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Abstracts due December 15, 2014

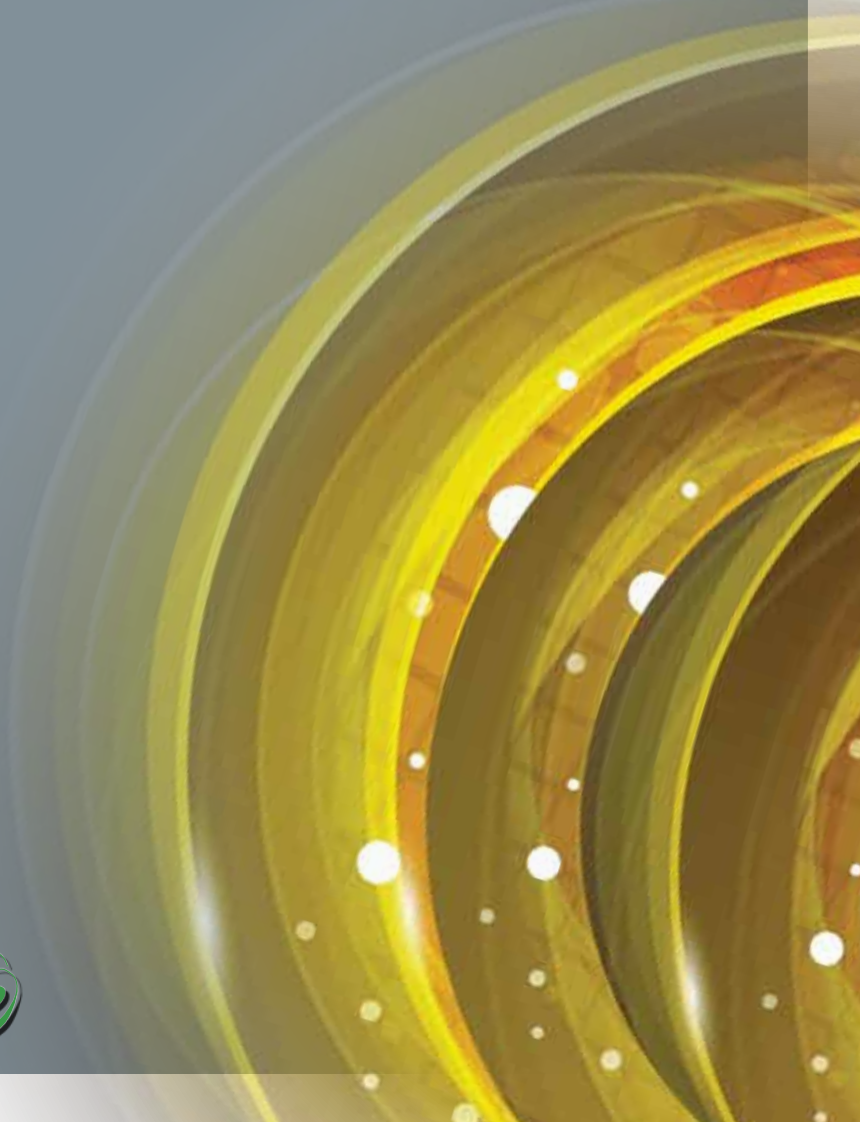
11th International Conference on Ceramic Materials and Components for Energy and Environmental Applications

Ceramic technologies for sustainable development

June 14-19, 2015

Hyatt Regency
Vancouver, BC
Canada

ceramics.org/11cmcee



The American Ceramic Society
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CMCee

11th International Conference on Ceramic Materials and Components for Energy and Environmental Applications

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Submit your abstract by December 15, 2014

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. Increasing demand for energy, healthcare, housing, transportation, and industrial products leads to a dramatic increase in the overall consumption of resources and rate of pollution, ultimately leading to climate change.

Energy efficient and environmentally-friendly technologies and systems are critically needed for further growth and sustainable development. Advanced materials and technologies play a crucial role in developing these systems. Among these, advanced ceramics are enabling materials for a number of demanding applications in aerospace, power generation, ground transportation, nuclear, and chemical industries.

The 11th International Conference on Ceramic Materials and Components for Energy and Environmental Applications continues a series that began in the 1980s. The conference was last held in Dresden, Germany in 2012. Over the years, CMCEE has established a strong reputation for state-of-the-art presentations and information exchange on the latest emerging ceramic technologies and their wide ranging applications. They have facilitated global dialogue and discussion with leading world experts to address energy and environmental challenges facing society today.

The conference opens with a plenary session entitled, "Technological Innovations and Sustainable Development." The technical program comprises 32 symposia covering wide-ranging topics. Also, it will stimulate important discussion directing where particular fields are heading on a global scale. Two honorary symposia are planned, along with many networking events.

We invite you to take advantage of this opportunity to visit the great city of Vancouver and participate in CMCEE11. This conference will provide an excellent forum for interaction and friendship with participants from various continents and discussion of the latest trends for applying ceramic technologies for sustainable development of society.

We look forward to your participation in CMCEE 11!

Mrityunjay Singh
Chair
Ohio Aerospace Institute, USA

Tatsuki Ohji
Co-chair
AIST, Japan

Alex Michaelis
Co-chair
Fraunhofer IKTS, Germany

"The goal is to identify key challenges and opportunities for various ceramic technologies in creating sustainable development."

Tentative Schedule

Sunday – June 14, 2015	
Registration	4 – 7 p.m.
Welcome Reception	5 – 7 p.m.
Monday – June 15, 2015	
Registration	8:30 a.m. – 5 p.m.
Plenary Session	8 a.m. – Noon
Lunch	Noon – 1:30 p.m.
Concurrent Sessions	1:30 – 5 p.m.
Tuesday – June 16, 2015	
Registration	8 a.m. – 7:30 p.m.
Concurrent Sessions	8:30 a.m. – 5 p.m.
Lunch on own	Noon – 1:30 p.m.
Poster Session and Reception	5 p.m. – 7:30 p.m.
Wednesday – June 17, 2015	
Registration	8 a.m. – Noon
Concurrent Sessions	8:30 a.m. – Noon
Thursday – June 18, 2015	
Registration	8 a.m. – 5 p.m.
Concurrent Sessions	8:30 a.m. – 5 p.m.
Conference Dinner	5 – 7:30 p.m.
Friday – June 19, 2015	
Registration	8 a.m. – Noon
Concurrent Sessions	8:30 a.m. – Noon

TRACK I: CERAMICS FOR ENERGY CONVERSION, STORAGE, AND DISTRIBUTION SYSTEMS

T1S1: High-temperature Fuel Cells and Electrolysis

High-temperature fuel cells (SOFC, MCFC) have evolved beyond lab testing and technology demonstration and are marketed for stationary power generation and combined heat and power (CHP) in the range between 100 W and 1 MW. However, basic research, materials development, and process engineering are still essential for achieving competitiveness with respect to lifetime and cost. The development of novel solutions on cell, component, and system levels is required to open additional markets for high-temperature fuel cells. Sophisticated design concepts and manufacturing technologies are essential for the up-scaling of plant sizes and production numbers.

New solid oxide electrolysis cells (SOEC) and reversible SOFC (R-SOFC) technologies have gained increased interest, motivated by the growing share of renewable energy sources in power distribution grids. While a number of proven SOFC solutions may be adopted for high-temperature electrolysis, particular material developments and system integration concepts are still necessary—challenging tasks for basic and applied sciences. Together with the use of biogenic fuels in SOFC, the development of SOEC and R-SOFC constitutes the role of ceramics-based energy converters in future renewable energy scenarios.

