive effects of La incorporation also extend to the conductivity of the solar cells, evidenced by a reduction in charge transfer resistance (Rct) from 3100 Ω in pristine cells to 1200 Ω. Additionally, the presence of La shortens the carrier lifetime, indicating reduced recombination processes and more efficient charge carrier transfer from the perovskite layer. Overall, while there is still room for enhancing the power conversion efficiency of La–NiOx PSCs through further modifications, the addition of La has demonstrably improved their stability, paving the way for future commercialization opportunities.

Keywords: Additive engineering; lanthanum; hole transporting layer; power conversion efficiency,stability

Biography:

Teo Siow Hwa is a senior lecturer in the Faculty of Science and Technology, Universiti Malaysia Sabah. He received his Ph.D. degree majoring in Catalysis from the Catalysis Science and Technology Research Centre, Universiti Putra Malaysia in 2015. He was then joined as a postdoctoral researcher at the Catalysis Science and Technology Research Centre in 2015–2017. After that, he was appointed as an Assistant Professor at Kyushu Institution of Technology, Japan from 2017 to 2019. His research focuses on catalysis, renewable energy conversion, solar energy materials, perovskite solar cells, and semiconductor photo-physical properties for clean energy applications.

Yung-kuan Tseng
National Yunlin University of Science and Technology, Yunlin, Taiwan

Research on Microstructural and Compositional Changes in Degraded Perovskite Solar Cells

This study aims to thoroughly investigate the microstructural and compositional changes of degraded perovskite solar cells after accelerated aging, with the goal of elucidating the underlying mechanisms of performance degradation. The research will involve fabricating standard perovskite solar cells and subjecting them to various accelerated aging experiments. IV curve measurements will be conducted at different aging time points to assess the extent of performance degradation. Subsequently, multiple analytical techniques will be employed to observe and analyze the degraded cells: Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) will be used to observe film morphology, grain changes, cracks, and interfacial defects; X-ray Diffraction (XRD) will analyze crystal structure and phase composition changes. For compositional and chemical changes, Energy Dispersive X-ray Spectroscopy (EDS) will provide elemental distribution information, X-ray Photoelectron Spectroscopy (XPS) and Fourier Transform Infrared Spectroscopy (FTIR) will analyze elemental and organic component changes, while a Raman spectrometer will be used to detect lattice vibrational modes and defect information. Through these comprehensive microstructural and compositional analyses, this study aims to precisely identify the defect types, formation mechanisms, and material chemical transformations leading to the performance decline of perovskite solar cells, thereby providing a solid experimental basis and scientific insights for the future development of more stable, long-lifetime perovskite solar cells.

Biography:

Yung-Kuan Tseng is a professor in the Department of Cultural Heritage Conservation at National Yunlin University of Science and Technology in Taiwan, and also holds a joint appointment at the Graduate School of Materials Science. His recent research primarily focuses on protective materials for outdoor geo-material cultural heritage, nanostructured materials, and sustainable energy materials.

Priyanka Aggarwala
Tantia University, India

Superior Electrochemical Water Splitting Achieved by Incorporating Molybdenum in Self-standing NiSe2/CoSe2 Heterostructures

The strategic development of highly active, low-cost, and durable electrocatalysts for hydrogen (HER) and oxygen evolution (OER) reactions is crucial for the advancement of renewable energy technologies. In this study, we explore a unique heterostructure composed of molybdenum-doped NiSe2/CoSe2 (Mo-NiSe2/CoSe2) supported on nickel foam substrate as efficient electrocatalyst for HER, OER, and overall water splitting. The binder-free Mo-NiSe2/CoSe2 catalyst demonstrated exceptional performance with overpotentials of a mere 99, 198, and 342 mV (at -10, -100 and -500 mA cm−2) for HER and 254, 340, 400 mV (at 10, 100, and 500 mA cm−2) for OER, along with Tafel slopes of 84.9 mV dec−1 and 49.4 mV dec−1, respectively, in 1 M KOH solution. As a bifunctional electrocatalyst for the overall water splitting, Mo-NiSe2/CoSe2 achieved a low cell voltage of 1.66 V at a current density of 10 mA cm−2 and displayed remarkable stability over 96 h. Mo-doping and the synergistic effects from heterointerfaces has helped in reducing water dissociation barrier, offer abundant active sites, and facilitate electron transfer kinetics, thereby improving both the catalytic activity and durability. Moreover, post-OER characterization reveals the surface oxidation of Mo-NiSe2/CoSe2 to form Mo-doped NiOOH/CoOOH species on the catalyst surface during the OER process that actually contributes to the outstanding OER activity and stability. This study highlights the potential of metal-doped heterostructured diselenides in advancing the scalability of alkaline water splitting.

