Symposium 1:
Crystalline and Amorphous Transparent Optical Materials and Photonic Technologies

Transparent crystalline and amorphous optical materials have a wide range of applications in the fields of optoelectronics, optics, photonics, defense protection, bioengineering, and sustainable energy. The symposium is aimed at providing a forum for researchers, students, and entrepreneurs to present and discuss their recent scientific results on a wide variety of topics related to science and engineering issues associated with transparent crystalline and amorphous materials and photonic technologies. An emphasis will also be placed on the fundamental issues to advance our understanding and utilizations of advanced transparent materials and related-devices applied to environment, healthcare, and energy.

<PROPOSED SESSION TOPICS>

- Functionality of transparent crystalline and amorphous materials
- Fundamental sciences of optical transparent materials
- Photonic and optical transparent materials
- Novel transparent materials design and mechanical properties
- Advanced processing of transparent materials and devices
- Transparent materials for scintillators and spectroscopy
- Optoelectronic transparent materials
- Crystalline and amorphous transparent laser materials
- Optical materials for bioengineering and sustainable energy
- Persistent phosphor materials and their applications
- Crystal/ceramic fiber for solid state laser application
- Mid-infrared application of optical materials
- Modeling and theory computation of optical materials

<ORGANIZERS>

Yiquan WU, Alfred University, USA
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Akio IKESUE, World-lab Corp, Japan
Do Kyung KIM, Korea Advanced Institute of Science and Technology, Korea
Ying SHI, Shanghai University, China
Takunori TAIRA, Institute for Molecular Science, Japan
Jian ZHANG, Shanghai Institute of Ceramics, China
Dariusz HRENIAK, Polish Academy of Sciences in Wroclaw, Poland
Yiquan WU, Alfred University, USA

Symposium 2:
Solid Oxide Fuel Cells and Hydrogen Technologies

Worldwide interest in solid oxide fuel cells (SOFCs), as a promising future electricity-generation technology, has remarkably increased in recent years due to their high electrical efficiency and multi-fuel capability (hydrogen, carbon monoxide, methane, etc.). Recent developments in engineered electrode architectures, component materials chemistry, cell and stack designs, and fabrication processes have led to significant improvements in the electrical performance and performance stability as well as reduction in the operating temperature of such cells. Although their development still faces various problems with high-temperature materials, design of cost-effective materials and manufacturing processes, SOFCs are expected to enter the commercial markets in the near future.
Hydrogen economy as an emerging energy alternative relies on development of novel materials to realize the promise and expectation for a cleaner environment. Material needs and technologies in the areas of hydrogen production, storage, delivery and safety will be addressed in conjunction with hydrogen-based alternative energy sources. Papers are solicited on all aspects of SOFCs and hydrogen energy.

<PROPOSED SESSION TOPICS>

•Oxygen ion, proton and mixed conductors; conduction mechanisms, materials limitations
•Electrode materials and microstructural engineering; ceramic and metallic interconnects; degradation mechanisms
•Sealing materials, compatibility and designs
•Reliability and degradation, stability of cells and stacks
•Electrochemical performance, modeling, cell and stack designs
•Utilization of various fuels with or without reformation
•Materials and technologies for hydrogen production, storage, transportation and safety
•Prototype SOFC systems, commercialization plans, field test experience and cost

<ORGANIZERS>

Fatih Dogan, Missouri University of Science and Technology, USA
Masanobu Awano, National Institute of Advanced Industrial Science and Technology, Japan
Yasunobu Mizutani, Toho Gas Co., Ltd., Japan
Nguyen Minh, University of California, San Diego, USA
Guntae Kim, Ulsan National Institute of Science and Technology, Korea"

Symposium 3:
Advanced Structural Ceramics for Extreme Environments

Advanced structural ceramics are enabling materials for applications that involve extreme environments such as those associated with nuclear power generation, turbine engines, hypersonic flight, high speed machining, and other demanding applications. The radiation levels, temperatures, heat fluxes, wear/abrasion, and other environments encountered in these applications exceed the capabilities of existing materials. Hence, new advances in the understanding of structure-property relationships and improving the performance by designing new composition/ composites are needed. Some of the critical challenges to be met include thermal/chemical stability, complex shape forming, thermal shock resistance, radiation tolerance, and damage tolerance. This symposium will focus on design of new materials, processing, structure-property relationships, thermal and mechanical properties, oxidation resistance, machining and joining, and stability of advanced structural ceramics both from fundamental and application-oriented perspectives.

<PROPOSED SESSION TOPICS>

•Oxide, carbide, boride, and nitride based ceramics and composites
•MAX phases, MAB phases, MXenes, MBenes, and related compounds
•New precursors for powders, coatings, and matrix or fibers of composites
•Structure-property relationships at room and elevated temperatures
•Materials design, new compositions, and composites
•Novel processing methods (bulk, coatings and thin films)
•Novel characterization methods and lifetime assessment
•Methods for improving damage tolerance and resistance to oxidation, radiation, thermal shock, etc.
•New methods for joining and machining
•Structural stability in extreme environments (irradiation, ultrahigh temperature)

<ORGANIZERS>

Yan-Chun Zhou (Aerospace Research Institute of Material & Processing Technology, China)
William G. Fahrenholtz (Missouri University of Science and Technology, USA)
Sea-Hoon Lee (Korea Instituteof MaterialsScience, Korea)
Jon Binner (University of Birmingham, UK)
Thierry Cabioc'h (Université de Poitiers, France)
Per Eklund (Linköping University, Sweden)
Greg Hilmas (Missouri University of Science and Technology, USA)
Young-Wook Kim (University of Seoul, Korea)
Dietmar Koch (German Aerospace Center, Germany)
Zoltan Lences (Institute of Inorganic Chemistry, Slovak Academy of Sciences, Slovakia)
Yoshio Sakka (National Institute for Materials Science, Japan)
Diletta Sciti (Institute of Science and Technology of Ceramics-CNR, Italy)
Luc J Vandeperre (Imperial College London, UK)
You Zhou (AIST, Japan)

Symposium 4:
Symposium on Multiferroic Materials

Multiferroic materials especially magnetoelectric materials have been receiving the increasing scientific interests because of rich physics and great potential applications in spintronic technologies, and they are just on the cutting edge of materials sciences. Recently, great progresses have been achieved both in composite and single phase multiferroic materials. This symposium provides a forum for the worldwide multiferroic community from both fields of materials sciences and condensed matter physics to discuss hot topics such as multiferroic theory, materials development, design, structure and property control, characterization, and possible applications.

