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Abstracts due December 15, 2015

9TH INTERNATIONAL CONFERENCE ON HIGH TEMPERATURE CERAMIC MATRIX COMPOSITES - HTCMC 9

GLOBAL FORUM ON ADVANCED MATERIALS AND TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT - GFMAT 2016

JUNE 26 – JULY 1, 2016

The American Ceramic Society
www.ceramics.org

ceramics.org/htcmc9_gfmat2016

June 26 – July 1, 2016 | Toronto Marriott Downtown Eaton Centre Hotel |

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GLOBAL FORUM ON ADVANCED MATERIALS AND TECH

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Global population growth and tremendous economic development has 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 and offer energy efficient and ecofriendly applications, including aerospace, ground transportation, and power-generation systems.

The American Ceramic Society is organizing and will host the 9th International Conference on High Temperature Ceramic Matrix Composites (HTCMC-9) in Toronto, Canada from June 26–30, 2016. HTCMC-9 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), and Xi'An (China, 2013). This conference series has been recognized as the global and central meeting event in high-temperature ceramic composite science and technology.

In addition to HTCMC-9, the Global Forum on Advanced Materials and Technologies for Sustainable Development (GFMAT 2016) also is being organized. This forum will address key issues, challenges, and opportunities in a variety of advanced materials and technologies that are critically needed for sustainable societal development. A Young Professionals Forum, industrial exposition, and poster sessions are planned for the meeting.

We invite all of you to take advantage of this opportunity to visit the great city of Toronto 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 applications of ceramic technologies for sustainable development. We look forward to your participation in HTCMC-9 and GFMAT 2016.

Organizing Chairs


Singh

Mrityunjay Singh
General chair
OAI, USA


Ohji

Tatsuki Ohji
HTCMC-9 Lead chair
AIST, Japan


Morscher

Gregory N. Morscher
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Abstract Submission Instructions

Visit www.ceramics.org/htcmc9_gfmat2016 to submit your abstract. Select "Submit Abstract" to be directed to the Abstract Central website. Please contact **Marilyn Stoltz** at mstoltz@ceramics.org or 614-794-5868 with questions.

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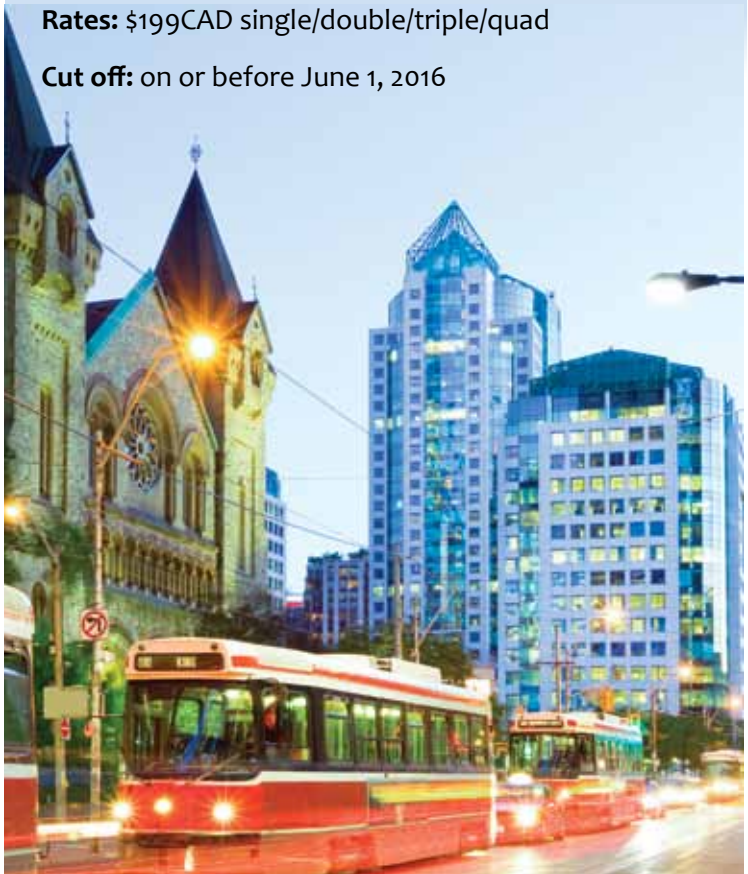
Rates: $199CAD single/double/triple/quad

Cut off: on or before June 1, 2016



H1: Computational modeling and design of new materials and processes

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. Special attention will be given to experimental verification of models, but papers focused on design and creation of new concepts are also particularly welcome.

Proposed session topics:

- Ab-initio computations
- Atomistic modeling
- Thermodynamic computations
- Diffusions, defects, and coupled phenomena
- Macroscopic scale modeling (e.g., finite elements)
- Computation of mechanical, thermal, and thermomechanical properties
- Simulation of materials processing and degradation
- Image processing and image-based modeling
- Model verification and certification; uncertainty qualification
- Computer-based design, including composition, phases, structure, and organization

Organizers:

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– Qingfeng Zeng, Northwestern Polytechnical University, China
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H2: Design and development of advanced ceramic fibers, interfaces, and interphases in composites: A symposium in honor of professor Roger Naslain

Ceramic fibers are key components of ceramic matrix composites. Although advanced ceramic matrix composite materials have been developed with fibers available on the market, there is still demand for fiber materials with even better high-temperature performance. Oxide fibers have limitations due to creep and grain growth, and nonoxide fibers are not stable against oxidation at high temperatures, while both are sensitive to subcritical crack growth. Research is focused on shifting the temperature limit to higher temperatures and on improving long time performance of fibers. Beyond fibers and the matrix materials themselves, the interface or interphase between fibers and the matrix plays an

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important role in performance of the ceramic matrix composite in terms of fracture toughness and damage tolerance. The interface can also be a protective layer for the fibers, consisting of specially designed interphases.

