CALL FOR PAPERS

49th

JANUARY 26—31, 2025

International Conference and Exposition on Advanced Ceramics and Composites

Hilton Daytona Beach Resort and Ocean Center
Daytona Beach, Florida, USA

Abstracts due on September 2, 2024

ceramics.org/icacc2025

The American Ceramic Society
ceramics.org

Engineering Ceramics Division
The American Ceramic Society

Organized by:
The Engineering Ceramics Division
of The American Ceramic Society

Welcome

Amjad Almansour
NASA Glenn Research Center, USA
Program Chair, ICACC 2025

The 49th International Conference & Exposition on Advanced Ceramics & Composites (ICACC 2025) will be held from Jan. 26—31, 2025, in Daytona Beach, Fla. It is a great honor to chair this conference, which has a strong history of being one of the best international meetings on advanced structural and functional ceramics, composites, and other emerging ceramic materials and technologies. The American Ceramic Society's Engineering Ceramics Division (ECD) has organized this esteemed event since 1977. Over the years, the conference has experienced tremendous growth, worldwide interest and active participation from ceramic researchers, developers, and end users from the globlal community.

This year, the technical program consists of nineteen symposia, seven focused sessions, one special focused session and the 14th Global Young Investigator Forum. These technical sessions, consisting of both oral and poster presentations, will provide an open forum for scientists, researchers and engineers from all over the world to present and exchange findings on recent advances on various aspects related to ceramic science and technology.

The technical program encompasses diverse areas of ceramics and advanced composites, with particular emphasis on the current trends in the research, development, engineering and application of advanced ceramics. The well-established nineteen symposia at this conference include Mechanical Behavior of Ceramics and Composites, Advanced Ceramic Coatings, Solid Oxide Cells, Protective Ceramics, Bioceramics, Materials for Rechargeable Energy Storage, Nanomaterials for Sustainable Energy and Health Applications, Materials for Thermoelectric and Thermionic Energy Conversion Advanced Processing and Manufacturing Technologies, Porous Ceramics, Modeling and Design, Production Root Technologies, Nanolaminated Ternary Carbides/Nitrides, Nuclear Materials, Optical Materials, Additive Manufacturing, Geopolymers, Photonics, Ultra-High Temperature Ceramics and Molecular-level Processing and Chemical Engineering.

Additionally, there will be seven focused sessions, including two new topics on Innovative Material Processing for Diverse Resource Circulation Loops and Ceramics for Global Decarbonization, as well as topics carried over from 2024 on Bioinspiration and Green Processing, Protective Ceramics, Chemical Sensors, Ceramic/Carbon Reinforced Polymers and High Voltage Materials. Moreover, the Special Focused Session on Diversity, Entrepreneurship, and Commercialization will be organized to recognize the ECD Jubilee Global Diversity Awardees, along with other invited speakers who will present their contributions and showcase some of the recent developments in entrepreneurship and commercialization in the field of ceramics science and engineering. Building on successful interactions and excitement generated in the first 13 years, the 14th Global Young Investigator Forum will be organized and facilitated by a group of our young researchers from diverse backgrounds.

The ECD Executive Committee and volunteer organizers sincerely hope you will join us at this conference for a stimulating and enjoyable ICACC 2025.

We look forward to seeing you in Daytona Beach, Fl, in January 2025.

TENTATIVE SCHEDULE OF EVENS

SUNDAY, JANUARY 26, 2025

Conference Registration	2:00pm - 7:00pm
Member and Publication Center	2:00pm - 7:00pm
Speaker Ready Room	2:00pm - 7:00pm
Welcome Reception	5:30pm - 7:00pm

MONDAY, JANUARY 27, 2025

Conference Registration	7:00am - 6:00pm
Member and Publication Center	7:00am - 6:00pm
Speaker Ready Room	8:00am - 4:00pm
Opening Awards Ceremony & Plenary Session	8:30am - Noon
Companion Coffee	9:00am - 10:30am
Coffee Break	10:10am - 10:40am
Lunch On Own	Noon - 1:20pm
Concurrent Technical Sessions	1:30pm - 6:10pm
Coffee Break	3:00pm - 3:20pm

TUESDAY, JANUARY 28, 2025

Conference Registration	7:30am - 6:00pm
Member and Publication Center	7:30am - 6:00pm
Speaker Ready Room	8:00am - 4:00pm
Concurrent Technical Sessions	8:30am - Noon
Coffee Break	10:00am - 10:20am
Exhibitor Set-up	Noon - 4:00pm
Lunch On Own	Noon - 1:20pm
Concurrent Technical Sessions	1:30pm - 5:30pm
Coffee Break	3:00pm - 3:20pm
Poster Session A Set-up	3:00pm - 4:30pm
Exhibits & Poster Session A Including Reception	5:00pm - 8:00pm

HILTON DAYTONA BEACH RESORT

100 North Atlantic Avenue, Daytona Beach, FL 32118
Phone: 1-386-254-8200

Rates: One to four occupants: $192 USD
US government employee: Prevailing rate

Make reservations online under the Hotel and Travel link at **www.ceramics.org/icacc2025** or reserve by telephone. Mention The American Ceramic Society to obtain the special rate.

ABSTRACT SUBMISSION INSTRUCTIONS

Visit **www.ceramics.org/icacc2025** to review session topics. Select "Submit Abstract" to be directed to the Abstract Central website.

Abstract title plus text total character limit (including spaces) is 1,500 characters.

If you have questions, please contact Karen McCurdy at kmccurdy@ceramics.org

WEDNESDAY, JANUARY 29, 2025

Conference Registration	7:30am - 5:30pm
Member and Publication Center	7:30am - 5:30pm
Speaker Ready Room	8:00am - 4:00pm
Concurrent Technical Sessions	8:30am - Noon
Lunch On Own	Noon - 1:20pm
Concurrent Technical Sessions	1:30pm - 5:30pm
Coffee Break	3:00pm - 3:20pm
Poster Session A Set-up	3:00pm - 4:30pm
Exhibits & Poster Session A Including Reception	5:00pm - 8:00pm

THURSDAY, JANUARY 30, 2025

Conference Registration	7:30am - 5:30pm
Member and Publication Center	7:30am - 5:30pm
Speaker Ready Room	8:00am - 4:00pm
Concurrent Technical Sessions	8:30am - Noon
Lunch On Own	Noon - 1:20pm
Concurrent Technical Sessions	1:30pm - 5:30pm
Coffee Break	3:00pm - 3:20pm
Last Night Reception	5:30pm - 6:30pm

FRIDAY, JANUARY 31, 2025

Conference Registration	8:00am - Noon
Concurrent Technical Sessions	8:30am - 11:40am
Coffee Break	10:00am - 10:20am

ACerS Engineering Ceramics Division Leadership

Chair: Young-Wook Kim, *University of Seoul, South Korea*

Chair-elect: Jie Zhang, *Institute of Metal Research, China*

Vice-chair/Treasurer: Amjad Almansour, *NASA Glenn Research Center, USA*

Secretary: Federico Smeacetto, *Politecnico di Torina, Italy*

Trustee: Michael C. Halbig, *NASA Glenn Research Center, USA*

Parliamentarian: Manabu Fukushima, *National Institute of Advanced Industrial Science and Technology, Japan*

Counselors: Palani Balaya, *National University of Singapore*

Hisayuki Suematsu, *Nagaoka University of Technology, Japan*

***ACerS* Board of Directors Division Liaison: Kristin Breder,** *Saint-Gobain Ceramics & Plastics, USA*

Young Professionals Network Division Liaison: Jackson Majher, *Glass Coatings and Concepts, USA*

President's Council of Student Advisors Delegates: Christine Brockman, *Oklahoma State University, USA*

Milos Dujovic, *Texas A & M University, USA*

DEI Subcommittee representative: Federico Smeacetto, *(2022–2023), Politecnico di Torino*

SPECIAL EVENTS

AT ICACC 2025!
NEW IN PROGRAMMING FOR 2025!

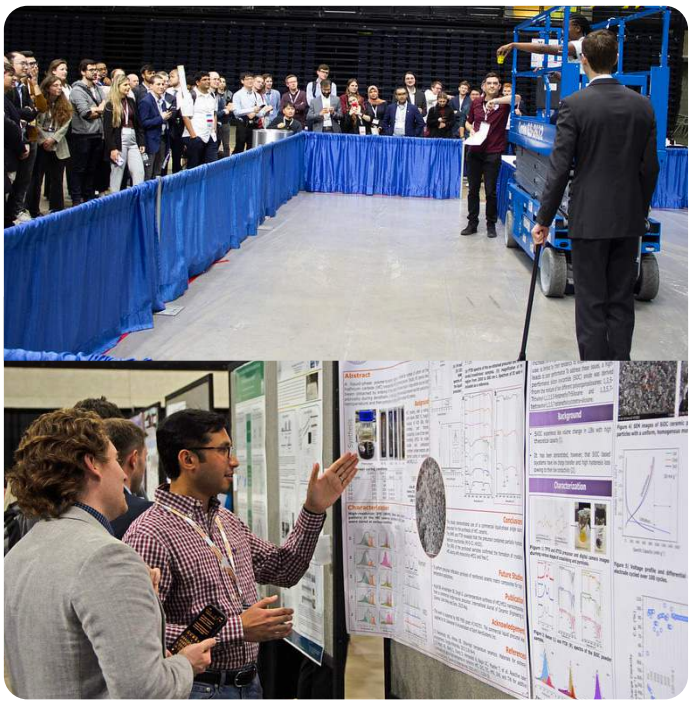
ICACC 2025 will offer a number of special events to not only encourage invaluable networking opportunities with colleagues, but also help to supplement your travel budget! ICACC 2025 registration includes four evening receptions with food and drink provided, as well as two coffee breaks per day, a diversity luncheon on Thursday and an additional evening reception for students and young professionals. The host hotel, the Hilton Daytona Beach, will also offer lunch specials for conference attendees.