<PROPOSED SESSION TOPICS>

•Fundamental issues and frontiers of multiferroics
•Multiferroic thin films
•Multiferroic and superlattices
•Type-I multiferroics and $BiFeO_3$-based ceramics
•Type-II multiferroics
•Single phase R-T multiferroic new systems
•Calculation and theoretical prediction on multiferroics
•Characterizations and applications of multiferroic materials

<ORGANIZERS>

Xiang Ming Chen, Zhejiang University, China
Laurent Bellaiche, University of Arkansas, USA
Sang Wook Cheong, Rutgers University, USA
Tsuyoshi Kimura, The University of Tokyo, Japan
Jun-Ming Liu, Nanjing University, China
Ramamoorthy Ramesh, University of California, Berkeley, USA

Symposium 5:
Polymer Derived Ceramics (PDCs) and Composites

The conversion of polymers directly into ceramics offers unusual scientific and technological opportunities. The polymers can be shaped in the organic state before being transformed into ceramics, and their properties and nanostructure can be manipulated at the molecular level. Their properties can be controlled based on the chemistry and molecular architecture of the precursors and the high temperature processing adopted. Unusual porous structures can also be produced from them. Their potential applications range from energy and environment, to medicine, sensors, aerospace and defense.
The objective of this Symposium is to address recent developments in PDCs that include processing and innovative shaping approaches (e.g. Additive Manufacturing), characterization of their structure at different length scales, new chemistries, and their structural and functional properties. These attributes arise from the direct relationship between the various scientific and technological aspects, starting with chemical design of the organic molecules, to the processes for fabricating net shape engineering components.
Presentations that emphasize applications of PDCs in fields of energy, life sciences, defense, aerospace, and security are welcomed. Participation of young researchers is especially encouraged.
The objective of this Symposium is to address recent developments in PDCs that include processing and innovative shaping approaches (e.g. Additive Manufacturing), characterization of their structure at different length scales, new chemistries, and their structural and functional properties. These attributes arise from the direct relationship between the various scientific and technological aspects, starting with chemical design of the organic molecules, to the processes for fabricating net shape engineering components.
Presentations that emphasize applications of PDCs in fields of energy, life sciences, defense, aerospace, and security are welcomed. Participation of young researchers is especially encouraged.

<PROPOSED SESSION TOPICS>

•Synthesis of advanced preceramic polymers
•Nanostructure, modeling and thermodynamics of polymer-derived-ceramics
•Structural and functional properties
•Advanced and innovative polymer-to-ceramic conversion methods
•Advanced and innovative fabrication processes, including Additive Manufacturing
•Polymer-derived ceramic matrix composites and in situ formation of nano-composites
•Polymer-derived ceramics for energy applications
•Application of PDCs in various engineering fields

<ORGANIZERS>

Paolo Colombo, University of Padova, Italy
Ralf Riedel, Technical University Darmstadt, Germany
Yuji Iwamoto, Nagoya Institute of Technology, Japan
Samuel Bernard, IRCER - University of Limoges, France
Raj Bordia, Clemson University, SC, USA
Dong-Pyo Kim, Pohang University of Science and Technology, Korea
Peter Kroll, The University of Texas Arlington, TX, USA
Philippe Miele, University of Montpellier 2, France
Gurpreet Singh, Kansas State University, USA
Gian Domenico Sorarù, University of Trento, Italy
Yiguang Wang, Beijing Institute of Technology, China
Yingde Wang, National University of Defence Technology, Changsha, Hunan, China

Symposium 6:
Environmental Functional Materials

Environmental problems such as global warming and air and water pollution become serious year by year, and effective new countermeasure technologies are demanded. Various environmental ceramic materials can contribute to mitigation of these problems by reducing environmental loads. The “environmental materials” concept does not merely include materials for separation, decomposition, or sensing of hazardous substances, but ranges for reducing CO_2 emissions, enhancing energy conservation, harvesting water, and supporting efficient chemical reaction, energy conversion, and resource recovery. Today, investigations of environmental materials are widely conducted in academia and various industries, and such materials have become an important research topic in the materials science field. Solid surfaces represent a field of chemical reaction and a direct interface against other substances, light, heat, and electric charges for the solid itself. If we can control chemistry and structure of solid surface appropriately, then we can impart specific properties onto the solid or increase its original performance remarkably. This symposium specifically examines design, efficient processing, and perspicuous evaluations of environmental materials and related technologies from the viewpoint of surface–interface engineering to elucidate current conditions and prospective challenges for this field of materials research.

