CALL FOR PAPERS

12th International Conference on HIGH TEMPERATURE CERAMIC MATRIX COMPOSITES (HTCMC-12)

COMBINED WITH

Global Forum on ADVANCED MATERIALS AND TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT (GFMAT-3) 2026

Sheraton San Diego Hotel & Marina | San Diego, California, USA

MAY 31 – JUNE 5, 2026

The American Ceramic Society
ceramics.org

Abstract due November 21, 2025

htcmc2026.abstractcentral.com

INTRODUCTION

Global population growth and tremendous economic development have brought us to the crossroads of long-term sustainability and risk of irreversible changes in the ecosystem. Energy efficient and ecofriendly technologies and systems are critically needed for further growth and sustainable development. While ceramic matrix composites were originally developed to overcome problems associated with the brittle nature of monolithic ceramics, today the composites can be tailored for customized purposes to support energy efficient and eco-friendly applications, including aerospace, space transportation, ground transportation, and power generation systems.

The American Ceramic Society (ACerS) is organizing and hosting the 12th International Conference on High Temperature Ceramic Matrix Composites (HTCMC-12) in San Diego, CA, USA, May 31-June 5, 2026. HTCMC-12 will continue the tradition of successful previous conferences held in Bordeaux (France, 1993), Santa Barbara (USA, 1995), Osaka (Japan, 1998), Munich (Germany, 2001), Seattle (USA, 2004), New Delhi (India, 2007), Bayreuth (Germany, 2010), Xi'An (China, 2013), Toronto (Canada, 2016), Bordeaux (France, 2019), and Jeju (Korea, 2023). This conference series has been recognized as the global and central meeting event in high-temperature ceramic composite science and technology.

The 3rd Global Forum on Advanced Materials and Technologies for Sustainable Development (GFMAT-3), whose 1st and 2nd meetings were held in Toronto, Canada, in 2016 and 2019, respectively, will address various key issues, challenges and opportunities in a wide variety of advanced materials and technologies that are critically needed for a sustainable societal development. Because of its great attention and importance in various technical fields, we also organize the Joint Symposium, "Additive Manufacturing Technologies and Applications".

We invite all of you to take advantage of this opportunity to visit the great city of San Diego and actively participate in this conference. We are hopeful that this meeting will provide an excellent forum for interaction and friendship with international participants to discuss the latest trends in the applications of ceramic technologies for sustainable development. We look forward to your participation in HTCMC-12 and GFMAT-3.




Submit your abstract by NOVEMBER 21, 2025 at ceramics.org/htcmc12_gfmat3

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SCHEDULE OF EVENTS

Sunday, May 31

4 – 6 p.m. Registration

5 – 6 p.m. Welcome Reception

Monday, June 1

8 a.m. – 5 p.m. Registration

8:30 a.m. – 5 p.m. Technical Programming

Noon – 1:30 p.m. Lunch provided

Tuesday, June 2

8 a.m. – 5 p.m. Registration

8:30 a.m. – 5 p.m. Technical Programming

5:30 – 7 p.m. Poster Session & Reception

Wednesday, June 3

8 a.m. – Noon Registration

8:30 a.m. – Noon Technical Programming

Afternoon on own

Thursday, June 4

8 a.m. – 5 p.m. Registration

8:30 a.m. – 5 p.m. Technical Programming

6 – 8:30 p.m. Conference Dinner

Friday, June 5

8 a.m. – Noon Registration

8:30 – Noon Technical Programming

Highlight of Events

- Welcome Reception
- Plenary Session
- Networking Lunch
- Industry Roundtable on HTCMCs
  Manufacturing, performance, applications, supply chains, etc.
- Young Professionals Forum
- Poster Session and "Best Poster Awards"
- Poster Session Preview:
  Two-minute "Poster Preview Pitch"
  (Not mandatory to poster authors)
- Industrial Exposition
- Networking Time
- Conference Dinner

Sheraton San Diego Hotel & Marina

1380 Harbor Island Dr, San Diego, CA 92101
Phone number: (619) 291-2900

Marina Tower Run of House Rate:
$269.00 a night plus tax.

Guests can book their rooms by either:

- Calling 1-888-236-2427 and mentioning
  The American Ceramic Society / HTCMC 2026
- Using your custom booking link:
  The American Ceramic Society HTCMC 2026
- Current government per diem rate:
  $237.00 a night plus tax.

Limited government rate rooms available on a first-come, first-served basis.

BOOK HERE!

Reservation cutoff date is May 1, 2026

ABSTRACT SUBMISSION INSTRUCTIONS

Submit your abstract by November 21, 2025:
htcmc2026.abstractcentral.com

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

IMPORTANT INFORMATION! It is unavoidable that some symposia and presentations will be scheduled for the last day of the conference. Please refrain from making flight reservations or travel arrangements until your presentation has been scheduled. If you are unable to present on your assigned day, ACerS cannot guarantee we will be able to reschedule your presentation. Special requests for specific presentation times and dates are discouraged.

Due to costs associated with hosting a professional scientific conference, ACerS does not offer complimentary or discounted registration for this meeting. All attendees, to include our invited speakers and students, are expected to register for the event through our registration system at the appropriate rate. All student attendees will be asked to show valid student id to retrieve their badges on site.

HTCMC-12 SYMPOSIUM 1:

Computational Modeling and Design of New Materials and Processes

Overcoming the current limitations of CMCs in terms of performance, use and market competitivity requires large efforts in two main directions: (i) a better knowledge of the actual capabilities of the existing materials and of the processes for their fabrication, and (ii) the design of new structures and processing routes. For this, modeling activities are a key component of the research & development strategy, attracting wide interest in the CMC community. This symposium is devoted to broad applications of modeling techniques or sets of techniques to high-temperature ceramic matrix composites - their fabrication, structure and organization and behavior in use. Modeling may address any scale from angstrom to meters, ranging from ab-initio and atomistic computations to continuum physics, and any physical phenomenon of interest (principally mechanical, thermal, and chemical) considered alone or coupled together. Nowadays, artificial intelligence (AI) and meta-modeling tools bring new perspectives to tackle the inherent complexity of CMC design. Special attention will be given to experimental verification of models, but papers focused on design and creation of new concepts are also particularly welcomed.

Proposed Session Topics

- Atomistic modeling
- Multi-scale, multi-physics modeling
- Thermodynamic computations
- Diffusion, defects and coupled phenomena
- Computation of mechanical, thermal and thermomechanical properties
- Simulation of materials processing and degradation
- Modeling of damage and fracture evolution across spatiotemporal scales
- Image processing and image-based modeling for structure-property relationships
- Model verification and certification; uncertainty quantification
- Computer-based design, applied to composition, phases, structure, and organization
- Ceramic genome and material informatics
- Data mining, AI, digital twins and surrogate models
- Ablation modeling

Symposium Organizers

- Gerard Vignoles, LCTS, University of Bordeaux, CNRS, France
- Jingyang Wang, Institute of Metal Research, Chinese Academy of Sciences, China
- Sathiskumar Anusuya Ponnusami, City St George's, University of London, UK
- Ghatu Subhash, University of Florida, USA
- Guillaume Couégnat, LCTS, University of Bordeaux, CNRS, France
- Hyung Wook Park, Ulsan National Institute of Science and Technology, Korea
- David B. Marshall, University of Colorado, USA
- Craig P. Przybyla, Air Force Research Laboratory, USA
- Junjie Wang, Northwestern Polytechnical University, China
- Jiwoong Kim, Soongsil University, Korea

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HTCMC-12 SYMPOSIUM 2:

Fibers, Preforms, and Interphases

Even though advanced ceramic matrix composites (CMCs) based on market-available fibers, including carbon and ceramic fibers, have already been developed, there is still a demand for new fiber materials with even better high temperature performance. In addition, interest in cost-effective CMCs has emerged in recent years and continues to grow. In order to make the materials accessible for widespread use, additional availability of low-cost fibers is also needed.