Welcome Reception

Network with colleagues at the reception and enjoy food, drink and live entertainment at the kick-off event.

ACerS Student and Young Professional Networking Mixer

Join fellow students and young professionals for food and drink at the student and young professionals networking event.



Shot Glass Contest

Organized by *ACerS* President's Council of Student Advisors *(PCSA)*, test your skills with this design contest! Competing teams of four will be given 15 pipe cleaners to build a protective device for their shot glass provided by SCHOTT. Then, the glasses will be dropped from increasing heights until the breaking threshold is reached. The glass with the highest successful drop distance wins!

Last Night Reception with Trivia Contest

Recap the week's excitement with your colleagues and friends. Join in the trivia contest to win some great prizes!

Expo and Poster Session

Visit with vendors from the ceramic and glass industry and check out scientific posters!

NEW!

Poster Session Preview

At ICACC 2025, poster presenters will have the opportunity to make a two-minute "Poster Preview Pitch" in front of their colleagues at the end of their respective technical session each day, in addition to presenting their poster in the two-day poster session. This is optional and poster authors can indicate their interest in participation when submitting their abstract in Scholar One.

MECHANICAL BEHAVIOUR AND PERFORMANCE OF ADVANCED CERAMICS AND COMPOSITES

Advanced structural ceramics, cermets and ceramic matrix composites (CMCs) are enabling materials for applications in various industries such as energy generation and storage (e.g., concentrated solar power, nuclear, combustion, batteries), extreme environment, space, transportation, medicine, microelectronics and optical systems. High mechanical reliability is a key issue for their ultimate use in short to long-term applications. Identification and quantification of failure mechanisms by fracture, creep, fatigue and/or irreversible deformation are essential, as well as their correlation with structure, processing and exposure to severe service conditions. Extreme environments and challenging applications have necessitated new approaches for sustainable manufacturing and characterization of ceramic materials. The development of novel methods to advance and accelerate computationally driven materials characterization and validate structure/property relationship and multiscale models are needed to improve predictions of material behavior, lower costs and consider sustainability and life cycle assessment. This symposium solicits abstracts related to the diverse aspects of the mechanical behavior of ceramics and composites and their correlations with processing, component performance and reliability.

Proposed Session Topics

- Mechanical characterization of ceramics and composites, techniques and equipment
- Small-scale testing and in-situ characterization using photons and neutrons
- Fracture mechanics, failure analysis and fractography
- Environmental effects, thermo-mechanical creep, fatigue performance and tribology
- Design, reliability, and life prediction modeling of materials devices, and components
- Novel computational approaches to enhance performance and characterization
- Processing-microstructure-mechanical properties correlation
- Role of fibers, matrices, coatings and interfaces in mechanical behavior
- Functionally graded materials and multilayer ceramic systems
- Manufacturing and testing of joined and integrated components and structures
- Ceramics for aerospace and other transport applications
- Ceramics for energy generation, turbines and environmental applications
- Ceramics for concentrated solar-thermal power and industrial process heat
- Correlation of resource efficient processing of ceramics and CMCs with their performance

Symposium Organizers

Amjad Almansour, *NASA Glenn Research Center, USA*

Dong (Lilly) Liu, *University of Oxford, UK*

Jonathan Salem, *NASA Glenn Research Center, USA*

Monica Ferraris, *Politecnico di Torino, Italy*

Gerard Vignoles, *University of Bordeaux, France*

Dileep Singh, *Argonne National Laboratory, USA*

Craig Przybyla, *Air Force Research Laboratory, USA*

Dietmar Koch, *University of Augsburg, Germany*

Emmanuel Maillet, *GE Research, USA*

Kamala Raghavan, *U.S. Department of Energy, USA*

Kevin Strong, *Sandia National Laboratory, USA*

Stefan Schafföner, *University of Bayreuth, Germany*

Raul Bermejo, *Montanuniversitaet Leoben, Austria*

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ADVANCED CERAMIC COATINGS FOR STRUCTURAL, ENVIRONMENTAL, AND FUNCTIONAL APPLICATIONS

High-performance ceramic coating systems are key to current and future technologies. Ceramic coatings extend lifetime or even enable the operation of engineering materials in harsh environments. Advanced gas turbine engine components made of ceramic matrix composites, intermetallics or superalloys promise higher energy efficiency due to increasing operation temperatures. Advanced thermal and environmental barrier coatings (T/EBC) are mandatory to protect components against the synergistic attack of heat, combustion atmosphere and inorganic, CMAS-type aerosols. Oxidation protection provided by ceramic coatings is crucial for non-oxide, ultra-high temperature ceramics and composites to be used in reusable spacecraft or hypersonic vehicles. Protection of metal components against oxidation, corrosion, erosion and wear by innovative ceramic coatings is also a central building block for many other technologies. Functional ceramic coatings are essential for many renewable energy applications.

The symposium addresses research and development in the fields of processing, microstructure, performance and durability of advanced ceramic coatings. New materials, innovative processing technologies, advanced characterization methods and modeling are particularly emphasized.

Proposed Session Topics

- Thermal and environmental barrier coatings for CMC, intermetallics and alloys
- CMAS-type degradation of T/EBC: Fundamentals, modeling and mitigation strategies
- Ceramic coatings for protection against oxidation, corrosion, erosion and wear
- Ceramic coatings for renewable energy applications
- Processing of ceramic coatings (thermal spraying, PVD, CVD, aerosol deposition, sintering)
- Microstructure-property relationships
- Advanced destructive and non-destructive characterization methods
- Modeling and simulation

Symposium Organizers

Peter Mechnich, *German Aerospace Center (DLR), Germany*

Douglas E. Wolfe, *The Pennsylvania State University, USA*

Jie Zhang, *Institute of Metal Research, CAS, China*

Bryan Harder, *NASA Glenn Research Center, USA*

Elizabeth Opila, *University of Virginia, USA*

Ravisankar Naraparaju, *German Aerospace Center (DLR), Germany*

Nadia Rohbeck, *Pratt and Whitney, USA*

Kuiying Chen, *NRC Ottawa, Canada*

Kang N. Lee, *NASA Glenn Research Center, USA*

Eric H. Jordan, *The University of Connecticut, USA*

Robert Vaßen, *Forschungszentrum Jülich, Germany*

Julin Wan, *GE Global Research, USA*

Satoshi Kitaoka, *Japan Fine Ceramics Center, Japan*

Byung-Koog Jang, *Kyushu University, Japan*

David Poerschke, *University of Minnesota, USA*

Ping Xiao, *University of Manchester, UK*

Rodney W. Trice, *Purdue University, USA*

Yutaka Kagawa, *University of Tokyo, Japan*

Eugene Medvedovski, *Endurance Technologies Inc., Canada*

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22ND INTERNATIONAL SYMPOSIUM ON SOLID OXIDE CELLS (SOC): MATERIALS, SCIENCE AND TECHNOLOGY

Solid oxide cells (SOCs) offer great potential for clean and efficient power generation from a wide variety of fuels ranging from hydrocarbons to renewables and for highly efficient conversion of electricity to hydrogen or synthesis gas via electrolysis. Durable electrochemical energy conversion in SOC is only possible by proper material choice and processing, cells stacking technology, and stack module design. Application of SOC in scalable systems for power, heat, hydrogen and synthetic gas generation requires serious consideration of the stack operating window, operating environment, contaminants sources/level and customer specifications to realize competitive solutions.

This symposium provides an excellent platform for academia and industry to present and discuss novel solutions for materials, components design, mechanical robustness, durability and system layouts and exchange their experience in the application of SOCs in different areas. The goal of the symposium is not only the exchange of recent results by experienced and young scientists but also extensive discussion of unsolved problems and development directions.

Proposed Session Topics

- Electrolytes: oxygen ion, proton and mixed conductors; conduction mechanisms
- Electrode materials and microstructural engineering: electrode processes, defect chemistry, characterization, accelerated testing and lifetime prediction
- Ceramic and metallic interconnects: Materials development and properties, coatings, accelerated testing and lifetime prediction
- Sealing and brazing technology: Material development and characterization, designs, and approaches, interactions with sealing materials
- Novel processing and design for cells, stacks, reformers, burners and other system components
- Mechanical and thermomechanical properties of materials and components up to high temperatures
- Surface and interfacial reactions: Electrochemical transport and electrode poisoning, catalytic degradation, carbon fouling
- Simulation: Electrode performance and degradation, distribution of temperature, current density and mechanical stresses in cells and stacks, system layout, stationary and dynamic system operation, etc.
- High-temperature electrolysis: Steam, steam and CO_2, chemical process engineering utilizing SOEC
- System design and demonstration

Symposium Organizers

Scott A. Barnett, *Northwestern University, USA (lead organizer)*

Federico Smeacetto, *Politecnico di Torino, Italy*

Mihails Kusnezoff, *Fraunhofer IKTS, Germany*

John Hardy, *Pacific Northwest National Laboratory, USA*

Olga Marina, *Pacific Northwest National Laboratory, USA*

Henrik Lund Frandsen, *DTU Energy Conversion and Storage, Denmark*

Prabhakar Singh, *University of Connecticut, USA*

Tae Ho Shin, *Korea Institute of Ceramic Engineering & Technology, Republic of Korea*

Sebastian Molin, *Gdansk University of Technology, Poland*

Julie Mougin, *CEA, France*

Vincenzo Esposito, *DTU Energy Conversion and Storage, Denmark*

Ruey-Yi Lee, *Institute of Nuclear Energy Research Taiwan*

Tatsumi Ishihara, *Kyushu University, Japan*

Toshiaki Matsui, *Kyoto University, Japan*

Narottam P. Bansal, *NASA Glenn Research Center, USA*

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ADVANCED MATERIALS FOR THERMOELECTRIC AND THERMIONIC ENERGY CONVERSION

Thermoelectric power generation relies on a thermally induced electrical current in an all-solid-state device. Thermionic energy conversion also utilizes a temperature gradient to generate an electrical current, but the materials research and device applications are still underdeveloped compared with those in thermoelectrics. In both heat-to-electricity direct energy conversion technologies, the useful power and the power conversion efficiency depend on the transport of charge carriers (electrons or holes) and propagation of lattice vibrations (phonons) in the materials involved. Broader applications of thermoelectric/thermionic devices can be expected if new materials can be developed and assembled to meet the requirements reliably under a variety of environments and duty loads. Deeper insight into mechanisms by novel theoretical concepts and advanced manufacturing techniques is needed to realize a breakthrough in thermoelectric as well as thermionic materials and devices, which enables far greater figure of merit and higher power factor than those of currently available counterparts. Computational sciences also afford researchers tools and methods to guide in design, performance and evaluation of non-traditional thermoelectric and thermionic materials and devices.