Proposed session topics:

- Materials development and microstructural engineering for enhanced performance and durability of electrolytes, cell components, and functional layers
- Lifetime-related phenomena on material, component, and system levels
- Modeling of electrochemical, thermal, mechanical, and coupled phenomena in high-temperature fuel cells
- Materials development and system engineering for high-temperature electrolysis and R-SOFC
- Materials development and process engineering for low-cost, series production of high-temperature fuel cells and SOEC
- Mass production processes and manufacturing technologies for fuel cell components, stacks, and systems, including energy efficiency savings, recovery, and recycling
- System design and optimization for performance, cost, and durability
- Fuel processing technologies and BoP components
- High-temperature fuel cell systems for residential, special markets, industrial, and large-scale applications

Organizers:

- **Thomas Pfeifer**, Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Germany, thomas.pfeifer@ikts.fraunhofer.de
- Alexander Michaelis, Fraunhofer IKTS, Germany
- Chan Siew Hwa, Nanyang Technological University, Singapore
- Prabhakar Singh, University of Connecticut, USA
- Mihails Kusnezoff, Fraunhofer IKTS, Germany
- Toshio Suzuki, AIST, Japan
- R. Muccillo, Energy and Nuclear Research Institute, Brazil
- Brian Borglum, Versa Power Systems / Fuel Cell Energy, Canada

Abstract Submission Instructions

Visit **ceramics.org/11cmcee**. Select "Submit Abstract" to be directed to the Abstract Central website. Please contact Marilyn Stoltz at **mstoltz@ceramics.org** or +1 614-794-5868 with questions.

T1S2: Ceramics-related Materials, Devices, and Processing for Heat-to-electricity Direct Conversion Aiming at Green and Sustainable Human Societies

This symposium will provide a forum to discuss ceramic materials and processing for thermoelectric, thermionic, and thermophotovoltaic materials and technologies in heat-to-electricity direct conversion. Materials and processing to optimize efficiency will be covered. Cost vs. performance aspects of heat-to-electricity direct conversion emphasizing electrical and thermal transport properties tailored to global environmental safety and sustainability will also be discussed.

Proposed session topics:

- High-performance materials for heat-to-electricity direct conversion
- New concepts and strategies for novel thermoelectric materials
- Ceramic and novel processing for thermoelectric materials and devices
- Advanced thermoelectric devices and modules and system-level applications
- Solid-state and defect chemistry on thermoelectric materials and candidates
- Theoretical studies of bulk materials and low-dimensional nanostructures
- New thermoelectric materials

Organizers:

- **Michitaka Ohtaki**, Kyushu University, Japan, ohtaki@kyudai.jp
- Ryoji Funahashi, AIST, Japan
- Qiang Li, Brookhaven National Laboratory, USA
- Yuzuru Miyazaki, Tohoku University, Japan
- Takao Mori, National Institute for Materials Science, Japan
- Tsunehiro Takeuchi, Toyota Technological Institute, Japan
- Terry M. Tritt, Clemson University, USA

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Ceramic technologies for sustainable development

T1S3: Photovoltaic Materials, Devices, and Systems

The significant increase in demand of world energy consumption, including clean and efficient energy resources, have prompted the imperative searches of new materials, devices, and technologies. The technologies aiming for the effective and efficient use of solar energy is one of the top priorities to guarantee sustainable growth and development of the present society. This symposium will focus on the advanced ceramics, glass, and related materials technologies, including semiconductor, charge transfer materials, and device/systems that could help to achieve that goal. A broad perspective is desired, including photovoltaic materials, solar cells, solar-energy conversion systems for better energy efficiency, and transparency conduction oxides/nonoxides/compounds films/electrodes. Fundamental materials properties and characterization of solar-energy conversion, state-of-the art of solar cell materials and architectures, structure-property correlations, and materials development and processing technologies for reliable, efficient solar-energy conversion, and practical application technologies are also highly desired.

Proposed session topics:

- Fundamental phenomena and properties in photovoltaic materials and solar cells
- Semiconductor photovoltaic materials and thin films solar cells
- Single crystal, polycrystalline and amorphous materials utilizing homo- and hetero-junctions
- Sensitized solar cell materials and systems
- Energy efficient materials and architectures
- Ceramic processing technologies for advanced solar-energy conversion
- Novel design and strategies for solar energy conversion systems
- Transparent conduction oxide films for solar cells
- Materials for solar-thermal device and applications
- Surfaces and interfaces in solar-energy conversion systems
- Energy and cost-efficient manufacturing technologies and industrial applications
- Computational sciences in photovoltaic materials and solar-energy conversion systems

Organizers:

- **Tohru Sekino**, The Institute of Scientific and Industrial Research, Osaka University, Japan, sekino@sanken.osaka-u.ac.jp
- Jin-Hyo Boo, Sungkyunkwan University, Korea
- Robert Chang, Northwestern University, USA
- Yoshikazu Suzuki, Tsukuba University, Japan

T1S4: Material Science and Technologies for Advanced Nuclear Fission and Fusion Energy

Advanced ceramics, ceramic composites, and glasses have long played a key role in the nuclear industry for applications ranging from fuel fabrication to irradiation and reprocessing to waste stabilization. Research and development of these materials is essential for future low-carbon nuclear fission and fusion energy systems that are tolerant against severe accidents and economically competitive. Recent advancements and achievements, such as development of novel high-temperature ceramics and capability of computational materials design and engineering to commercial deployment of ceramic matrix composites in various industrial sectors, assures that advanced materials will address the critical challenges imposed by the demanding operating environments in advanced nuclear systems. This symposium will provide a forum to present and discuss the latest developments on advanced ceramics, glasses, composites, and carbon materials for nuclear energy systems and their environmental impacts.

Proposed session topics:

- Innovative concepts of nuclear systems, fuels, components, and waste management enabled by ceramics, ceramic composites, and glasses
- Emerging and novel materials for nuclear energy
- Ceramic and glass sciences for waste immobilization
- Refractory ceramics and carbon materials for high-temperature reactors
- Ceramic technology for nuclear heat exchangers
- Joining and integration technologies for ceramic structures
- Ceramics for accident-tolerant fuels, reactor cores, and reaction control systems
- Qualification of ceramic components for nuclear reactors

Organizers:

- **Josef Matyas**, Pacific Northwest National Laboratory, USA, josef.matyas@pnnl.gov
- **Yutai Katoh**, Oak Ridge National Laboratory, USA, katohy@ornl.gov
- Kyle Brinkman, Clemson University, USA
- Raghunath Kanakala, University of Idaho, USA
- Ram Devanathan, Pacific Northwest National Laboratory, USA
- Jake Amoroso, Savannah River National Laboratory, USA

"CMCEE provides an optimum platform to stimulate international technology transfer from research to application with symposia balanced with contributions from academia and industry."
—Michaelis

T1S5: Functional Nanomaterials for Sustainable Energy Technologies

This symposium will focus on the functional and multifunctional inorganic materials and techniques that offer advanced processing, improved properties, and low-cost/low-temperature synthesis, with a strong focus on the recent innovation in nanotechnological approaches and the assessment of their industrial impact. Special emphasis will be given to novel synthesis approaches, functionalization, processing, and characterization of nanoparticles, nanowires, nanoscopic films, and their heterostructures. Application of nanostructures in catalysis, energy and sensing applications, nanocomposites in structural lightweight materials, nanostructured coatings for photovoltaic, biomedical, and optical applications will form the major scientific thrust. It will provide a forum for the technological advances and latest research on the state-of-the-art in innovative processing and device applications of new materials to meet the challenges of sustainable energy and environment technologies.

Proposed session topics:

- Processing of functional nanomaterials: Electrospinning, plasma-assisted chemical vapor deposition, atomic layer deposition and microwave-enhanced synthesis, sol-gel, and chemical solution techniques
- Synthesis, functionalization, and assembly of nanomaterials
- Fabrication of interface-driven functionalities and multimaterial heterostructures and nanocomposites
- Functional metal oxide nano- and heterostructures for energy harvesting
- Perovskite-based photovoltaic cells
- Nanostructured oxide and nanocomposites for excitonic solar cells
- Piezoelectric nanostructures for self-powered systems
- Nanodevices: Fabrication and large-scale integration
- Nanomaterials for renewable fuels, energy generation, energy storage devices, supercapacitors, photocatalysis, and solar hydrogen production
- Nanotechnology for chemical sensors

Organizers:

- **Sanjay Mathur**, University of Cologne, Germany, sanjay.mathur@uni-koeln.de
- Dunwei Wang, Boston College, USA
- Silke Christiansen, Max-Planck-Institut for the Science of Light, Germany
- Ausrine Bartasyte, Université Franche-Comté, France
- Xavier Obrados, ICAMB, Spain
- Anke Weidenkaff, University of Stuttgart, Germany
- Yoshitake Masuda, AIST, Japan
- Taejin Huang, KITECH, Korea

T1S6: Advanced Multifunctional Nanomaterials and Systems for Photovoltaic and Photonic Technologies

Due to the soaring global demand of environmentally-friendly energy, the development of new types of energy harvesting devices has been strongly driven. Recently, there has been interest in utilization of quantum dots, nanoparticles, nanowires or nanorods, nanonetworks, and metal nanoparticles for photovoltaic and photonic applications. This symposium will focus on new nanomaterials, such as graphene, pervoskite, and chalcopyrite and their applications for high-efficient and cost-effective photovoltaic and photonic devices. Innovative photonic concepts for renewable energy and energy harvesting, such as light harvesting and management and surface plasmonic effect will also be presented.