Ceramic fibers are the key components of ceramic matrix composites. Existing challenges include the microstructural degradation and low creep performance of oxide fibers and lack of long-term resistance of non-oxide fibers at high temperatures in oxidative atmospheres or under irradiation conditions. These issues are exacerbated by increased requirements for the production and use of composite materials. Research is therefore focused on pushing the performance limits to higher temperatures, improved thermomechanical stability and longer fiber lifetime, but also on more cost-efficient production processes.

For many applications, textile preforms made of ceramic fibers are used for the manufacturing of CMC components. In the simplest case, these are flat woven fabrics. But the development of more complex preforms, which can already be based on 3D woven fabrics, is also becoming increasingly important, although the handling of ceramic fibers for these purposes is still a challenge. However, this offers starting points for improving the processability of the fibers. Further developments in the field of woven textiles are aimed at fabrics with higher denier rovings, which can be produced more cost-effectively but place high demands on infiltration of ceramic matrices.

The performance of CMCs is not only determined by the fiber material and the matrix material. The fiber-matrix interface and interphase are critical components of CMCs, which also have an important influence on their fracture toughness and damage tolerance. An interface is a surface between two phases or between the fiber and the matrix. An interphase is a film of one or more layers bonded to the fiber and matrix. It therefore has at least two interfaces: one with the fiber and one with the matrix, and more if the interphase consists of several layers.

The key role of interfacial domain is to protect the reinforcing fibers from fracture, especially in aggressive atmospheres. This means meeting several requirements that may seem contradictory, such as, proper fiber-matrix bonding for material integrity, stopping and redirecting cracks that develop in the matrix at the interphase or interfaces, while the loads are still carried by the matrix to prevent overloading of the fibers.

Proposed Session Topics

- New developments in oxide and non-oxide ceramic fibers
- Characterization of the high temperature behavior of ceramic fibers
- Performance of ceramic fibers in corrosive environments
- Nanotubes or nanowires as reinforcements
- New developments of interphases in ceramic composites
- Performance of interfaces/interphase in extreme environments
- Reinforcement of interfaces/interphases
- New fiber architectures and structures for CMCs (high denier woven
  fabrics, 2D, 2.5D, 3D woven, braided, filament wound preforms…)
- Textile processing of ceramic fibers for producing fabrics and preforms
- Cost consideration for the development of competitive CMCs
- Characterization and evaluation of interfacial/interphase properties

Symposium Organizers

- Sylvain Jacques, LCTS, University of Bordeaux, CNRS, France
- Stephanie Pfeifer, German Institutes of Textile and Fiber Research, Germany
- Emmanuel Boakye, Air Force Research Laboratory, USA
- Prarthanaa Khokar, Fureho AB, Sweden
- Calvin Prentice, Archer Technicoat Ltd., UK
- Bernd Clauß, German Institutes of Textile and Fiber Research, Germany
- Judith Moosburger-Will, University of Augsburg, Germany
- Katsumi Yoshida, Institute of Science Tokyo, Japan
- Dong-Geun Shin, Korea Institute of Ceramic Engineering and Technology, Korea
- Cédric Sauder, French Alternative Energies and Atomic Energy Commission, France

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HTCMC-12 SYMPOSIUM 3:

Polymer Derived Ceramics and Composites

The chemical approach based on well-defined preceramic polymers, called the polymer-derived ceramics (PDC) route, offers precise control over chemical composition and microstructure at low processing temperatures, which provides access to a large variety of ceramic compositions and structures (crystalline or amorphous) as well as microstructures (e.g. nanocomposites). Additionally, the PDC route allows exploiting plastic-forming or non-conventional processing techniques to produce advanced ceramic fibers, coatings and matrices, i.e. all the ceramic-matrix-composite (CMC) components. By coupling the PDC route with the generation of a porous network, ceramics with a multiscale porosity can be generated. Thus, this approach makes PDCs of interest for a wide range of engineering and functional applications, in key sectors such as energy, transportation, environment, and defense.

This symposium will discuss the latest developments in the field of PDCs, from the synthesis of new polymeric systems to structural characterization, microstructure/property correlation, modeling, and manufacturing of functional and structural components.

Special emphasis will be placed on the design of specific components for CMCs, like matrices, fibers, and protective or functional coatings, as well as on potential applications of PDCs in various engineering fields.

Proposed Session Topics

- Synthesis of condensed molecular phases as precursors and chemistry of new polymeric systems
- Inorganic polymer derived ceramics
- Rheological properties of preceramic polymers
- Advanced and innovative fabrication processes, including additive manufacturing
- Plastic-forming techniques
- Porosity network engineering
- Polymer-derived complex ceramic systems, including nanocomposites and high entropy phases
- Polymer-derived ceramic fibers and matrix composites for ultra-high temperature applications
- Protective and functional ceramic coatings
- Design of nanocomposites, including metal-modified PDCs
- Reinforced foams
- Functional ceramics
- Structural characterization, microstructure/property correlation
- Thermomechanical properties of PDCs
- Chemical reactivity (e.g. corrosion) of PDCs
- Simulation of phase formation, separation, and crystallization
- Prediction of ceramic properties in dependency on the precursor
- Thermodynamics of PDCs, including CALPHAD
- Prediction of properties using density functional theory (DFT), quantum monte carlo (QMC), and phonon calculations
- Application of PDCs in various engineering fields, including energy and environment

Symposium Organizers

- Gurpreet Singh, Kansas State University, USA
- Matthew Dickerson, Air Force Research Laboratory, USA
- Samuel Bernard, University of Limoges, CNRS, France
- Paolo Colombo, University of Padova, Italy
- Dong-Pyo Kim, Pohang University of Science and Technology, Korea
- Ralf Riedel, Technical University Darmstadt, Germany
- Yoshiyuki Sugahara, Waseda University, Japan
- Waltraud M. Kriven, University of Illinois at Urbana-Champaign, USA
- Peter Kroll, University of Texas at Arlington, USA
- Rick Laine, University of Michigan, USA
- Zhaoju Yu, Xiamen University, China
- Jie Kong, Northwestern Polytechnical University, China
- Georges Chollon, LCTS, University of Bordeaux, CNRS, France
- Günter Motz, University of Bayreuth, Germany
- Ravi Kumar NV, Indian Institute of Technology, Madras, India
- Gian Domenico Sorarù, University of Trento, Italy
- Yuji Iwamoto, Nagoya Institute of Technology, Japan
- Toshihiro Ishikawa, Tokyo University of Science, Yamaguchi, Japan
- Masaki Kotani, Japan Aerospace Exploration Agency, Japan
- Yoonjoo Lee, Korea Institute of Ceramic Engineering and Technology, Korea

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HTCMC-12 SYMPOSIUM 4:

Innovative Design, Advanced Processing and Manufacturing Technologies in Non-oxide and Oxide Composites

Fiber-reinforced ceramic matrix composites (CMCs) are becoming increasingly important materials for a wide range of high temperature applications, in aero-engine components and clean energy technologies, and CMCs are widely expected to extend their range of application fields in the near future. However, despite extensive research over recent decades, CMCs still have a number of unsolved issues that need to be addressed before the new applications can become a reality. This symposium has been designed to exchange ideas related to (i) innovative design approaches, including reliability assessment; (ii) advanced processing, including sintering, polymer impregnation and pyrolysis (PIP), reactive metal infiltration (RMI) and chemical vapor infiltration (CVI), amongst others; (iii) toughening and manufacturing approaches across both non-oxide and oxide composites. Thus SiC/SiC, C/SiC, oxide/oxide and hybrid-type CMCs, including short fiber-reinforced ceramic matrix composites, are all to be included in this symposium. Other topics related to the processing and (new) characterization of CMCs, such as quality assessment, in-use damage, repair and cost reduction methods are also welcomed.