<PROPOSED SESSION TOPICS>

- Catalysts
- Photocatalysts
- Materials and technologies related to environmental purification
- Materials for environmental sensing
- Materials for water harvesting
- Energy-saving materials and related technologies
- Separation materials
- Materials and related technologies on resource recovery
- Green processes for materials
- Other surface functional materials

<ORGANIZERS>

Akira Nakajima, Tokyo Institute of Technology, Japan
Jinhua Ye, National Institute of Materials Science, Japan
Yoshikazu Kameshima, Okayama University, Japan
Takahiro Takei, University of Yamanashi, Japan
Ryo Sasai, Shimane University, Japan
Ken-ichi Katsumata, Tokyo University of Science, Japan"

Symposium 7:
Dielectric, Piezoelectric, and Ferroelectric Materials: Advances for Emerging Applications

Dielectric, piezoelectric, and ferroelectric materials have played key roles in a variety of modern electric devices and established the huge market. The application field of the electroceramics keeps expanding, while the lack of solution materials seems to remain barriers in some applications, e.g., electric double layer capacitors for energy storage, high temperature capacitors for power devices, post-barium titanate for sustainable downsizing of MLCC, and lead-free piezoelectrics for RoHS. These pressing applications need the evolution of the dielectric materials for breakthroughs. Toward the evolution, advanced approaches: materials computations, noble sintering processes incorporating liquids, defects or stress engineering, materials probing with advanced photon or electron sources, and so on are attracting much attention of researchers and engineers. This symposium covers a variety of topics for the advancement of electroceramics. The aim of this symposium is stimulating innovative approaches for unique dielectrics, which can be the solutions for the emerging applications.

<PROPOSED SESSION TOPICS>

•Fundamentals and applications of piezoelectric materials (single crystals, nano-domain, domain engineering, grain-oriented ceramics, PZT-based system, lead-free system, sensors and actuators)
•Ferroelectric thin film memories and MEMS devices
•Fundamentals of ferroelectrics and related materials (multi-ferroic and relaxor materials, etc.)
•Novel processing of electronic ceramics and oxide thin films (hydrothermal process, low temperature sintering, and non-equilibrium process, etc.)
•Dielectric materials and capacitor applications
•Optical properties of ferroelectric ceramics and optical crystals
•Processing and properties of energy materials (piezoelectric, ferroelectric, and ionic materials)

<ORGANIZERS>

Brady Gibbons, Oregon State University, USA
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John Daniels, The University of New South Wales, Australia
Guoron Li, Shanghai Institute of Ceramics, China
Cheol Seong Hwang, Seoul National University, Korea
Soonil Lee, Korean Institute of Ceramic Engineering and Technology, Korea
Hajime Nagata, Tokyo University of Science, Japan
Ichiro Fujii, University of Yamanashi, Japan
Rintaro Aoyagi, National Institute of Advanced Industrial Science and Technology, Japan
Takayuki Watanabe, Canon Inc., Japan

Symposium 8:
Materials for Solar Thermal Energy Conversion and Storage

Concentrated solar technology is expected to contribute significantly to a future sustainable, efficient and diverse energy mix. Together with suitable thermal energy storage systems concentrated solar energy may provide base load power. Moreover, concentrated solar energy can be used for high temperature process technology, e.g. for the production of fuels or chemicals. Material requirements in the field of concentrated solar energy are manifold: Besides thermal, thermomechanical and chemical stability, lifetime and environmental resistance, appropriate functional properties (optical, chemical and thermal properties) must also be taken into account.
The symposium Materials for Solar thermal Energy Conversion and Storage will be focused on CSP-related materials in a broader sense. In particular, the following topics will be covered:

- Absorber materials
- Mirrors and reflector coatings
- Heat transfer media
- Thermal energy storage materials
- Materials for solar fuels
- Structural materials for solar receivers and solar reactors

<PROPOSED SESSION TOPICS>

- Absorber materials (light absorbing performance, selective coatings, robustness against thermal cycling, interactions with environmental effects such as airborne mineral dust, vapor, salts, etc.).
- Innovative high temperature construction and isolation materials for solar receivers and solar reactors
- Mirrors and mirror coatings (reflectivity, stability against pitting and delamination, self-cleaning surfaces, life time prediction considering temperature swings, UV irradiation, rain, dust, etc.).
- Heat transfer media (molten salts, particles, molten metals etc.) with improved stability and wider operating temperatures; reactions between heat transfer media and other components.
- Novel materials for thermal energy storage systems (molten salt storage, phase change materials, materials for thermochemical storage systems).
- Materials for (solar) thermochemical processes to produce H_2, CO or synthetic fuels (Metal Oxide-Based Redox Materials, Catalysts, Sulfur-Based Cycles, Cu-Cl Cycle, etc.).

<ORGANIZERS>

Martin Schmücker, German Aerospace Center, Institute of Materials Research, Germany
Martin Roeb, German Aerospace Center, Institute of Solar Research, Germany

Symposium 9:
Science and applications of amorphous materials

The subject of the session is amorphous materials. The session covers various topics of glass, such as fabrication of novel glass, structural analysis of glass, theoretical approach, optical and optoelectronic application, industrial glass manufacturing, and so on.

<PROPOSED SESSION TOPICS>

- Amorphous materials
- Glasses
- Structural analysis
- Simulation
- Theoretical study
- Melt
- Crystallization of glass

<ORGANIZERS>

Hirokazu Masai, AIST, Japan
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Shinji Kohara, NIMS, Japan
Tsuyoshi Honma, Nagaoka University of Technology, Japan
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Yasuhiko Benino, Okayama University, Japan
Tetsuo Kishi, Tokyo Institute of Technology, Japan
Alex Hannon, ISIS Facility, England
Jianrong Qiu, South China University of Technology, China
Yong Gyu Choi, Korea Aerospace University, Korea

Symposium 10:
Bioceramics and Bioinspired Materials

For the last four decades, a field of bioactive and biomimetic materials has progressed and innovated tremendously to substitute or regenerate not only skeletal but also soft tissues. These innovative materials have been studied to be applied for maxillofacial and orthopaedic implants, bone substitutes, bone cements, dental prostheses, drug delivery carriers and even for cancer treatments. In addition to conventional materials, bioactive composite or hybrid materials of ceramic/polymer and ceramic/metal have been also developed based on an understanding of biological responses to the materials. On the other hand, the biological responses and interactions between materials and our body might still remain unclear, and broad and deep understandings should be required to expect appropriate performances of newly developed materials to human body. This symposium thus focuses on topics covering processing of novel bioceramics, and synthesis of bio-hybrids and bioinspired materials in addition to biodegradability, biocompatibility, and medical application. Contributions on tissue engineering, drug delivery system, and bio-sensing fields are also welcome.