The focus of this symposium is to convene leading global field experts to engage in ceramic technology-centered dialogues to address critical issues in the development of thermoelectric and thermionic energy conversion materials and devices. Researchers and scientists in thermoelectrics/thermionics and related fields are cordially invited to participate in this symposium.

Proposed Session Topics

- Ceramic technology-centered materials development in thermoelectric and thermionic energy conversion for electrical power generation and cooling/thermal management
- Novel thermoelectric and thermionic materials with high power factor and/or high figure of merit
- Organic thermoelectric materials and organic-inorganic hybrid systems
- Flexible thermoelectric materials and devices
- Porous thermoelectric/thermionic materials
- Electronic and phononic band structure engineering, nanostructure engineering, superlattice structures and 2D thermoelectric/thermionic materials
- Thermal stability and mechanical properties of thermoelectric/thermionic materials and reliability of devices
- Electrical and thermal contact resistivity and their interplay with joining of thermoelectric/thermionic materials
- Structure/property relationships, thermodynamics and solid-state defect chemistry of thermoelectric/thermionic materials
- Theoretical and experimental approaches to thermal and electrical transport mechanisms in thermoelectric/thermionic materials
- Design of new thermoelectric and thermionic materials using density functional theory or other first principles computational methods
- Innovative processing routes for thermoelectric and thermionic materials
- Advanced manufacturing technologies for thermoelectric/thermionic devices and modules
- Miniaturized and integrated thermoelectric and thermionic devices
- System-level applications of advanced thermoelectric devices and modules in electrical power generation (i.e. thermogenerators), sensor technology and heating/cooling

Symposium Organizers

Michitaka Ohtaki, *Kyushu University, Japan*
Armin Feldhoff, *Leibniz University Hannover, Germany*
Sunmi Shin, *National University of Singapore, Singapore*
Kyu Hyoung Lee, *Yonsei University, Republic of Korea*
Mona Zebarjadi, *University of Virginia, USA*
Mari-Ann Einarsrud, *Norwegian University of Science and Technology, Norway*
Jon C. Goldsby, *NASA Glenn Research Center, USA*
Peng Jiang, *Dalian Institute of Chemical Physics, China*
Theodora Kyratsi, *University of Cyprus, Cyprus*
Takao Mori, *National Institute for Materials Science, Japan*
Amin Nozariasbmarz, *Pennsylvania State University, USA*
Daryoosh Vashaee, *North Carolina State University, USA*
George Nolas, *University of South Florida, USA*
Winnie Wong-Ng, *NIST, USA*
Takayoshi Katase, *Tokyo Institute of Technology, Japan*

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NEXT GENERATION BIOCERAMICS AND BIOCOMPOSITES

The last few decades have witnessed significant progress in the use of ceramics and composites for biomedical applications, with anticipated benefits in clinical diagnosis and treatment. In addition to conventional ceramic fabrication technologies, biomimetic processes are also being adopted to develop bio-inspired materials and inorganic-organic hybrids. The advent of nanotechnology and additive manufacturing has further increased the spectrum of applications of bioceramics and biocomposites. This symposium will provide a platform to stimulate discussion among active researchers from academia/national labs, medical device manufacturers, entrepreneurs and clinicians, who are involved in the development and use of bioceramics.

Proposed Session Topics

- Bioactive and resorbable ceramics and composites
- In *vitro* and in *vivo* biocompatibility of bioceramics
- Mechanical properties of bioceramics and biocomposites
- Porous bioceramics and composites (joint with Symposium 9)
- Nanostructured bioceramics (joint with Symposium 7)
- Ceramics and composites with antimicrobial/antiviral properties
- Additive manufacturing of bioceramics
- Self-assembled bioceramics
- Surface modification techniques for bioceramics
- Biomineralization and tissue-material interactions
- Bio-inspired, bio-synthetic and biomimetic ceramics and composites
- Bioceramic coatings for implants and medical devices
- Ceramics for drug and gene delivery
- Bioceramics and composites for orthopedic and dental applications
- Magnetic nanoceramics and composites for biomedical applications
- Light-emitting nanoceramics for bioimaging, sensing and therapy
- Ceramic biosensors

Symposium Organizers

Katalin Balazsi, *Center for Energy Research, Hungary*

Hui-Suk Yun, *Korea Institute of Materials Science, Republic of Korea*

Cristina Balagna, *Politecnico di Torino, Italy*

Roger Narayan, *University of North Carolina, USA*

Eva Hemmer, *University of Ottawa, Canada*

Akiyoshi Osaka, *Okayama University, Japan*

Antonia Ressler, *University of Zagreb, Croatia*

Aldo Boccaccini, *University of Erlangen-Nuremberg, Germany*

Monika Tatarková, *Slovak Academy of Sciences, Slovakia*

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ADVANCED MATERIALS AND TECHNOLOGIES FOR RECHARGEABLE ENERGY STORAGE

The significant increases in demand for world energy consumption, as well as clean and efficient energy resources, have prompted the imperative searches for new materials and technologies. The intermittent nature of renewable power generation technologies will require new solutions for efficient and reliable energy storage. This symposium will focus on the advanced engineering ceramics and technologies that could help the global community achieve the stated goals. It will explore state-of-the-art materials and technologies for energy storage, improvements in materials design, electrode architecture, electrolytes, separators and cell chemistries. These are key factors to extend the life, enhance the safety and lower the cost of rechargeable batteries, which are regarded as the most efficient energy storage systems for portable electronics, renewable energy storage, smart grid and transportation applications. A deeper understanding of the battery materials/property relationship, electrode/electrolyte interface phenomena and cell failure mechanisms is critically needed to face these challenges. The search for advanced high-capacity electrode materials, solid electrolytes and the implementation of the very challenging all-solid-state batteries, lithium batteries, lithium-sulfur, metal-air batteries, beyond lithium technologies including sodium batteries, Mg/Ca/Al-based batteries will be necessary to overcome the energy density shortfall and safety issues in currently commercial batteries.

This symposium will focus on crystal chemistry, structural analysis, materials processing, powder metallurgy, sintering, transport properties, structural and mechanical characterization, new testing methods, cost/performance and reliability issues, commercialization, market prospects and recyclability related to batteries and supercapacitors.

Proposed Session Topics

- Solid electrolytes for batteries
- All-solid-state batteries
- Advanced anode and cathode materials for lithium batteries
- Materials design, screening, and electrode architectures for lithium batteries
- Diagnostics and materials characterization for lithium batteries
- Electrode/electrolyte interface characterization for lithium batteries
- Applications focused on lithium batteries
- Lithium-sulphur battery technology
- Sodium batteries, potassium batteries, magnesium batteries and calcium batteries
- Materials of capacitive energy storage (super-capacitors)
- Recycling of battery materials
- Stationary rechargeable batteries for grid, solar and wind technologies

Symposium Organizers

Palani Balaya, *National University of Singapore, Singapore*

Naoaki Yabuuchi, *Yokohama National University, Japan*

Olivier Guillon, *Forschungszentrum Jülich, Germany*

Valerie Pralong, *CNRS CRISMAT, France*

Mali Balasubramanian, *Oak Ridge National Laboratory, USA*

Prabeer Barpanda, *Indian Institute of Science, India*

Donald Dornbush, *NASA Glenn Research Center, USA*

Byounwoo Kang, *Pohang University of Science and Technology, Republic of Korea*

Shih-Kang Lin, *National Cheng Kung University, Taiwan*

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19TH INTERNATIONAL SYMPOSIUM ON FUNCTIONAL NANOMATERIALS AND THIN FILMS FOR SUSTAINABLE ENERGY, ENVIRONMENTAL AND BIOMEDICAL APPLICATIONS

Functional nanomaterials with intrinsically new and tailored properties are key elements for developing sustainable solutions for energy, environment and health. Specifically, this symposium will focus on new materials, energy technologies and devices based on inorganic, hybrid and composite materials. Particular emphasis will be given to novel synthesis approaches, surface functionalization, heterostructuring of nanoparticles, nanowires and nanoscopic films, fundamentally new properties and energy-efficient materials synthesis. Functional surfaces fabricated using emerging processing techniques, such as jet printing, 3D printing, etc, are also within the scope of the symposium. Applications of nanostructures in photocatalysis, energy, sensing and bio-medical applications that combine advanced processing with conceptual advancement will form the major thrust areas. Contributions related to energy applications such as photovoltaics (perovskite materials), photothermal materials, batteries, fuel cells, thermoelectric materials, water splitting and carbon dioxide conversion, as well as transparent conductors and challenges related to the large-scale production and integration of functional and structural nanomaterials, are highly desired.