Proposed Session Topics

- SiC/SiC, C/SiC composites
- Oxide/oxide composites, hybrid CMCs
- Innovative design philosophies
- Advanced processing and manufacturing technologies
- Characterization, damage assessment
- Quality assessment techniques
- Cost reduction approaches

Symposium Organizers

- Dietmar Koch, University of Augsburg, Germany
- Daejong Kim, Korea Atomic Energy Research Institute, Korea
- Katsumi Yoshida, Tokyo Institute of Technology, Japan
- Jon Binner, University of Birmingham, UK
- Matthew Dickerson, Air Force Research Laboratory, USA
- Stefan Schafföner, University of Bayreuth, Germany
- Jesús González-Julián, LCTS, University of Bordeaux, CNRS, France
- Se-Young Kim, Korea Institute of Energy Research, Korea
- Andrea Lazzeri, University of Pisa, Italy
- Yongsheng Liu, Northwestern Polytechnical University, China
- Wataru Nakao, Yokohama National University, Japan
- Alberto Ortona, University of Applied Sciences and Arts of Southern Switzerland, Switzerland
- Walter Pritzkow, Pritzkow Spezialkeramik, Germany
- Dileep Singh, Argonne National Laboratory, USA
- Gerard Vignoles, LCTS, University of Bordeaux, CNRS, France
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Advanced Thermal and Environmental Barrier Coating - Processing, Properties, and Applications

This symposium focuses on recent advances in thermal barrier, environmental barrier and multifunctional coatings for high temperature ceramic matrix composites (CMCs). The symposium will address fundamental aspects of coating sciences and technologies, emphasizing advanced design methodologies; processing; property evaluation and modeling; non-destructive testing; as well as coating integration with ceramic matrix composite systems. Topics of interest include simulation and coating performance demonstration; multi-scale modeling and experiment validation of coating processing-microstructure-property relationships; enhanced coating environmental stability, durability, and multi-functionality through innovative coating composition, architecture and processing optimizations; novel, hybrid and sensor embedded coating processing for extreme environments; coating testing and response to simulated operating conditions, life prediction and modeling; design of coating interfaces and grain boundaries for low diffusion, high fracture toughness, and calcia-magnesia-alumino-silicate (CMAS) resistance. Case studies on engineered thermal/environmental barrier coating/CMC systems for aerospace, automotive, and energy applications are also of interest.

Proposed Session Topics

- Thermal and environmental barrier coatings for CMCs
- Integrated coating - composite systems
- Ceramic coatings for protection against oxidation, corrosion, erosion, wear, and tribological loadings
- Multifunctional coating systems - design, integration, and processing
- Interface phenomena, adhesion and interfacial properties
- Advanced coating processing methods, including additive manufacturing, tool development, and applications
- Advanced testing and non-destructive evaluation methodologies
- Multi-scale design and modeling of coating materials, properties, mechanisms and life prediction

Symposium Organizers

- Peter Mechnich, German Aerospace Center, Germany
- Douglas E. Wolfe, The Pennsylvania State University, USA
- Jie Zhang, Institute of Metal Research, Chinese Academy of Sciences, China
- Satoshi KItaoka, Japan Fine Ceramics Center, Nagoya, Japan
- Hideki Kasikawa, National Institute for Material Science, Japan
- Elizabeth Opila, University of Virginia, USA
- Jingyang Wang, Institute of Metal Research, Chinese Academy of Sciences, China
- Bryan Harder, NASA Glenn Research Center, USA
- Wei Pan, Tsinghua University, China
- Byung Koog Jang, Kyushu University, Japan
- David Poerschke, University of Minnesota, USA
- Ravisankar Naraparaju, German Aerospace Center, Germany
- Georg Mauer, Forschungszentrum Jülich GmbH, Germany
- Yoon-Suk Oh, Korea Institute of Ceramic Engineering and Technology, Korea
- Kee Sung Lee, Kookmin University, Korea
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HTCMC-12 SYMPOSIUM 6:

Carbon/Carbon (C/C) - Carbon Fiber Reinforced Carbon Composites

Carbon-carbon composites and their preforms are a mature technology. Even though research and development on C/C composites is still very active, with studies focused on fundamental science (chemistry, mechanics, engineering science) up to the design of innovative carbon-based composites for new applications. Designed originally for space applications under extreme thermal and mechanical loads and reduced time of utilization, they have diversified their applications to many other fields. They are remarkably successful commercially, with examples such as rocket nozzles and aircraft and race car brakes. In addition, their applications range from turbine engine components, aircraft components such as heat sinks to protect metal structures, general industrial components such as heating elements, furnace insulation, furnace stages for annealing metals as well as to furnace susceptors and melting crucibles. This symposium covers fields such as structural design, manufacturing, property and performance evaluation, and surface modification and coatings related to C/C composites.

Proposed Session Topics

- Fabrication processing - polymer, pitch or gas routes
- Environmental compatibility - oxidation and/or ablation behavior
- Multiscale structure determination
- Mechanical and thermal properties
- Design for specific applications
- Surface coating - friction behavior
- Material, process development
- Production news
- Application and performance
- Aircraft brakes, F1 brakes
- Industrial applications

Symposium Organizers

- Ralf Goller, Technical University of Applied Sciences Augsburg, Germany
- Matthias Kroedel, ECM Engineered Ceramic Materials GmbH, Germany
- Joseph Schnoell, Technical University of Applied Sciences Augsburg, Germany
- Bill Goodman, Goodman Technology, USA
- Zlatomir Apostolov, Air Force Research Laboratory, USA
- Seyoung Kim, Korea Institute of Energy Research, Korea
- Laura Silvestroni, CNR, Istituto di Scienza, Tecnologia e Sostenibilitá per lo sviluppo dei Materiali Ceramici, Italy
- Alain Celzard, University of Lorraine, France
- Sylvie Bonnamy, ICMN, University of Orléans, CNRS, France
- Florent Bouillon, Safran Ceramics, France
- Chisung Ahn, Korea Institute of Industrial Technology, Korea
- Henry Shin, DACC Carbon, Korea
- Dong Won Im, DACC Carbon, Korea

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- Bill Goodman, bgoodman@goodmantechnologies.com

HTCMC-12 SYMPOSIUM 7:

Materials for Extreme Environments - UHTCs, MAX phases, and Nanolaminates

Ultra-high temperature ceramics (UHTCs), MAX phases, and nanolaminate compounds are families of materials that can withstand extreme operating conditions such as high temperatures, heat fluxes, radiation and/or corrosive environments due to their unique features. UHTCs are carbides, nitrides, and borides of transition metals with melting points above 3000 °C that exhibit other properties such as high hardness and stiffness, elevated thermal and electrical conductivities, and excellent ablation and radiation resistance. These properties make them potential candidates for hypersonic vehicles, nuclear fusion reactors, solar power concentrators, nuclear fission reactors, and others. MAX phases are ternary carbides and nitrides – recently borides too as MAB phases – that present a unique combination of properties, bridging the gap between ceramics and metals. As ceramics they are lightweight and present high elastic modulus and thermal and chemical stability, while as metals they exhibit easy machinability, good damage tolerance and thermal shock resistance. They have attracted interest in the aerospace, transportation and energy sectors, among others. Nanolaminate ceramics and 2D derivatives such as MXenes have also received huge attention in the last decades due to their unique characteristics, making them appealing candidate materials for diverse structural and functional applications. This symposium will focus on design, processing, structure-property relationships, thermal, electrical, optoelectronic, solid lubrication and mechanical properties, oxidation/corrosion resistance, machining, joining, thermal/chemical stability and radiation tolerance of UHTCs, UHTC composites, MAX phases, MXenes, and nanolaminates 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
- Characterization methods and lifetime assessment
- Methods for improving damage tolerance, oxidation behavior, and thermal shock resistance
- Response in extreme environments (e.g., irradiation, ultra-high temperatures)
- Simulation and theory for predicting stability or behavior of the materials
- Study of electronic, optical, plasmonic and thermoelectric properties
- Entropy stabilized compositionally complex UHTCs and MAX phases
- Superhard UHTCs
- Novel applications and device fabrication (electrochemical energy storage, biosensors, etc.) of MAX and MAB phases and their 2D derivatives

Symposium Organizers

- Diletta Sciti, CNR, Istituto di Scienza, Tecnologia e Sostenibilitá per lo sviluppo dei Materiali Ceramici, Italy
- Jesus Gonzalez-Julian, LCTS, University of Bordeaux, CNRS, France
- Bai Cui, University of Nebraska-Lincoln, USA
- Bill Fahrenholtz, Missouri University of Science and Technology, USA
- Sea Hoon Lee, Korea Institute of Materials Science, Korea
- Yujin Wang, Harbin Institute of Technology, China
- Hanjung Kwon, Jeonbuk National University, Korea
- Jason Lonergan, Missouri University of Science and Technology, USA
- Miladin Radovic, Texas A&M University, USA
- Dong-geun Shin, Korea Institute of Ceramic Engineering and Technology, Korea
- Yoonjoo Lee, Korea Institute of Ceramic Engineering and Technology, Korea
- Clio Azina, LCTS, University of Bordeaux, CNRS, France
- Surojit Gupta, University of North Dakota, USA
- Michel Barsoum, Drexel University, USA
- Antonio Vinci, CNR, Istituto di Scienza, Tecnologia e Sostenibilitá per lo sviluppo dei Materiali Ceramici, Italy

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HTCMC-12 SYMPOSIUM 8:

Testing and Evaluation of Ceramic Matrix Composites (from Constituents and Coupons to Components, including EBCs)

Advanced 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 and thermal reliability is a key issue for their ultimate use in short- to very long-term applications. Understanding the thermomechanical performance of composites is essential to effectively life-model CMC performance for desired uses and to discern advancements in CMC technology. Effective test techniques which incorporate aspects of stress, time, temperature, and environment are critical for this work which necessitates understanding the effects of material variation, test environment, the statistical nature of the results as well as degradation mechanisms and fracture mechanical behavior. Further advancement of elevated temperature testing which better represents use conditions and/or produces improved diagnostic understanding of material response to thermomechanical environment is highly sought after. Identification and quantification of failure mechanisms by fracture, creep, fatigue, oxidation 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 CMCs. The development of novel methods to advance and accelerate computationally driven materials characterization and validate structure/property relationship is needed to improve predictions of material behavior and lower costs.

This symposium solicits abstracts related to the diverse aspects of mechanical behavior of CMCs and their constituents, including environmental barrier coatings (EBCs) and correlations with processing, component performance and reliability. Presentations which address these issues, including standards and database development of these properties, are welcome.

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
- Novel computational approaches to enhance characterization
- Processing - microstructure - mechanical properties correlation
- Role of fibers, matrices, coatings, and interfaces in mechanical behavior
- Testing of joined and integrated components and structures
- Correlation of resource efficient processing of ceramics and CMCs with their performance
- Thermal conductivity (performance, measurements, etc.)
- Optical properties - emissivity and absorptivity
- Environmental barrier coatings (EBC) properties and performances
- Development of standards and databases

Symposium Organizers

- Amjad Almansour, NASA Glenn Research Center, USA
- Pascal Reynaud, MatéIS, France
- Yutaka Kagawa, Tokyo University of Technology, Japan
- Ken Goto, Japan Aerospace Exploration Agency, Japan
- Frederic Laurin, Onera, France
- Gerard Vignoles, LCTS, University of Bordeaux, CNRS, France
- James D. Kiser, NASA Glenn Research Center, USA
- Dileep Singh, Argonne National Laboratory, USA
- George Jefferson, Air Force Research Laboratory, USA
- Kamala Raghavan, U.S. Department of Energy, USA
- Stefan Schafföner, University of Bayreuth, Germany
- Toshio Ogasawara, Tokyo University of Agriculture and Technology, Japan
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- Satoshi Kitaoka, Japan Fine Ceramics Center, Japan
- Sung Min Lee, Korea Institute of Ceramic Engineering and Technology, Korea
- Dong-Ho Rhee, Korea Aerospace Research Institute, Korea
- Christophe Lorrette, French Alternative Energies and Atomic Energy Commission, France
- Takuya Aoki, Japan Aerospace Exploration Agency, Japan

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Joining and Integration Technologies for Ceramic Matrix Composites (CMCs)

Development of joining and integration technologies is essential for enabling the application of CMCs. Even though various techniques have been developed for the joining and integration of ceramics, efforts for new technology development are still needed for the CMC's integration, including the creation of an innovative concept, application of new fillers, long-term reliability test, and much more. Each joining and integration need requires a tailored solution which considers such factors as materials selection and compatibility, application conditions, service life requirements, component geometry, interlayer reactions and/or wetting, and thermomechanical properties.

Therefore, the aim of this symposium is to discuss both current studies and future research directions of the CMCs joining technologies, which can promote the use of CMCs by realizing complex shapes. By gathering the experts from industry and academia worldwide, all issues on CMCs joining and integration will be discussed intensively. Joining and integration of CMCs include adhesive joining, solid-state diffusion bonding, transient liquid phase joining, direct joining, glass-ceramic joining, metallic brazing, reaction bonding, preceramic joining, MAX phase joining, and surface engineering to enhance the joint strength. Reliable test methods to estimate joint strength and application of new concept will also be very important part of this symposium.