<PROPOSED SESSION TOPICS>

•Advanced Processing of Bioceramics and Biomimetic Materials
•Synthesis of Bioinspired and Biohybrid Materials
•Tissue Engineering Scaffolds
•Interactions of Biomaterials with Biological Systems
•Bionanotechnology for Drug, Gene, Cell-delivery Devices
•Sensing and Diagnostics in Medical Applications

<ORGANIZERS>

Chikara Ohtsuki, Nagoya University, Japan
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Yin Xiao, Queensland University of Technology, Australia
Min Wang, The University of Hong Kong, Hong Kong
Tim Woodfield, University of Otago, New Zealand
Hui-suk Yun, Korea Institute of Materials Science, Korea
Tomohiko Yoshioka, Okayama University, Japan
Shogo Yamaguchi, NGK Spark Plug Co., Ltd., Japan
Shinya Yamada, Olympus Terumo Biomaterials Corp., Japan
Yuki Shirosaki, Kyushu Institute of Technology, Japan

Symposium 11:
Advanced Powder Processing and Manufacturing Technologies

Powder processing is critical to the economical production of high reliability advanced ceramics, and can also enhance materials functionalities to enable new and broader application in high-technology clean energy and energy-saving industries for sustainable society. To realize these attributes, powder design and synthesis, suspension control, and structural control of the granulated feedstock, green body and sintered ceramics must be well-understood and carefully engineered. This symposium focuses on advanced powder processing and manufacturing technologies including the following areas:

<PROPOSED SESSION TOPICS>

•Nanoparticle and powder design and synthesis
•Particle coating technology and composite particle fabrication
•Particle dispersion control in liquid or polymers
•Novel forming and sintering technology
•Nano/microstructure control
•Controlled composites or pore structure
•Low cost and energy-saving processes

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Yuji Hotta, National Institute of Advanced Industrial Science and Technology, AIST, Japan
C.C.Huang, Hosokawa Micron Powder Systems, USA
Toshihiro Ishikawa, Tokyo University of Science, Japan
Hai-Doo Kim, Korea Institute of Machinery & Materials, KIMM, Korea
Sanjay Mathur, University of Cologne, Germany
Makio Naito, Joining and Welding Research Institute, JWRI, Osaka University, Japan
Junichi Tatami, Yokohama National University, Japan
Satoshi Tanaka, Nagaoka University of Technology., Japan
Wei-Hsing Tuan, National Taiwan University, Taiwan
Tetsuo Uchikoshi, National Institute of Materials Science, NIMS, Japan
Jingxian Zhang, Shanghai Institute of Ceramics, P.R. China"

Symposium 12:
Novel nanocrystal technologies for advanced ceramic materials & devices

A recent progress in nanocrystal technologies for advanced ceramics-based materials and devices has a great impact on a wide range of research fields, and such technologies are of considerable scientific and practical importance. Most of the useful properties of nanocrystals, nanocrystal assemblies and composites are defined by their size, shape, dimension, nanostructure (interface structure), composition, and combination. The size-, morphology-, nanostructure-, and interface-structure-control techniques are strongly demanded to develop the novel ceramic-based materials and devices exhibiting the extraordinary performance for the applications such as electronics, photonics, sensors, catalysts, energy renewable and storage devices, and so on. This symposium focuses on the synthesis and characterization of nanocrystals, the fabrication of 1D-, 2D-, and 3D-architectures, composites, coating films, bulk ceramics by nanocrystals, and the systems and devices based on nanocrystals. The characterization and calculation for fundamental and advanced properties of isolated nanocrystals as well as their assemblies will be discussed to understand mechanisms of the anomalous properties induced by designed nanoarchitectures.

<PROPOSED SESSION TOPICS>

•Synthesis of nanocrystals
•Fabrication of 1D, 2D, and 3D-assemblies, coating films, and bulk ceramics by using nanocrystals
•Colloidal science for nanostructured materials
•Characterization techniques of nanocrystals and nanostructured architectures
•Fundamental and advanced properties of isolated and assembled nanocrystals
•Systems and devices based on nanocrystals
•Nanomaterial design based on calculation

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Kouichi Nakashima, Ibaraki University, Japan
Takaaki Taniguchi, National Institute for Materials Science, Japan
Kazuyoshi Sato, Gunma University, Japan
Dewei Chu, University of South Wales, Australia
Bryan D. Huey, University of Connecticut, USA
Feng Dang, Shandong University, China
Shao-Sian Li, Taipei Medical University, Taiwan

Symposium 13:
Engineering Ceramics: Processing and Characterization

Engineering ceramics offer unique combinations of properties that have the potential to fulfill the demanding material needs in structural and functional applications, such as components in aerospace, automotive, energy, manufacturing, environmental, and microelectronics industries. Globally, significant progress has been made in the material development and manufacturing technologies pertaining to these materials. However, challenges remain with regard to increasing the extent of penetration of these materials into the marketplace. The successful entry of engineering ceramics into the marketplace strongly depends on the consistent development of materials with improved properties, thus providing solutions for application conditions with special requirements. The purpose of this symposium is to provide a broader forum to scientists and engineers from around the world to present and discuss their recent advances and developments in the areas of processing, characterization, and applications of engineering ceramics.