Proposed Session Topics

- Synthesis, functionalization and assembly of inorganic and hybrid nanostructures
- Nanomaterials for energy conversion, storage and catalysis
- Metal oxide nanostructures for sensing, batteries and water-splitting applications
- Nanomaterials for thermoelectrics, photocatalysis, electrocatalysis and solar hydrogen
- Nanotoxicity, bio-imaging, drug-delivery and tissue engineering with tailored nano-bioconjugates
- Transition metal chalcogenides, Carbon nanostructures, 2D materials
- Functional coatings and innovative thin-film techniques (e.g., ALD, PECVD)
- Industrial production and application of nanomaterials & coatings
- Computational methods in the design of tailored nanostructured materials
- Interfacial materials and multi-material heterostructures & nanocomposites

Symposium Organizers

Muhammet S. Toprak, *KTH Royal Institute of Technology, Sweden*

Sanjay Mathur, *University of Cologne, Germany*

Andreu Cabot, *Catalonia Institute for Energy Research, Spain*

Sedat Ballikaya, *Istanbul University, Turkey*

Milos Dujovic, *Texas A&M University, USA*

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19TH INTERNATIONAL SYMPOSIUM ON ADVANCED PROCESSING AND MANUFACTURING TECHNOLOGIES FOR STRUCTURAL AND MULTIFUNCTIONAL MATERIALS AND SYSTEMS (APMT19)

The properties and performance of structural and multifunctional materials largely depend on their processing and manufacturing routes. Manufacturing processes carefully designed with sufficient understanding of forming/sintering behaviors lead to reliable performance of components and products of large sizes and complex shapes. On the other hand, recently developed new processing and fabrication techniques of ceramic materials and systems give us unique properties that cannot be achieved from the conventional routes. The aim of this international symposium is to discuss global advances in the research and development of advanced processing and manufacturing technologies for a wide variety of non-oxide and oxide-based structural ceramics, fiber-reinforced and particulate composites and multifunctional materials, as well as their components and devices. Current advances and state-of-the-art in various eco-friendly processing approaches will also be covered.

Proposed Session Topics

- Novel forming/sintering technologies, near-net shaping
- Rapid prototyping, 3D printing, patterning, templates and self-assembly
- Advanced composite manufacturing technologies, hybrid processes
- Microwave processing, SPS, flash sintering, high-pressure assisted sintering
- Advanced powder synthesis and processing
- Aqueous synthesis, colloidal processing, bio-inspired synthesis and processing
- Polymer-based processing
- Design-oriented manufacturing and processing
- Joining, integration, machining, repair and refurbishment technologies
- Green manufacturing, global environmental issues and standards

Symposium Organizers

Hisayuki Suematsu, *Nagaoka University of Technology, Japan*

Young-Wook Kim, *University of Seoul, Republic of Korea*

Tatsuki Ohji, *National Institute of Advanced Industrial Science and Technology (AIST), Japan*

Wei-Ji, Wuhan*, University of Technology, China*

Enrico Bernardo, *University of Padova, Italy*

Surojit Gupta, *University of North Dakota, USA*

Eugene Medvedovski, *Endurance Technologies Inc., Canada*

Tohru S. Suzuki, *National Institute for Materials Science (NIMS), Japan*

Yiquan Wu, *Alfred University, USA*

Chang-Jun Bae, *Korea Institute of Materials Science, Republic of Korea*

Satoshi Tanaka, *Nagaoka University of Technology, Japan*

Manuel Belmonte, *Institute of Ceramics and Glass (ICV-CSIC), Spain*

Kyu Hyoung Lee, *Yonsei University, Republic of Korea*

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POROUS CERAMICS: NOVEL DEVELOPMENTS AND APPLICATIONS

Porous materials are essential components in many applications including, but not limited to, thermal insulation, catalysts, catalyst supports, filters, adsorbers, sensors and lightweight components. This symposium aims to bring together the scientific community to share recent advances in the formation, characterization, properties and modeling of porous ceramic, carbon, glass and glass-ceramic components for diverse applications. These materials contain pore sizes from nanometers to millimeters, can have textured to random or hierarchical porosity and are based on various pore architectures such as foams, honeycombs, fiber networks and bio-inspired structures. They can be produced using a variety of fabrication approaches, from direct foaming to replication of a porous scaffold, from the use of sacrificial fillers to additive manufacturing. Because of these properties, porous materials are widely used in environmental, energy, biological and other applications. This symposium will be the ideal showcase for the research activities of the many groups involved in the development and use of porous materials, including but not limited to ceramics, chemistry, mechanics, fluid dynamics, modeling and simulation and applications engineering.

Proposed Session Topics

- Innovations in processing methods & synthesis of porous ceramics
- Structure and properties of porous ceramics
- Novel characterization tools and software for porous structures
- Computational techniques, machine learning (ML) and artificial intelligence (AI) for porous ceramics
- Mechanical behavior of porous ceramics
- Hierarchical, micro-porous and mesoporous ceramics and gas-separation ceramic membranes
- Engineered porous architectures enabled by additive manufacturing technologies
- Porous ceramics for environmental, energy, biological and functional applications

Symposium Organizers

Tobias Fey, *Friedrich-Alexander University of Erlangen-Nürnberg, Germany*

Manabu Fukushima, *National Institute of Advanced Industrial Science and Technology (AIST), Japan*

Paolo Colombo, *University of Padova, Italy*

Samuel Bernard, *Institute of Research for Ceramics-CNRS, Limoges, France*

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INTEGRATED COMPUTATIONAL-EXPERIMENTAL MODELING AND DESIGN OF CERAMICS AND COMPOSITES

Recent advances in computational materials science coupled with artificial intelligence and machine learning approaches have significantly enhanced our understanding of fundamental phenomena in material behavior. These advances have contributed to improvement in materials performance as well as the discovery and design of new materials and structures.

This symposium solicits research on state-of-the-art machine learning architectures for a range of analysis, characterization, design and modeling of ceramics and composites with tailored properties. Approaches in both computational research and experimental measurements across the length and time scales are encouraged. Examples include, but are not limited to, ML-assisted novel microstructure/composite material design, establishing structure-property relationships in complex material microstructures, multiscale modeling through ML-driven coupling between scales, AI-augmented experimental design, characterization and computational surrogate models for (multiphysics) behavioral predictions and data-driven frictional and mechanical response models. Of particular interest is also thermo-electro-mechanical response of ferroelectric ceramics, micro-structure characterization and the development of physically-informed materials design strategies. A broader perspective is desired, including the interest related to ceramic genome, virtual materials design, materials processing and performance, simulation of novel ceramics for functional applications and the modeling of surfaces, interfaces and grain boundaries at multiple scales.

Proposed Session Topics

- High-throughput design and characterization
- Informatics and machine learning
- Friction, wear and tribology
- Fracture and damage mechanics
- Multi-scale modeling of processing, microstructure, and performance
- Modeling of structure and property of ceramics and composites
- Modeling defects and amorphous matter
- Modeling of surfaces, interfaces and grain boundaries at multiple scales
- Electro-active materials (ferroelectrics and dynamic viscoelasticity)

Symposium Organizers

Jingyang Wang, *Institute of Metal Research, Chinese Academy of Sciences, China*

Gerard L. Vignoles, *University of Bordeaux, France*

Ghatu Subhash, *University of Florida, USA*

Sathiskumar Anusuya Ponnusami, *University of London, United Kingdom*

Joaquin Garcia Suarez, *École polytechnique fédérale de Lausanne, Switzerland*

Vignesh Kannan, *École Polytechnique, Palaiseau, France*

Peter Kroll, *University of Texas at Arlington, USA*

Jian Luo, *University of California, San Diego, USA*

Yixiu Luo, *Institute of Metal Research, Chinese Academy of Sciences, China*

Sergei Manzhos, *Tokyo Institute of Technology, Japan*

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ADVANCED MATERIALS AND INNOVATIVE PROCESSING IDEAS FOR PRODUCTION ROOT TECHNOLOGIES

"Production root technologies" refers to a collection of six production technologies including, casting, molding, forming, welding, heat treatment and surface treatment. Production root technologies involve both materials and process technologies that are hidden behind products and do not frequently appear outward. However, they are very important fundamentally and greatly influence material or module performance. As the functions of products become more complex and robust, the importance of these production root technologies is concurrently growing.

Production root technologies have an inherent interdisciplinary nature, inevitably including a broad spectrum of skills from fundamental materials all the way up to component manufacturing and module integration. As demand increases for sustainable energy and semiconductor processes, especially by employing relevant materials, composites and/or functional techniques, the interdisciplinary approach plays an even greater role. Therefore, this symposium is designed to provide an opportunity for the world's leading scientists and engineers from many fields to exchange ideas and to build new collaborations in the fields of production root technologies.

