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ABSTRACTS DUE SEPT. 1, 2022

47TH INTERNATIONAL CONFERENCE AND EXPOSITION ON ADVANCED CERAMICS AND COMPOSITES

JAN. 22–27, 2023

HILTON DAYTONA BEACH RESORT AND OCEAN CENTER | DAYTONA BEACH, FLA., USA

ceramics.org/icacc2023

The American Ceramic Society
www.ceramics.org

Engineering Ceramics Division
The American Ceramic Society

Organized by the Engineering Ceramics Division of The American Ceramic Society

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Young-Wook Kim
University of Seoul
Program Chair, ICACC 2023

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WELCOME

We would like to welcome you to 47th International Conference & Exposition on Advanced Ceramics & Composites (ICACC 2023) in Daytona Beach, Florida. Since its inception in 1977, this prestigious conference has been organized by the Engineering Ceramics Division (ECD) of The American Ceramic Society (ACerS). Over the years, the conference has experienced tremendous growth in interest and participation from researchers, educators, technology developers, manufacturers, and end users from all over the world.

The 47th ICACC will provide a platform for the state-of-the-art presentations and information exchange on the cutting-edge ceramic and composite technologies. The technical program of ICACC2023 consists of 19 Symposia, four Focused Sessions, one Special Focused Session, the 5th Pacific Rim Engineered Ceramics Summit, the 12th Global Young Investigator Forum, and one Honorary Symposium.

The well-established 19 symposia at this conference include Mechanical Behavior of Ceramics and Composites, Advanced Ceramic Coatings, Solid Oxide Cells, Armor Ceramics, Bioceramics, Materials for Rechargeable Energy Storage, Nanomaterials for Energy Harvesting, Advanced Processing and Manufacturing Technologies, Porous Ceramics, Modeling and Design, Production Root Technologies, Nanolaminated Ternary Carbides/Nitrides, Nucelar Materials, Optical Materials, Additive Manufacturing, Geopolymers, Photonics, Ultra-High Temperature Ceramics, and Molecular-level Processing and Chemical Engineering. In addition to the core symposia, the technical program will include four Focused Sessions on emerging technologies: Bioinspiration and Green Processing, Thermoelectric and Thermionic Energy Conversion, Chemical Sensors, and Ceramic/Carbon Reinforced Polymers.

The 12th Global Young Investigator Forum and a Special Focused Session on Diversity, Entrepreneurship, and Commercialization will be organized to recognize early career researchers and the ECD Jubilee Global Diversity Awardees along with other invited speakers who will present on recent developments in entrepreneurship and commercialization, respectively. The 5th Pacific Rim Engineered Ceramics Summit will be held that will bring together experts from the Pacific Rim countries to foster information exchange on current status and emerging trends in research and development, engineering, manufacturing, and application of ceramics. In addition, an International Symposium entitled "Emergent Materials and Sustainable Manufacturing Technologies in a Global Landscape" will be held in Honor of Dr. Tatsuki Ohji to recognize his long term and outstanding contributions to ECD, ACerS, and the global ceramics community.

The ICACC Exposition will be held on Tuesday and Wednesday evenings in the Ocean Center, and it will provide a place for attendees to connect with business partners and explore new opportunities and see new materials, processing and characterization tools, and products. Poster sessions will be held in conjunction with the Exposition.

The ECD Executive Committee, ICACC Programming Committee, and volunteer organizers, together with The American Ceramic Society, would like to thank you for joining us in Daytona Beach, Florida, for what should be a stimulating and beneficial experience.

The COVID-19 pandemic had forced ICACC as a virtual conference for the last two years. But I really miss the opportunity to meet people and to interact with friends and colleagues. I look forward to seeing you all in Daytona Beach, Florida, in January 2023.

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ACerS ENGINEERING CERAMICS DIVISION LEADERSHIP

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- Chair-Elect: **Palani Balaya**, **Palani Balaya**, National University of Singapore, Singapore, mpepb@nus.edu.sg
- Vice-Chair/Treasurer: **Young-Wook Kim**, University of Seoul
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- ACerS Board of Directors Division Liaison: **Kristin Breder**, Saint-Gobain Ceramics & Plastics
- President's Council of Student Advisors Delegates: **Kartik Nemani**, Indiana University; **Isabella Costa**, University of California, Davis

HILTON DAYTONA BEACH RESORT

100 North Atlantic Ave. | Daytona Beach, FL 32118
Phone: 1-386-254-8200

Rates: One to four occupants: $188 USD
US government employee: Prevailing rate

Make reservations online under Hotel and Travel link at ceramics.org/icacc2022 or reserve by telephone, mention The American Ceramic Society to obtain the special rate.
Room rates are effective until Jan. 1, 2023 and are based on availability.

ORGANIZED BY THE ENGINEERING CERAMICS DIVISION OF THE AMERICAN CERAMIC SOCIETY

TENTATIVE SCHEDULE OF EVENTS

Sunday, Jan. 22, 2023

Conference registration	2–7 p.m.
Member and publication center	2–7 p.m.
Speaker ready room	2–7 p.m.
Welcome reception	5:30–7 p.m.

Monday, Jan. 23, 2023

Conference registration	7 a.m.–6 p.m.
Member and publication center	7 a.m.–6 p.m.
Speaker ready room	8 a.m.–4 p.m.
Opening awards ceremony & plenary session	8:30 a.m.–Noon
Companion coffee	9–10:30 a.m.
Coffee break	10:10–10:40 a.m.
Lunch on own	Noon–1:20 p.m.
Concurrent technical sessions	1:30–6:10 p.m.
Coffee break	3–3:20 p.m.

Tuesday, Jan. 24, 2023

Conference registration	7:30 a.m.–6 p.m.
Member and publication center	7:30 a.m.–6 p.m.
Speaker ready room	8 a.m.–4 p.m.
Concurrent technical sessions	8:30 a.m.–Noon
Coffee break	10–10:20 a.m.
Exhibitor set-up	Noon–4 p.m.
Lunch on own	Noon–1:20 p.m.
Concurrent technical sessions	1:30–5:30 p.m.
Coffee break	3–3:20 p.m.
Poster session A set-up	3–4:30 p.m.
Exhibits & poster session A, including reception	5–8 p.m.