Keywords: Mo doping, Hydrogen evolution reaction; water splitting; metal selenides; bifunctional electrocatalysts

Biography:

Dr. Priyanka Aggarwal is an Assistant Professor in the Department of Physics at Tantia University, Sriganganagar. She earned her PhD in Physics from Malaviya National Institute of Technology (MNIT), Jaipur, where her research focused on “Modified Transition Metal Dichalcogenide Electrocatalysts for Enhanced Hydrogen Evolution Reaction”. She has a strong academic background with an M.Sc. and B.Sc. in Physics and has successfully qualified national-level examinations including CSIR-NET-JRF (AIR-119) and GATE. Her research interests include electrocatalysis, energy materials, water splitting, nanomaterials synthesis, hydrogen evolution reaction, oxygen evolution reaction, electrochemical analysis, Materials characterization, and transition metal dichalcogenides (TMDs). She has published several research papers in peer-reviewed journals, authored book chapters, and contributed to high-impact publications. She was selected for the prestigious Sakura Science Exchange Program in Japan and visited for academic and research exchange. She was also honored with the Best Presentation Award at an international conference for her work on advanced electrocatalysts for hydrogen generation.

Bijendra Singh
School of Chemical Sciences, Central University of Gujarat, India

Complex Metal Ions Role to Enhancing Conversion and Storage of Solar Energy using Reductant and Photosensitizer

Photogalvanic effect was investigated using reductant EDTA-LGB-XCFF system.Investigated photogalvanic system can be used for 54 minutes in dark at its power point, effect of various parameter on electrical output of the photo galvanic cell was studied ,fill factor and conversion efficiency.Fill factor and conversion efficiency of the investigated system calculated as 0.40 and 0.83 % respectively. On the basis electroactive species and investigated EDTA-LGB-XCFF system a mechanism of generation of current has also been proposed with Green & Sustainable renewable energy.

Keywords: Photo galvanic cell, fill factor, conversion efficiency, storage capacity.

Biography:

Dr. Bijendra Singh is a researcher known for his work in the field of photogalvanic cells (PGCs), particularly in the context of solar energy conversion to contribute developing clean, renewable, and eco-friendly sources of energy with photoelectrochemical cells (PECs) to enhancing solar energy conversion and storage capacity, Nano materials application for biomedical impact, water treatment, medicine and recovery of minerals from waste materials with environmental impact. Dr. Bijendra Singh has completed his PhD from Central University of Gujarat, India and M.Phil. From School of Chemical Sciences, Central University of Gujarat, India. He has published more than 30 papers in reputed journals & more than 21 International and national oral presentation.

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

Crystallographic Transformations and Energy Storage and Dissipation in Thermomechanical Processes in Shape Memory Alloys

Shape memory alloys take place in a class of advanced smart materials, by exhibiting dual memory characteristics, shape memory effect and superelasticity. Shape memory effect is initiated with thermomechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of material cycle between original and deformed shape in reversible way. Therefore- this behavior can be called Thermoelasticity. This is plastic deformation, due to the soft character of the material in low temperature condition, with which strain energy is stored in the material and releases on heating by recovering original shape.

This phenomenon is governed by crystallographic transformations, thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movements of atoms in <110 > -type directions on the {110} - type close packed planes of austenite matrix, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures. The twinned structures turn into the detwinned martensite structures by means of stress induced martensitic transformation, with deformation in the martensitic condition. However, lattice twinning and detwinning reactions play important role in martensitic transformations, and they are driven by internal and external forces by means of inhomogeneous lattice invariant shear. Superelasticity is performed with stressing and releasing material the material in elasticity limit at a constant temperature in parent phase region, and shape recovery is performed simultaneously upon releasing the applied stress, by exhibiting elastic material behavior. It is important that stressing and releasing paths are different in stress-strain diagram, and hysteresis loops refer to energy dissipation. Superelasticity is also result of stress induced martensitic transformation and ordered parent phase structures turn into detwinned martensite structure with stressing in the parent phase region.