Proposed session topics:

- Synthesis, functionalization, processing, and self-assembly of nanomaterials
- Next generation solar cells with perovskite, chalcopyrite, and graphene-based materials
- Nanostructured materials and electrochemistry for dye-sensitized solar cells
- Materials and fabrication process for thin film solar cells
- Solution-process-based hybrid solar cells
- Nanostructured materials for high-efficiency Si solar cells
- Photonic technologies for light harvesting and management
- Energy-efficient printing technologies for photovoltaic and photonic devices

Organizers:

- **Yoon-Bong Hahn**, Chonbuk National University, Korea, ybhahn@chonbuk.ac.kr
- **Giovanni Fanchini**, University of Western Ontario, Canada, gfanchin@uwo.ca
- Ravi Silva, University of Surrey, UK
- S. Christiansen, MPI, Germany
- Yunhang Hu, Michigan Technological University, USA

T1S7: Advanced Batteries and Supercapacitors for Energy Storage Applications

Batteries and supercapacitors are important electrochemical energy storage devices. Batteries store electrical energy as chemical energy, while supercapacitors store energy at the electrode-electrolyte interface. Several battery and supercapacitor concepts represent a multibillion-dollar industry. State-of-the-art battery and supercapacitor systems are not able to meet the requirements for energy-efficient use in transportation, grid, and commercial technologies. Both storage technologies seek new materials design concepts to overcome limitations of performance and lifetime. Critical insights are required for novel ceramic material compositions and structures, including surface or interfacial reactions to design next-generation electrode materials for higher energy densities, higher power densities, and longer cycle life of batteries and supercapacitors.

Proposed session topics:

Fundamentals, modeling, mechanisms, materials design, screening, electrode architectures, diagnostics, materials characterization and electrode–electrolyte interface characterization of the following systems:

- Lithium-ion batteries
- Sodium-ion batteries
- Magnesium batteries
- Lithium-air batteries
- Lithium-sulfur batteries
- Redox flow batteries
- All-solid-state batteries
- High-temperature Batteries
- Supercapacitors
- Supercapbatteries

Organizers:

- **Palani Balaya**, National University of Singapore, Singapore, mpepb@nus.edu.sg
- Partha P. Mukherjee, Texas A&M University, USA
- Dany Carlier-Larregaray, ICMCB-CNRS, France
- Pengjian Zuo, Harbin Institute of Technology, China
- Robert Dominko, National Institute of Chemistry, Slovenia

"Ceramic materials and technologies play a key role in solving major energy and environmental challenges facing the global community."

—Singh

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T1S8: Materials for Solar Thermal Energy Conversion and Storage

Concentrated solar power (CSP) technology is expected to significantly contribute to the future sustainable, efficient, and diverse energy mix. Together with suitable thermal storage systems, CSP may provide base load power. Moreover, concentrated solar heat can be used for high-temperature process technology for the production of fuels or chemicals. However, for widespread use of CSP, it is estimated that cost to produce electricity should be about $0.06/kWh. This requires higher plant efficiencies, power cycles operating at higher temperatures, and thermal energy storage solutions for future CSP plants. In this regard, there are significant materials challenges to meet the demanding performance and cost requirements. This symposium solicits abstracts related to the diverse aspects of materials and components for CSP systems and their processing, integration, performance and reliability.

Proposed session topics:

- Collectors, mirrors, and coatings
- Receivers, absorber materials, and heat transfer media
- Materials for advanced power cycles
- Novel materials and systems for thermal energy storage
- Materials for thermochemical processes to produce fuels
- System integration technologies
- Environmental effects on material components
- Modeling of degradation mechanisms
- Reliability and lifetime predictions

Organizers:

- **Dileep Singh**, Argonne National Laboratory, USA, dsingh@anl.gov
- **Martin Schmuecker**, DLR, Germany, Martin.Schmuecker@dlr.de
- A. Oztekin, Lehigh University, USA
- R. Reddy, University of Alabama, USA
- J. Gomez, National Renewable Energy Laboratory, USA
- M. Roeb, DLR, Institute for Solar Research, Germany
- Chr. Sattler, DLR, Institute for Solar Research, Germany

T1S9: High-temperature Superconductors: Materials, Technologies, and Systems

Since the discovery of superconductivity in cuprates, pnictides, and related materials and the huge outburst of research activity that it generated, the key challenge remained understanding mechanisms of unconventional superconductivity, still under debate in spite of many relevant advances in research and materials development. Meanwhile many new superconductors have emerged, including ruthenates, cobaltates, borides, borocarbides, doped fullerenes and intercalated graphite, and organic and heavy-fermion superconductors, accompanied by in-depth characterization of physical properties a variety of experimental approaches and successful applications in wires, tapes, processing in electronics, and in novel nano-related technologies like nano-engineering. This symposium will highlight the progress achieved in various issues of fundamental and technological character of known superconducting materials. The focus will be on novel aspects, issues, and systems, as well as all superconducting-related topics, including fundamental aspects of theory, advances in synthesis, functionalization and processing, and the latest progress in devices at small and large scale ranges.

Proposed session topics:

- Materials, structure, physical chemistry, and general properties
- New superconductors of pnictides and related-families
- Properties of superconductors (any type)
- Theory and mechanisms (normal and superconducting states)
- Vortex lattice physics
- Synthesis and processing
- Power applications
- Low-power applications and superconducting electronics

Organizers:

- **Davor Pavuna**, EPFL, Switzerland, davor.pavuna@epfl.ch
- Andrea Damascelli, UBC, Canada
- John Wei, University of Toronto, Canada
- Christos Panagopoulos, NTU, Singapore

TRACK 2: CERAMICS FOR ENERGY CONSERVATION AND EFFICIENCY

T2S1: Advanced Ceramics and Composites for Gas Turbine Engines

Over the last decade, substantial progress has been made in the material development, manufacturing technologies, and applications of advanced ceramics and composites for gas turbine engines. Ceramic materials with superior mechanical and chemical properties, such as high hardness, high strength, good heat/corrosion resistance, and good tribological properties have been achieved via careful engineering design and tailoring of microstructure and interfacial properties. Thus, advanced ceramics and composites now exhibit potential uses as key hot section components in engines for ecofriendly transportation and electrical power systems with high fuel efficiency and minimum emissions. Long-term durability and structural reliability are critical issues for the secure and safe usage of these materials. This symposium will focus on the microstructural engineering, mechanical behavior, and component design of advanced ceramics and composites for gas turbine engines. Engineers and scientists are persevering in their efforts to understand the relationship between mechanical performance and material micro- and nanostructures for the purpose of establishing the reliability and durability of these materials, and this symposium is perfectly suited for this dialog.