Wednesday, Jan. 25, 2023

Conference registration	7:30 a.m.–5:30 p.m.
Member and publication center	7:30 a.m.–5:30 p.m.
Speaker ready room	8 a.m.–4 p.m.
Concurrent technical sessions	8:30 a.m.–Noon
Coffee break	10–10:20 a.m.
Lunch on own	Noon–1:20 p.m.
Concurrent technical sessions	1:30–5 p.m.
Coffee break	3–3:20 p.m.
Poster session B set-up	3–4:30 p.m.
Exhibits & poster session B, including reception	5–7:30 p.m.

Thursday, Jan. 26, 2023

Conference registration	7:30 a.m.–5:30 p.m.
Member and publication center	7:30 a.m.–5:30 p.m.
Speaker ready room	8 a.m.–4 p.m.
Concurrent technical sessions	8:30 a.m.–Noon
Coffee break	10–10:20 a.m.
Lunch on own	Noon–1:20 p.m.
Concurrent technical sessions	1:30–5:30 p.m.
Coffee break	3–3:20 p.m.
Last night reception	5:30–6:30 p.m.

Friday, Jan. 27, 2023

Conference registration	8 a.m.–Noon
Concurrent technical sessions	8:30–11:40 a.m.
Coffee break	10–10:20 a.m.

ABSTRACT SUBMISSION INSTRUCTIONS

- Visit **www.ceramics.org/icacc2023** 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 **Marilyn Stoltz** at mstoltz@ceramics.org or +1 614-794-5868.

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TECHNICAL SYMPOSIA

S1: MECHANICAL BEHAVIOR AND PERFORMANCE OF ADVANCED CERAMICS & COMPOSITES

Advanced structural ceramics and composites are enabling materials for applications in various industries including energy generation and storage, environment, space, transportation, medicine, microelectronics, and optical systems. High mechanical reliability is a key issue for their ultimate use in short- to very long-term applications. Identification and quantification of failure mechanisms by fracture, 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 of ceramic materials have necessitated new approaches for manufacturing and characterization. Furthermore, the development of novel methods to advance and accelerate computationally driven materials characterization and validate structure/property relationship models is needed to improve prediction of material behavior and lower costs. This symposium solicits abstracts related to the diverse aspects of mechanical behavior of ceramics and composites and their correlations with processing and component performance and reliability.

Proposed Session Topics

- Mechanical characterization of ceramics and composites, techniques & equipment
- Small-scale testing and in-situ characterization using photons & neutrons
- Fracture mechanics, failure analysis and fractography
- Environmental effects, thermomechanical performance, and tribology
- Design, reliability, and life prediction modeling of 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 energy generation, turbines, and environmental applications

Symposium Organizers

- Amjad Almansour, NASA Glenn Research Center, USA
- Dong (Lilly) Liu, University of Bristol, UK
- Jonathan Salem, NASA Glenn Research Center, USA
- Monica Ferraris, Politecnico di Torino, Italy
- Gerard Vignoles, University of Bordeaux, France
- Raul Bermejo, Montanuniversitaet Leoben, Austria
- Craig Przybyla, Air Force Research Laboratory, USA
- Dietmar Koch, University of Augsburg, Germany
- Emmanuel Maillet, GE Research, USA
- Andrew Wereszczak, Oak Ridge National Laboratory, USA
- Kevin Strong, Sandia National Laboratory, USA

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- **Monica Ferraris**: monica.ferraris@polito.it
- **Gerard Vignoles**: vinhola@lcts.u-bordeaux.fr

S2: ADVANCED CERAMIC COATINGS FOR STRUCTURAL, ENVIRONMENTAL, AND FUNCTIONAL APPLICATIONS

Research and development in the field of high-performance ceramic coating systems is a key to current and future technologies. Ceramic coatings extend lifetime or even enable 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 a key issue for nonoxide, ultrahigh-temperature ceramics and composites to be used in reusable spacecraft or hypersonic vehicles. Protection of metals against oxidation, corrosion, erosion, and wear by innovative ceramic coatings is also a central building block for many industrial applications. Functional ceramic coatings are essential for many renewable energy applications.

The symposium addresses processing, microstructure, performance, and durability of advanced ceramic coatings. New materials, innovative processing technologies, advanced characterization methods, and thermodynamic modeling are particularly emphasized. Materials scientists and engineers from around the world are invited to present and discuss cutting-edge ceramic coating science and technology.

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 nondestructive characterization methods
- Modeling and simulation

Symposium Organizers

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

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- Douglas E. Wolfe, The Pennsylvania State University, USA
- Jie Zhang, Institute of Metal Research, CAS, China
- Bryan Harder, NASA Glenn Research Center, USA
- Eugene Medvedovski, Endurance Technologies Inc., Canada
- Elizabeth Opila, University of Virginia, USA
- Eric H. Jordan, The University of Connecticut, USA
- Robert Vaßen, Forschungszentrum Jülich, Germany
- Kang N. Lee, NASA Glenn Research Center, USA
- Satoshi Kitaoka, Japan Fine Ceramics Center, Japan
- Byung-Koog Jang, Kyushu Universtiy, Japan
- David Poerschke, University of Minnesota, USA
- Ping Xiao, University of Manchester, UK
- Julin Wan, GE Global Research, USA
- Yutaka Kagawa, University of Tokyo, Japan
- Rodney W. Trice, Purdue University, USA
- Uwe Schulz, German Aerospace Center (DLR), Germany
- Kaylan Wessels, Pratt and Whitney, USA

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S3: 20TH 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, system layouts, and exchange their experience in application of SOCs in different areas. The goal of the symposium is not only 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 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

- Mihails Kusnezoff, Fraunhofer IKTS, Germany
- Federico Smeacetto, Politecnico di Torino, Italy
- John Hardy, Pacific Northwest National Laboratory, USA
- Narottam P. Bansal, NASA Glenn Research Center, USA
- Prabhakar Singh, University of Connecticut, USA
- Scott A. Barnett, Northwestern University, USA
- Henrik Lund Frandsen, DTU Energy Conversion and Storage, Denmark
- Vincenzo Esposito, DTU Energy Conversion and Storage, Denmark
- Tae Ho Shin, Korea Institute of Ceramic Engineering & Technology, South Korea
- Ruey-Yi Lee, Institute of Nuclear Energy Research, Taiwan
- Tatsumi Ishihara, Kyushu University, Japan
- Julie Mougin, CEA, France
- Sebastian Molin, Gdansk University of Technology, Poland