<PROPOSED SESSION TOPICS>

•Innovative Processing Routes and Synthesis Methods
•Sintering and Microstructure Control
•Mechanical Properties
•Thermal Properties
•Electrical and Optical Properties
•Corrosion and Oxidation Behavior
•Reliability and lifetime prediction and modelling
•Applications

<ORGANIZERS>

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Young-Wook Kim, University of Seoul, Korea
Hagen Klemm, Fraunhofer Institute for Ceramic Technologies and Systems, IKTS, Germany
Michael Halbig, NASA Glenn Research Center, USA
Pavol Saigalik, Slovak Academy of Sciences, Slovakia
Hua-Tay Lin, Guangdong University of Technology, China
Katsumi Yoshida, Tokyo Institute of Technology, Japan
Tohru S. Suzuki, National Institute for Materials Science, Japan

Symposium 14:
Advanced structure analysis and characterization of ceramic materials

Recent developments in structure analysis and characterization of inorganic crystalline and amorphous materials, such as X-ray, neutron, synchrotron, and electron diffraction, x-ray/neutron scattering, IR/Raman scattering, NMR, XAFS, pdf, first-principles calculations, computer simulations, Rietveld analysis, maximum-entropy method, in situ measurements at high temperatures/pressures and electron/nuclear density analysis are remarkable. These techniques enable one to study not only static and long-range periodic structures but also dynamic and short-/intermediate-range structures. Knowledge of the crystal and electronic structures is quite important in the exploration of novel materials. Multi-scale characterization from electron level to micrometers is becoming more important to understand the phenomena at the interface, grain boundaries and surfaces of ceramic materials. In this symposium, we discuss the structure-property relationship of various ceramic materials (Electro, Magnetic and Optical Ceramics; Energy and Environment Related Ceramics; Bio-ceramics; Ceramics for Safety and National Security Secure Society; Traditional Ceramics). Material design based on the crystal and electronic structures is also important topic in this session.

<PROPOSED SESSION TOPICS>

X-ray, neutron, synchrotron and electron diffraction, XAFS, PDF analysis, light scattering, computer simulation, first-principles calculations, physico-chemical properties, structure-property relationships, crystal structure, glasses and amorphous materials, nano-structure, micro-structure, interfaces, surfaces and grain boundaries. Structure-based material design. New material exploration and structure determination.

<ORGANIZERS>

Masatomo Yashima, Tokyo Institute of Technology, Japan
Scott T. Misture, Alfred University, USA

Symposium 15:
Advanced Nanocharacterization and Atomic-Scale Modeling of Grain Boundaries and Interfaces in Ceramics: Structures, Dynamics and Properties

Understanding the fundamental role of grain boundaries and interfaces in ceramics down to atomistic scale is the key to design next-generation ceramics applied for energy, device, automotive, aircraft and medical fields. Rapid progress in nanocharacterization and computational approaches has been enabling precise modelling of ceramic grain boundaries and interfaces from their detailed atomic-scale structures to their nano-scale dynamic behaviors. This symposium will focus on the forefront of nanocharacterization and theoretical modeling of ceramic grain boundaries and interfaces for the future design of novel structural and functional ceramics with desired properties. This symposium will cover a broader field of ceramic interface topics: grain boundaries, domain boundaries, surfaces and heterointerfaces, with special focus on their structure –property relationships from the atomistic scale.

<PROPOSED SESSION TOPICS>

•Advanced Nanocharacterization techniques and computer modellings for interfaces
•Grain boundary and interface structures
•Microstructure evolution and grain growth
•In-situ observations and dynamics

<ORGANIZERS>

Naoya Shibata, The University of Tokyo, Japan
Katsuyuki Matsunaga, Nagoya University, Japan
Klaus van Benthem, University of California, Davis, USA
Sung-Yoon Chung, Korea Advanced Institute of Science and Technology, Korea
Xiuliang Ma, Institute of Metal Research, Chinese Acacemy of Science, China
Masato Yoshiya, Osaka University, Japan

Symposium 16:
Single Crystals, Thin Films and Microstructures in Rechargeable Battery Systems

Over the past decade, substantial advances have been achieved for the developments of anode, cathode and electrolyte materials for lithium ion batteries such as optimizing materials composition, exploring functional dopants and controlling microstructures. These significant improvements allow us to store higher capacity of electrochemical energy in a smaller volume and furthermore the lifetime or charge-discharge-cycles of the battery system becomes much longer than ever before. However, battery cell failures −capacity loss, slower charge rate, or short circuit− inevitably occur and it is therefore necessarily to understand the above failure mechanisms. The materials currently used in real battery cells involve multiple structural, chemical and electrochemical complexations. In order to develop a mechanistic understanding of each failure processes, it is a prerequisite to simplify related materials' structures and their interfaces, e.g. by using the forms of single crystals or thin films. These failure issues are essentially related to the pre-existence and/or the developments of atomistic defects during electrochemical cycling, such as transition metal antisite defects, oxygen vacancies, reconstruction of the surface structures. Atomic-resolution electron microscopy, scanning tunneling microscopy and atomic force microscopy should be versatile tools for defective structural analysis.

This symposium will focus on the growth methodology of high purity single crystals and thin films and their atomic and electronic structure analysis based on microscopy for the understanding of hindered lithium ion battery materials problems. We will also provide the discussion among the group of people in this field, leading to the further synergetic collaborations.