Proposed session topics:

- Mechanical properties of ceramics and composites
- Processing-microstructure-mechanical properties relationships
- Fiber, matrices, and interfaces
- Thermal shock and corrosion resistance
- Machining of ceramics and composites
- Functionally-graded materials and systems
- Mechanics and characterization techniques
- Design, reliability, and life prediction methods
- NDE of ceramic components
- Simulated and field testing of components

Organizers:

- **Hua-Tay Lin**, Guangdong University of Technology, China, huataylin265@gmail.com; huataylin@comcast.net

- **Walter Krenkel**, University of Bayreuth, Germany, walter.krenkel@uni-bayreuth.de
- **Yutaka Kagawa**, University of Tokyo, Japan, kagawa@rcast.u-tokyo.ac.jp
- Kang Lee, Rolls-Royce, USA
- Wei Pan, Tsinghua University, China
- Hai-Doo Kim, Korea Institute of Materials Science, Korea
- Yujin Wang, Harbin Institute of Technology, China
- Ping Xia, University of Manchester, UK
- David Marshall, Teledyne Scientific Co., USA
- Laifei Cheng, Northwestern Polytechnical University, China

T2S2: Advanced Ceramic Coatings for Power Systems

This symposium will provide discussion on recent advances in coating sciences and technologies reflecting theoretical and manufacturing issues, microstructure and property characterization, harsh environment resistance, and lifetime prediction. Innovative coating deposition techniques and surface modification processes are particularly emphasized to realize surfaces with enhanced structural and environmental properties and/or novel multifunctionality, enabling them to meet requirements and future challenges for more efficient, reliable, economical, and clean applications that serve technological needs. Coating materials systems and their processing based on oxide and nonoxide ceramics; new carbons; metal-ceramic, organic-ceramic and nanocomposites; and hybrid and graded structures will be discussed. Advanced ceramic coatings and components for aerospace, automotive, and energy applications are of interest.

Proposed session topics:

- Thermal and environmental coatings
- Coatings to resist chemical, wear, erosion, corrosion, and tribological loadings
- Advanced coatings for extreme environments
- Functionally-graded coatings
- Smart and multifunctional thin films and coatings: self-cleaning, antimicrobial, antismog, catalytic, electrically–magnetically–optically stimuli-responsive
- Advances in coating processing methods
- Advanced characterization techniques, properties and nondestructive testing
- Interface phenomena, adhesion, and functional coating properties
- Substrate materials, substrate treatments, post-deposition treatment
- Modeling, simulation, and database development for lifetime prediction of coatings

Organizers:

- **Hagen Klemm**, Fraunhofer Institute Ceramic Technologies and Systems, IKTS Dresden, Germany, hagen.klemm@ikts.fraunhofer.de
- Dongming Zhu, NASA Glenn Research Center, USA
- Satoshi Kitaoka, Japan Fine Ceramic Center, Japan
- Takashi Goto, Tohoku University, Japan
- Douglas Wolfe, Pennsylvania State University, USA
- Soumendra Basu, Massachusetts Institute of Technology, USA
- Robert Vaßen, Forschungszentrum Jülich GmbH, Germany
- Uwe Schulz, DLR, Germany
- Peter Mechnich, DLR, Germany

"All ceramic scientists, engineers, researchers, and manufacturers around the world are invited to share knowledge and state-of-the-art advancements in related materials technology."

—Ohji

T2S3: Energy-efficient Advanced Bearings and Wear-resistant Materials

Controlling friction and wear of ceramic materials and components are key technologies for innovation in energy saving and environmental protection. For example, ceramic bearings are strongly desired for use in aerospace, automobile, wind turbine, and semiconductor production. High stiffness, high strength, high fracture toughness, lightweight, low thermal expansion coefficient, high thermal conductivity, and high corrosion resistance are needed in these ceramic bearings and wear resistant components. Furthermore, low cost processing to make large components and tribology at high temperatures in extreme conditions are also important in order to expand the application fields.

Proposed session topics:

- Ceramic materials for bearing and wear-resistant applications
- Thermal durability, lightweight, low expansion coefficient, high hardness, toughness and strength, toughness, and high corrosion resistance
- Microstructural control for high low friction coefficient and high wear resistance
- Green-wear materials for renewable energy technology
- Low-cost processing to make large components
- Tribology at high temperatures in extreme conditions
- Triboluminescence
- Standardization for wear-resistant materials
- Solid lubricant

Organizers:

- **Junichi Tatami**, Yokohama National University, Japan, tatami@ynu.ac.jp
- Pavol Sajgalik, Slovak Academy of Sciences, Slovakia
- Hasan Mandal, Sabanci University, Turkey
- Katsutoshi Komeya, Yokohama National University, Japan

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(604) 683-1234

Rates:

Single/Double:	CA$220
Triple:	CA$255
Quad:	CA$290
Student:	CA$165

Cut off date: May 15, 2015

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T2S4: Materials for Solid-State Lighting

Solid-state lighting is generated by light emitting diodes (LEDs) by solid-state electroluminescence. Electroluminescent devices are fabricated using either organic or inorganic electroluminescent materials. The active materials are generally semiconductors of bandwidth wide enough to allow the exit of light. While the LED generates monochromatic light, society requires white light. This problem can be solved either by combining several LEDs (e.g. red, blue and green) or by using phosphors. The second solution seems to be more efficient and technologically viable. A wide variety of phosphors is already patented and fabricated by several companies. Oxide, nonoxide, crystalline, and/or amorphous inorganic materials are studied and synthetized for this particular purpose. Computational modeling is also involved to make the selection of the proper materials and dopants more effective for the perspective phosphors. This symposium will cover all aspects of synthesis, simulation, and fabrication of phosphors suitable for the production of white light using LEDs.

Proposed session topics:

- Phosphors for better performance of white LEDs
- Amorphous phosphors (powders, thin films)
  - – Oxide-based phosphors
  - – Nonoxide-based phosphors
- Crystalline phosphors (powders, thin films)
  - – Oxide-based phosphors
  - – Nonoxide-based phosphors
- Thin film phosphor processing
- Thin layer architecture of white emitting phosphors
- Computer simulation of phosphor composition (excitation, emission wave length)
- Industrial applications of phosphors

Organizers:

- **Ralf Riedel**, Technical University of Darmstadt, Germany, riedel@materials.tu-darmstadt.de
- **Pavol Sajgalik**, SAS Bratislava, uachsajg@savba.sk
- R.J. Xie, NIMS, Japan
- K. Hirao, AIST, Japan

T2S5: Advanced Refractory Ceramic Materials and Technologies

Though refractory ceramic materials have often been considered a commodity, they are actual complex engineered ceramic materials. Refractory materials are used in energy-intensive manufacturing applications where they provide thermal insulation, as well as chemical and structural durability in extreme environments. As such, there is great opportunity to decrease the energy, environmental, and economic impact of global industry through improved selection, design, and implementation of these materials. This symposium will highlight advances in design and engineering of refractory materials and explore application of refractory materials in various industries to promote energy and environmental efficiency.

Proposed session topics:

- Raw material availability, selection, and use
- Refractory design
- Additive manufacturing and advance processing techniques
- Refractory characterization through testing and simulation
- Refractory materials and technologies for iron and steel, nonferrous metallurgy, glass manufacture, petrochemical applications, and cement and lime production

Organizers:

- **James Hemrick**, Oak Ridge National Laboratory, USA, hemrickjg@ornl.gov
- Christos G. Aneziris, TU Bergakademie Freiberg, Germany
- Valeriy V. Martynenko, Ukrainian Research Institute of Refractories, Ukraine
- Victor C. Pandolfelli, Universidade Federal de São Carlos, Brazil
- Josh Pelletier, Kerneos Aluminate Technologies, USA
- Jeffrey D. Smith, Missouri University of Science and Technology, USA
- Harald A. Walter, Refratechnik North America, USA

T2S6: Advanced Nitrides and Related Materials for Energy Applications

Increasing economic and ecological demands, as well as stricter governmental regulations require the development of novel multifunctional materials for applications in different fields of life and technology. In this context, advanced nitrides and related compounds play an important role because of their exceptional structural and functional properties applicable in extreme environments, microelectronics, and energy. For example, in Europe the Marie Curie ITN Program FUNEA (Functional Nitrides for Energy Applications) was established to discover and prepare new nitride-based compounds with novel physical and chemical properties. The symposium will present innovative methods to synthesize nitrides and related materials with advanced functionality and exceptional levels of performance, their characterization, and applications in the fields of energy and environment.