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- **John Hardy**: John.Hardy@pnnl.gov

S4: ARMOR CERAMICS – CHALLENGES AND NEW DEVELOPMENTS

Advanced ceramic and glass materials possess high ballistic efficiencies for a wide variety of threats. However, performance improvements have been hindered by the lack of knowledge and understanding of the effects of composition and multiscale structure on the fundamental damage and deformation mechanisms that govern strength and penetration resistance under high-rate and dynamic loading conditions. This symposium is an opportunity for industry, academia, and government attendees to openly discuss new developments in fundamental research on processing, structure, properties, performance relationships for armor ceramic and glass materials. For ICACC'23, in addition to proposed session topics listed below, sessions with invited speakers on the following focus topics

are planned: (1) fracture and fragmentation, (2) reaction-based ceramic composites, and (3) advances in transparent ceramics and glasses. Contributing presentations addressing either the proposed session topics or focus topics are welcomed.

Proposed Session Topics

– Ceramic and glass science and engineering
– Conventional, reactive, novel, and emerging synthesis and processing
– Processing and design of hierarchically structured bodies
– Process modeling
– Microstructure characterization and advanced methods
– High-rate and dynamic behavior, including underlying mechanisms
– Quasi-static mechanical properties
– Constitutive modeling

Symposium Organizers

- Jerry LaSalvia, DEVCOM ARL, USA
- Jeffrey Swab, DEVCOM ARL, USA
- Michael Bakas, DEVCOM ARO, USA
- Kristopher Behler, DEVCOM ARL, USA
- Anthony DiGiovanni, DEVCOM ARL, USA
- Richard Haber, Rutgers University, USA
- Neil Middleton, DSTL, UK
- Ghatu Subhash, University of Florida, USA
- Andrew Wereszczak, ORNL, USA

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- **Jerry LaSalvia**: jerry.c.lasalvia.civ@army.mil
- **Jeffrey Swab**: jeffrey.j.swab.civ@army.mil

S5: NEXT GENERATION BIOCERAMICS AND BIO-COMPOSITES

The last few decades have witnessed significant progress in the use of ceramics 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 bioinspired 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

– Porous bioceramics (joint with Symposium 9)
– Additive manufacturing of bioceramics
– Biomineralization and tissue-material interactions
– Bioactive and resorbable ceramics
– Bioinspired, biosynthetic, and biomimetic ceramics
– Self-assembled bioceramics
– Ceramics for drug and gene delivery
– Ceramics with antipathogenic properties
– In vitro and in vivo biocompatibility of bioceramics
– Mechanical properties of bioceramics
– Orthopedic and dental applications of bioceramics
– Nanostructured bioceramics (joint with Symposium 7)
– Magnetic nanoceramics 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, 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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S6: ADVANCED MATERIALS AND TECHNOLOGIES FOR RECHARGEABLE ENERGY STORAGE

The significant increases in demand of world energy consumption as well as clean and efficient energy resources have prompted the imperative searches of new materials and technologies. The intermittent nature of the 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 to achieve the stated goals. It will explore state-of-the-art materials and technologies for energy storage, improvements in materials design, electrodes 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.

Symposium will focus on crystal chemistry, structural analysis, materials

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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 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
- Olivier Guillon, Forschungszentrum Jülich, Germany
- Naoaki Yabuuchi, Yokohama National University, Japan
- Valerie Pralong, CNRS CRISMAT, France
- Do Kyung Kim, Korea Advanced Institute of Science and Technology, Korea
- Yasutoshi Iriyama, Nagoya University, Japan
- Prabeer Barpanda, Indian Institute of Science, India
- Richard M Laine, University of Michigan, USA
- Ruhul Amin, Oak Ridge National Laboratory, USA
- Yu Yau Wai Denis, City University of Hong Kong, Hong Kong
- Shih-Kang Lin, National Cheng Kung University, Taiwan

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S7: 17TH INTERNATIONAL SYMPOSIUM ON FUNCTIONAL NANOMATERIALS AND THIN FILMS FOR SUSTAINABLE ENERGY HARVESTING, ENVIRONMENTAL AND HEALTH 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 energy technologies and devices based on inorganic, hybrid, and composite materials. Particular emphasis will be given to novel synthesis approaches, surface functionalization, and heterostructuring of nanoparticles, nanowires, and nanoscopic films, fundamentally new properties, and energy-efficient materials synthesis. Applications of nanostructures in photocatalysis, photovoltaic, energy, sensing, and biomedical applications that combine advanced processing with conceptual advancement will form the major thrust areas. Contributions related to energy applications such as perovskite 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 and 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 nanobioconjugates
– Functional coatings on glass & innovative thin film techniques (e.g., ALD, PECVD)
– Industrial production and application of nanomaterials & coatings
– Carbon nanostructures, 2D materials, and metal chalcogenides
– Computational methods in the design of tailored nanostructured materials
– Interfacial materials and multimaterial heterostructures & nanocomposites

Symposium Organizers

- Muhammet S. Toprak, KTH Royal Institute of Technology, Sweden
- Miso Kim, Sungkyunkwan University, Republic of Korea
- Gang Liu, Institute of Metal Research, CAS, China
- Sanjay Mathur, University of Cologne, Germany
- Shashank Mishra, University of Lyon, France
- Sedat Ballikaya, Istanbul University, Turkey
- Andreu Cabot, Catalonia Institute for Energy Research, Spain
- Abdulhadi Baykal, Imam Abdulrahman Bin Faisal University, Saudi Arabia

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S8: 17TH INTERNATIONAL SYMPOSIUM ON ADVANCED PROCESSING AND MANUFACTURING TECHNOLOGIES FOR STRUCTURAL AND MULTIFUNCTIONAL MATERIALS AND SYSTEMS (APMT17)

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 size 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 nonoxide 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 be also 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, bioinspired 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
- Weimin Wang, 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

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- 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
- Csaba Balazsi, Centre for Energy Research ELKH, Hungary
- Heping Li, Huazhong University of Science and Technology, China
- Zhixiao Zhang, Hebei University of Engineering, China

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S9: 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, and sensors. 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 multifaceted applications. These materials contain pore sizes from the nanometers to millimeters, and can have textured to random porosity or hierarchical porosity and be based on various pore architectures, such as foams, honeycombs, fiber networks, bioinspired structures. Because of these characteristics, porous materials are extensively studied in environmental, energy, and/or biological applications. This symposium will be the ideal showcase for the research activities of many groups involved in the development and use of porous materials including but not limited to the areas of ceramics, chemistry, mechanics, fluid dynamics, modeling and simulation, and application engineering.