Copper- based alloys exhibit this property in metastable β-phase region. Lattice invariant shear and twinning is not uniform in these alloys and gives rise to the formation of complex layered structures, depending.

In the present contribution, x-ray and electron diffraction studies were carried out on two copper- based CuAlMn and CuZnAl alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections, inherited from the parent phase structures, due to the diffusionless character of transformations.

Keywords: Shape memory effect, martensitic transformation, thermoelasticity, superelasticity, twinning, detwinning

Biography:

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied were focused on shape memory effect in shape memory alloys. His academic life started following graduation by attending an assistant to Dicle University in January 1975. He became professor in 1996 at Firat University in Turkey, and retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He supervised 5 PhD- theses and 3 M. Sc- theses and published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international level with contribution. He served the program chair or conference chair/co-chair in some of these activities. Also, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Additionally, he joined over 230 online conferences in the same way in pandemic period of 2020-2024.

Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data)

Paulo C. De Morais
Catholic University of Brasilia, Genomic Sciences and Biotechnology, Brazil

Prospective Investigation of Metal-Oxide Nanofilms for High Performance Devices

The presentation will be focused on exploring the use of the thermal evaporation technique for fabrication of copper and copper oxide nanofilms, the latter addressed to be used as sensors of small organic molecules. The nanofilm's thickness control is achieved through modulation of the Z-position (metal source-to-substrate distance) within the chamber. It is found that the grain size (⟨D⟩) is strongly correlated with the film thickness (ω), being described by a power law (⟨D⟩∝ω^n), where n is around 0.5 for the as-fabricated copper nanofilms. Measurements reveal resistivity ranging in the range of 3 to 5 μΩcm for the copper nanofilms, aligning closely with expectations for copper nanofilms composed of crystallites sized between 20 and 30 nm, which is consistent with the grain sizes obtained from x-ray diffraction (XRD) data. In order to produce copper oxide nanofilms, thermal annealing process was carried out at 200°C in air for 20 hours. XRD data analysis indicates mean crystallite sizes varying from about 9 nm up to about 24 nm as the nanofilm's thickness increases. Electrical measurements indicate a p-type copper oxide semiconductor, with carrier concentrations of around 1014 cm-3, which shows a slight decrease as the nanofilm's thickness increases.

Biography:

Professor Paulo César De Morais, PhD, was full Professor of Physics at the University of Brasilia (UnB) – Brazil up to 2013. Appointed as UnB's (Brazil) Emeritus Professor (2014); Visiting Professor at the Huazhong University of Science and Technology (HUST) – China (2012-2015); Distinguished Professor at the Anhui University (AHU) – China (2016-2019); Full Professor at the Catholic University of Brasília (CUB) – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-years (1987-1988) post-doc position with Bell Communications Research, New Jersey – USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais (UFMG) – Brazil. With over 13,500 citations, He has published more than 500 papers (Web of Science), presented more than 200 invited talk (35 countries), and filed 16 patents.

Livia Valentim Sanches
Sao Paulo State University, Brazil

Synthesis of biodegradable carboxymethylcellulose polymer hydrogels for water stress mitigation and controlled release of nitrogen and phosphate fertilizers

Hydrogels are materials formed by two or more components consisting of a threedimensional polymer network capable of absorbing and retaining large amounts of water or other fluids without dissolving. Studies point to beneficial effects of hydrogel use on soil properties such as water retention, field capacity, and hydraulic conductivity. The fact that hydrogels increase the water storage capacity of the soil may also enable the storage of nutrients contained in solid fertilizers, which are gradually released into the soil solution as the water retained in the hydrophilic nanocomposite is released. The controlled release of nutrients through hydrogel would allow the application of fertilizers at the time of sowing, thus favoring better synchronization of the availability of essential nutrients with the nutritional demand of the plant throughout the phenological cycle. This effect, although more pronounced for nitrogen fertilizers, also influences the dynamics of phosphorus, especially poorly soluble rocks, accelerating their dissolution by the displacement of ions resulting from the high cation exchange capacity of the system. Materials based on carboxymethylcellulose (CMC) polymer and crosslinked with different concentrations of iron chloride are being developed, achieving swelling values between twenty and almost ninety times their own weight in water.