Proposed session topics:

- Energy efficient processing of nitride materials from powders (FAST, SPS, etc.)
- Precursor and sol-gel based processing of nitrides
- Processing of functional nitrides
- Analytical electron microscopic characterization of nitrides
- Catalytic conversion of exhaust or toxic gases
- Refinement of natural products (e.g. lignin) to chemicals for industry
- Formation of ultra-high temperature stable nitrides from metals
- Investigation of nanostructure-properties relationship
- High pressure synthesis of nitrides
- Porous nitride-based ceramics for hydrogen separation or storage
- Functional and protective coatings for high-temperature applications
- Nitrides for energy storage and energy conversion
- Industrial applications of nitrides

Organizers:

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- Yoshiyuki Sugahara, Waseda University, Japan
- Paolo Colombo, Università di Padova, Italy
- Rajendra K. Bordia, Clemson University, USA
- Hui Gu, Shanghai Institute of Ceramics, China

T2S7: Ceramics in Conventional Energy, Oil, and Gas Exploration

Ceramic-based materials are increasingly used for demanding applications in conventional energy, oil, and gas exploration, including reusing ceramic byproducts of the manufacturing process. Nanotechnology is increasingly used in these fields. Recent studies include developing wear-resistant materials and structural components, piezoelectric sensors, gas sensors, engineered ceramic proppants based materials, reusing fly ash (FA) and coal gangue for different applications, and developing multifunctional nanomaterials for different oil exploration. There are numerous challenges and opportunities in developing extremely reliable, heat-stable, and corrosion-resistant structural components, which this symposium will cover.

Proposed session topics:

- Wear resistant materials and structural components
- Proppants for shale gas and oil recovery
- Nanotechnology in coal and oil exploration
- Green cements or other applications by reutilizing FA and coal gangue
- Advanced manufacturing processes
- Sensor development
- Novel ceramic-based materials for insulation
- Emerging exploration applications

Organizers:

- **Surojit Gupta**, University of North Dakota, USA, surojit.gupta@engr.und.edu
- Dongsheng Wen, University of Leeds, UK
- Aiguo Zhou, Henan Polytechnic University, China

TRACK 3: CERAMICS FOR ENVIRONMENTAL SYSTEMS

T3S1: Photocatalysts for Energy and Environmental Applications

Researchers have made remarkable progress in the fields of photocatalysis for energy and environment, including solar fuels (CO_2 capture, water splitting, etc.), photocatalytic degradation of pollutants, disinfection, self cleaning, and photocatalytic organic synthesis. The research, development, demonstration, and commercialization have attracted global interest from academia, government research laboratories, and industry. Accordingly, this symposium will focus on the science of ceramic materials for energy and environmental technologies and facilitate information sharing on the current developments and industrial applications of photocatalysis. These techniques will be essential for generating renewable energy and eliminating environmental pollutants in future generations.

Proposed session topics:

- Photocatalysts for environmental purification (water, air, soil)
- Solar fuels
- Photocatalytic water splitting
- Photoinduced self-cleaning coatings
- Photocatalytic antimicrobial materials
- Photocatalytic membranes, photocatalytic reactors, and systems
- Photoelectrochemistry, photoelectrochemical cells, and devices
- Solar-thermal reactors and systems
- Photocatalytic mechanism, and processing
- Fundamental researches on photocatalysis
- Evaluation of photocatalytic materials
- Development of new photocatalytic materials
- Photocatalytic application

Organizers:

- **Wenzhong Wang**, Shanghai Institute of Ceramics, China, wzwang@mail.sic.ac.cn

T3S2: Advanced Functional Materials, Devices, and Systems for Environmental Conservation and Pollution Control

Ceramic materials are heat-resistant and chemically stable with a variety of functions. However, new materials are needed to develop ceramics safe for the next generation that consider environmental conservation and development. This symposium will cover a variety of topics for novel and environmentally-conscious ceramic materials.

Proposed session topics:

- Ion conducting ceramics
- Volatile organic compounds (VOCs) and CO abatement
- Low-temperature methane oxidation
- Diesel particulate filters
- Automotive ceramic sensors
- Semiconductor materials for *p-n* junction diode
- Porous materials
- Phosphors and optical ceramics for light emitting diodes (LEDs)
- 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
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- Youichi Shimizu, Kyushu Institute of Technology, Japan
- Teng-Ming Chen, National Chiao Tung University, Taiwan
- Kenji Toda, Niigata University, Japan
- Toshiyuki Masui, Osaka University, Japan

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11th International Conference on Ceramic Materials and Components for Energy and Environmental Applications

Ceramic technologies for sustainable development

T3S3: Geopolymers, Inorganic Polymer Ceramics and Sustainable Composites

Ceramic-like, inorganic polymers can be made under low-energy conditions, such as ambient temperatures and pressures. These materials include aluminosilicates or geopolymers, phosphates, and other chemically bonded inorganic compounds. Relatively pure geopolymers are made from metakaolin and aqueous alkali-silicate solutions, but industrial waste products such as type F fly ash or other natural materials can also be used as starting materials for less pure materials. Ceramic, metallic, polymeric or biological reinforcements, such as particulates, chopped fibers, unidirectional fibers, or planar weaves have been used to make structural ceramic composites. Higher technology functional ceramic composites can also be made. Such novel potential applications include hydrogen storage, water purification and biocidal activity, porous materials for CO_2 sequestration, thermal insulation, fire-resistant panels, and architectural panels as building materials.

Proposed session topics:

- Synthesis, processing microstructure
- Tailored porosity (micro-, meso-, nano-, macro-)
- Mechanical properties and thermal shock resistance
- Composites
- Waste encapsulation
- Conversion to ceramics
- Construction materials
- Coatings (fire-resistant, acid resistant)
- Sustainable materials and novel applications
- Other inorganic analogues

Organizers:

- **Waltraud M. Kriven**, University of Illinois at Urbana-Champaign, USA, kriven@illinois.edu
- Claus H. Rüscher, Leibniz University of Hannover, Germany
- Sylvie Rossignol, GEMH-ENSCI, France
- Hubert Rahier, Vrije Universiteit, Belgium
- John L. Provis, University of Sheffield, UK

T3S4: Porous and Cellular Ceramics for Filter and Membrane Applications

Porous and cellular ceramic materials and components with pore sizes ranging from several tens of microns down to sub-nanopores are essential in many environmental and energy related applications, often based on hierarchical pore structures, including catalyst supports, filters, adsorbers, sensors, and lightweight structural components. Porous ceramics can be obtained by partial sintering, pyrolysis of preceramic polymer, templating, blowing, and additive manufacturing. Various pore architectures can be based on foams, honeycombs, fibrous and bioinspired structures, and recently, engineered ones thanks to additive manufacturing. Recent interests include mass and gas separation, particulate filtration of hot gases and motor exhaust, water purification, energy conversion and storage, and sensors as well as catalysis and adsorption. For efficient separation, high fluxes and permeances combined with a high rejection and/or separation factor are required, as well as a high mechanical strength, thermal stability, and chemical robustness. Long-term stability of the material and the separation performance are needed. In addition, inexpensive and reproducible preparation techniques are required. The filter or membrane has to be completed with a housing before it will be implemented in a plant. Especially for high-temperature applications, the joining and sealing is challenging. This symposium will showcase recent research interests and activities, including ceramics, chemistry, mechanics, fluid dynamics, characterization, modeling, and simulation.