Proposed Session Topics

– Innovations in processing methods & synthesis of porous ceramics
– Structure and properties of porous ceramics
– Novel characterization tools of porous structures
– Software tools for characterization
– Computational techniques in porous ceramics
– Machine learning (ML) and artificial intelligence (AI) for porous ceramics
– Mechanical behavior of porous ceramics
– Micro-porous and Meso-porous ceramics
– Gas separation ceramic membranes
– Ceramics with hierarchical porosity
– Engineered porous architectures enabled by additive manufacturing technologies
– Porous ceramics for environmental applications
– Porous ceramics for energy applications
– Porous ceramics for biological applications
– Porous ceramics for functional applications

Symposium Organizers

- Manabu Fukushima, National Institute of Advanced Industrial Science and Technology (AIST), Japan
- Tobias Fey, University of Erlangen-Nuremberg, Germany
- Paolo Colombo, University of Padova, Italy
- Farid Akhtar, Lulea University of Technology, Sweden
- Samuel Bernard, Institut de Recherche sur les Céramiques de Limoges, France
- Miki Inada, Kyushu University, Japan
- Oleksandr Kravchenko, Old Dominion University, USA
- C.D. Madhusoodana, Ceramic Technological Institute Bharat Heavy Electricals Ltd., India
- Yuki Nakashima, National Institute of Advanced Industrial Science and Technology (AIST), Japan
- Jian-feng Yang, Xi'an Jiaotong University, China

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- **Paolo Colombo:** paolo.colombo@unipd.it

S10: MODELING AND DESIGN OF CERAMICS AND COMPOSITES

Recent progress in computational materials science has significantly enhanced the efficiency with which the understanding of fundamental phenomena, the improvement of materials performance, the optimization of processing, the discovery of new materials, and the design of structural components can be achieved. This symposium will focus on the high-throughput design and characterization, informatics and machine learning, and modeling of ceramics and composites with different approaches in both computational research and experimental measurements across the length and time scales so as to further optimize their behavior and facilitate the design of new ceramics and composites with tailored properties. A broader perspective is desired, including the interest related to ceramic genome; virtual materials design; informatics and machine learning for new innovative materials and thermostructure; integrated materials computational engineering, prediction of the structure and properties of crystals, glasses, and defects; modeling materials behavior under extreme/harsh environments, application of novel simulation methods for 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
– Multiscale 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

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Symposium Organizers

- Jingyang Wang, Institute of Metal Research, Chinese Academy of Sciences, China
- Valentino Cooper, Oak Ridge National Laboratory, USA
- Hyung-Tae Kim, Korean Institute of Ceramic Engineering and Technology, Korea
- Bin Liu, Shanghai University, China
- Jian Luo, University of California, San Diego, USA
- Yixiu Luo, Institute of Metal Research, Chinese Academy of Sciences, China
- Katsuyuki Matsunaga, Nagoya University, Japan
- Sergei Manzhos, Tokyo Institute of Technology, Japan
- Paul Rulis, University of Missouri-Kansas City, USA
- Gerard L. Vignoles, University of Bordeaux, France
- William J. Weber, University of Tennessee, USA

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S11: 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 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 starting materials all the way up to component manufacturing and module integration. As demand increases for sustainable energy, especially by employing novel materials, composites and/or functional (e.g., energy scavenging, storage, and saving) techniques, the interdisciplinary approach plays even a 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. Many successful stories and noteworthy examples of transforming dangerous, dirty, and difficult aspects of production root technologies into automatic, clean and easy form will also be recognized and shared.

Proposed Session Topics

– Starting materials: mining, particles, bulk, and functional materials and precursors
– Sustainable energy concepts and applications
– Transitioning fundamentals to industry
– Forming and shaping processes for advanced materials
– Recycling and reuse processes
– Coating processes for low friction and energy solutions
– New concepts and emerging technologies for enhanced product performance
– Industrial root technology based on KITECH and GIGAKU concept

Symposium Organizers

- Chisung Ahn, Korea Institute of Industrial Technology, Korea
- Sungwook Mhin, Kyonggi University, Korea
- Tadachika Nakayama, Nagaoka University of Technology, Japan
- Kyoung Il Moon, Korea Institute of Industrial Technology, Korea
- Jun Akedo, National Institute of Advanced Industrial Science and Technology (AIST), Japan
- Byungkoog Jang, Kyushu University, Japan
- Kouichi Yasuda, Tokyo Institute of Technology, Japan
- Hyuksu Han, Konkuk University, Korea

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S12: 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, and stiffness at high temperatures. 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 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, and 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.

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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
- Konstantza Lambrinou, SCK · CEN, Belgium
- Jochen M. Schneider, Uppsala University, Sweden
- Thierry Cabioch, Université de Poitiers, France
- Sylvain Dubois, Université de Poitiers, France
- Per Eklund, Linköping University, Sweden
- Johanna Rosen, Linköping University, Sweden
- Jesus Gonzalez, RWTH Aachen University, Germany
- Chenxu Wang, Peking University, China

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- **Miladin Radovic**: mradovic@tamu.edu

S13: 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, processing, and performance under relevant nuclear environments. Also included will be discussions on prospects and perspectives related to commercial development, and qualification and licensing requirements. The symposium is co-sponsored by the Energy Materials and Systems Division.