This international symposium is held in honor of professor Roger Naslain and recognizes his outstanding contributions to science and technology of advanced ceramic fibers, interfaces or interphases, ceramic matrix composites, and carbon–carbon composites and his tireless efforts in promoting their wide-scale industrial applications. The aim of this symposium is to discuss advances in ceramic fiber and interface or interphase developments and performance of these materials at high temperatures.

Proposed session topics:

- New developments in oxide and nonoxide ceramic fibers
- Characterization and evaluation of temperature-dependent properties of ceramic fibers
- Performance of ceramic fibers in extreme environments (gas turbines)
- Textile processing of ceramic fibers for producing fabrics and preforms
- Nanotube or nanofiber reinforcement
- Interfaces or interphases in ceramic matrix composites

Organizers:

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– Akira Kohyama, Muroran Institute of Technology, Japan

– Natalya I. Baklanova, Institute of Solid State Chemistry and Mechanochemistry, Russia

– Sylvain Jacques, French National Centre for Scientific Research, Laboratory for Thermostructural Composites, France

– Ji Yeon Park, Korea Atomic Energy Research Institute, Korea

– Shaoming Dong, Shanghai Institute of Ceramics, Chinese Academy of Sciences, China

H3: Innovative design, advanced processing, and manufacturing technologies

As important structural materials, ceramic matrix composites seriously impact the development of new technologies. Recent progress in high-tech industries puts strong demand on high-performance composites. Properties and performance of ceramic matrix composites are strongly dependent on their design, processing, and manufacturing routes. Different manufacturing techniques lead to different properties, producing cost and application fields. Also, it should be noted that design of fiber preform and matrix plays an increasingly important role in producing quality ceramic matrix composites. Carefully designed manufacturing processes bring excellent and reliable performance of the materials and their components, especially for large sizes and complex shapes. Numerous innovative processing and manufacturing technologies have been developed recently, which give the materials unique properties that cannot be achieved with conventional routes. The aim of this symposium is to discuss advances in a variety of design, processing, and manufacturing technologies for ceramic matrix composites. Understanding the correlation between properties and processing techniques is also emphasized.

Proposed session topics:

- Manufacture of oxide and nonoxide ceramic matrix composites
- Manufacturing of carbon–carbon composites
- Manufacturing short fiber-reinforced composites
- Composition and structure design for matrix and coatings
- Nano-reinforcement design and fabrication
- Rapid and near net size molding technology and hybrid processes
- Green precursor systems and manufacturing
- Low cost manufacturing and time efficient processing
- Large scale or complicated shape processing
- Fabrication of high density ceramic matrix composites
- Fabrication of hybrid-reinforced ceramic matrix composites

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– Yutaka Kagawa, University of Tokyo, Japan
– Christian Wilhelmi, EADS Innovation Works, Airbus Group Innovations, Germany
– Dechang Jia, Harbin Institute of Technology, China

H4: Materials for extreme environments: Ultrahigh-temperature ceramics and nano-laminated ternary carbides and nitrides (MAX phases)

Ultrahigh-temperature ceramics and nano-laminated ternary carbides and nitrides (MAX phases) are potential materials for extreme environments that are beyond the capabilities of current structural ceramic materials. These ceramics could enable revolutionary improvements in energy efficiency of advanced nuclear reactors, concentrated solar power, and industrial heating. However, their thermal and chemical stability in extreme environments, ability to be formed into complex shapes, thermal shock resistance, irradiation resistance, and damage tolerance are critical challenges limiting near-term industrial applications of these materials. For such extreme environment applications, new advances in the understanding of structure–property relations and improved performance are needed. These will require development of new approaches for improving thermal shock resistance, thermochemical stability, damage tolerance, and machinability as well as discovery of new materials to ensure an enormous leap forward in performance. This symposium will focus on design, processing, structure–property relationships, thermal and mechanical properties, oxidation resistance, machining and joining, and stability of ultrahigh-temperature ceramics and MAX phases both from fundamental and application-oriented perspectives.

Proposed session topics:

- New precursors for powders, coatings, matrices, and fibers of ultrahigh-temperature ceramics
- Structure–property relationships of existing systems
- Materials design of new compositions and composites
- Novel processing methods, including bulk, coatings, and thin films
- Novel characterization methods and lifetime assessment
- Methods for improving damage tolerance, oxidation, and thermal shock resistance
- Structural stability under extreme environments, including irradiation and ultrahigh temperatures

Organizers:

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– Peter McBreen, Laval University, Canada
– Frederic Monteverde, Institute of Science and Technology for Ceramic Materials, National Research Institute, Italy
– Miladin Radovic, Texas A&M University, USA
– Jochen Schneider, Rhine-Westphalia Institute of Technology Aachen, Germany
– Luc J. Vandeperre, Imperial College London, UK
– Guo-Jun Zhang, Shanghai Institute of Ceramics, Chinese Academy of Sciences, China

H5: Polymer-derived ceramics and composites

Preceramic polymers, organic–inorganic polymers capable of being transformed into ceramics by heat treatment or nonthermal methods, are materials of choice for fabrication of advanced ceramic fibers and have been successfully used as matrices for ceramic matrix composites. Due to their nanostructure, these materials possess unique properties that make them of interest for a range of engineering and functional applications in key sectors, such as energy, transportation, environment, defense, and health. The possibility of exploiting plastic forming techniques or unconventional processing methods has led to fabrication of components at different length scales, ranging from coatings to fibers and foams to bulk parts.