Proposed session topics:

- Novel processing technologies to create porosities in ceramic materials
- Destructive and nondestructive methods of characterization of pore size, porosity, and defects
- Additive manufacturing of porous ceramics
- Microstructural and morphological control of porous ceramics
- Modeling and simulation of transport of liquids and gases through porous ceramics
- Ceramic filters for hot gas and soot filtration
- Membranes for liquid filtration and gas separation (e.g. zeolites, carbon, CNT, graphene)
- Ceramic materials for adsorptive separation (e.g. zeolites)
- Joining and sealing for high-temperature application
- Large scale/complicated shape processing
- Innovative characterization tools for macroporosity
- Environmental interaction with porous ceramics
- Engineering applications of filter or membrane for environmental protection, energy applications, functional applications, emission control

Organizers:

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- **Manabu Fukushima**, AIST, Japan, manabu-fukushima@aist.go.jp
- **Hannes Richter**, Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Germany
- Paolo Colombo, Università di Padova, Italy
- Tobias Fey, Universität Erlangen-Nürnberg, Germany
- Young-Wook Kim, University of Seoul, Republic of Korea
- Alberto Ortona, University of Applied Sciences and Arts of Southern Switzerland, Switzerland
- Takashi Shirai, Nagoya Institute of Technology, Japan
- Sujanto Widjaja, Corning Incorporated, USA
- Yu-ping Zeng, Shanghai Institute of Ceramics, China

T3S5: Advanced Sensors for Energy, Environment and Health Applications

This symposium will be devoted to recent developments in materials, methods, and materials integration into appropriately designed devices for measurement of single or multiple analytes over a range of temperatures and concentrations, ranging from subambient to high temperatures and from micro-molar to several tens of percent, respectively. The sensor could be electrochemical, semiconducting, impedimetric, amperometric, capacitive, optical, acoustic, piezoelectric, or a combination of these and any others. The sensors could be invasive or noninvasive type for improving safety, security, and health. Papers focusing on signal processing, mechanisms, kinetics, modeling, simulation, new materials, including metals, ceramics and polymers, heterojunctions at the nanoscale, new paradigms in chemical sensing, nanomaterials using nanoparticles, graphene, CNTs, MEMS / CMOS platform, sensors on-a-chip, manufacturing, and packaging of sensors are welcome.

Proposed session topics:
- Chemical and biochemical sensors
- Sensor materials, methods, mechanisms
- Emerging materials, technologies, and future challenges
- Sensors for safety, security, and health
- Sensors for environmental monitoring and 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 Kale**, University of Leeds, UK, g.m.kale@leeds.ac.uk
- Sheikh Akbar, Ohio State University, USA
- Yasuhiro Shimizu, Nagasaki University, Japan
- Sanjay Mathur, University of Cologne, Germany
- Jong-Huen Lee, Korea University, Korea
- R. Vasant Kumar, University of Cambridge, UK
- J.A. Varela, FAPESP, Brazil

TRACK 4: CROSS-CUTTING MATERIALS TECHNOLOGIES

T4S1: Computational Design and Modeling

Recent progress in computational materials science has significantly enhanced the efficiency with which the understanding of fundamental phenomena, the improvement of materials performance, the discovery of new materials, and the design of structural and functional components can be achieved. This symposium will focus on the design and modeling of ceramics and composites to further optimize their behavior and facilitate the design of new ceramics and composites with tailored properties. A broader perspective is desired that includes interests related to the ceramic genome, design for new innovative ceramics and components, integrated computational engineering, prediction of the structure and properties of crystals and defects, modeling materials behavior under extreme/harsh environments, application of novel simulation methods for materials processing and performance, and simulation of ceramics for energy and environmental applications.

Proposed session topics:
- Ceramic genome
- Computational engineering of integrated materials
- Multiscale modeling approaches
- Modeling and design of ceramics for energy and environmental applications
- Modeling materials behavior under extreme/harsh environments (ultra-high temperature, radiation, environmental damages and severe load and stresses)
- Prediction of the crystal structure and properties of new ceramics
- Modeling defects and amorphous matter

Organizers:
- **Jingyang Wang**, Shenyang National Laboratory for Materials Science, Institute of Metal Research, Chinese Academy of Sciences, China, jywang@imr.ac.cn
- Wai-Yim Ching, University of Missouri-Kansas City, USA
- Kwang-Ryeol Lee, Korea Institute of Science and Technology, Korea
- Isao Tanaka, Kyoto University, Japan
- Hans J. Seifert, University of Karlsruhe, Germany
- Sean Smith, University of New South Wales, Australia
- Gerard L. Vignoles, University of Bordeaux, France
- William J. Weber, University of Tennessee, USA

T4S2: Additive Manufacturing Technologies

Additive manufacturing technologies are novel fabrication processes of ceramic components with functional structures. The processes allow for innovative complex part fabrication, client customization, rapid prototyping, and distributed manufacturing. 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. High-resolution laser beams are scanned on a spread ceramic powder bed with or without resin binders to form solid planes of two-dimensional cross sections. Through layer stacking, ceramic precursors or components with the three-dimensional models are fabricated rapidly and exactly. In other processes, paste materials with ceramic particles dispersed are fused from nozzles moving freely in three dimensions to create composite precursors. Various functional components of dielectric lattices to control electromagnetic waves, biomaterials components for medical applications, and ceramic electrodes with large surface area will be developed. Large-scale structural components for aerospace and other high-temperature applications can be fabricated with internal cooling path networks formed without casting molds. This symposium focuses on superiority of design, efficient processing, and perspicuous evaluations in the additive manufacturing processes.

Proposed session topics:
- Selective laser sintering (SLS)
- Stereolithography
- Direct writing technologies
- Fused deposition modeling (FDM)
- Laminated object manufacturing / green tape stacking
- Ink jet printing technologies
- Powder bed fusion process
- Emerging additive manufacturing technologies

Organizers:
- **Soshu Kirihara**, Osaka University, Japan, kirihara@jwri.osaka-u.ac.jp
- Roger Narayan, NC State University, USA
- Michael C. Halbig, NASA Glenn Research Center, USA
- Hiroya Abe, Osaka University, Japan
- Johannes Homa, Lithos GmbH, Austria
- Nahum Travizky, University of Erlangen-Nürnberg, Germany
- Martin Schwentenwein, Lithos GmbH, Austria

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Ceramic technologies for sustainable development

T4S3: Novel, Green, and Strategic Processing and Manufacturing Technologies

The properties and performance of materials largely depend on their processing and manufacturing routes. Recently developed new processing and manufacturing technologies of ceramic materials and systems give us unique properties, which cannot be achieved from the conventional routes. Two critical issues impact materials and products manufacturing. First, technologies are green or environmentally benign to avoid hazards to the population and to protect the environment by preserving energy during fabrication. Second, they are strategic because they use less rare natural resources for stable production. Keeping these aspects in view, this symposium will discuss advances in processing and manufacturing technologies for a wide variety of ceramic materials.

Proposed session topics:

- Green manufacturing, global environmental issues, and standards
- Alternative manufacturing processes with lower environmental burden
- Nanotechnology for environmental remediation and protection
- Energy-efficient processing
- Education and learning in sustainable materials processing
- Ecological binder and slurry technologies
- Strategic materials: Processing and manufacturing technologies
- Materials recycling for ceramic manufacturing
- Alternatives for rare metals and materials
- Room/low-temperature synthesis
- Aqueous synthesis and processing, colloidal processing
- Polymer-based processing
- Rapid prototyping, patterning, templates, and self-assembly
- Large scale/complicated shape processing
- Advanced composite manufacturing technologies, hybrid processes

Organizers:

- **Tatsuki Ohji**, AIST, Japan, t-ohji@aist.go.jp
- Surojit Gupta, University of North Dakota, USA
- Mathias Herrmann, Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Germany
- Eugene Medvedovski, Endurance Technologies Inc., Canada
- Richard D. Sisson, Jr., Worcester Polytechnic Institute, USA
- Michael Stelter, Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Germany
- Tohru S. Suzuki, NIMS, Japan
- Junichi Tatami, Yokohama National University
- Yiquan Wu, Alfred University, USA
- Guo-Jun Zhang, Shanghai Insititute of Ceramics, Chinese Academy of Science, China

T4S4: Powder Processing Technology for Advanced Ceramics

Powder processing technology is key to the design, development, and production of advanced ceramic materials and components for energy and environmental applications. Processes, including ceramic powder design and synthesis, milling, mixing and dispersion, granulation, green body forming, and sintering must be fully understood and controlled to produce optimized microstructure and property of advanced ceramics for energy and environmental applications. This symposium will focus on the current state of and recent advances in advanced powder processing and manufacturing technologies.