Proposed Session Topics

- Joining of CMCs to CMCs or ceramics
- Joining, brazing, and adhesion of CMCs to metals or other dissimilar materials
- Joining of CMCs at nano- and micro-scales
- Selective joining of CMCs using lasers
- Designing and modeling of CMC joints and interfaces
- Innovative joining techniques for CMCs, including new filler materials
- Mechanics of wetting and adhesion
- Thermodynamics and kinetics of interface formation
- Mechanical testing of CMC joints
- Nondestructive evaluation and characterization techniques of CMC joints
- Testing and stability of CMC joints at extreme conditions
- Joining enabled component fabrication and demonstration

Symposium Organizers

- Michael C. Halbig, NASA Glenn Research Center, USA.
- Monica Ferraris, Politecnico di Torino, Italy
- Peter Tatarko, Slovak Academy of Sciences, Slovakia
- Dang-Hyok Yoon, Yeungnam University, Korea
- Hans-Peter Martin, Fraunhofer Institute for Ceramic Technologies and Systems, Germany
- Jose' Arregui Mena, Oak Ridge National Laboratory, USA
- Rajiv Asthana, University of Wisconsin-Stout, USA
- Salvatore Grasso, Queen Mary University of London, UK
- Xiaobing Zhou, Ningbo Institute of Materials Technology and Engineering, China
- Hyeon-Geun Lee, Korea Atomic Energy Research Institute, Korea
- Stefano De la Pierre, Politecnico di Torino, Italy
- Anming Hu, University of Tennessee Knoxville, USA

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HTCMC-12 SYMPOSIUM 10:

CMC Applications I - Aerospace Propulsion and Structures

Silicon carbide fiber reinforced silicon carbide matrix composites (SiC/SiC CMCs) and oxide fibers reinforced oxide matrix composites (Oxide CMCs) are a leading alternative for the design and manufacture of next generation gas turbine engine components such as airfoils, shrouds, combustor liners, and exhaust sections. These materials offer higher temperature capability than the current state-of-the-art metallic superalloys and are tougher than monolithic ceramics. The growing interest in CMC technologies is directly linked to new engine design constraints: an increase in operating temperature and reduction in weight, drastic decrease in community noise and air polluting emissions, and specific fuel consumption decrease. During the last fifteen years, substantial research efforts have been devoted to evaluating a wide range of CMCs and manufacturing routes. Recent experience with sub-element rig tests and engine ground and flight tests have confirmed the expected gains and provided significant lessons on CMC behavior for field service. Furthermore, design tools and test methods have been optimized for further understanding of behavior, damage tolerance, design criteria, and certification approaches. On the other hand, the development of UHTC matrix CMCs can offer opportunities for designing components subjected to very high flows, beyond C/C and C/SiC technologies, particularly for hypersonic vehicles.

Proposed Session Topics

- Recent CMC technological improvements for gas turbine applications
- CMC sub-element testing in realistic environment and life prediction approaches
- Ground and flight test experiences of CMC engine components
- Integration and attachment CMC parts with metallic parts: design and testing methodologies
- UHTC-CMC, emerging development and related applications

Symposium Organizers

- Eric Bouillon, Safran Ceramics, France
- Craig Smith, NASA Glenn Research Center, USA
- Marc Bouchez, MBDA, France
- Katie Detwiler, Air Force Research Laboratory, USA
- Dong-won Lim, DACC Carbon Ltd., Korea
- Gwang-soo Kim, DACC Carbon Ltd., Korea
- Jared Weaver, GE Aerospace, USA
- Richard Jones, Pratt & Whitney, USA
- Ian Edmonds, Rolls Royce, UK
- Ken Goto, Japan Aerospace Exploration Agency, Japan
- Jon Binner, University of Birmingham, UK
- Chris Hawkins, Defence Science and Technology Laboratory (DSTL), UK

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HTCMC-12 SYMPOSIUM 11:

CMC Applications II - Solar, Nuclear and Propulsion Systems

Ceramic matrix composites are key materials for the development of novel concepts and ensuring transformative performances of energy & power systems that enable a low carbon future. However, the requirement for materials to withstand the harsh operating conditions for such applications, combining extreme temperature, thermal/mechanical loading, chemical and corrosive environments, and radiation, presents tremendous challenges to all aspects of ceramic matrix composites technologies. This symposium intends to provide a venue of information exchanges and discussion on the technologies and the underlying science of ceramic matrix composites for energy systems with the main focuses on applications in reducing carbon emission from the energy sector.

Proposed Session Topics

- CMC for energy systems, primarily including concentrated solar power, nuclear fission, fusion, propulsion, but would also accept contributions from geothermal, and hydrogen economy
- CMC for hydrogen economy and carbon management - industrial gas turbines, interaction with new synthesis or green fuels, etc.
- UHTCMCs for relevant energy sectors
- Coatings, integration, joining and machining
- Effects of operating environment on the microstructure, physical and mechanical properties - heat, chemical, mechanical, flow, radiation, shear due to rotating detonation, etc.
- Novel materials, processing, manufacturing, design, and qualification for energy applications
- Porous permeability and long-term compatibility with different fluids

Symposium Organizers

- Dong (Lilly) Liu, University of Oxford, UK
- Takaaki Koyanagi, Oak Ridge National Laboratory, USA
- Jens Schmidt, Fraunhofer Institute for Silicate Research ISC, Germany
- Christophe Lorrette, French Alternative Energies and Atomic Energy Commission, France
- Tatsuya Hinoki, Kyoto University, Japan
- Yutai Kato, Oak Ridge National Laboratory, USA
- Marc Bouchez, MBDA, France
- Anteneh Kebbede, General Electric, USA
- Kamala Raghavan, U.S. Department of Energy, USA
- Zhi Sun, Dalian University of Technology, China
- David Mitchell, University of Central Florida, USA
- Farhad Mohammadi-Koumleh, CTP, USA
- Ryo Ishibashi, Hitachi, Ltd., Japan
- Sosuke Kondo, Tohoku University, Japan
- Weon Ju Kim, Korea Atomic Energy Research Institute, Korea
- Hua-Tay Lin, Guangdong University of Technology, China
- Abhendra K. Singh, Baylor University, USA

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- Jens Schmidt, jens.schmidt@isc.fraunhofer.de

Additive Manufacturing Technologies and Applications

Although ceramics have excellent properties (thermal, electrical, optical, chemical, and biological, etc.) to be used in wide ranges of industries, there is a critical limitation to widen its business market because of its brittleness and the consequential limitation of shape control. Additive manufacturing (AM) technology can be a great solution to overcome this intrinsic limit. AM enables an automatic device to transform a virtual design file into a physical object by layer-by-layer stacking of a 2-dimensional structure. Ceramics, ceramic-based materials, and ceramic matrix composites (CMC) can be applicable to various types of AM technologies and applications. There are still a bunch of technical difficulties that have to be overcome to complete ceramics and CMC AM technologies.

This symposium covers current AM and hybridized technologies, including raw materials, AM processes, post processes, digitalization of designs & simulations, characterization, and systems based on ceramics and CMC materials. The symposium will also address the various applications of ceramics and CMC AM in different fields.