This symposium will address the latest developments in polymer-derived ceramics, following the processing chain—from synthesis of new polymer systems, to precursor modification for tailored properties or functionalities, to subsequent shaping and advanced polymer-to-ceramic conversion. Emphasis will be placed on development of innovative processes and techniques to improve components for ceramic matrix composites, including special matrices, ceramic fibers, joining, and protective or functional coatings. This also includes modeling and structural characterization of new or improved materials and their properties. Polymer-derived ceramic-based engineering components offer enormous potential for applications in key technologies.

Proposed session topics:

- Synthesis and tailoring of novel preceramic polymers
- Nanostructure, modeling, and thermodynamics of polymer-derived ceramics
- Structural and functional properties

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- In situ formation of nanocomposites
- Advanced and innovative polymer-to-ceramic conversion methods
- Advanced and innovative fabrication processes, including additive manufacturing
- Polymer-derived ceramic fibers
- Polymer-derived ceramic matrix composites
- Precursor-derived polymer and ceramic coatings
- Polymer-derived ceramic components with functional properties
- Metal–ceramic and ceramic–ceramic composites via polymer-derived ceramic techniques
- Application of polymer-derived ceramics in engineering fields
- Industrial applications

Organizers:

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– Gian Domenico Sorarù, University of Trento, Italy
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– Gurpreet Singh, Kansas State University, USA
– Yuichi Ikuhara, University of Tokyo, Japan
– Yuji Iwamoto, Nagoya Institute of Technology, Japan
– Zhaoju Yu, Xiamen University, China
– Yiguang Wang, Northwestern Polytechnical University, China
– Yingde Wang, National University of Defense Technology, China

H6: Advanced thermal and environmental barrier coatings: Processing, properties, and applications

This symposium focuses on recent advances in ceramic thermal and environmental barrier coating developments for high-temperature ceramic matrix composite applications. The symposium will address fundamental aspects of coating sciences and technologies, emphasizing advanced design methodologies, processing, property evaluation and modeling, nondestructive testing, and inspection of advanced multifunctional thermal and environmental barrier coatings as well as coating integration with ceramic matrix composite component systems. Particular emphases are also placed on integrated coating structural and component design and performance; multiscale modeling and experimental validation of coating processing–microstructure–property relationships; enhanced coating environmental stability, durability, and functionality through innovative coating composition, architecture, and processing optimizations; novel hybrid coating processing and nanocomposite coatings for extreme harsh environments; and coating simulative operating condition testing and life prediction modeling. Special sessions will be dedicated to advanced ceramic coating and component system developments for aerospace, automotive, and energy applications.

Proposed session topics:

- Thermal and environmental barrier coatings
- Thermal protection systems and coatings
- Coatings to resist CMAS, wear, erosion, corrosion, and tribological loadings
- Advanced coating component systems for use at extreme harsh environments
- Oxidation and diffusion barrier coating systems
- High-temperature vibration damping coatings
- Nanostructured and nanocomposite coatings
- Functionally graded coatings and materials
- Multifunctional coating system integration: performance and durability
- Advanced design, coating processing methods, and modeling
- Advanced testing and nondestructive evaluation methodologies
- Interface phenomena, adhesion, and fundamental coating interfacial properties
- New horizons in environmental barrier coatings: Progress in thermal spraying, PVD, CVD, and polymer-derived coatings
- Computer simulation for coating materials
- Multiscale modeling of coating properties and life prediction

Organizers:

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– Yutaka Kagawa, University of Tokyo, Japan
– Daniel R. Mumm, University of California, Irvine, USA
– Rogerio S. Lima, National Research Council, Canada

– Molly Gentleman, Stony Brook University, USA
– Ping Xiao, University of Manchester, UK
– Jacques Lamon, National Centre of Scientific Research, France
– Yan-Chun Zhou, Aerospace Research Institute of Material and Processing Technology, China
– Valerie Wiesner, NASA Glenn Research Center, USA

H7: Thermomechanical behavior and performance of composites

This symposium will provide a forum for presentation and discussion of recent research and development activities in elevated temperature mechanical behavior of ceramic matrix composites. The symposium will include thermal, mechanical, and environmental behavior of all ceramic composite systems, including oxide as well as nonoxide. Attention will be given to presentations covering experimental results for different composite systems, including constituent content and fiber–architecture effects; developments in elevated temperature testing; developments in modeling for thermal, mechanical, and environmental conditions; and design considerations for a range of environments and mechanical conditions.