<PROPOSED SESSION TOPICS>

•Synthesis of single crystals and thin films
•Atomic and electronic structure analysis of defects, surface and interfaces
•Atomic-resolution STEM, STM, AFM

<ORGANIZERS>

Ryo Ishikawa, University of Tokyo, Japan
Nobuyuki Zettsu, Shinshu University, Japan
Yumi H. Ikuhara, Japan Fine Ceramics Center, Japan
Taro Hitosugi, Tokyo Institute of Technology, Japan
Miaofang Chi, Oak Ridge National Laboratory, USA
Sung-Yoon Chung, Korea Advanced Inst. Sci. and Tech., Korea
Lin Gu, Chinese Academy of Science, China
Rong Huang, East China Normal University, China

Symposium 17:
Green processing and Green energy materials for sustainable society

The increasing demand for energy requires the development of new technologies and materials of energy generation and efficient use of energy. Especially the experience of current global warming derives us to the research area of achieving sustainable society. Ceramic materials and composite materials are some of the materials that have been studied extensively for the generation of energy especially to achieve sustainable society. Another approach would be to make efficient use of energy, leading to the society that uses less energy.
The objective of this symposium is to bring together scientific experts from academia, industry, and government agencies around the world to discuss the current research area of green processing and green energy harvesting materials.
Specifically, we will focus on 4 key research fields. (1) Photocatalysts for hydrogen generation, (2) Solution Processing for inorganic materials, (3) Green processing, (4) New Functional materials for sustainable society.

<PROPOSED SESSION TOPICS>
Photocatalysts for hydrogen generation, Solution Processing for inorganic materials, Green processing, New Functional materials for sustainable society.

<ORGANIZERS>
Naoki Wakiya, Shizuoka University, Japan
John Wang, National University of Singapore, Singapore
Shenglei Che, Zhejiang University of Technology, China
Tewei Chiu, National Taipei University of Technology, Taiwan
Yasuro Ikuma, Kanagawa Institute of Technology, Japan
Naonori Sakamoto, Shizuoka University, Japan
Takaaki Taniguchi, National Institute for Materials Science, Japan
Nobuhiro Matsushita, Tokyo Institute of Technology, Japan
Hajime Wagata, Meiji University, Japan
Tomoaki Watanabe, Meiji University, Japan

Symposium 18:
Additive Manufacturing and 3d Printing Techonologies

Additive manufacturing is expected as 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 slicing operations automatically. 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. 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, bio-materials components for medical applications and ceramics electrode with large surface area will be newly developed. Large scale structural components for aerospace and other high temperature applications can be fabricated with internal cooling path networks formed. 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
Mrityunjay Singh, Ohio Aerospace Institute, USA
Mr. Michael Halbig,, NASA Glenn Research Center, USA
Hui-suk Yun, KIMS, Korea
Martin Schwentenwein, Lithoz GmbH, Austria

Symposium 19:
Mixed Anion Compounds for Novel Functionalities

Recently, mixed anion compounds consisting of multiple anions have attracted much attention. The use of multiple anions affords, for example, unusual local coordination around a cation in an inorganic crystal, giving greater chances to impart new materials properties as compared to conventional mono-anionic oxides or nitrides. In addition, as anions of abundant elements including hydrogen, chlorine, sulfur, phosphorus, carbon are especially focus on, the mixed anion approach is unimpeded by conventional problems of resource scarcity and distribution. The concept of the mixed anion compounds may not be restricted in inorganic crystalline solids, but expand to amorphous, non-crystalline nanomaterials, organic-inorganic hybrids, and other emerging materials. We now stand at the dawn of the mixed anion age.

This symposium will provide a forum for extensive discussion and exchange of information among researchers exploring new mixed anion compounds and their functions with 'mixing' research communities that have been divided into many narrow disciplines. The scope of the symposium will include state-of-the art methods for structural and chemical characterization such as synchrotron-based spectroscopy and diffractometry, and combined in many cases with theoretical and simulation methodologies. In addition, new methodologies for synthesis tailor-made for the mixed anion compounds will also be one of the main topics under discussion. Photocatalysis, electrocatalysis, dielectrics, fluorescent materials, magnetic materials, fast ionic conductors, thermoelectrics, superconductors, rechargeable batteries, fuel cells, and thin film based devices will be some of the main applications to be discussed.

<PROPOSED SESSION TOPICS>

•Novel approaches to synthesis such as combination of multiple techniques
•Precious control of chemical composition and atomic arrangement
•Analysis and design of crystal structure and local coordination
•Materials informatics-based material design
•Combined analyses of spectroscopy and theoretical calculation
•Theoretical approaches for understanding chemical bonding, physical properties and material functions
•Materials for energy creation and saving
•Materials for electronics and informatics

<ORGANIZERS>

Katsuro Hayashi, Kyushu University, Japan
Teruki Motohashi, Kanagawa University, Japan
Nobuhito Imanaka, Osaka University, Japan
Kenneth R. Poeppelmeier, Northwestern University, USA
David O. Scanlon, University College London, UK
Gang Liu, Chinese Academy of Sciences, China
Yumi Tanaka, Tokyo University of Science, Japan
Takafumi Yamamoto, Kyoto Univeristy, Japan
Akihide Kuwabara, Japan Fine Ceramic Center, Japan
Fuxiang Zhang, Dalian Institute of Chemical Physics, China
Sung-Wng Kim, Sungkyunkwan University, Korea

Symposium 20:
Ceramics for Rechargeable Energy Storage

The significant demands of higher safety and reliability together with high energy density for advanced rechargeable battery system have promoted the developments of new materials and technologies. This symposium will focus on the advanced ceramic materials and technologies that could help the community to achieve the next generation energy storage. Materials design, electrodes architecture, and cell chemistry are key factors to extend the life, enhance the safety, and lower the cost of rechargeable batteries, which are the most efficient energy storage systems for IoT sensor devices, portable electronics, renewable energy storage, smart grid, and transportation applications. Especially, all solid-state battery system using ceramic solid electrolyte materials is critical issue for the higher safety batteries. The search for advanced high ionic conducting materials, zero-strain electrode materials, and the implementation of the challenging interface configuration of electrode-electrolyte interface against Li-metal propagation phenomena will be necessary for the next generation all solid-state energy storage system.