Proposed session topics:

- Nanoparticle and powder design and synthesis
- Composite particle fabrication and particle coating technology
- Particle dispersion control in a liquid or polymers
- Novel forming and sintering technology
- Nano/microstructure control by powder processing
- Composite or porous structure control by powder processing
- Low cost and energy-saving processing of advanced ceramics

Organizers:

- **Makio Naito**, Joining and Welding Research Institute, Osaka University, Japan, m-naito@jwri.osaka-u.ac.jp
- **Junichi Tatami**, Yokohama National University, Japan, tatami@ynu.ac.jp
- Kevin Ewsuk, Sandia National Laboratories, USA
- Yuji Hotta, AIST, Japan
- C. C. Huang, Hosokawa Micron Powder Systems, USA
- Norifumi Isu, LIXIL Corp., Japan
- Esko I. Kauppinen, Aalto Univeristy, Finland
- Ungyu Paik, Hanyang University, Korea
- Tetsuo Uchikoshi, NIMS, Japan

T4S5: Advanced Materials, Technologies, and Devices for Electro-optical and Biomedical Applications

The session will cover recent research and development activities in advanced materials, technologies, and devices from basic research and material characterization, through physicochemical aspects of growth and deposition techniques, to the technological development of industrialized materials. The broad scope of the symposium assures a wide overview of the state-of-the-art issues on crystalline materials, aiming to stimulate interdisciplinary discussions and collaborations in a wide range of fields.

Proposed session topics:

- Semiconductors for LED/LD, power devices, sensors
- Optical materials for lasers, nonlinear optics, optical isolators, phosphors
- Scintillators for X-, gamma- and neutron detection
- Piezo-, ferro- and magnetoelectric materials
- Nanomaterials and biomaterials
- Growth mechanisms, defect chemistry, crystalline quality

Organizers:

- **Kiyoshi Shimamura**, NIMS, Japan, SHIMAMURA.Kiyoshi@nims.go.jp
- Noboru Ichinose, Waseda University, Japan
- Matthias Bickermann, The Leibniz Institute for Crystal Growth (IKZ), Germany
- Xutang Tao, Shandong University, China
- Alain Largeteau, Institute for Solid State Chemistry Bordeaux, France
- Gen Sazaki, Hokkaido University, Japan

T4S6: Multifunctional Coatings for Energy and Environmental Applications

This symposium invites scientists, engineers, and practitioners from around the world to discuss the latest advances in coating technologies, which can give totally new or markedly improved functions onto materials' surface in terms of physical, mechanical, thermal, chemical, optical, electrical, electronic, and/or magnetic properties. These functional coatings include thin film technologies, such as PVD, CVD, and sol-gel methods, and thick film technologies, such as thermal spray, cold spray, and aerosol deposition. The goal is to identify current key issues, effective approaches, and future outlook for functional coating technologies and applications through comprehensive discussion.

Proposed session topics:

- Innovative coating technologies for various industrial products (e.g. automobiles, electronic devices, mechanical parts, etc.)
- PVD, CVD, sol-gel technologies, etc.
- Thermal spray, cold spray, aerosol deposition, etc.
- Coatings for new functional applications
- Functionally-graded coatings and materials
- Nanostructured and multifunctional coating
- Interface phenomena, adhesion, and other fundamentals of coatings
- Technical issues and potential solutions of surface related properties and processes in industries
- Characterization of microstructure and properties of coatings
- Next generation production methods for surface engineering

Organizers:

- **Jun Akedo**, AIST, Japan, akedo-j@aist.go.jp
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- Soshu Kirihara, University of Osaka, Japan
- Balu Balachandran, Argonne National Laboratory, USA
- Armelle Vardelle, University of Limoges, France
- Ralf Moos, University of Bayreuth, Germany
- Valentin Craciun, National Institute for Laser, Plasma, and Radiation Physics, Romania
- Kyoung Il Moon, Korea Institute of Industrial Technology, Korea
- Hyungsun Kim, Inha University, Korea
- Minoru Osada, NIMS, Japan

T4S7: Materials for Extreme Environments: Ultra-high Temperature Ceramics (UHTCs) and Nanolaminated Ternary Carbides and Nitrides (MAX Phases)

Ultra-high temperature ceramics (UHTCs) and nanolaminated ternary carbides and nitrides (MAX phases) are potential materials for use in extreme environments, such as scramjet engine components, leading edges and thermal protection systems for hypersonic vehicles, and cladding materials in generation IV nuclear reactors. However, thermal/chemical stability in extreme environments, ability to form into complex shapes/sharp edges, 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 understanding structure-property relations and improving performances are needed, which require developing new approaches for improved thermal shock resistance, thermochemical stability, damage tolerance and machinability, and discovering new materials to ensure an enormous leap forward in performances. This symposium will focus on design, processing, structure-property relationships, thermal and mechanical properties, oxidation resistance, machining and joining, and stability of UHTCs, and MAX phases both from fundamental and application-oriented perspectives.

Proposed session topics:

- New precursors for powders, coatings, and matrix or fibers of composites
- Structure-property relationships of existing systems
- Materials design, new composition, and composites
- Novel processing methods (bulk, coatings, and thin films)
- Novel characterization methods and lifetime assessment
- Methods for improving damage tolerance, oxidation, and thermal shock resistance
- New methods for joining and machining of components
- Structural stability under extreme environments (irradiation, ultra-high temperature)

Organizers:

- **Yanchun Zhou**, Aerospace Research Institute of Materials & Processing Technology, China, yczhou714@gmail.com
- Jon Binner, University of Birmingham, UK
- Erica L. Corral, University of Arizona, USA
- Sea-Hoon Lee, Korea Institute of Materials Science, Korea
- Per Eklund, Linköping University, Sweden
- William G. Fahrenholtz, Missouri University of Science and Technology, USA
- Greg Hilmas, Missouri University of Science and Technology, USA
- Frederic Monteverde, Institute of Science and Technology of Ceramics-CNR, Italy
- Miladin Radovic, Texas A&M University, USA
- Jochen Schneider, Materials Chemistry, RWTH Aachen, Germany
- Luc J. Vandeperre, Imperial College London, UK
- Guo-Jun Zhang, Shanghai Institute of Ceramics, Chinese Academy of Sciences, China

T4S8: Ceramic Integration Technologies for Energy and Environmental Applications

Despite having excellent properties, ceramics and ceramic matrix composites (CMCs) are still much less used than metals and polymers for energy and environmental applications, such as energy production systems (fuel cells, thermoelectrics, photovoltaics, nuclear systems, wind, and geothermal), energy storage and distribution (batteries, phase changing materials), energy conservation and efficiency (gas turbines, heat exchangers), and environmental systems (advanced sensors, filters, and membranes). It is impossible to weld or rivet ceramics and CMCs together or to other materials. However, ceramics and CMCs integration to metals and to other materials is increasingly considered an enabling technology to obtain more efficient components, devices, and structures for energy production and environment. Together with the development of reliable joining materials and technologies, the availability of widely accepted testing methods for joined ceramics and CMCs can also widen their use.

Proposed session topics:

- Joining of ceramics and CMCs
- Joining of ceramics and CMCs to metals
- Mechanical tests of joined ceramics and CMCs
- Joining at the nano- and microscales
- Design and modeling of joints and interfaces
- Joining applications and enabled components, and their evaluation in relevant operating conditions

Organizers:

- **Milena Salvo**, Politecnico di Torino, Italy, milena.salvo@polito.it
- Monica Ferraris, Politecnico di Torino, Italy
- Michael C. Halbig, NASA Glenn Research Center, USA
- Michael J Reece, Queen Mary, University of London, UK
- Jacques Lamon, CNRS LMT ENS Cachan, France
- Tatsuya Hinoki, Kyoto University, Japan

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T4S9: Environmentally-friendly and Energy-efficient Manufacturing Routes for Production Root Technology

Production Root Technology symbolically refers to an integration of six production technologies: casting, molding, forming, welding, heat treatment, and surface treatment. Production Root Technology includes both materials development and process technologies, which strongly influence the final product's quality below sea level. Recently, significant issues arose in Production Root Technology on green growth through the development of environmentally friendly and energy efficient manufacturing processes. Also, industry strongly demands recycling and resource management of various materials, including critical and rare materials. This symposium serves as a forum for scientists and engineers to exchange ideas and to build collaborations in the Production Root Technology sector.