Proposed session topics:

- Creep, creep-rupture, and fatigue of ceramic matrix composites
- Stress–environment interactions at elevated temperatures
- Elevated temperature test techniques
- Modeling thermal, mechanical, and environmental behavior of ceramic matrix composites
- Design and transition experiences and realistic component testing of ceramic matrix composites

Organizers:

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– Jacques Lamon, National Centre of Scientific Research, France
– Craig Przybyla, US Air Force Materiel Command, US Air Force Research Laboratory, USA
– Frank Zok, University of California Santa Barbara, USA
– Marina Ruggles-Wrenn, Air Force Institute of Technology, USA
– James D. Kiser, NASA Glenn Research Center, USA

H8: Ceramic integration and additive manufacturing technologies

Traditional methods for fabricating ceramics and ceramic matrix composites are limited by manufacturability of large parts and complex shapes. In addition, component production can be time consuming and costly. Novel fabrication processes in additive manufacturing, joining, and integration of ceramics and ceramic matrix composites can overcome these limitations. Ceramic integration and additive manufacturing technologies increasingly enable fabrication and utilization of components for high-temperature structural applications, including those in energy, environment, transportation, and aerospace. Joining processes allow combination of simpler parts to form large structures or complicated shapes. Integration processes allow incorporation of ceramic and ceramic matrix composite components with metal-based systems. Joining and integration approaches include adhesives, brazing, glass sealing, diffusion bonding, transient liquid phase bonding, and reactive processes.

Additive manufacturing processes allow innovative complex part fabrication, client customization, rapid prototyping, and distributed manufacturing. In additive manufacturing approaches, three-dimensional models are designed minutely according to theoretical concepts in computer graphic applications, and two-dimensional cross sections are created by automatic slicing operations. Two-dimensional layers are built up through powder bed processes that use high resolution laser beams or binder jetting to form solid planes, or through layer stacking processes, paste extrusion, fused deposition, and curing of photoreactive resins.

Proposed session topics:

- Joining of ceramics and ceramic matrix composites
- Integration of ceramics and ceramic matrix composites to metals
- Nanoscale and microscale joining
- Emerging additive manufacturing technologies
- Selective laser sintering and stereolithography
- Direct writing technologies
- Fused deposition modeling and 3-D printing technologies
- Laminated object manufacturing and powder bed fusion processes
- Mechanical tests of additively manufactured and joined ceramics and ceramic matrix composites
- Design and modeling of additive manufacturing materials and interfaces
- Additive manufacturing-enabled components and their evaluation in relevant operating conditions

Organizers:

– **Monica Ferraris**, Politecnico di Torino, Italy, monica.ferraris@polito.it
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– Michael J. Reece, Queen Mary University of London, UK
– Cesar R. Foschini, Sao Paulo State University, Brazil
– Thomas Weißgärber, Fraunhofer Institute for Manufacturing Technology and Advanced Materials, Dresden, Germany

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H9: Component testing and evaluation of composites

Advanced ceramics, composite materials, and ceramic structures are developed for critical components for modern systems, such as stationary gas turbines, jet engines, space propulsion, transportation, and frictional devices. Long-term reliability under relevant conditions is a key issue for the materials' use in specific applications. To provide reliable and predictable use of these components, a deep understanding of mechanical, thermal, and chemical properties of ceramic composites is necessary. Correlations between service conditions and component behavior by loading, deformation, fatigue, thermal shock, or corrosive attack are of great interest. Based on experimental data, new modeling and simulation tools will provide lifetime prediction of components for present and future applications.

This symposium focuses on new testing methods, experimental characterization, and evaluation of composite materials and complex components, including analysis of joining methods; functional performance of complex devices; and new methods for material diagnostics and structural health monitoring to assure functional reliability. Additionally this symposium addresses evaluation of experimental results and virtual interpretation and simulation of material properties to optimize design of components and predict reliability and lifetime.

Proposed session topics:

- Mechanics, characterization techniques, and equipment
- Processing–microstructure–mechanical properties correlation
- Mechanical, thermal, and corrosive testing
- Fatigue evaluation
- Characterization of components, joint structures, and integrated composites
- Ultrasound, acoustic, and optical characterization
- Structural health monitoring
- Nondestructive evaluation
- Modeling and simulation
- Defect effects and lifetime prediction

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H10: Energy and aerospace applications: Challenges and opportunities

Superior high-temperature mechanical properties and excellent damage resistance have allowed ceramic matrix composites to be developed, designed, and realized for various hot section components of gas turbine engines. These materials allow turbine inlet temperatures to rise above the limit of superalloys and thus significantly improve thermal efficiency, exhaust emission reduction, and lifetime performance. In addition to high-temperature mechanical properties, certain ceramic matrix composites exhibit excellent resistance to neutron radiation. These composites have been developed for next-generation nuclear energy systems, with operation temperatures possibly extending above 1,000°C in harsh environments.

Although composite materials and their manufactured components have played a key role in gas turbines and the nuclear industry, the materials still face challenges to ensure long-term materials stability, lifetime performance, reliability, and safety. However, new application opportunities should be explored and expanded for compsite systems as well. This symposium provides a premium forum to address current state-of-the-art technologies and applications of ceramic matrix composites in energy and aerospace technologies and industrial sectors, and also challenges and opportunities to achieve sustainable, efficient, and clean energy resources. The symposium will bring together leading experts from universities, industries, research and development laboratories, and government agencies, providing a unique opportunity to facilitate multidisciplinary collaboration on innovative and sustainable solutions.