Proposed Session Topics

– Material technologies for enhanced accident tolerance LWR fuels and core
– Ceramic fuel materials, technologies, and characterization; TRISO fuels
– Graphite and carbon materials for nuclear applications
– High-temperature ceramics for space reactor applications
– New materials and containment for neutron moderators, reflectors, and shielding
– Novel ceramics and composites for nuclear systems
– 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
- Kyle Brinkman, Clemson University, USA
- Monica Ferraris, Politecnico di Torino, Italy
- Tatsuya Hinoki, Kyoto University, Japan
- Dong Liu, University of Bristol, UK
- Caen Ang, USNC-Technologies, USA
- Kelsa Palomares, Analytical Mechanics Associates, USA
- Samuel Humphry-Baker, Imperial College London, UK
- David Sprouster, Stony Brook University, USA

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- **Takaaki Koyanagi**: koyanagit@ornl.gov

S14: CRYSTALLINE MATERIALS FOR ELECTRICAL, OPTICAL AND MEDICAL APPLICATIONS

This symposium 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 symposium 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
- Noboru Ichinose, Waseda University
- Luisa E. Bausá, Autonomous University of Madrid

- Victoria Blair, U.S. Army Research Laboratory
- Nerine J. Cherepy, Lawrence Livermore National Laboratory
- Yoshihiko Imanaka, S-Nanotech Co-Creation
- Kenji Toda, Niigata University
- Tetsuo Tsuchiya, National Institute of Advanced Industrial Science and Technology
- Yiquan Wu, Alfred University
- Takayuki Yanagida, Nara Institute of Science and Technology
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S15: 7TH INTERNATIONAL SYMPOSIUM ON ADDITIVE MANUFACTURING AND 3D PRINTING TECHNOLOGIES

Additive manufacturing 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, 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 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, biomaterials components for medical applications, and ceramics electrode with large surface area 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 multi-functionality. This symposium focuses on 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

– Laminated object manufacturing/green tape stacking
– Powder bed fusion/selective laser melting and sintering
– Material extrusion/fused deposition modeling
– Binder jetting processes
– Vat photopolymerization/substrate stereolithography
– Direct writing/ink jet printing technologies
– Multimaterial and hybrid printing techniques
– Design with/for additive manufacturing
– Materials and process characterization tools
– Qualification, certification, standards, and property database
– Applications of AM Materials and Components

Symposium Organizers

- Soshu Kirihara, Osaka University, Japan
- Mrityunjay Singh, Ohio Aerospace Institute, USA
- Michael Halbig, NASA Glenn Research Center, USA
- Andrew Allan, NIST, USA
- Arnaldo Moreno Berto, ITC, Spain
- Zhangwei Chen, Shenzhen University, China
- Corson L. Cramer, Oak Ridge National Laboratory, USA
- Giorgia Franchin, Università di Padova, Italy
- Majid Minary, Arizona State University, USA
- Alberto Ortona, SUPSI, Switzerland
- Tobias A. Schaedler, HRL Laboratories LLC, USA
- Martin Schwentenwein, Lithoz GmbH, Austria
- Hui-Suk Yun, KIMS, Korea

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S16: GEOPOLYMERS, INORGANIC POLYMERS 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, aluminosilicates, silico-aluminate phosphates, or stoichiometric geopolymers (which convert to single phase ceramics upon heating), as well as other chemically bonded, inorganic compounds. 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 1,000°C, whereupon it converts to a ceramic or a ceramic plus glass. Novel potential applications of such composites include fire and corrosion resistant coatings; thermal insulation; porous materials; structural ceramic composites containing ceramic, metal, organic, or biological reinforcements; nanozeolites for liquid and water purification, as well as infrastructure and construction materials. The nanoparticulate nature of geopolymers also provides a low-energy processing route to ultrarefractory ceramic powders or versatile forming methods, including 4D printing.

Proposed Session Topics

– Synthesis, processing microstructure
– Mechanical properties, thermal shock resistance
– Composites

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– Alkali-based geopolymers
– Acid-based phosphate geopolymers
– Other inorganic geopolymer analogues
– Geopolymer-derived processing routes
– Conversion to ceramics
– Use of waste materials to make geopolymers
– Coatings (fire resistant, acid resistant)
– Waste encapsulation
– Sustainable materials
– Novel applications

Symposium Organizers

- Waltraud M. Kriven, University of Illinois at Urbana-Champaign, USA
- Joseph Davidovits, Geopolymer Institute, St. Quentin, France
- Ghassan Al Chaar, US Army Corps of Engineers, ERDC, CERL, USA
- Don Seo, Arizona State University, USA
- Henry A. Colorado, Universidad de Antioquia, Medellin, Colombia

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S17: 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, multiferroic 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 with an overview toward integration with other classes of materials (e.g., polymers, metals). New nanotechnology tools and technological procedures for the development of new functional devices integrating bottom-up and top-down technologies will be also 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, INRS, Canada
- Yasuhiro Tachibana, RMIT University, Australia
- David Kisailus, University of California at Riverside, U.S.
- Tohru Sekino, Osaka University, Japan
- Isabella Concina, Luleå University of Technology, Sweden
- Haiguang Zhao, Qingdao University, China
- Francesco Enrichi, National Research Council (CNR), Italy
- Daniele Benetti, INRS, Canada

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- **Federico Rosei**: Federico.Rosei@inrs.ca

S18: 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 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
– Entropy stabilized 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 (e.g., irradiation, ultrahigh temperatures)
– 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, Korea
- Frederic Monteverde, National Research Council-Institute of Science and Technology for Ceramics, Italy
- Luc J Vandeperre, Imperial College London, UK
- Guo-Jun Zhang, Donghua University, Shanghai, China
- Carolina Tallon, Virginia Tech, USA
- Ji Zou, Wuhan University of Technology, China
- Lisa Rueschhoff, Air Force Research Laboratory, USA
- Emanuel Ionescu, Technical University Darmstadt, Germany
- Lavina Backman, Naval Research Laboratory, USA

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S19: 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 an extensive knowledge about their (thermal) conversion into desired functional materials are of crucial importance for providing improved rational preparative concepts towards tailor-made (multi)functional structures. Molecular synthesis techniques toward functional materials are highly attractive, as they can be performed with 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 for developing 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 multicomponent 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 solution such as sol-gel, solvothermal, electrospinning, microwave, chemical vapor deposition and atomic layer deposition techniques will be critically analyzed. Specific emphasis will be laid on materials manufacturing strategies such as 3D printing and chemically controlled assembly and purpose-driven modification of materials. Nonconventional synthesis and analytical methods enabling in-situ diagnostics and mechanistic insights into nucleation, growth, and self-assembly are in particular focus. Emphasizing the need of 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 concerning 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