Proposed Session Topics

- Stereolithography, binder jetting, direct ink writing, fused deposition, selective laser sintering, laminated object manufacturing, hybridization technologies
- Emerging AM technologies
- Multi-material AM
- Composite material AM
- Design and computational design for simple and complex ceramic architectures
- Modeling of materials, structures, and interfaces
- Numerical simulation of AM ceramic component's performances
- Integration of artificial intelligence (e.g. machine learning, deep learning) into AM
- Thermal and post-processing techniques (e.g. debinding, sintering, polishing)
- Applications (energy, chemical, aerospace, military, transportation, electrics, biomedical, optics, other novel markets)

Symposium Organizers

- Hui-suk Yun, Korea Institute of Materials Science, Korea
- Alberto Ortona, University of Applied Sciences and Arts of Southern Switzerland, Switzerland
- Paolo Colombo, University of Padova, Italy
- Amjad Almansour, NASA Glenn Research Center, USA
- Michael Halbig, NASA Glenn Research Center, USA
- Corson Cramer, Oak Ridge National Laboratory, USA
- Soshu Kirihara, Osaka University, Japan
- Rujie He, Beijing Institute of Technology, China
- Zhangwei Chen, Shenzhen University, China
- Hyung-il Choi, M.O.P Co., Ltd, Korea
- Martin Schwentenwein, Lithoz, Austria

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Powder Processing Innovation and Technologies for Advanced Materials and Sustainable Development

Slight differences in powder processing can significantly influence material microstructure and properties. Consequently, understanding and control of powder processing techniques are critical to the design and fabrication of high-performance, reliable advanced materials and composites. Additionally, innovations in powder processing and characterization technologies are critical to develop advanced materials and composites with optimized functionality, including advanced materials for sustainable development.

In this symposium, materials and process scientists and engineers with interdisciplinary expertise in powder processing and characterization technologies will discuss powder processing control and innovative powder technologies, including powder synthesis and dispersion; particle design (molding and sintering); and innovative characterization or analytical techniques for advanced ceramics, ceramic composites, and advanced materials for sustainable development.

Proposed Session Topics

- Particle and powder design and synthesis
- Fabrication of composite particles and particle coating technology
- Particle dispersion control in liquid or polymers
- Novel shaping, forming, and sintering technology, including additive manufacturing
- Nanostructure and microstructure control
- Composite or porous structure control
- Low-cost and energy-saving processing of advanced ceramics and ceramic composites, including smart recycling of materials for sustainable development
- Advanced characterization and analytical techniques for powder processing and materials

Symposium Organizers

- Junichi Tatami, Yokohama National University, Japan
- Masayoshi Fuji, Nagoya Institute of Technology, Japan
- Yuji Hotta, National Institute of Advanced Industrial Science and Technology, Japan
- Satoshi Tanaka, Nagaoka University of Technology, Japan
- Jian Luo, University of California, San Diego, USA
- Sanjay Mathur, University of Cologne, Germany
- Eugene Olevsky, San Diego State University, USA
- Koji Morita, National Institute for Materials Science, Japan
- Taeseup Song, Hanyang University, Korea
- Jingxian Zhang, Shanghai Institute of Ceramics, China

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Functional Nanomaterials for Sustainable Energy Technologies

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 catalysis (including electro- and 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
- Transition metal chalcogenides, carbon nanostructures, 2D materials
- Computational methods in the design of tailored nanostructured materials
- Interfacial materials and multi-material heterostructures & nanocomposite

Symposium Organizers

- Alberto Vomiero, Luleå University of Technology, Sweden
- Elisa Moretti, Ca' Foscari University of Venice, Italy
- Muhammet S. Toprak, KTH Royal Institute of Technology, Sweden
- Rafik Naccache, Concordia University, Canada
- Ya Yang, Beijing Institute of Nanoenergy and Nanosystems, China
- Andreu Cabot, Catalonia Institute for Energy Research, Spain

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Novel, Green, and Strategic Processing and Manufacturing Technologies

The properties and performance of materials largely depend on their processing and manufacturing routes. Recently developed processing and manufacturing technologies of ceramic materials and systems yield unique properties which cannot be achieved from the conventional routes. On the other hand, we should consider at least two critical issues in making materials and products. One is that the technologies are "green" or environmentally benign, so as to avoid generation of elements and compounds hazardous to human health and environments and to protect the global environment by preserving energy during the fabrication. The other is that they are "strategic" or using no or less quantity of rare natural resources for stable production. Keeping these aspects in view, the aim of this symposium is to discuss advances in processing and manufacturing technologies for a wide variety of ceramic materials.

Proposed Session Topics

- Green manufacturing processes with lower environmental burden
- Energy efficient processing
- Microwave or microwave-assisted processing, SPS
- Education and learning in sustainable materials processing
- Materials recycling for ceramic manufacturing
- Alternatives for rare metals and materials
- Room/low-temperature synthesis
- Aqueous synthesis and processing, colloidal processing
- Advanced composite manufacturing technologies, hybrid processes

Symposium Organizers

- Tatsuki Ohji, YNU/NITech/AIST, Japan
- Daniel Oropeza, University of California, Santa Barbara, USA
- Enrico Bernardo, University of Padova, Italy
- Bai Cui, University of Nebraska-Lincoln, USA
- Theresa Davey, Bangor University, UK
- Wei Ji, Wuhan University of Technology, China
- Reginaldo Muccillo, Institute of Energy and Nuclear Research, University of São Paulo, Brazil
- Tohru Suzuki, National Institute for Materials Science, Japan
- Yiquan Wu, Alfred University, USA

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GFMAT-3 SYMPOSIUM 4:

Crystalline Materials for Semiconductor, Optical/ Scintillator and Dielectric Applications

This symposium will provide a forum for the presentation and discussion of recent research and development activities on crystalline materials. The symposium 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, worldwide experts in the different topics will be invited to introduce their most recent activities. The symposium provides a wide overview of the state-of-the-art issues on crystalline materials.

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
- Rong-Jun Xie, Xiamen University, China
- 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
- Hiroaki Furuse, National Institute for Materials Science, Japan
- Philippe Veber, West University of Timişoara, Romania
- Hiroki Tanaka, Leibniz-Institut für Kristallzüchtung, Germany
- Tetsuo Tsuchiya, National Institute of Advanced Industrial Science and Technology, Japan
- Javier E. Garay, University of California, San Diego, USA
- Kevin Anderson, U.S. Naval Research Laboratory, USA

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Porous Ceramics for Advanced Applications Through Innovative Processing

Porous ceramics with various pore scales have been widely utilized in numerous engineering applications. This symposium seeks engineers, researchers, and scientists in the area of porous ceramics, carbon, and glass to share recent advances in innovative processing routes, characterizations, physical properties, fluid dynamics, simulation and modeling. Porous components are prepared with wide range of pore size from nano- to milli-meters, controlled pore volume fraction and tailored pore configurations such as textured or random morphologies, interconnected or closed microstructures, sandwich structured ceramic matrix composites and hierarchical porosities. They are based on various morphologies: monolithic structures with controlled pore size, foams, syntactic foams, honeycombs, bio-inspired, membranes, aero-gels and additive manufacturing. Engineering applications can include biomedical applications, energy-related technologies, environmental protection and lightweight structural components. This symposium will be the ideal showcase for groups involved in the processing and applications of porous materials from design to application. In addition, research advancement and trends in next-generation porous materials, design, fabrication and characterization will be included.