Proposed session topics:

- Ceramic matrix composites for land-based gas turbine engines
- Aerospace turbines and space transportation
- Lightweight and multifunctional space structures
- Hypersonic and reentry vehicles, including TPS, leading edges, and aerostructures
- Composites for fossil and renewable energy
- Ceramic matrix composites for next-generation nuclear energy—fission and fusion
- Accident-tolerant fuel technologies
- Issues for ceramic matrix composite materials and components

Organizers:

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– Jay Lane, Rolls-Royce Corp., USA
– Shaoming Dong, Shanghai Institute of Ceramics, Chinese Academy of Sciences, China
– David Marshall, Teledyne Scientific Company, USA
– Jacques Lamon, National Centre for Scientific Research, France

H11: Ground-based applications: Transportation and industrial systems

Ceramic matrix composite materials combine favorable thermal and mechanical properties with low density. Composites can replace conventional materials, such as metals or monolithic ceramics, to overcome technical barriers in numerous applications. Beyond aerospace and power generation applications, ceramic matrix composites currently find applications in friction components for high-performance brakes and bearings as well as charging devices for high-temperature furnaces. Potential novel composite applications have been investigated in research projects worldwide. However, use of composite materials is still limited to niche markets characterized by small-scale serial production rates. To further extend industrial applications, tailored ceramic matrix composite materials—fitted to specific technical and economic requirements of each application—as well as reliable manufacturing processes are needed. This symposium will focus on technical as well as economic aspects of ceramic matrix composites by discussing an overview of products, current development activities, and promising future applications of these materials.

Proposed session topics:

- High-performance brakes and clutches in various application areas, including aircraft, trains, automobiles, cycles, elevators, and industrial devices
- Bearing systems and sliding elements
- Charging devices and supporting structures for heat treatment and joining of metallic parts
- Heat insulation and joining elements (e.g., screws and bolts) for high-temperature furnaces
- Oxidation and methanization of hot structures in realistic environments
- Geometrically stable structures based on ceramic matrix composites with low thermal expansion
- Abrasive resistant components
- Development activities in novel application areas
- Technology transfer, from material and prototype development to industrial production
- Design and modeling of parts in original geometry

Organizers:

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G1: Powder processing innovation and technologies for advanced materials and sustainable development

Coorganized with the Society of Powder Technology, Japan, and Society for the Promotion of Science 124th Committee, Japan

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; powder shaping (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

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– Sanjay Mathur, University of Cologne, Germany

– Yoshio Sakka, National Institute for Materials Science, Japan

– Koichi Yasuda, Tokyo Institute of Technology, Japan

– Di Zhang, Shanghai Jiao Tong University, China

G2: Functional nanomaterials for sustainable energy technologies

Research and development exploiting functional nanomaterials has great potential to efficiently contribute to the implementation of sustainable energy technologies, for instance, by discovering and utilizing environmentally friendly processes to enhance energy and resource efficiencies. Fabrication of new devices with enhanced performance and stability—achieved by nanoscale materials design and control using unique phenomena, such as quantum confinement effects—is key to success. This symposium offers a discussion forum for scientists, engineers, and professionals involved in research and development for a sustainable energy future.

Proposed session topics:

- Sustainable design and recyclability of functional materials and devices
- Ecological and energy-efficient processing of advanced functional nanostructures
- Nanotechnology for sustainable generation of renewable fuels
- Nanomaterials for energy-efficient buildings and green architecture
- Nanodevices for cost-effective water purification and desalinisation
- Nanodevices for atmospheric sensing
- Nanodevices for sustainable carbon dioxide capture and utilization
- Industrial production, implementation, and commercialization of sustainable systems
- Societal, educational, environmental, and economic aspects of sustainable energy technologies

Organizers:

– **Sanjay Mathur**, University of Cologne, Germany, sanjay.mathur@uni-koeln.de

– **Lionel Vayssieres**, Xi'an Jiaotong University, China, lionelv@xjtu.edu.cn

– Yoon-Bong Hahn, Chonbuk National University, Korea

– Silke Christiansen, Helmholtz Energy Zentrum, Berlin

– Heli Wang, National Renewable Energy Laboratory, Colorado, USA

– Juan-Ramon Morante, Catalonia Institute for Energy Research, Spain

– Gunnar Westin, Uppsala University, Sweden
– Daniel Chua, National University Singapore, Singapore
– Taejin Hwang, Korea Institute of Industrial Technology, Korea
– Thomas Fischer, University of Cologne, Germany

G3: Novel, green, and strategic processing and manufacturing technologies

Material properties and performance largely depend on processing and manufacturing routes. Recently developed processing and manufacturing technologies for ceramic materials and systems provide unique properties that cannot be achieved from conventional routes, but these technologies also come with critical issues. One consideration is whether technologies are "green" or environmentally benign, and thus avoid generation of elements and compounds hazardous to human health and to the environment and protect the global environment by preserving energy during fabrication. Another consideration is whether technologies are "strategic"—using no or lesser amounts of rare natural resources for stable production. Keeping these aspects in view, this symposium will discuss advances in processing and manufacturing technologies for a 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- or low-temperature synthesis
- Aqueous synthesis and processing, colloidal processing
- Polymer-based processing
- Large scale or complicated shape processing
- Advanced composite manufacturing technologies, hybrid processes

Organizers:

– **Tatsuki Ohji**, National Institute of Advanced Industrial Science and Technology, Japan, t-ohji@aist.go.jp
– Surojit Gupta, University of North Dakota, USA
– Manish Mehta, National Center for Manufacturing Sciences, USA
– Richard D. Sisson Jr., Worcester Polytechnic Institute, USA
– Tohru S. Suzuki, National Institute for Materials Science, Japan
– Yiquan Wu, Alfred University, USA
– Jerzy Lis, AGH University of Technology, Poland

G4: Ceramics for sustainable infrastructure: Geopolymers and sustainable composites

Sustainable infrastructure materials developments are increasingly incorporated in construction on building projects worldwide. Use of green building materials and products represents one important strategy for reducing negative impacts of the construction industry on the environment, by avoiding hazardous substances or reducing energy consumption to conserve natural resources. Keeping these critical aspects in view, this international symposium will bring together scientists and engineers working on geopolymers and sustainable composites to discuss and exchange the latest developments. The target audience for the symposium is construction and building materials manufacturers, scientists, engineers, graduate students, and technologists from industry, national and corporate research laboratories, and universities.