- Sanjay Mathur, University of Cologne, Germany
- Emanuel Ionescu, Technische Universität Darmstadt, Germany
- Samuel Bernard, University of Limoges, France
- Gurpreet Singh, Kansas University, USA
- Ravi Kumar, IIT Madras, India
- Peter Kroll, University of Texas at Arlington, USA
- Shashank Mishra, University of Lyon, France
- Maarit Karppinen, Aalto University, Finland
- Gunnar Westin, Uppsala University, Sweden
- Ausrine Bartasyte, University of Franche-Comté, France
- Hiromitsu Kozuka, Kansai University, Japan
- Hirokazu Katsui, Tohoku University, Japan
- Yoshiyuki Sugahara, Waseda University, Japan
- Dong-Pyo Kim, Pohang University of Science and Technology, South Korea
- Ulrich Wiesner, Cornell University, USA

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FS1: BIOINSPIRATION, GREEN PROCESSING, AND RELATED TECHNOLOGIES OF ADVANCED MATERIALS

During the last decades, bioinspiration has attracted increasing attention as well from basic and applied research as from various fields of industry and building construction. Bioinspiration has a high innovation potential and offers the possibility for the development of sustainable technical products and production chains. A bioinspired material is any material that exhibits a structure or function that is inspired in some material or process related aspect by examples found in living nature. The study of bioinspired materials is a technical means to learn from biology in order to develop new materials and structures with novel functionalities. In addition to bioinspired material, green processing and related technologies exhibit flexibility for materials design to impart various functionalities 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 bioinspired and green processing of advanced materials. Novel sophisticated methods for quantitatively analyzing and simulating the form–structure–function–relation on various hierarchical levels allow new fascination insights in multiscale mechanics and other functions of biological materials and surfaces. Additionally, new production methods enable for the first time the transfer of many outstanding properties of the biological role models into innovative biomimetic products for reasonable costs. A particular emphasis will be placed on the fundamental issues related to advancing our understanding and utilization of processes inspired by living nature to develop materials with new functionalities and structures, current progress and challenges, and future directions in green processing and related technologies as well.

Proposed Session Topics

– Bioinspired processing of ceramics and fiber-reinforced materials systems
– Advances in bioinspired materials and surfaces and related applications
– Bottom-up assembly and complex colloids
– Green processing for energy conversion and storage materials and systems
– Green processing of functional materials
– Green technology for environmental sustainability
– Future directions of bioinspired materials, green processing and technologies

Symposium Organizers

- Thomas Speck, Universität Freiburg, Germany
- Bastian Rapp, University of Freiburg, Germany
- Manoj K Mahapatra, University of Alabama at Birmingham, USA
- Cordt Zollfranck, Technical, Univeristy Munich, Germany
- André Studdart, ETH Zürich, Switzerland
- Ada-Ioana Bunea, DTU, Denmark
- Ina Yadroitsava, CUT, South Africa (now Moscow)

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FS2: MATERIALS FOR THERMOELECTRIC AND THERMIONIC ENERGY CONVERSION

Thermoelectric power generation relies on a thermally induced electrical current in an all-solid-state device. In principle, the same kind of device can be used to electrically induce a thermal current and thus enable coolers or heaters. In both operational modes, the useful power and the power conversion efficiency depend on transport of charge carriers (electrons or holes) and propagation of lattice vibrations (phonons) in the thermoelectric materials involved. Broader applications of thermoelectric devices can be expected if new materials can be developed and assembled to meet the requirements reliably under a number of environments and duty loads. Deeper insight into mechanisms by novel theoretical concepts and advanced manufacturing methods is needed to realize unique thermoelectric as well as thermionic materials and devices, which exhibit 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 the design, performance and evaluation of nontraditional 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 devices. Researchers/scientists in thermoelectrics and related fields are invited to participate in this symposium.

Proposed Session Topics

– Novel thermoelectric and thermionic materials with high power factor and/or high figure of merit
– Inorganic thermoelectric materials, organic thermoelectric materials and organic-inorganic hybrid systems
– Electronic and phononic band structure engineering, nanostructural engineering, superlattice structures, and 2D thermoelectric materials
– Porous thermoelectric materials
– Thermal stability and mechanical properties of thermoelectric materials and reliability of devices
– Electrical and thermal contact resistivity and their interplay with joining of thermoelectric materials
– Thermodynamics and solid-state defect chemistry of thermoelectric materials
– Theoretical and experimental approaches to thermal and electrical transport mechanisms in thermoelectric and thermionic materials
– Design 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 devices and modules
– Flexible thermoelectric materials and devices
– Miniaturized and integrated thermoelectric and thermionic devices
– System-level applications of advanced thermoelectric devices and modules in electrical power generation (e.g., thermogenerators), sensor technology, heating and cooling

47TH INTERNATIONAL CONFERENCE AND EXPOSITION ON ADVANCED CERAMICS AND COMPOSITES

JAN. 22–27, 2023 | HILTON DAYTONA BEACH RESORT AND OCEAN CENTER | DAYTONA BEACH, FLA., USA

Symposium Organizers

- Michitaka Ohtaki, Kyushu University, Japan
- Kyu Hyoung Lee, Yonsei University, Republic of Korea
- Armin Feldhoff, Leibniz University Hannover, Germany
- Sunmi Shin, National University of Singapore, Singapore
- Mari-Ann Einarsrud, Norwegian University of Science and Technology, Norway
- 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

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FS3: NANOSTRUCTURES AND LOW-DIMENSIONAL MATERIALS FOR CHEMICAL SENSORS

A chemical sensor is a self-contained analytical device that can provide information about the chemical composition of its environment, that is, a liquid or a gas phase. The information is provided in the form of a measurable physical signal that is correlated with the concentration of a certain chemical species (termed as analyte). Two main steps are involved in the functioning of a chemical sensor, namely, recognition and transduction. In the recognition step, analyte molecules interact selectively with receptor molecules or sites included in the structure of the recognition element of the sensor. Consequently, a characteristic physical parameter varies and this variation is reported by means of an integrated transducer that generates the output signal. A chemical sensor based on recognition material of biological nature is a biosensor. The application of chemical sensors has penetrated into the environment, medicine, industry, agriculture, and military. Recent IoT innovation made it possible to connect everyday things to the internet. Chemical sensors play an important role in creating solutions using IoT. In addition, the application of nanomaterials which have high surface to volume ratios and the application of microelectromechanical technology will boost the development of chemical sensors. So, chemical sensors are expected to make great progress in exploring new areas.