Proposed Session Topics

- Processing routes and synthesis of porous ceramics
- Chemical processing of functional porous materials
- Shape forming, joining and morphology of porous ceramics
- Additive manufacturing of porous and cellular ceramics
- Porous biomaterials (joint with GFMAT-3 Symposium 11)
- Micro- or meso-porous ceramics and hierarchical porosities
- Innovative characterization tools, design, simulation and modeling of porous ceramics
- Functional, mechanical and thermal properties of porous ceramics
- Characterization and behavior of porous ceramics

Symposium Organizers

- Tobias Fey, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
- Alberto Ortona, University of Applied Sciences and Arts of Southern Switzerland, Switzerland
- Manabu Fukushima, National Institute of Advanced Industrial Science and Technology, Japan
- Paolo Colombo, Università di Padova, Italy
- Samuel Bernard, Institute of Research for Ceramics, CNRS, France
- Jian-feng Yang, Xi'an Jiaotong University, China
- Eliandra de Sousa Triches, University of São Paulo, Brazil
- Gisele Lecomte-Nana, University of Limoges, France

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Advanced Batteries and Supercapacitors for Energy Storage Applications

Batteries and supercapacitors are essential energy storage devices that store energy by different mechanisms. Batteries store electrical energy by conversion into chemical energy while supercapacitors store energy at electrode/electrolyte interface and these devices make up multi-billion-dollar industries. The state-of-the-art battery and supercapacitor systems can be made better – whether it is to store more energy or to be produced via environmentally friendly means. Both storage technologies seek new concepts in materials design to overcome their current limitations of performance, cycle life and safety. More critical insights are required in terms of advanced material compositions and structures, including surface/interfacial reactions to produce next-generation electrode materials enabling higher energy densities, higher power densities, safety and longer cycle life of batteries and supercapacitors. This symposium will explore novel energy storage materials and technologies that are critical in making the current energy storage technologies more effective in the near future. Sessions will focus discussion on fundamental, modeling, mechanisms, materials design, screening, electrode architectures, diagnostics, materials characterization and electrode/electrolyte interface characterization of the following energy storage devices. Artificial intelligence (AI) offers opportunities to accelerate certain complex developments. Presentations on the integration of AI tools for accelerated discovery of new materials, prediction of device aging, improving safety or reliability, and other optimizations are also expected.

Proposed Session Topics

- Li-ion, Na-ion and K-ion batteries
- Multivalent batteries
- Metal sulfur batteries
- All-solid-state batteries
- High temperature batteries
- New battery concepts and systems
- Modeling and engineering of interfaces, materials and composites
- Reuse, Recycle, and Remanufacture (R3) of battery materials and systems
- Supercapacitors and Li-ion capacitors
- AI tools

Symposium Organizers

- Palani Balaya, National University of Singapore, Singapore
- Michael Dolle, Université de Montréal, Canada
- Naoaki Yabuuchi, Yokohama National University, Japan
- Mali Balasubramanian, Oak Ridge National Laboratory, USA
- Chunmei Ban, University of Colorado Boulder, USA
- Dany Carlier-Larregaray, ICMCB, University of Bordeaux, CNRS, France
- Robert Dominko, National Institute of Chemistry, Slovenia
- Donald Dornbusch, NASA Glenn Research Center, USA
- Shih-kang Lin, National Cheng Kung University, Taiwan
- Dong-Hwa Seo, Korea Advanced Institute of Science and Engineering, Korea
- Neeraj Sharma, University of New South Wales, Australia

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GFMAT-3 SYMPOSIUM 7:

Smart Processing and Production Root Technology for the Fourth Industrial Revolution

Research fields related to innovative manufacturing technologies such as "Smart Processing", "IoT", "Industry 4.0" are expanding. Even in the field of ceramics, such advanced manufacturing is an important research topic. "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.

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 "Smart Processing" and "Production Root Technologies".

Proposed Session Topics

- Integration of ceramics manufacturing process, AI and IT
- Process monitoring and quality improvement
- Starting materials - mining, particles, bulk and functional materials and precursors
- Sustainable energy concepts and applications and recycling and reuse processes
- Development of ceramics and its hybrid materials with thermal conduction, electrical insulation, battery, optical properties, solar cell, heat resistance, environmental resistance and biological applications
- Forming and shaping processes for advanced materials
- New concepts and emerging technologies for enhanced product performance

Symposium Organizers

- Tadachika Nakayama, Nagaoka University of Technology, Japan
- Sungwook Mhin, Kyonggi University, Korea
- Chisung Ahn, Korea Institute of Industrial Technology, Korea
- Sung Duk Kim, Korea Institute of Industrial Technology, Korea
- Jacob L. Jones, North Carolina State University, USA
- Ali Erdemir, Argonne National Laboratory, USA
- Chinnapat Panwisawas, Queen Mary University of London, UK
- Jun Akedo, National Institute of Advanced Industrial Science and Technology, Japan
- Byungkoog Jang, National Institute for Materials Science, Japan
- Kyoung Il Moon, Korea Institute of Industrial Technology, Korea
- Ayahisa Okawa, Tohoku University, Japan

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Advanced Ceramics and Composites Derived From Condensed Molecular Phases for Energy and Environmental Applications

The aim of the symposium is to highlight advanced concepts for the synthesis of novel multifunctional ceramics and ceramic composites, specifically from molecular precursors. Industrial demands on future technologies have created a need for new material properties which far exceed those of materials known today and that can only be produced by controlled synthesis-microstructure-property relations. Furthermore, the increasing miniaturization of components calls for new process technologies allowing reliable production of ceramics at and below the micrometer scale. Inorganic-organic hybrid materials as well as amorphous and polycrystalline materials can be produced by means of cross-linking routes in various states of condensation. In accordance with the so-called "bottom-up" approach, specific inorganic molecules are to be assigned to higher molecular networks and solid-state structures in the form of molecular nanotools by means of condensation and polymerization processes. This method enables the production of ceramics and ceramic composites inaccessible by thermodynamically controlled approaches. Therefore, the scope of the symposium concerns the development of solids derived from molecular units via kinetically controlled synthesis processes at the interface between molecular and solid-state chemistry, enabling specific adjustments to the resulting microstructure and solid-state properties. The focal point of the symposium is energy and environmental applications of advanced ceramics and composites derived from condensed molecular phases.

Proposed Session Topics

- Synthesis of condensed molecular phases as precursors for advanced ceramics and composites
- Processing and shaping of condensed molecular phases
- Synthesis - processing - microstructure relation
- Characterization and properties of advanced ceramics derived from condensed molecular phases
- Thermodynamics and kinetic phenomena
- Energy and environmental related applications

Symposium Organizers

- Ralf Riedel, Technische Universität Darmstadt, Germany
- Paolo Colombo, Università di Padova, Italy
- Samuel Bernard, Institute of Research for Ceramics, CNRS, France
- Gurpreet Singh, Kansas State University, USA
- Gunter Motz, University of Bayreuth, Germany
- Nicola Pinna, Humboldt-Universität zu Berlin, Germany
- Toshihiro Ishikawa, Tokyo University of Science, Yamaguchi, Japan
- Yoshiyuki Sugahara, Waseda University, Japan
- Yuji Iwamoto, Nagoya Institute of Technology, Japan
- Peter Kroll, University of Texas at Arlington, USA
- Rick Laine, University of Michigan, USA
- Gian Domenico Soraru, University of Trento, Italy
- Zhaoju Yu, Xiamen University, China
- Jie Kong, Northwestern Polytechnical University, China
- Ravi Kumar NV, Indian Institute of Technology, Madras, India

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- Samuel Bernard, samuel.bernard@unilim.fr

Ceramics for Sustainable Infrastructure - Geopolymers, Alkali Activated Materials and Sustainable Composites

Geopolymer inorganic aluminosilicate polymeric ceramics are made from high shearing a powder and liquid into a low viscosity paste which can set under ambient conditions into a solid amorphous ceramic. It is composed of calcined, amorphous aluminosilicate clay powder such as kaolinite, and "water glass" or sodium, potassium or another Group I metal metasilicate. Geopolymer has a composition centered at $M_2O{\bullet}Al_2O_3{\bullet}4SiO_2{\bullet}x\text{-}H_2O$ where x varies between 7-12 depending on particle size and specific surface area of the aluminosilicate source. Other emerging compositions include organic-based, charge-balancing, organic molecular groups, or acid-based compositions of $Al_2O_3{\bullet}2SiO_2{\bullet}P_2O_5$.