Proposed session topics:

- Geopolymers
- Alternative building materials
- Green building materials
- Sustainable composites for infrastructure

Organizers:

– **Waltraud M. Kriven**, University of Illinois at Urbana-Champaign, USA, kriven@illinois.edu
– **Henry A. Colorado**, University of Antioquia, Colombia, henry.colorado@udea.edu.co

G5: Advanced materials, technologies, and devices for electro-optical and medical applications

This symposium will provide a forum for presentation and discussion of recent research and development activities in advanced materials, technologies, and devices. The symposium will cover topics in this area that range from basic research and material characterization—through physicochemical aspects of growth, synthesis, and deposition techniques—to technological development of industrialized materials. The broad scope of this international and interdisciplinary symposium assures an overview of state-of-the-art issues on crystalline materials.

Proposed session topics:

- Semiconductors for light-emitting diodes or laser diodes, power devices, and sensors
- Optical materials for lasers, nonlinear optics, optical isolators, and phosphors
- Scintillators for X-ray, gamma-ray, and neutron detection
- Piezoelectric, ferroelectric, and magnetoelectric materials
- Nanomaterials and biomaterials
- Growth mechanisms, defect chemistry, and crystalline quality

Organizers:

– **Kiyoshi Shimamura**, National Institute for Materials Science, Japan, shimamura.kiyoshi@nims.go.jp
– Noboru Ichinose, Waseda University, Japan
– Didier Chaussende, National Centre for Scientific Research, Grenoble, France
– Christophe Dujardin, Claude Bernard University Lyon 1, France
– Qiang Li, Tsinghua University, China
– Alain Largeteau, Institute for Solid State Chemistry Bordeaux, France

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– Mikio Higuchi, Hokkaido University, Japan
– Toru Ujihara, Nagoya University, Japan
– Yuji Noguchi, Tokyo University, Japan
– Hiroshi Maiwa, Shonan Institute of Technology, Japan

G6: Porous ceramics for advanced applications through innovative processing

Porous ceramics with various pore scales are utilized in numerous engineering applications, including filters, separators, insulation, membranes, catalytic supports, catalysts, absorbers, sensors, and lightweight structural components. This symposium will aim to bring together engineers, researchers, and scientists of porous ceramics, carbon, and glass to share recent advances in innovative processing routes, characterizations, properties, fluid dynamics, simulation, and modeling of these components. Components include those with pore sizes from nanometers to millimeters, controlled pore volume fractions, and tailored pore configurations, such as textured or random morphologies, interconnected or closed microstructures, sandwich-structured ceramic matrix composites, and hierarchical porosities. Porous materials can be based on various morphologies, including, but not limited to: foams, syntactic foams, honeycombs, fibrous, bioinspired, membranes, aerogels, and additive manufactured. Engineering applications include energy-related technologies (renewable energy, energy-efficient, energy conversion, and heat exchange and storage), environmental protection (hot gas filtration or separation, filtration of fine particle matters, catalysts, adsorption, and sensors), and lightweight structural components for aerospace. This symposium will be the ideal showcase for research activities of groups involved in processing and applications of porous materials. The symposium will also include research advancement and trends in next-generation porous materials, design, fabrication, and characterization.

Proposed session topics:

- Novel processing routes and synthesis of porous ceramics
- Shape forming, joining, and morphology of porous ceramics
- Additive manufacturing of porous ceramics
- Ceramic membranes
- Microporous or mesoporous ceramics and hierarchical porosities
- Innovative characterization tools, design, simulation, and modeling of porous ceramics
- Mechanical characterization of porous ceramics
- Characterization and behavior of porous ceramics at elevated temperature
- Gas or dust separation and filtration
- Thermal protection of porous ceramics at ultrahigh temperature
- Porous ceramics for environmental, energy, functional, and lightweight structural applications

Organizers:

– **Manabu Fukushima**, National Institute of Advanced Industrial Science and Technology, Japan, manabu-fukushima@aist.go.jp
– **Young-Wook Kim**, University of Seoul, Korea, ywkim@uos.ac.kr
– Paolo Colombo, University of Padua, Italy
– Samuel Bernard, European Institute of Membranes, France
– Tobias Fey, University of Erlangen-Nuremberg, Germany
– Tim Van Gestel, Jülich Research Centre, Germany
– Yuji Iwamoto, Nagoya Institute of Technology, Japan
– Yasuo Kogo, Tokyo University of Science, Japan
– Alberto Ortona, University of Applied Sciences and Arts of Southern Switzerland, Switzerland
– Aleksander Pyzik, Dow Chemical Company, USA
– Yuping Zeng, Shanghai Institute of Ceramics, Chinese Academy of Sciences, China

G7: Advanced functional materials, devices, and systems for environmental conservation and pollution control

There is a growing trend toward the increasing importance of ceramic materials, which are heat-resistant, chemically stable, and multifunctional. However, new functions of ceramic materials are needed for environmental conservation efforts. This symposium will cover a variety of topics for the realization of novel and environmentally conscious functional ceramic materials. The aim of the symposium is to discuss advanced functional ceramic materials, such as environmental catalysts to control emissions; semiconductors and porous materials for chemical sensors and optical materials, such as mercury-free light-emitting diodes; environmentally friendly pigments and sunscreens free of toxic elements; and recovery and recycling of rare metals.