Proposed Session Topics

- Fundamental materials: mining, particles, bulk and functional materials and precursors
- Innovative manufacturing processes for recycling, sustainable energy or the semiconductor industry
- Future-oriented techniques for coating, forming and shaping materials
- Emerging intelligent technologies based on AI or IoT for enhancing product performance

Symposium Organizers

Chisung Ahn, *Korea Institute of Industrial Technology, Republic of Korea*

Sungwook Mhin, *Kyonggi University, Republic of Korea*

Ayahisa Okawa, *Tohoku University, Japan*

Son Thanh Nguyen, *National Institute of Technology, Japan*

Kyoung Il Moon, *Korea Institute of Industrial Technology, Republic of Korea*

Hyuksu Han, *Sungkyunkwan University, Republic of Korea*

Yuya Takimoto, *Nagaoka University of Technology, Japan*

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ON THE DESIGN OF NANOLAMINATED TERNARY TRANSITION METAL CARBIDES/NITRIDES (MAX PHASES) AND BORIDES (MAB PHASES), SOLID SOLUTIONS THEREOF AND 2D COUNTERPARTS (MXENES, MBENES)

The MAX and MAB phases are thermodynamically stable nanolaminates of early transition metals carbides, nitrides and borides. The MAX/MAB phases are hexagonal materials with an inherent nanolayered crystal structure that is responsible for an unusual and unique combination of metal-like and ceramic-like properties, such as machinability, good electrical/thermal conductivity, high thermal shock resistance, good oxidation/corrosion resistance, stiffness at high temperatures, etc. The unique properties of the MAX/MAB phases make them appealing candidate materials for diverse potential industrial applications. Rather recently, it was shown that it is possible to selectively etch atomic metal layers out of the crystal structure and to separate each nanolaminated block of these transition metal compounds to form 2D solids (MXenes, MBenes). Despite their relatively short history, MXenes (the 2D phases resulting from the removal of A layers from the corresponding MAX phases) have attracted attention due to their attractive properties, such as excellent electronic conductivity, surface functionality and tunability. Symposium 12 focuses on the design, processing, structure-property relationships, thermal, electrical, optoelectronic, solid lubrication and mechanical properties, stability, oxidation/corrosion resistance, radiation tolerance, as well as envisaged potential applications of these unique nanolaminated compounds in their 2D and 3D forms. In addition, exploratory research on further expanding the chemistry of ternary compounds is also invited, like in high entropy systems and new generation ternary borides.

Proposed Session Topics

- Design of novel compositions and manufacturing methods
- Methods for improving damage tolerance, oxidation/corrosion and thermal shock resistance
- Novel applications and device fabrication (electrochemical energy storage, biosensors, etc.) of MAX/MAB phases and MXenes/MBenes
- Study of electronic, optical, plasmonic and thermoelectric properties
- Theoretical calculations for designing and predicting the behavior of MAX/MAB phases and MXenes/MBenes
- Nuclear applications of the MAX/MAB phases

Symposium Organizers

Surojit Gupta, *University of North Dakota, USA*

Miladin Radovic, *Texas A&M University, USA*

Konstantina Lambrinou, *University of Huddersfield, UK*

Jochen M. Schneider, *RWTH Aachen University, Germany*

Thierry Cabioch, Université de Poitiers, France

Sylvain Dubois, *Université de Poitiers, France*

Per Eklund, *Uppsala University, Sweden*

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DEVELOPMENT AND APPLICATIONS OF ADVANCED CERAMICS AND COMPOSITES FOR NUCLEAR FISSION AND FUSION ENERGY SYSTEMS

The future safety and sustainability of nuclear energy systems based on fission and fusion technologies are strongly correlated to the development and application of advanced materials capable of withstanding the ever-increasingly harsh environments of a nuclear reactor core. This international symposium will bring together scientists and engineers to discuss opportunities and needs in key enabling materials for application in nuclear energy systems. This will include the most up-to-date science and state-of-the-art technologies, ranging from materials design and development to processing and performance under relevant nuclear environments. Discussions on prospects and perspectives related to commercial development and qualification and licensing requirements will also be included.

Proposed Session Topics

- Material technologies for core structures of light water reactors and advanced reactors
- Ceramic fuel materials, technologies and characterization
- Graphite and carbon materials for nuclear applications
- High-temperature ceramics for space reactor applications
- New materials and containment for neutron moderators, reflectors and shielding
- Processing and characterization of novel ceramics and composites for nuclear systems
- Ceramics and ceramic-based composites in nuclear fusion; blanket structural and functional materials, e.g., ceramic breeder and advanced plasma-facing materials
- Joining and coating technologies for reactor components
- Chemical compatibility and corrosion
- Radiation damage, defect production, evolutions and interactions
- Advanced characterization techniques and methods
- Fuel, cladding, assembly and core evolutions and performance modeling
- Test methods, codes and standards, design methodology and material qualification

Symposium Organizers

Takaaki Koyanagi, *Oak Ridge National Laboratory, USA*

Fabio Di Fonzo, *X-nano, Italy*

Monica Ferraris, *Politecnico di Torino, Italy*

Tatsuya Hinoki, *Kyoto University, Japan*

Samuel Humphry-Baker, *Imperial College London, UK*

Dong Liu, *University of Bristol, UK*

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CRYSTALLINE MATERIALS FOR ELECTRICAL, OPTICAL AND MEDICAL APPLICATIONS

This session will provide a forum for the presentation and discussion of recent research and development activities on crystalline materials. The session will cover all aspects, from basic research and material characterization through physicochemical aspects of growth, synthesis and deposition techniques to the technological development of industrialized materials. For this purpose, world-wide experts in the different topics will be invited to introduce their most recent activities. The broad scope of the session assures a wide overview of the state-of-the-art issues on crystalline materials, aiming to stimulate interdisciplinary discussions and collaborations in a wide range of fields.

Proposed Session Topics

- Semiconductors for LED/LD, power device, sensor
- Optical materials for laser, nonlinear optics, optical isolator, phosphor
- Scintillators for X-, gamma- and neutron detection
- Piezo-, ferro- and magneto-electric materials
- Transparent ceramics and nanocrystals
- Phase diagrams, defect chemistry, crystalline quality

Symposium Organizers

Kiyoshi Shimamura, *National Institute for Materials Science, Japan*

Nerine J. Cherepy, *Lawrence Livermore National Laboratory, USA*

Yiquan Wu, *Alfred University, USA*

Noboru Ichinose, *Waseda University, Japan*

Luisa E. Bausá, *Autonomous University of Madrid, Spain*

Victoria Blair, *U.S. Army Research Laboratory, USA*

Kenji Toda, *Niigata University, Japan*

Takayuki Yanagida, *Nara Institute of Science and Technology, Japan*

Romain Gaume, *University of Central Florida, USA*

Mariya Zhuravleva, *University of Tennessee, USA*

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9TH INTERNATIONAL SYMPOSIUM ON ADDITIVE MANUFACTURING AND 3D PRINTING TECHNOLOGIES

Additive manufacturing (AM) and 3D printing technologies are globally recognized as novel fabrication processes for advanced materials and components with multifunctional structures. These technologies offer tremendous potential for design innovations and customization, complex part fabrication with multifunctionality, rapid prototyping and distributed digital manufacturing. In this approach, three-dimensional models are designed and created according to theoretical concepts using computer software, and two-dimensional cross-sections are created by slicing operations automatically. In direct writing processes, paste materials with ceramic/metal particles dispersed in a binder system are fused from nozzles moving freely in three dimensions to create composite structures. In laser-based approaches, high-resolution laser beams are scanned on a spread ceramic powder bed with or without resin binders to form solid planes of two-dimensional cross-sections. Various functional components of dielectric lattices to control electromagnetic waves, bio-materials components for medical applications and ceramics electrodes with large surface areas could also be developed. Large-scale structural components for aerospace and other high-temperature applications can be fabricated with internal cooling path networks formed without casting molds. Utilizing smart additive manufacturing, it is possible to design for function and not for manufacturing. However, each technique needs special design adjustments to boost products' efficiency and multifunctionality. This symposium focuses on the superiority of design, efficient processing and perspicuous evaluations in the additive manufacturing and 3D printing processes. In addition, various topics related to starting materials, characterization tools, NDE and in-situ monitoring of processes, qualification and certification, cost and applications will also be discussed.

Proposed Session Topics

- Design with/for additive manufacturing
- Materials and process characterization tools
- Laminated object manufacturing/green tape stacking
- Powder bed fusion/selective laser melting and sintering
- Material extrusion/fused deposition modeling
- Binder jetting processes
- Vat photopolymerization/stereolithography
- Direct writing/Inkjet printing technologies
- Multi-material and hybrid printing techniques
- Qualification, certification, standards and property database
- Applications of AM materials and components
- AM of ceramic matrix composites fiber reinforced ceramics

Symposium Organizers

Soshu Kirihara, *Osaka University, Japan*

Michael Halbig, *NASA Glenn Research Center, USA*

Mrityunjay Singh, *Ohio Aerospace Institute, USA*

Martin Schwentenwein, *Lithoz GmbH, Austria*

Hui-Suk Yun, *KIMS, Republic of Korea*

Majid Minary, *University of Texas, USA*

Alberto Ortona, *SUPSI, Switzerland*

Zhangwei Chen, *Shenzhen University, China*

Corson L. Cramer, *Oak Ridge National Laboratory, USA*

Giorgia Franchin, *University of Padova, Italy*

Yan Li, *Dartmouth College, USA*

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GEOPOLYMERS, INORGANIC POLYMER-DERIVED CERAMICS AND SUSTAINABLE CONSTRUCTION MATERIALS

Refractory inorganic polymers can be made at ambient temperatures and pressures from a powder and a liquid to form a paste of low viscosity. These materials, called “geopolymers,” include alkali metakaolin-based, alumino-silicates, alumino silicate phosphates, magnesium phosphates, magnesium potassium phosphates and alternative geopolymer zincates. The use of biological materials as starting compounds or as reinforcements in composites demonstrates the eco-friendly and sustainable nature of these materials. The geopolymer “glue” is refractory up to 1000°C, whereupon it converts to a ceramic or a ceramic plus glass. Novel potential applications of such composites include organic alkali charge-balanced geopolymers; porous geopolymers for water purification by heavy metal removal; geopolymer-derived nano-zeolites for CO2 sequestration; porous geopolymers for thermal insulation; structural ceramic composites containing ceramic, metal, organic or biological reinforcements; fire and corrosion-resistant coatings; nuclear radiation shielding composites; infrastructure and construction materials. The nanoparticulate nature of geopolymers also provides a low energy, processing route to ultra-refractory ceramic powders or versatile forming methods based on transient, organic alkali, charge-balanced geopolymer and 4-D printing, taking advantage of geopolymer thixotropy.