In this focused session, we will seek to presentations which reflect the most complete and reliable source of information on recent progress and prospect of high performance chemical sensors using nanostructures of inorganic, organic, and inorganic-organic hybrid materials and low-dimensional materials including quantum dots, 2D materials, nanowires, and nanotubes. We also encourage the submission of abstracts related to theoretical calculations and modeling for chemical sensing and the application of chemical sensors in its broadest sense.

Proposed Session Topics

– Gas sensors and liquid sensors using nanomaterials
– Synthesis of nanostructures for sensitive chemical sensing
– Chemical sensors based on 0D, 1D, and 2D materials
– Surface 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

- Ho Won Jang, Seoul National University, Republic of Korea
- Kengo Shimanoe, Kyushu University, Japan
- Nicolae Barsan, University of Tuebingen, Germany
- Geyu Lu, Jilin university, China
- Sheikh A. Akbar, The Ohio State University, USA

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- **Ho Won Jang**: hwjang@snu.ac.kr
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FS4: 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 sessionm 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, in which that can provide various functionalities such as mechanical, thermal, biological, insulation, electric, chemical resistant and wear properties, composed of fillers or fibers from the nanometers to millimeters, and in textured to random. This session 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 composites
– 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

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ABSTRACTS DUE SEPT. 1, 2022

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ORGANIZED BY THE ENGINEERING CERAMICS DIVISION OF THE AMERICAN CERAMIC SOCIETY

– Innovation for integration of ceramics and composites
– The role of composites in multimaterial 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
- Joung-Man Park, Gyeongsang National University, South Korea
- 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
- Masato Sakaguchi, Salesian Polytechnic, Japan

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12TH GLOBAL YOUNG INVESTIGATOR FORUM

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 students GYIF presenters.

Proposed session topics

– Novel ceramic processing methods and synthesis routes, including new precursors for functional ceramics
– Additive manufacturing of ceramics and ceramic-based composites
– Advanced ceramics and coatings for structural, environmental and functional applications
– Computational materials prediction and design
– Non-destructive testing (NDT) for investigation of ceramics and composites
– Novel characterization tools of ceramics and composites
– Advanced and nanostructured materials: ceramic sensors and actuators, energy generation, saving and storage, catalysis, functional surfaces and biomedical applications
– Careers in science, technology, engineering and mathematics (STEM), including building collaborative

Symposium organizer

- Daniele Benetti, Institut National de la Recherche Scientifique, Canada
- Kaline P. Furlan, Hamburg University of Technology, Germany
- Andrew Rosenberger, US Army Research Laboratory, USA
- Theresa Davey, Tohoku University, Japan
- Yuki Nakashima, National Institute of Advanced Industrial Science and Technology (AIST), Japan
- William Costakis, Air Force Research Labs, USA

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EMERGENT MATERIALS AND SUSTAINABLE MANUFACTURING TECHNOLOGIES IN A GLOBAL LANDSCAPE: INTERNATIONAL SYMPOSIUM IN HONOR OF DR. TATSUKI OHJI

As the increasing global population drives to meet the basic necessities and improve its standard of living, the demand for energy, healthcare, housing, transportation, and industrial products is also growing rapidly. However, the higher demand and production in all these areas leads to a dramatic increase in the overall consumption of resources and rate of pollution leading to climate change that creates the risk of irreversible changes in ecosystem. New technologies and innovative solutions are required to address these needs. This symposium will address the critical role of emergent materials and sustainable manufacturing technologies in addressing various societal challenges. This symposium will cover wide ranging topics and identify key challenges and opportunities for various emerging materials and innovative manufacturing technologies in a global landscape.

This symposium is being held in honor of Dr. Tatsuki Ohji, National Institute of Advanced Industrial Science and Technology (AIST), Japan, recognizing his long-term and outstanding contributions to science and technology of advanced ceramic materials and technologies and promoting and developing human network and collaborations among the materials community worldwide. The technical program will cover, but not limited to:

- Global Resource Management for Sustainable Development
- Innovative Strategies for Sustainable and Self-sufficient Solutions
- Emergent Materials and Technologies
- Hybrid and Multifunctional Systems
- Materials for Sustainable Energy and Environmental Systems
- Technologies for Human Health and Societal Welfare
- Emerging Materials and Technologies for AI, IoTs, and Big Data
- Technologies for Solving Global Water Challenges
- Knowledge Management, Education, Mentoring, and Collaboration

A number of experts from all over the world will be invited to make presentations in their specific areas of interest and highlight specific contributions they have made to better the lives of people and sustainable societal development.

Symposium Organizers

- M. Singh, Ohio Aerospace Institute, Cleveland, USA
- Manabu Fukushima, National Institute of Advanced Industrial Science and Technology, Japan
- Jingyang Wang, IMR-Shenyang National Laboratory for Materials Science, China
- Palani Balaya, National University of Singapore, Singapore
- Kiyoshi Shimamura, National Institute of Materials Science, Japan
- Alexander Michaelis, Fraunhofer IKTS, Dresden, Germany
- Young-Wook Kim, University of Seoul, Korea
- Sanjay Mathur, University of Cologne, Germany
- Dileep Singh, Argonne National Laboratory, USA
- Monica Ferraris, Politecnico di Torino, Italy
- Zhengyi Fu, Wuhan University of Technology, China