<PROPOSED SESSION TOPICS>

•All solid-state lithium ion battery
•Solid electrolyte materials
•High capacity electrode materials
•Advanced energy storage system
•Lithium sulfur battery
•Lithium air battery
•Sodium ion battery

<ORGANIZERS>

Junji Akimoto, AIST, Japan
Naoaki Yabuuchi, Yokohama National University, Japan
Byoungwoo Kang, Pohang University of Science and Technology, Postech, Korea
Akitoshi Hayashi, Osaka Prefecture University, Japan
Yong-Sheng Hu, Key Laboratory for Renewable Energy(E01), Institute of Physics, Chinese Academy of Sciences, China
Yasutoshi Iriyama, Nagoya University, Japan
Yuichi Munakata, Tokyo Metropolitan University, Japan
Yoon Seok Jung, Hanyang Univeristy, Korea
Hirotoshi Yamada, Nagasaki University, Japan
Masashi Ohkubo, The University of Tokyo, Japan
Daisuke Mori, Mie University, Japan
Jeff Sakamoto, University of Michigan, USA

Symposium 21:
Specific Reaction Field and Material Fabrication Design

Now, traditional material processing is becoming saturated and it is more and more difficult to fabricate innovative materials. For innovative material fabrication, innovative fabrication design is needed. One of the innovative material fabrication design realization means includes the use of specific reaction field. As specific reaction field, ultrasonic, microwave, laser, supercritical fluid, implosion, hydrothermal, solvothermal, etc. are included. These specific reaction fields are different from conventional reaction fields in the viewpoint of local reactor as non-equilibrium and non-linear, reaction temperature, pressure, time, and so on. These characteristics are specifically affected for nucleation, atom diffusion and growth in material fabrication. Thus specific reaction field are very important for innovative material design and innovative processing, new material fabrication. In this session, new material and material processing using specific reaction field will be discussed for material fabrication design. New material, strange structure, nanoparticle, film, bulk, 3D, morphology control, sintering, function, etc. are included

<PROPOSED SESSION TOPICS>

•New Material, Strange structure, Nanoparticle, Film, Bulk, Synthesis, Sintering, Function
•Ultrasonic Processing, Microwave Processing, Laser Processing, Supercritical Fluid Processing
•Hydrothermal, Solvothermal Processing, Implosion Processing

<ORGANIZERS>

Yamato Hayashi, Tohoku University, Japan
Shu Yin, Tohoku University, Japan
Takahiro Nakamura, Tohoku University, Japan
Takashi Shirai, Nagoya Institute of Technology, Japan
Masaru Watanabe, Tohoku University, Japan
Naoya Enomoto, National Institute of Technology, Ariake College, Japan
Yunzi Xin, Nagoya Institute of Technology, Japan
Wenbin Cao, University of Science and Technology Beijing, China
Soo Wohn Lee, Sunmoon University, Korea
Stephan Barcikowski, University of Duisburg-Essen, Germany
Sébastien Vaucher, Empa, Swiss Federal Laboratories for Materials Science and Technology, Switzerland
Maria-Magdalena Titirici, University of London, England
Sivakumar Manickam, The University of Nottingham Malaysia Campus, Malaysia

Symposium 22:
Layered Double Hydroxides: Science and Design of Binding Field with Charged Layers

Layered double hydroxides (LDHs) are anionic clays, and the general formula for LDHs is $[M^{II}_{1-x}\ M^{III}_{x}(OH)_2][(A^{n-})_{x/n}\cdot mH_2O]$, where M^{II} is a divalent cation, and M^{III} is a trivalent cation, and A^{n-} is an anion. LDHs consist of the positively charged metal hydroxide layers ("Charged Layers") with a field formed by binding chemical species located in the interlayer ("Binding Field"). Over the last decade, the research on LDHs has been developing in several fields and applications, on both fundamental and applied aspects of these materials. However, the communication of the researchers on LDHs with different research fields is insufficient. Collaboration of researchers under the concept of "Science and Design Binding Field with Charged Layers" must lead to significant developments in hydroxide-based materials with layered structure.

This symposium will focus on preparation, characterization, application, and novel properties of LDHs, layered hydroxides, and hydroxide nano-sheets, in any research field. The science and design of "Binding Field with Charged Layers" will be discussed.

<PROPOSED SESSION TOPICS>

·Layered double hydroxides
·Layered hydroxides
·Hydroxide nanosheets
·Advanced structural analysis, novel preparation process, and novel properties of these materials
·Application of these materials to electrochemical devices, magnetic materials, catalysts, optical materials, drug-delivery system, anion exchanger, water purification system, etc.

<ORGANIZERS>

Kiyoharu TADANAGA, Hokkaido University, Japan
Chikako MORIYOSHI, Hiroshima University, Japan
Kentaro TERAMURA, Kyoto University, Japan
Jae-Min Oh, Yonsei University, Korea"

Symposium 23:
Geopolymer, building materials and low environmental loading construction materials

Recently, reduction of carbon dioxide emission and effective usage of industrial waste is very important for establishment of low carbon and recycling-oriented society. Research on blended cement with high fly-ash replacement is attracting great attention. And blended cement such as energy CO_2 Minimum (ECM) cement using high volume blast furnace slag, ordinary Portland cement and gypsum were designed for a large amount of CO_2 emission reduction. On the other hand, alkali activated material using fly-ash such as geopolymer and hybrid-type geopolymer using fly-ash and blast furnace slag are attracting high attention as alternative material for cement. In this session, we will discuss the recent researches on low environmental loading construction material. In addition, since geopolymer materials have a high temperature resistivity, they will be expected as high temperature construction materials, namely refractories. In this session, application to novel use of geopolymer will be also discussed.