Proposed Session Topics

- Synthesis, processing microstructure
- Mechanical properties, thermal shock resistance
- Alkali-based geopolymers
- Acid-based phosphate geopolymers
- Other inorganic geopolymer analogues
- Geopolymer-derived processing routes
- Nuclear radiation shielding
- Sustainable construction materials
- Use of waste materials to make geopolymers
- Novel applications

Symposium Organizers

Waltraud M. Kriven, *University of Illinois at Urbana-Champaign, USA*

Joseph Davidovits, *Geopolymer Institute, St. Quentin, France*

Henry A. Colorado, *Universidad de Antioquia, Medellin, Colombia*

Cristina Leonelli, *University of Modena and Reggio Emilia, Italy*

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ADVANCED CERAMIC MATERIALS AND PROCESSING FOR PHOTONICS AND ENERGY

In the past few years, significant progress has been reported on the synthesis and structural, physical and chemical characterization of ceramic nanostructures that exhibit size-dependent properties and on novel glass-based materials for optical lasers and amplifiers. Nanomaterials have been widely studied and are leading to fundamental new discoveries as well as applications in Photovoltaics, Optical sources, Electroceramics, Multi-ferroic materials, Catalysis and Solar Hydrogen.

This symposium focuses on all ceramic materials with application potential as functional materials, with particular consideration given to the capability to tailor and control material properties via surface and structural modifications. The session also includes novel optical glass-based and glass-ceramic materials with new functionalities, new emission wavelengths and an overview of integration with other classes of materials (polymers, metals). New nanotechnology tools and technological procedures for the development of new functional devices integrating bottom-up and top-down technologies will also be considered.

Proposed Session Topics

- Multifunctional materials
- Advanced and nanostructured materials for photonics, electronics and sensing
- Advanced and nanostructured materials for photovoltaics and solar fuels
- Advanced glass-based and glass-ceramic materials for laser sources and non-linear applications

Symposium Organizers

Alberto Vomiero, *Luleå University of Technology, Sweden*

Federico Rosei, *University of Trieste, Italy*

Yasuhiro Tachibana, *RMIT University, Australia*

Isabella Concina, *Luleå University of Technology, Sweden*

Haiguang Zhao, *Qingdao University, China*

Francesco Enrichi, *University of Verona, Italy*

Kassa Belay Ibrahim, *Ca' Foscari University of Venice, Italy*

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ULTRAHIGH TEMPERATURE CERAMICS

Ultrahigh temperature ceramics (UHTCs) are materials of interest for use in extreme environments that are beyond the capabilities of other materials. Some proposed applications for UHTCs include scramjet engine components, leading edges and thermal protection systems for hypersonic vehicles, plasma-facing materials in nuclear fusion reactors, solar power concentrators, fuel forms in nuclear fission reactors and others. Challenges that exist for UHTCs and limit near-term use include thermal/chemical stability in extreme environments, the ability to be formed into complex shapes, thermal shock resistance, irradiation resistance and damage tolerance. For such extreme environment applications, advances in the understanding of structure-property relations and performance are needed. This symposium will focus on design, processing, processing-microstructure-property relationships, thermal and mechanical properties, oxidation resistance, machining, joining and thermal/chemical stability of UHTCs and UHTC composites both from fundamental and application-oriented perspectives.

Proposed Session Topics

- Novel processing methods for bulk, coatings, thin films, fibers and/or composites
- Precursors for powders, coatings and matrix or fibers of composites
- Processing-microstructure-property relationships of existing or new systems
- Bulk ceramics, thin films, coatings, fibers and composites
- Compositionally complex UHTCs
- Super-hard UHTCs
- Characterization methods and lifetime assessment
- Methods for improving damage tolerance, oxidation behavior and thermal shock resistance
- Response in extreme environments (irradiation, ultra-high temperature, etc.)
- Simulation and theory for predicting stability or behavior under extreme environments

Symposium Organizers

Bai Cui, *University of Nebraska-Lincoln, USA*

William G, *Fahrenholtz, Missouri University of Science and Technology, USA*

Sea-Hoon Lee, *Korea Institute of Materials Science, Republic of Korea*

Frederic Monteverde, *National Research Council-Institute of Science and Technology for Ceramics, Italy*

Guo-Jun Zhang, *Donghua University, China*

Ji Zou, Wuhan, *University of Technology, China*

Lisa Rueschhoff, *Air Force Research Laboratory, USA*

Lavina Backman, *Naval Research Laboratory, USA*

Simon Middleburgh, *Bangor University, UK*

Jon Binner, *University of Birmingham, UK*

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MOLECULAR-LEVEL PROCESSING AND CHEMICAL ENGINEERING OF FUNCTIONAL MATERIALS

Materials synthesis based on the use of molecular precursors has been recognized as a powerful way to access compounds with controlled and adjustable compositions, crystal structures, morphologies, and, consequently, property profiles. Thus, a careful design of suitable molecular precursors, as well as extensive knowledge about their (thermal) conversion into desired functional materials are of crucial importance for providing improved rational preparative concepts toward tailor-made (multi)functional structures. Molecular synthesis techniques for functional materials are highly attractive, as they can be performed with a highly efficient atom economy. They allow access to well-defined chemical and phase compositions as well as to unique morphologies and (metastable) phases.

This Symposium intends to conceptually unite materials chemists, ceramists and materials engineers to develop new concepts and pathways for synthesis, net-shaping and device integration of functional materials. Whereas the conventional top-down methods are preferred due to their simplicity and to some extent predictable nature, they operate mostly in the thermodynamical regimes and are less suited for synthesizing multi-component and hybrid (organic-inorganic) materials.

Despite the well-known benefits of molecular-level processing of inorganic solids, a major challenge lies in the limited insight into molecule-to-material transformations and the fact that many of the molecular precursors are commercially not available. During this Symposium, the role of precursor chemistry and additives in solutions such as sol-gel, solvothermal, electrospinning, microwave, Chemical Vapor Deposition (CVD) and Atomic Layer Deposition (ALD) techniques will be critically analyzed. Specific emphasis will be laid on materials manufacturing strategies such as 3D printing, chemically controlled assembly and purpose-driven modification of materials. Non-conventional synthesis and analytical methods enabling in-situ diagnostics and mechanistic insights into nucleation, growth and self-assembly are in particular focus.

Emphasizing the need for new and smart chemical processing methods to obtain specific material compositions that can integrate the advancements in materials processing techniques with the existing knowledge base of materials chemistry will also be a part of this Symposium. The industrial potential of chemically processed materials will be analyzed and discussed in terms of their simplicity, scalability and cost-effectiveness. Moreover, aspects related to the potential of using molecular precursor synthesis concepts toward circular economy, waste-less processes and effective materials recycling will also be considered and critically discussed.

Proposed Session Topics

- Precursor chemistry—structural and thermal transformations
- Chemically processed nanostructures and on-surface nanochemistry
- Two-dimensional materials and their chemical functionalization
- Solution-processing of nanomaterials for optical, catalytic and sensing applications
- Molecular precursor approaches for vapor-phase synthesis (ALD, CVD) of materials
- In-situ studies on nucleation and growth of solid-state phases in solution and gas phases
- Smart chemistry for functionalization of nanostructures
- Chemical approaches to new processing methods such as 3D-printing
- Scaled-up production of precursor-derived materials
- Materials integration and device applications

Symposium Organizers

Peter Kroll, *University of Texas at Arlington, USA*

Yoshiyuki Sugahara, *Waseda University, Japan*

Samuel Bernard, *University of Limoges, France*

Christina Birkel, *Arizona State University, USA*

Emanuel Ionescu, *Technische Universität Darmstadt, Germany*

Thomas Konegger, *TU Wien, Austria*

Ravi Kumar NV, *IIT Madras, India*

Sanjay Mathur, *University of Cologne, Germany*

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BIOINSPIRATION, DESIGN, GREEN PROCESSING, AND RELATED TECHNOLOGIES OF ADVANCED MATERIALS

During billions of years of evolution and natural selection, living organisms can efficiently and accurately produce complex and multifunctional materials under environmentally benign conditions. Taking inspiration from the structure-function relationships and the fabrication processes of these biological materials, numerous advanced materials with novel structures and functions have been designed and fabricated. In addition, novel bio-fabrication techniques, multi-scale modeling accelerated by AI, green processing and related technologies exhibit flexibility in materials design to impart various functions for diverse applications. The symposium is aimed at providing a forum for researchers, students and entrepreneurs to present and discuss their recent scientific results on a wide variety of topics related to science and engineering issues associated with biological materials, bioinspired materials, rational optimization and green processing technologies of advanced materials. A particular emphasis will be placed on the fundamental issues related to advancing our understanding and utilization of biological materials synthesis and fabrication strategies, current progress and challenges and future directions in green processing and related technologies.