Proposed session topics:

- Ion-conducting ceramics
- Volatile organic compounds and carbon monoxide abatement
- Low-temperature methane oxidation
- Diesel particulate filters

- Automotive ceramic sensors
- Semiconductor materials for *p-n* junction diodes
- Porous materials
- Phosphors and optical ceramics for light-emitting diodes
- Advanced process control system for recycling
- Environmentally friendly pigments
- Sunscreen materials
- Recovery and recycling of rare metals

Organizers:

– **Nobuhito Imanaka**, Osaka University, Japan, imanaka@chem.eng.osaka-u.ac.jp
– Taek-Soo Kim, Korea Institute of Industrial Technology, Korea
– Shinobu Fujiwara, Keio University, Japan
– Yasuhiro Shimizu, Nagasaki University, Japan

G8: Multifunctional coatings for sustainable energy and environmental applications

This symposium invites scientists, engineers, and practitioners from around the world to discuss advances in coating technologies, which offer new or improved functions onto material surfaces through physical, mechanical, thermal, chemical, optical, electrical, electronic, and magnetic properties, for sustainable energy and environmental applications. These functional coatings include thin-film technologies, such as physical vapor deposition, chemical vapor deposition, and sol-gel methods; and thick-film technologies, such as thermal spray, cold spray, aerosol deposition, and suspension plasma spray. The goal of the symposium is to identify current key issues, effective approaches, and future outlooks for functional coating technologies and applications through comprehensive discussion.

Proposed session topics:

- Innovative coating technologies for various industrial products, including automobiles, gas turbines, electronic devices, and mechanical parts
- Conventional coating processes, including thermal spray, physical vapor deposition, chemical vapor deposition, and sol-gel technologies
- Novel coating processes, including suspension plasma spray, cold spray, and aerosol deposition
- Coatings for new functional applications
- Functionally graded coatings and materials
- Thermal barrier coatings and environmental barrier coatings
- Nanostructured and multifunctional coatings
- Interface phenomena, adhesion, and other coating fundamentals
- Technical issues and potential solutions of surface-related properties and processes in industry
- Characterization of microstructure and properties of coatings
- Next-generation production methods for surface engineering

Organizers:

– **Jun Akedo**, National Institute of Advanced Industrial Science and Technology, Japan, akedo-j@aist.go.jp
– Seiji Kuroda, National Institute for Materials Science, Japan
– Hiroaki Nishikawa, Kinki University, Japan
– Sanjay Sampath, Stony Brook University, USA
– Tom Coyle, University of Toronto, Canada
– Dong-Soo Park, Korea Institute of Materals Science, Korea
– Tatsuki Ohji, National Institute for Materials Science, Japan
– Tetsuo Tsuchiya, National Institute for Materials Science, Japan

G9: Bioinspired and hybrid materials

This symposium will share information on bioinspired and hybrid materials, including all types of bioinspired and organic or inorganic hybrid materials and their properties and applications. Research topics include synthesis, processing techniques (molecular crystals, multilayers, self-assemblies, and ultrathin films), compounds (composites and blends), microfabrication and nanofabrication, interfaces, spectroscopic characterization (linear and nonlinear), morphology, and electronic and photonic properties.

Proposed session topics:

- Processing and forming for nano and hybrid composite ceramics
- Ceramic–polymers, ceramic–inorganic, ceramic–metal, and ceramic–bio hybrid composites
- Nanoparticles, nanofiller, nanopowder, nanosheets, nanofibers, and nanotube materials
- Simulations, characterization, and applications of nano and hybrid composite ceramics
- Multifunctional materials and complex functional materials
- Advanced manufacturing technology, patterning, nanoimprinting, 3-D printing, and self assembly
- Energy harvesting, environmental, optical, thermal management, painting, film, coating, and lightweight structure application
- New concepts for multidisciplinary research, development, and applications

Organizers:

– **Tadachika Nakayama**, Nagaoka University of Technology, Japan, nky15@nagaokaut.ac.jp
– Roger Narayan, North Carolina State University, USA
– Di Zhang, Shanghai Jiao Tong University, China
– Ping Xu, Harbin Institute of Technology, China
– Shaifulazuar Bin Rozali, University of Malaya, Malaysia
– Nisanart Traiphol, Chulalongkorn University, Thailand

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G10: Energy-efficient lighting and power devices: Materials, technologies, and applications

Lighting consumes about 20% of electricity used in the United States, so it is not surprising that energy-efficient technologies are a current hot topic to reduce electricity usage. This symposium provides an overview of the main technologies used to produce energy-efficient lighting and power devices. Experts in materials science and devices in the fields of light-emitting diodes, lasers, and compact fluorescent lights are invited to participate.

Proposed session topics:

- Semiconductor materials for light-emitting diodes and power devices
- Laser and nonlinear optical materials
- Compact fluorescent lighting technology
- Street lighting and display applications

Organizers:

– **Gisele Maxwell**, Shasta Crystals Inc., USA, gmaxwell@shastacrystals.com

– Kiyoshi Shimamura, National Institute for Materials Science, Japan

– Tatsuo Fujimoto, Nippon Steel and Sumitomo Metal Corp., Japan

– Anja Mudring, Iowa State University, USA

– Gregory Miller, Dolby Laboratories, USA

G11: Biochemical sensors for environment and health

This symposium will bring together interdisciplinary researchers from engineering to science and technology to discuss recent developments in materials, methods, and materials integration for biochemical sensors. These devices measure single or multiple analytes over wide temperatures and concentrations, ranging from sub-ambient to high temperatures and from micromolar to several tens of percent, respectively. Biochemical sensors can be electrochemical, mixed potential, semiconducting, impedimetric, amperometric, capacitive, optical, acoustic, piezoelectric, or a combination of these and more. Sensors can be invasive or non-invasive types for improving safety, security, and health. Papers focusing on new materials, including metals, ceramics, and polymers; nanoscale heterojunctions; nanomaterials using nanoparticles; graphene; carbon nanotubes; signal processing; mechanisms, kinetics, modeling, and simulation; MEMS/CMOS platforms; sensors on-a-chip; and manufacturing and packaging of sensors are welcome.