Keywords: Nanocomposites. Polymers. Water deficit

Biography:

Livia Sanches graduated from the São Paulo State University "Júlio de Mesquita Filho" (Unesp) – Faculty of Sciences and Engineering of Tupã. Currently, at 23 years of age, she is a master's student in the Department of Agronomy at Unesp – Faculty of Agronomic Sciences of Botucatu, in partnership with the Brazilian Agricultural Research Corporation (Embrapa) in São Carlos in the nanotechnology laboratory and with the Department of Environmental Science at Bangor University with Professor Davey L. Jones. Lívia has five full articles published in journals and is a member of the research group for Agricultural Biosystems, called BioAgro.

Paulo C. De Morais
Catholic University of Brasilia, Brazil

Nanocomposite and Radiofrequency Synergism Addressed to Cell Viability Response

In this keynote talk, it will be explored the use of the Hill model to assess the Benchmark dose (BMD), the lethal dose 50 (LD50), the cooperativity (E) and the dissociation constant (K) while analyzing cell viability data using nanomaterials. The presentation is addressed to discuss the antitumor potential while combining radiofrequency (RF) therapy in and selected nanomaterials. In particular, it will be discussed the use of nanocomposites, for instance comprising graphene oxide (GO) surface functionalized with polyethyleneimine (PEI) and decorated with gold nanoparticles (GO-PEI-Au). Data collected from the cell viability assays using different tumor cell lines (e.g. LLC-WRC-256 and B16-F10) will be presented and discussed. The findings will demonstrate that while the tested nanocomposite (e.g. GO-PEI-Au) may be biocompatible against different cancer cell lines in the absence of radiofrequency (nRF), the application of radiofrequency (RF) enhances the cell toxicity by orders of magnitude, pointing to prospective studies with the tested cell lines using tumor animal models.

Biography:

Professor Paulo César De Morais (H59), PhD, was full Professor of Physics at the University of Brasilia (UnB) – Brazil up to 2013. Appointed as UnB's (Brazil) Emeritus Professor (2014); Visiting Professor at the Huazhong University of Science and Technology (HUST) – China (2012-2015); Distinguished Professor at the Anhui University (AHU) – China (2016-2019); Full Professor at the Catholic University of Brasília (CUB) – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-years (1987-1988) post-doc position with Bell Communications Research, New Jersey – USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais (UFMG) – Brazil. With more than 13,500 citations, He has published more than 500 papers (Web of Science), delivered more than 200 international invited talks, and filed 16 patents.

Carlos Enrique Torres Aguilar, Edgar Vicente Macias Melo, Karla María Aguilar Castro
Universidad Juárez Autónoma de Tabasco, Cunduacán, Tabasco, México

Analyzing Heat Transfer in Solar-Powered Ventilation to Enhance Energy Efficiency in Buildings