Proposed Session Topics

- Structure and properties of biological materials
- Aqueous synthesis, colloidal processing and bottom-up assembly
- Advances in multiscale modeling, physics-informed machine learning and artificial intelligence methods
- Advances in bioinspired materials and bioprocess-inspired fabrication techniques
- Advances in the cold sintering process on functional ceramic materials
- Green processing for energy conversion and storage materials and systems
- Green processing for environmental sustainability
- Future directions of bioinspired materials, green processing and technologies

Symposium Organizers

Zhaoyong Zou, *Wuhan University of Technology, China*

Manoj K Mahapatra, *University of Alabama at Birmingham, USA*

Zhao Qin, *Syracuse University, USA*

Ling Li, *University of Pennsylvania*

Wei Zhai, *National University of Singapore, Singapore*

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PROTECTIVE CERAMICS—FUNDAMENTAL CHALLENGES AND NEW DEVELOPMENTS

Ceramic and related composite materials possess qualities that make them useful for applications involving high-velocity impact. Fundamentally, such intense events are governed by momentum transfer moderated by high-rate inelastic material behavior and failure. Understanding material behavior and failure under these conditions is highly challenging due to the nonlinear, nonuniform, coupled interactions between dynamic stresses and the inherent multi-scale material structure, from atomic defects to processing flaws. This can lead to the initiation and growth of a multitude of inelastic deformation mechanisms such as phase transformations, dislocations, twinning, stacking faults, microcracking, fracture and others, resulting in fragmentation of the solid body. By identifying and understanding underlying mechanisms, their consequences, and processing-structure-property relationships, material behavior can be controlled. This Symposium is focused on the fundamental challenges and new developments associated with the topics listed below. In addition, special sessions on: (1) Ultrahard ceramics, (2) High-throughput experimentation and data-driven techniques and (3) Dynamic behavior, are planned. Presentations addressing these topics and those listed below are welcome.

Proposed Session Topics

- Traditional and emerging ceramic science and composite engineering
- Conventional, reactive, novel and emerging synthesis and processing
- Materials-by-design and process modeling
- Microstructure characterization and advanced methods
- High-rate and dynamic behavior, including underlying mechanisms
- Quasi-static mechanical properties
- Constitutive modeling

Symposium Organizers

Anthony DiGiovanni, *DEVCOM ARL, USA*

Kristopher Behler, *DEVCOM ARL, USA*

Neil Middleton, *DSTL, UK*

Ghatu Subhash, University of Florida, USA

Jerry LaSalvia, *DEVCOM ARL, USA*

Michael Bakas, *DEVCOM ARO, USA*

Jeffrey Swab, *DEVCOM ARL, USA*

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NANOSTRUCTURES AND LOW-DIMENSIONAL MATERIALS FOR CHEMICAL SENSORS

A chemical sensor is a self-contained analytical device that provides information about the chemical composition of a liquid or gas phase. It generates a measurable physical signal related to the concentration of a specific chemical species known as the analyte. The functioning of a chemical sensor involves two main steps: recognition and transduction. In the recognition step, analyte molecules selectively interact with receptor molecules or sites in the recognition element, causing a physical parameter to change. An integrated transducer reports this variation as an output signal. If a chemical sensor uses biological recognition material, it is called a biosensor. Chemical sensors find applications in medicine, industry, agriculture, the military and play a crucial role in IoT solutions. Advancements in nanomaterials and microelectromechanical technology contribute to further progress in chemical sensor development. This session aims to provide comprehensive information on recent progress and prospects of high-performance chemical sensors using nanostructures of various materials, including inorganic, organic and inorganic-organic hybrids, as well as low-dimensional materials like quantum dots, 2D materials, nanowires and nanotubes. The session also welcomes abstracts related to theoretical calculations and modeling for chemical sensing and the newest applications of chemical sensors.

Proposed Session Topics

- Chemical sensors using nanostructures
- Chemical sensors based on 0D, 1D and 2D materials
- Synthesis of nanostructures for sensitive chemical sensing
- Modification of nanomaterials for selective sensing
- New applications of chemical sensors
- Operando studies on chemical sensing mechanism
- Sensor array, e-nose and e-tongue
- Theoretical calculations on chemical sensing

Symposium Organizers

Juliano Chaker, *University of Brasilia, Brazil*

Koichi Suematsu, *Kyushu University, Japan*

Nicolae Barsan, *University of Tuebingen, Germany*

Alberto Vomiero, *Ca' Foscari University of Venice, Italy*

Geyu Lu, *Jilin University, China*

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CERAMIC/CARBON REINFORCED POLYMERS

This focused session will cover ceramic/carbon-reinforced polymer composites utilized in a wide range of industrial applications, including energy, environment, biological, space, transportation, building and sport. This symposium aims to bring together the technical community to share recent advances in experimental or simulation approaches for the fabrication, processing, characterization, properties and modeling of ceramic, ceramic/carbon-reinforced polymers. The role of inorganic phases in the composites can provide various functionalities such as mechanical, thermal, biological, insulation, electric, chemical resistance and wear properties, composed of fillers or fibers from the nanometers to millimeters and in textured to random. This symposium will be the ideal showcase for the research activities of many groups involved in the development of ceramic/carbon reinforced polymers and composites and their recycling technology, including but not limited to the areas of ceramics, plastics, their interface chemistry, mechanics, modeling and simulation and engineering application.

Proposed Session Topics

- Innovative processing of ceramics and ceramic/carbon-reinforced polymers
- Novel process and characterization technology of fiber, filler, matrix and composites
- Mechanical behavior—fracture, fatigue, deformation and machine processing of ceramic/carbon-reinforced polymers and composite
- Big data, informatics, computing, simulation, modeling and theoretical approaches in ceramic/carbon reinforced polymers and composites
- Environmental, infrastructure, energy, biological, space, transportation, building and sport applications
- Innovation for integration of ceramics and composites
- The role of composites in multi-material systems
- Thermoplastics-based composites
- Composite Recycling technology

Symposium Organizers

Satoshi Kobayashi, *Tokyo Metropolitan University, Japan*

Manabu Fukushima, *National Institute of Advanced Industrial Science and Technology (AIST), Japan*

Toshio Ogasawara, *Tokyo University of Agriculture and Technology, Japan*

Shinji Ogihara, *Tokyo University of Science, Japan*

Tomohiro Yokozeki, *The University of Tokyo, Japan*

Takenobu Sakai, *Saitama University, Japan*

Sota Oshima, *Tokyo Metropolitan University, Japan*

Masato Sakaguchi, *Salesian Polytechnic, Japan*

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HIGH VOLTAGE MATERIALS FOR ADVANCED HIGH POWER ELECTRICAL APPLICATIONS

High voltage (HV) electrified systems for aerospace and terrestrial applications are getting a lot of attention due to their importance in enabling the next generation of high-power technologies for aircraft and space exploration where lightweight, compact and high-speed power transmission are critical. Electrified systems require the development of novel, lightweight, multifunctional materials to lower the specific weight of power cables' insulation and conductor architectures. An improvement from state of the art in conductor and electrical insulation is a step forward in that advancement of technology. Carbon fibers and other carbon nanomaterials have been considered to lower the specific weight of the electrical conductor by trying to achieve conductivities like or better than copper. While the polymers used in state-of-the-art electrical insulation materials are not enough to achieve the performance required for these applications, the addition of ceramic fillers is being studied to improve their performance. Moreover, the developed materials systems need to function properly at high voltages while withstanding extreme missions' electrical, chemical, thermal and mechanical loading profiles. This necessitates developing relevant high-voltage testing methods and combining them with identification, quantification and modeling of durability, failure mechanisms, and aging and life models of high-voltage materials and components. In addition, the developed test capabilities should be used to measure the developed materials' electrical properties, such as ampacity, electrical conductivity and breakdown voltage and mechanical properties, such as stiffness, strength, and fatigue durability, and thermal properties, such as thermal conductivity and upper-temperature capability. This symposium solicits abstracts related to the development and processing of lightweight electrical conductors, electrical insulation and hybrid materials and components such as wires and cables, as well as their testing in extreme environments, characterization and performance. Although this solicitation is for Aerospace application, it is also beneficial to terrestrial application.

Proposed Session Topics

- Development of lightweight, durable conductors with metals and/or nanomaterials or carbon inclusions
- Electrical insulation development using ceramic fillers in polymer and other novel materials and methods
- Ceramic candidates to improve electrical insulation performance
- Lifecycle characterization of HV power transmission components
- Processing of HV electrical component materials to form reliable electrical insulation and conductors
- Development of techniques to test, characterize, and design components in aerospace conditions at HV
- Identification, quantification, and modeling of durability and failure mechanisms of high-voltage materials
- Modeling the electrical performance of conductors and insulations in extreme environments

Symposium Organizers

Maricela Lizcano, *NASA Glenn Research Center, USA*

Diana Santiago, *NASA Glenn Research Center, USA*

Amjad Almansour, *NASA Glenn Research Center, USA*

Michael F. Mulzer, *DuPont, USA*

Gian Carlo Montanari, *University of Bologna, Italy and Florida State University, USA*

Ian Cotton, *University of Manchester, UK and aerospaceHV Ltd., UK*

Michael Cullinan, *University of Texas, USA*

Mehran Tehran, *University of California, San Diego, USA*

Vesselin Shanov, *University of Cincinnati, USA*

Marina Gandini, *Prysmian Group, Italy*

Chanyeop Park, *University of Wisconsin, USA*

Zhiting Tian, *Cornell University, USA*

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INNOVATIVE MATERIAL PROCESSING FOR DIVERSE RESOURCE CIRCULATION LOOPS

The circular economy, coupled with carbon neutrality and nature positivity, is increasingly expected by society. It is a business policy oriented toward growth and regional development, even in the face of environmental and resource constraints. Emerging innovations and high-tech products to achieve decarbonization are reliant on access to an increasing demand for raw materials, which are considered critical for both economic importance and supply risk. Most critical raw materials are irreplaceable in batteries, solar panels, wind turbines and energy-efficient lighting, therefore their circular use is becoming key for fighting climate change while satisfying society's needs.