Proposed session topics:

- Chemical and biochemical sensors
- Characterization of graphene, carbon nanotubes, and nanomaterials and their composites for sensing applications
- Sensor materials, methods, and mechanisms, including selectivity, sensitivity, and response time
- Emerging materials, technologies, and future challenges
- Sensors for safety, security, and health
- Sensors for environmental monitoring
- Sensors for in-line process diagnostics
- Sensors for extreme, corrosive, and harsh environments
- Sensors for marine, mines, and space applications
- Sensor reliability and reproducibility
- Wireless technologies for remote sensing, monitoring, and actions
- Sensor manufacturing, packaging, and integration
- Data acquisition and real-time process monitoring, evaluation, feedback, and control
- Theory, modeling, and simulation

Organizers:

– **Girish M. Kale**, University of Leeds, UK, g.m.kale@leeds.ac.uk

– **Mohamed Siaj**, Université du Québec à Montréal, Canada, siaj.mohamed@uqam.ca

– Sheikh Akbar, Ohio State University, USA

– Jong-Huen Lee, Korea University, Korea

– Sanjay Mathur, University of Cologne, Germany

YOUNG PROFESSIONALS FORUM

Next-generation materials for multifunctional applications and sustainable development, and concurrent societal challenges in the new millennium

Sustainability is an integral component of research in the 21st century. The key motivating factors are (a) rapid urbanization, population growth, and aging populations; (b) large amounts of waste yearly disposed to landfills; (c) global impoverishing of natural resources and environment (fossil fuels, minerals, water, and energy scarcity); (d) declining infrastructure; (e) emergency of carbon dioxide emissions; and (f) climate change, among others. For instance, development of new biomarkers for reliable early-stage detection of diseases, molecular imaging, targeting, and therapy are crucial for a healthy society, while development of more efficient energy conversion technologies, fuel cells, and batteries is an essential step facing increasing demand for energy supply. Consequently, recent global research trends cover the search for alternative and reusable energy, for fast and reliable medical diagnostic and therapeutic methods, and for new functional materials—as well as "greener," or more efficient, synthesis approaches—that exhibit unique properties that allow implementation in energy, health, and environment applications.

The focus of this symposium will rest on recent societal challenges in the new millennium, including—but not limited to—energy, health, and environmental aspects. In addition, novel material design paradigms are needed to fabricate materials with multifunctional applications that can bring solutions to some of today's biggest problems. This symposium aims to bring together young researchers and scientists from around the globe to discuss new approaches and challenges in materials synthesis and to provide a platform for intensive exchange of ideas, knowledge, and networking.

Proposed session topics:

- Multifunctional, porous, and catalytic materials
- Sensing materials, including gas, pollutant, and drugs sensors
- Energy: New solar cell materials, fuel cells, batteries, water splitters, and hydrogen generation techniques
- Environment: Sustainable materials, CO_2 capture and storage, and membranes and filters for air treatment
- Health: Diagnostics (imaging, sensing, and assays) and therapies (drug release, light-based photodynamic, and hyperthermic) to theranostics; semiconductor quantum dots, inorganic nanomaterials, carbon-based, and polymers; composites; from synthesis to application approaching assemblies; and biosensors and lab-on-a-chip
- Alternative synthesis approaches for advanced functional materials, including green chemistry, low-temperature, and sustainable use of resources and recycling (quantum dots, nanoparticles, thin films, and one-dimensional structures)
- Innovative manufacturing technologies, including green manufacturing and additive manufacturing
- Technology development and entrepreneurship, from laboratory to industrial scale
- Information and communication technologies, including RF devices, terahertz devices, and MEMS
- Computing, simulation, and theoretical approaches towards new functional materials

Proposed session topics:

- Global Networking — Challenges and Chances for Young Scientists, "Survival Skills for Scientists."* Accomplished scientists and thinkers are invited to influence the career development of young professionals.
- Young Professional Forum Speaking Contest
- Poster Award

(*) Federico Rosei, Survival Skills for Scientists, World Scientific Publishing; 1 edition (Dec 24 2004), ISBN-10: 1860946410.

Organizers:

– **Surojit Gupta**, University of North Dakota, USA, surojit.gupta@engr.und.edu

– **Eva Hemmer**, National Institute of Scientific Research – Center for Energy, Materials and Telecommunications, Canada, eva.hemmer@emt.inrs.ca

– Rafik Naccache, National Institute of Scientific Research – Center for Energy, Materials and Telecommunications, Canada

– Peter Wich, Johannes Gutenberg University Mainz, Germany

– Partha P. Mukherjee, Texas A&M University, USA

– Aiguo Zhou, Henan Polytechnic University, China

– Dongsheng Wen, University of Leeds, UK

– P. Ramasamy, Anna University, India

– Thomas Fischer, University of Cologne, Germany

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