Proposed session topics:

- Environmentally-friendly and less emission process
- Energy control issues and energy efficient process
- Recycling and resource management
- Smart usage of ceramics, composites and other materials
- Rapid and innovative processing routes
- Advanced and hybrid process for novel materials

Organizers:

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- L. K. Sharma, CSIR-Central Glass & Ceramic Research Institute, India
- Martin Fehlbier, Institut für Produktionstechnik und Logistik, Germany
- Horst Wolff, IfG - Institute for Foundry Technology, Germany
- Taek Soo Kim, Korea Institute for Rare Metals, Korea
- Dechang Jia, Harbin Institute of Technology, China
- Tadachika Nakayama, Nagaoka University of Technology, Japan

T4S10: Bioinspired and Hybrid Materials

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

Proposed session topics:

- Processing and forming for the hybrid materials
- Organic/inorganic hybrid materials
- Simulations, characterization, and applications of hybrid materials
- Nanoparticles, nanosheet, nanofiber, and nanotube materials
- Multifunctional material, complex functional materials, and multidiciprinaly
- Advanced manufacturing technologies, patterning, and self-assembly
- New concepts for the multi-disciplinary R&D and applications

Organizers:

- **Tadachika Nakayama**, Nagaoka University of Technology, Japan nky15@nagaokaut.ac.jp
- **Roger Narayan**, NC State University, USA, roger_narayan@msn.com
- Seiichi Takami, Tohoku University, Japan
- Yong-Ho Choa, Hanyang University, Korea
- Simon Hall, University of Bristol, UK
- Koji Kuraoka, Kobe University, Japan
- Ping Xu, Harbin Institute of Technology, Harbin, China
- Shaifulazuar Bin Rozali, University of Malaya, Malaysia

T4S11: Materials Diagnostics and Structural Health Monitoring of Ceramic Components and Systems

Advanced ceramics, composite materials, and ceramic structures are utilized in critical components for modern systems, such as batteries, fuel cells, sensors, high temperature electronics, and membranes, as well as for traditional applications, such as seals, valves, implants, and high temperature components. Ceramic components, while being subjected to increasingly extreme conditions, are being pushed to their performance limits. Dependable performance of these ceramic components is often the crucial basis for the reliability of the entire system. With the development of new processing and fabrication techniques, unique properties, which cannot be achieved via conventional routes, can now be attained. These novel processes and materials require new methods for process control, materials diagnostics, and structural health monitoring in order to assure functional reliability. On the other hand, structural health monitoring is often based on sensors containing ceramic materials. Monitoring of components for energy and environmental applications is receiving increased interest, because of the long life requirements for systems, such as wind power engines, solar energy systems, and energy storage devices. In this way sustainable, integrated, energy efficient, or harvesting sensors are required. This symposium will discuss global advances in the research and development of sophisticated and novel characterization technologies for structural ceramics, particulate- and fiber-reinforced ceramics composites, and multifunctional materials, as well as their components and devices. Current advances and state-of-the-art in various material diagnostics techniques, such as optical, X-ray, ultrasound- and acoustic-based, nanoparticle-based, and ultra-high resolution technologies will be covered. Future developments of structural health monitoring of components of systems for energy and environmental applications will also be covered.

Proposed session topics:

- Novel ceramic characterization technologies
- Materials diagnostics for ceramics
- Structural health monitoring
- Fatigue evaluation
- Emerging optical characterization technologies
- Characterization by high resolution X-ray techniques
- Ultrasound and acoustic characterization
- Nanoparticle-based monitoring
- Ultra-high resolution technologies

- Nondestructive evaluation of ceramic components
- Modeling and simulation

Organizers:

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- Qiwen Zhan, University of Dayton, USA
- P. Terry Murray, University of Dayton, USA
- Mathias Herrmann, Fraunhofer Institute for Ceramic Technologies and Systems, Germany
- Klaus-Juergen Wolter, Electronics Packaging Lab (IAVT), TU Dresden, Germany
- Bernd Koehler, Fraunhofer Institute for Ceramic Technologies and Systems, Germany
- Peter Czurratis, PVA TePla Analytical Systems GmbH, Germany
- Juergen Schreiber, Nuga Lab, Germany
- Viktoryia Lapina, Academy of Science, Belarus
- Cerasela Zoica Dinu, West Virginia University, USA
- Ben Dutton, MTC Limited, UK

HONORARY SYMPOSIA

Symposium H1: Innovative Processing and Microstructural Design of Advanced Ceramics—*A Symposium in Honor of Professor Dongliang Jiang*

The properties and performance of advanced ceramics closely depend on their processing routes and resulting microstructures. Recently many innovative processing and manufacturing technologies of ceramic materials have been developed, which provide the materials with unique microstructure and properties that cannot be achieved by conventional routes. This symposium will discuss the advances in processing and manufacturing technologies for a wide variety of ceramics. This symposium is being held in honor of Professor Dongliang Jiang, an academician of the Chinese Academy of Engineering, for his life-long contributions and achievements in the field. Professor Jiang has conducted unique and innovative work in the field of carbide ceramics and their composites, transparent ceramics, and bioceramics that includes materials forming, sintering and densification, microstructure, toughening mechanisms, and mechanical performance assessment. He also has developed the forming and densification techniques for large-sized carbide parts of complex shapes, and devoted to engineering applications of these materials.

Proposed session topics:

- Novel forming/sintering technologies
- Advanced ceramics manufacturing process
- Aqueous synthesis and processing, colloidal processing
- Polymer-based processing
- Large scale and complicated shape processing
- Processing-microstructure-mechanical properties correlation
- Processing and applications of transparent ceramics

Tentative Organizers:

- **Shaoming Dong**, Shanghai Institute of Ceramics, China, smdong@mail.sic.ac.cn
- **Yanchun Zhou**, Aerospace Research Institute of Material & Processing Technology, China, yczhou@imr.ac.cn
- **Hua-Tay Lin**, Guangdong University of Technology, huataylin@comcast.net
- Makio Naito, Osaka University, Japan
- Suk-Joong Kang, Korea Advanced Institute of Science and Technology, Korea
- Hai-Doo Kim, Korea Institute of Materials Science, Korea
- Shiwei Wang, Shanghai Institute of Ceramics, China
- Yi-Bing Cheng, Monash University, Australia

Symposium H2: Materials Processing Science with Lasers as Energy Sources—*A Symposium in Honor of Professor Juergen Heinrich*

Industrial production processes are inconceivable without lasers. Lasers are used in numerous areas of materials processing, such as cutting, drilling, and welding. Advantages of laser technologies include their cost-effectiveness, the reproducible adjustability of process parameters, and the excellent quality of processed products. Laser systems are suitable for providing controllable energies in a defined volume with a minimum heat transfer to surrounding components. Furthermore, the transfer of process heat via lasers does not impose the risk of contamination or unwanted chemical reactions with gaseous media from, for example, a combustion process. These unique properties are continuously stimulating new applications for lasers as energy sources in thermal processing. Consequently, novel processing routes in additive manufacturing (stereolithography, selective laser sintering), coating technologies (pulsed laser deposition, matrix assisted pulsed laser evaporation), and nanoparticle synthesis (laser ablation, laser vaporisation) are on their way from research to industry. Getting acquainted with these approaches, their relative merits and limits, has the potential to trigger new developments in the field of laser assisted materials processing. This symposium will bring together experts from materials science and from the laser community with common interests in laser assisted materials processing.

Proposed session topics:

- Lasers vaporization
- Laser sintering of ceramics
- Cutting, drilling, and joining
- Laser fusing

Organizers:

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- Frank A. Müller, Friedrich-Schiller-University of Jena, Germany
- Francis Cambier, INISMa-CRIBC (EMRA), Belgium
- Carina Oelgardt, H.C. Starck GmbH, Goslar
- Christof Siebert, TRUMPF Laser- und Systemtechnik GmbH, Germany