In response to this urgent need, it is necessary to conceive a multiple resource circulation loop from resource-saving strategies such as long life and maintenance and sharing resource circulation strategies such as reuse, refurbishment and recycling. Circulating resources require energy for recovery and separation, and these cycles are not complementary to carbon neutrality unless they are carried out within the limits of renewable energy. In other words, energy-saving and cost-effective separation processes play a key role in achieving both the reduction of environmental burdens, such as GHG emissions and resource demand, while making the recovery and reuse economically feasible. In this regard, research efforts are dedicated to the further development of innovative disassembly strategies and high-precision physical/chemical separation technologies, enabling the selective and energy-efficient recovery of valuable materials/components from complex products.

Furthermore, the resource circulation loop that is closer to the consumer, such as longevity and reuse, makes the greatest contribution to both energy and resource conservation, therefore, the materials and components of the next-generation products are required to have a long service life, to be repairable and easily disassembled for regeneration. With the perspective of maximizing resource efficiency and creating economic value from sustainable and circular practices, another promising approach is represented by the valorization and stabilization of wastes to develop alternative raw materials for functional and structural applications. This symposium solicits abstracts related to novel material processing and disassembly/separation technologies that can contribute to efficient resource circulation loops and waste valorization.

Proposed Session Topics

- Recovery of critical/valuable materials from exhausted complex products
- Circular economy perspectives for inorganic waste/wastewater valorization/stabilization
- Valorization and reuse of construction and demolition wastes
- Structural control for easy decomposition of resins for diverse resource circulation
- Novel products and materials oriented toward easy disassembly and circulation design
- Advanced powder processing both for carbon net zero and circular economy
- Advanced material processing for longevity and repairability
- Data utilization/modeling/simulation for material circulation strategies

Symposium Organizers

Chiharu Tokoro, *Waseda University, Japan*

Sonia Lucia Fiorilli, *Politecnico di Torino, Italy*

Manigandan Kannan, *University of Akron, USA*

Henry Colorado, *Universidad de Antioquia, Colombia*

Enrico Bernardoi, *University of Padova, Italy*

Hidehiro Kamiya, *Waseda University, Japan*

Motoyuki Iijima, *Yokohama National University, Japan*

Norifumi Isu, *Sinshu University, Japan*

Manabu Fukushima, *AIST, Japan*

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CERAMICS FOR GLOBAL DECARBONIZATION

Reducing and, preferably, eliminating unsustainable greenhouse gas emissions is critical to preventing the damaging and costly effects of climate change. Technology plays a key role in the direct avoidance of carbon emissions, carbon capture storage and utilization, alternative fuels production, renewable energy generation and use and energy efficiency. There is extensive global activity in decarbonization technology, and ceramic materials have a significant impact on many of these technologies. This symposium will be a platform to discuss the latest advances, novel solutions and remaining challenges for materials (including discovery, property engineering, processing, and manufacturing), components and systems. The goal of the symposium is not only the exchange of recent results by experienced and young scientists, but also extensive discussion of unsolved problems and development directions.

Proposed Session Topics

- **Carbon Direct Avoidance technology**
  - Ceramics for green steel production
  - Inert Anodes for aluminum production
  - Ceramics for oxyfuel combustion
- **Carbon Capture, Utilization, and Storage**
  - Solid CO_2 sorbents
  - Membranes for CO_2 capture and utilization
  - Ceramics and catalysts for utilization of CO_2 or solid carbon as feedstocks
  - Chemical Looping for CO_2 valorization
- **Alternative Fuels Production**
  - Hydrogen (excluding high-temperature electrolysis)
  - Ceramics for ammonia synthesis, reforming, separation, storage and handling
  - Ceramics for biofuel and biochar production and use
  - Catalysts and materials for Fischer-Tropsch reactions
- **Hydrogen Utilization**
  - Materials and Coatings for hydrogen engines
  - Materials and Coatings for hydrogen pipelines
  - Ceramics for hydrogen storage
  - Hydrogen sensors
  - Membranes for separation of hydrogen from natural gas, ammonia, etc.
- **Electrification**
  - Ceramics for industrial-scale electricity-to-heat conversion: heating, etc.
  - Ceramics for electrical production of heat or steam
  - High voltage power electronics
- **Energy Efficiency**
  - Microreactors for process intensification
  - Heat exchangers for industrial processes
  - Materials, coatings and components for supercritical CO_2 power cycles

Symposium Organizers

Charles Lewinsohn, *Colorado State University, USA*

Federico Smeacetto, *Politecnico di Torino, Italy*

Alexander Michaelis, *IKTS, Germany*

Marta Boaro, *Università di Udine, Italy*

Takashi Makino, *AIST, Japan*

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14th

GLOBAL YOUNG INVESTIGATOR FORUM ON SUSTAINABILITY

The Global Young Investigators Forum (GYIF) aims to bring together students, postdoctoral researchers, young professionals and early career faculty from around the world to showcase their research and promote scientific discussions to identify and tackle emerging global challenges at the forefront of ceramic science and engineering research. The GYIF-dedicated symposium and poster session are a platform to support networking among young professionals, fostering global cooperation to approach current and future challenges in ceramic science and technology. The Global Young Investigator Award laureate will deliver the opening keynote lecture of the symposium.

All GYIF participants will be invited to attend a private luncheon hosted by the President of The American Ceramic Society. The American Ceramic Society will also provide complimentary student registration for a select number of eligible student GYIF presenters.

This year's GYIF seeks to promote a theme of sustainability, a global issue to be addressed by the next generation of leaders and international cooperation. Presentations and posters should discuss how the work may address sustainability needs through various approaches.

Proposed Session Topics

- Sustainable Materials Development: Exploring renewable and eco-friendly alternatives to traditional ceramics and composites and understand their thermo-mechanical behaviors
- Life Cycle Assessment (LCA) of ceramic and composite products: Analyzing the environmental impacts from raw material extraction to end-of-life disposal or recycling
- Energy and material-efficient manufacturing processes: Strategies for reducing material usage, energy consumption and greenhouse gas emissions during ceramic and composite production
- Circular economy approaches in ceramics and composites: Designing products and processes that promote reuse, remanufacturing and recycling to minimize waste
- Eco-design principles for ceramics and composites: Integrating sustainability considerations into the design phase to minimize environmental impacts
- Energy harvesting for sustainable systems: Enhancing the efficiency of functional materials and devices through innovations in piezoelectrics, batteries and beyond
- Green chemistry and sustainable synthesis methods: Utilizing environmentally benign chemicals and processes in the fabrication of ceramics and composites
- Case studies and best practices in sustainable ceramics and composites: Showcasing successful sustainability initiatives and projects from industry and academia
- Sustainable careers: Career development in Science, Technology, Engineering, Mathematics, and Medicine (STEMM), including building collaborative networks and research projects, as well as supporting diversity, maintaining work-life balance and promoting sustainability in the field of ceramics

Symposium Organizers

Dong (Lilly) Liu, *University of Bristol, UK*

Meelad Ranaiefar, *NASA Glenn Research Center, USA*

Bai Cui, *University of Nebraska-Lincoln, US*

Daniel Oropeza, *University of California at Santa Barbara, USA*

Mark Du, *Argonne National Laboratory, USA*

Fiona Spirrett, *Osaka University, Japan*

Jackson Majher, *Glass Coatings & Concepts LLC, USA*

James Wade-Zhu, *UK Atomic Energy Agency, UK*

Nor Ezzaty Ahmad, *Universiti Teknologi Malaysia, Malaysia*

Luchao Sun, *Institute of Metal Research, China*

Yuki Nakashima, *National Institute of Advanced Industrial Science and Technology (AIST), Japan*

Ho Jin Ma, *Korea Institute of Materials Science, Republic of Korea*

Stefano De la Pierre, *Politecnico di Torino, Italy*

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SESSION ON DIVERSITY, ENTREPRENEURSHIP, AND COMMERCIALIZATION

One of the critical goals of this special session is to recognize Jubilee Global Diversity Awardees—early-to-mid-career women and/or underrepresented minorities (based on race, ethnicity, nationality and/or geographic location) who have demonstrated exceptional and innovative research in the area of ceramic science and engineering. The awardees will be recognized and invited to present their contributions. In addition, this session will also focus on other aspects of being a working materials engineer or scientist. Skills such as team building, entrepreneurship, creativity, commercialization or scaling up, communication and business acumen are all important. Entrepreneurship and commercialization have become important tools for job creation and building a diverse skill set. More particularly, the entrepreneurial process is a highly rewarding process that revolves around freedom of thought, originality, risk-taking, recognizing gaps in the market, proactiveness and persistence.

Proposed Session Topics

- Jubilee Global Diversity Awardees Invited Presentation
- Designing a successful start-up, for example, building a diverse team, business strategy and business idea generation
- Assembling a focused team for a successful venture or product development
- Reallocating different resources, for example, human resource management
- Promoting problem-solving and creative and out-of-the-box thinking
- Impact of diversity on ideation and project outcomes
- Creating saleable products from research results
- Methods and tools for fostering and retaining broad diversity in science, technology, engineering and mathematics (STEM) with main focus on ceramic science

Symposium Organizers

Valerie Wiesner, *NASA Langley Research Center, USA*

Young-Wook Kim, *University of Seoul, Republic of Korea*

Theresa (Tessa) Davey, *Tohoku University, Japan*

Kristin Breder, *Saint-Gobain Research, USA*

Surojit Gupta, *University of North Dakota, USA*

Marissa Reigel, *Saint-Gobain NorPro, USA*

Jie Zhang, *Institute of Metal Research, China*

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Abstracts due on September 2, 2024