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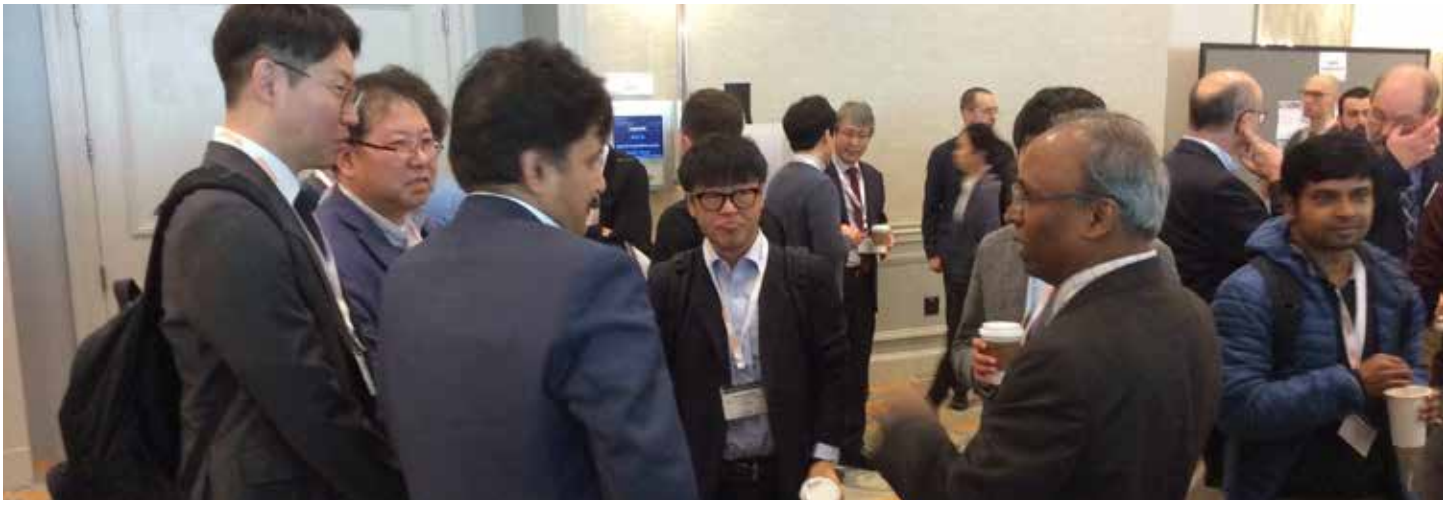

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SPECIAL FOCUSED SESSION ON DIVERSITY, ENTREPRENEURSHIP, AND COMMERCIALIZATION

One of the critical goals of this special session is to recognize Jubilee Global Diversity Awardees, or exceptional early- to mid-career women and/or underrepresented minorities (based on race, ethnicity, nationality and/or geographic location) in the area of ceramic science and engineering who will be invited to present their contributions. In addition, this session will also focus on entrepreneurship and commercialization. As a background, entrepreneurship has become an important tool for job creation. More particularly, entrepreneurial process is a highly rewarding process that revolves around freedom of thoughts, originality, risk-taking and recognizing gaps in the market, proactiveness, and competitive aggressiveness.

Proposed session topics

- Jubilee Global Diversity Awardees Invited Presentation
- Designing a successful start-up, for example, business strategy, and business idea generation
- Assembling a focused team for a successful venture
- Reallocating different resources for the same, for example human resource management
- Promoting problem-solving, and creative and out-of-the-box thinking.
- Impact of diversity on ideation and entrepreneurial endeavors
- Creating saleable products from research results
- Methods and tools for fostering and retaining broad diversity in STEM with main focus to ceramic science

Symposium organizer

- Surojit Gupta, University of North Dakota, USA
- Valerie L Wiesner, NASA Langley Research Center, USA
- Jie Zhang, Institute of Metal Research, CAS, China
- Miso Kim, Sungkyunkwan University, Republic of Korea
- Kristin Breder, Saint Gobain Research, USA
- Katalin Balázsi, Institute for Technical Physics and Materials Science, MTA EK, Budapest, Hungary
- Phylis Makurunje, Nuclear Futures Institute, Bangor University, Wales, UK
- Scott McCormack, University of California Davis, USA
- Lavina Backman, Naval Research Laboratory, USA

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5TH PACIFIC RIM ENGINEERED CERAMICS SUMMIT

During the past fifty years, Pacific Rim countries have proudly contributed to ground breaking research, technology development, and commercialization in the field of engineered and functional ceramics. These important contributions led to the advancement and wide-scale utilization of ceramics in energy, aerospace, transportation, healthcare, communication, infrastructure, environmental, as well as other industrial sectors. In turn, these ceramic technologies and systems led to significant improvements in living standards and quality of life for people across the world.

The International Summit series started in 2011 with the focus being on Pacific Rim countries. The second summit in 2012 focused on EU/US ceramic efforts, while in 2013 it was titled the Summit of Americas. The second round for both the Pacific Rim and EU/US summits were held in 2014 and 2015, respectively. The third and fourth Pacific Rim summits were held in 2017 and 2020. In 2023, the 5th Pacific Rim Engineering Ceramics Summit will bring together experts from academia, industry, and government research institutes/laboratories to discuss the current state-of-the-art and various technical challenges in research and development, engineering, manufacturing, and application of ceramic materials. The goal of the summit is to provide a forum for global information exchange concerning the current status and emerging trends in various ceramic technologies in Pacific Rim countries.

Proposed Session Topics:

- Current trends and future directions for research and technology
- Challenges and opportunities for various ceramic technologies
- Role of ceramics in energy, photonics and environmental issues
- Applications of engineering, functional, and structural ceramics
- Hybrid interface materials
- Advanced ceramics for environmental conservation, pollution control and critical materials
- Ceramic education, training, and knowledge management
- Overview of major ceramics efforts in the region

Symposium Organizers

- Nobuhito Imanaka, Osaka University, Japan
- Young-Wook Kim, University of Seoul, Republic of Korea
- Jingyang Wang, Institute of Metal Research, China
- Amjad Almansour, NASA Glenn Research Center, USA
- Lalit Kumar Sharma, Mahamana Ceramic Development Organizational Soc, India
- Wei-Hsing Tuan, National Taipei University, Taiwan
- Jakrapong Kaewkhao, Nakhon Pathom Rajabhat University (NPRU), Thailand
- Manabu Fukushima, AIST, Japan
- Kiyoshi Shimamura, National Institute for Materials Science, Japan
- Miso Kim, Sungkyunkwan University, Republic of Korea
- Ziqi Sun, Queensland University of Technology, Australia
- Palani Balaya, National University of Singapore, Singapore
- Andrew L. Gyekenyesi, Ohio Aerospace Institute, USA

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