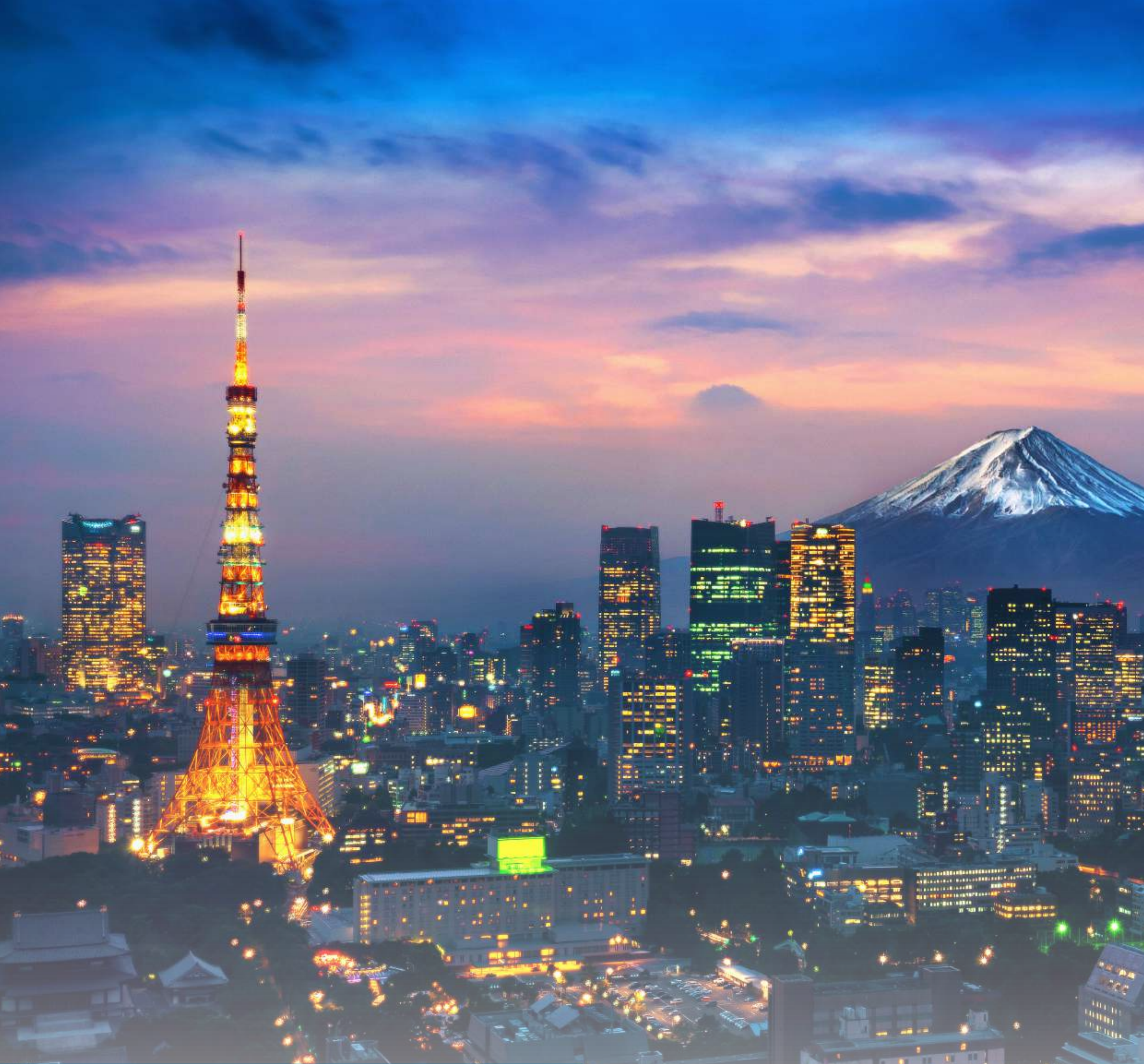
In this work, the thermal behavior of a solar chimney model was evaluated for its application in buildings as a strategy to improve energy efficiency and reduce dependence on artificial air conditioning systems. The study focused on analyzing airflow and heat transfer within the solar chimney, considering the specific climatic conditions of Villahermosa, Tabasco, throughout the year. To this end, theoretical and numerical methods were employed, using an approach based on global energy balances to represent the processes of conduction, convection, and thermal radiation in the different components of the system. The methodology incorporated the analogy with electrical circuits, allowing the thermal resistances of materials to be represented and facilitating the analysis of the system's behavior through nodal modeling. A computational code was also developed in C++ to solve the model using the Gauss-Seidel and Jacobi iterative methods. The meteorological data used was obtained from CONAGUA, considering temperature, wind speed, solar radiation, and atmospheric pressure variables. The study varied the number of nodes and the orientation of the chimney. Among the most relevant results, it was found that the best conditions for induced mass flow occurred on warm days, reaching a maximum of 0.05508 kg/s, while on cold days, minimum values as low as 0.000046 kg/s were recorded. It was observed that east and west orientations offered better thermal performance. The results show that properly designed and oriented solar chimneys represent an efficient alternative for natural ventilation and improving thermal comfort in buildings, with great application potential in warm and humid climates.

Keywords: Solar chimney, Building, Comfort, Ventitalion

Biography:

Carlos Enrique Torres Aguilar completed his PhD at the age of 30 years from National Center for Research and Technological Development, México. He has published more than 10 papers in reputed journals and is associate editor of the journal Applied Thermal Engineering-Elsevier. He is a National System of Researchers and Professor-Researcher member at the Universidad Juárez Autónoma de Tabasco, México.

Index



SEE YOU AT UPCOMING 2026

2nd International Conference on

POLYMER SCIENCE & COMPOSITE MATERIALS

https://polymerscienceconference.org

5th World Congress on

MATERIALS SCIENCE & ENGINEERING

https://www.materialsciencecongress.com

October 12-13, 2026 | Tokyo, Japan

Email: contact@inovineconferences.com | Phone/WhatsApp: +1-408-648-2233/+44 7361 618033