While cements are based on a calcium silicate hydrate (CSH) binder phase, alkali activated, cementitious materials can also be made from waste products such as Class F fly ash and amorphous ground granulated blast furnace slag which is a source of aluminum, silicon and calcium as well as other impurities. When alkali hydroxide and alkali silicate liquids can be mixed with these starting powders, they produce a solid material which is a mixture of CSH (e.g. 55 wt%) and a minor amount of geopolymer (14%), as determined by NMR of selectively leached components of the product phase. Such composites can have significantly superior mechanical properties compared to OPC, as well as improved chemical durability depending on their geopolymer content.

Proposed Session Topics

- Synthesis, processing, microstructure
- Characterization and composition
- Durability
- Mechanical and thermal properties
- Composites
- Infrastructure and construction materials
- Other indigenous resource materials
- Other inorganic analogues

Symposium Organizers

- Waltraud M. Kriven, University of Illinois at Urbana-Champaign, USA
- Sylvie Rossignol, Ecole Nationale Superieure de Ceramique Industrielle, France
- Claus Rüscher, Institut für Mineralogie, Leibniz Universität Hannover, Germany
- Ana C. C. Trindade, University of São Paulo, Brazil

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Materials Recycling for Energy and Environment Applications

Materials recycling for energy and environmental applications has become a critical engineering issue. There are several sectors, including batteries, solar panels, and wind turbines, which rely heavily on the growing demand for raw materials deemed critical due to their economic significance and supply risks. These sectors urgently need innovative solutions for resource circulation and materials recycling. With this perspective, it has become pivotal to engineer novel recycling processes for critical raw materials and Rare Earth Elements (REEs) from local resources (i.e. coal, slags) and from scrap/end-of-life complex products (i.e. spent Li-ion batteries, fuel cells). Similarly, recycling thermoset and magnetic materials for wind energy-based applications has become another critical issue. Bioplastics have emerged as a potential solution, but their potential is riddled with several issues like weak mechanical properties, constraining their versatility in various applications. To tackle this, researchers are delving into extensive studies on reinforcement additives, aiming to create bioplastic composites with improved properties. Seaweed accumulation during storms and other natural processes is a problem. Although the shoreline is cleaned regularly, the washed-up seaweed ends up in landfills. The usage of waste seaweed as a source of energy can be sustainable, and it has the potential to solve climatic and environmental issues while replacing fossil fuels. The cultivation of seaweed also potentially has several benefits: employment generation, an increase in product portfolio, and restorative aquaculture, among others. Currently, there are several critical issues related to the beneficial usage of seaweeds. High water content in seaweed feedstock is a major impediment of the usage of seaweed as an energy source via pyrolysis.

Proposed Session Topics

- Disassembly and recycling solutions for end-of-life batteries, fuel cells
- Wind energy-based recycling and usage
- Recycling of thermosets and plastics
- Beneficial usage of local materials like algae and seaweed for energy and related applications
- Recycling of glass and ceramics for different applications
- Life cycle analysis and techno-economic analysis of the technologies

Symposium Organizers

- Surojit Gupta, University of North Dakota, USA
- Chiharu Tokoro, Waseda University, Japan
- Sonia Lucia Fiorilli, Politecnico di Torino, Italy
- Motoyuki Iijima, Yokohama National University, Japan
- Tohru Suzuki, National Institute for Materials Science, Japan
- Alberto Mannu, University of Brescia, Italy
- Enrico Bernardo, University of Padova, Italy

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GFMAT-3 SYMPOSIUM 11:

Ceramics and Glasses for Bio-Medical Applications

Biomaterials science and bioceramic engineering have remained a frontier and growing area of research and innovation within the global engineering science community, considering the number of scientific discoveries and their societal impact. Significant attempts on bioceramics and composites have been made to re-create functional musculoskeletal systems with considerable potential to treat various types of human diseases, fabricate high-performance bio-inspired and biomimetic materials, confer new properties to materials and improve their performances, innovate new materials synthesis methods and manufacturing technologies, etc. This symposium will provide a platform to facilitate discussion among researchers from academia, hospitals, industry and medical device companies, involved in biomaterials, bioglasses, biomanufacturing, and biotechnological innovation, while inspiring many young researchers in this emerging field.

Proposed Session Topics

- 3D printing of bioceramics
- Bioceramics for regenerative bioelectronics
- Porous bioceramics (joint with GFMAT-3 Symposium 5)
- Bioglasses
- Bioactive and resorbable ceramics and composites
- Bio-inspired and biomimetic ceramics and composites
- Self-assembled bioceramics and tissue-material
- Ceramics for drug and gene delivery
- Antimicrobial bioceramics and composites
- Dental bioceramics and composites
- Ceramic biosensors

Symposium Organizers

- Katalin Balázsi, HUN-REN Centre for Energy Research, Hungary
- Cristina Balagna, Politecnico di Torino, Italy
- Elzbieta Pamula, AGH University of Science and Technology, Poland
- Csaba Balázsi, HUN-REN Centre for Energy Research, Hungary
- Justin J. Chung, Seoul National University Hospital, Korea
- Reeja Jayan, Carnegie Mellon University, USA
- Dong Hou, Clemson University, USA
- Sungho Lee, National Institute of Advanced Industrial Science and Technology, Japan
- Shiv Prakash Singh, Liaoning Academy of Materials, China

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The Young Professionals Forum (YPF) aims to bring together students, postdoctoral researchers, young professionals, and early career faculty members 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 YPF 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.

Proposed Session Topics

- Fabrication, characterization and modeling of advanced ceramics, ceramic-based composites and coatings for energy, environmental and functional applications
- Advanced and nanostructured ceramics for sensors and actuators, energy generation, energy storage, catalysis, functional surfaces and biomedical applications
- Novel ceramic processing methods and synthesis routes, including new precursors for functional ceramics
- Additive manufacturing of ceramics and ceramic-based composites
- Non-destructive testing (NDT) and advanced real time monitoring techniques/methods
- Bridging ceramics and nuclear science: opportunities for young professional
- Career development in science, technology, engineering, mathematics and medicine (STEMM), including building collaborative networks, research projects, as well as supporting different perspective and promoting sustainability in the field of ceramics

Symposium Organizers

- Yuki Nakashima, National Institute of Advanced Industrial Science and Technology, Japan
- Dong (Lilly) Liu, University of Oxford, UK
- Meelad Ranaiefar, NASA Glenn Research Center, USA
- Bai Cui, University of Nebraska-Lincoln, USA
- Elisa Moretti, Ca' Foscari University of Venice, Italy
- Chenxu Wang, Peking University, China
- Qiance Quincy Zhang, University of Oxford, UK
- Nor Ezzaty Ahmad, Universiti Teknologi Malaysia, Malaysia
- Alex Leide, UK Atomic Energy Authority, UK
- Nico Langhof, Universität Bayreuth, Germany

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