<PROPOSED SESSION TOPICS>

・Low Carbon and Recycling-oriented Society
・Reduction of CO_2 emission
・Management of Industrial Waste

<ORGANIZERS>

Shinobu HASHIMOTO, Nagoya Institute of Technology, Japan
Daiki ATARASHI, Shimane University, Japan

Symposium 24:
Advanced Wear Resistant Materials: Tribology, Coatings and Reliability

This symposium focuses on recent advances in wear-resistant materials and coatings development, evaluation of microstructures and properties, and novel applications based on tribology and reliability. Particular emphasis is placed on integrated structural properties, environmental properties, and functionality through innovative material and coating processing; composition and architecture optimization; advanced wear-resistant materials; and low friction coatings for extreme environments and life prediction modeling. Useful information on successful applications to industry, such as automobile and high-load machinery, will be included.

<PROPOSED SESSION TOPICS>

·Wear Resistant Materials for Tools and Molds in Precision Machining Applications
·Advanced Coating for Automobile and Air Craft Applications
·Low Friction Coatings and Materials
·Characterization and Test Methods on Wear Resistant Materials.
·Mass production and reliability of wear-resistant coatings

<ORGANIZERS>

Kyoung Il Moon, KITECH, Korea
Kouichi Yasuda, Tokyo Tech., Japan
Tim Hosenfeldt, Schaeffler AG
Ali Erdemir, Argonne National Laboratory
Zhengyi Fu, Wuhan Univ. Tech., China
Doan Dinh Phuong, Vietnam Academy of Science and Technology, Vietnam
Jindrich Musil, University of West Bohemia, Czech Republic
Mustafa Urgen, Istanbul Teknik Universites, Turkey
Robert Vassen, Forschungszentrum Jülich Gmbh, Germany
In Woong Lyo, Hyundai Motor Company, Korea
Se-Hun Kwon, Pusan National Univ., Korea
Jongkuk Kim, Korea Institute of Materials Science, Korea
Min Su Jung, KITECH, Korea
Byung-Koog Jang, Kyushu Univ., Japan
Tadachika Nakayama, Nagaoka Univ. Tech., Japan

Symposium 25:
Direct Thermal-to-Electrical Energy Conversion Materials and Thermal Energy Harnessing Challenges

Thermal energy conversion and harnessing - TECH - is one of the ultimate challenges in science and technology to make our modern society more efficient as well as environmentally benign. Scientific and technological progress in materials design and synthesis has always been a key to develop direct thermal-to-electrical energy conversion and related technologies. Moreover, recent advances in nanotechnology have elicited unconventional thermal transport across nanostructured materials and nano-interfaces, realizing a novel means to harness thermal energy. This symposium provides an open forum to highlight up-to-date theoretical ideas, new materials, and new device concepts and applications by focusing on novel processing and synthesis methods, materials, technologies, and applications related to direct thermal-to-electrical energy conversion and thermal energy harnessing. Thermal, electrical, and mechanical properties of new materials and processing of those materials into device structures will also be emphasized. It also highlights theoretical insight and materials innovations in unconventional heat transfer that enables us novel approaches toward higher efficiency and revolutionary technologies in thermal energy harvesting and heat management.

<PROPOSED SESSION TOPICS>

•High-efficiency bulk thermoelectric materials
•Nanoscale thermoelectric materials and nanocomposites (nanomaterials and inherent nanostructures in bulk thermoelectric material matrices)
•Theoretical studies on material transport properties, band structures, crystal chemistry, thermodynamic analysis, and energy transfer for high-efficiency thermoelectric energy conversion
•Oxides and other materials with strong electron correlation and spin freedom exploitation
•Thermionics and other related topics
•New capabilities in solid-state synthesis, bulk materials, thin films, superlattices, nano-interfaces, and nanostructured materials for novel materials and compounds
•Processing of bulk and thin-film nanostructured materials
•Inorganic/organic hybrids and nanocarbon materials for energy harvesting and flexible/wearable thermoelectric applications
•New developments in material property and device performance measurements/ metrology
•Novel ideas, materials, and device concepts for thermal energy harnessing
•Phase transformation, thermal conductivity switching, and defect engineering in inorganic and organic solids for thermal energy harnessing
•Phonon engineering and emerging thermal transport technologies
•Phonon transmission and scattering across nano-interfaces
•Design, performance testing, fabrication, and processing of thermal energy conversion devices
•Device performance requirements for future TECH applications

<ORGANIZERS>

Michitaka Ohtaki, Kyushu University, Japan
Takao Mori, National Institute for Materials Science, Japan
Lidong Chen, Shanghai Institute of Ceramics, CAS, China
Wonseon Seo, Korea Institute of Ceramic Eng. & Tech., Korea
Gang Chen, Massachusetts Institute of Technology, USA
Emmanuel Guilmeau, CNRS-CRISMAT, France
H.-T. Lin, Guangdong University of Technology, China
Koji Miyazaki, Kyushu Institute of Technology, Japan
Min-Wook Oh, Hanbat National University, Korea
Junichiro Shiomi, The University of Tokyo, Japan
Chunlei Wan, Tsinghua University, China
Anke Weidenkaff, University of Stuttgart, Germany
Mona Zebarjadi, University of Virginia, USA

Symposium 26:
Ceramic Materials for Nuclear Energy

Glass and ceramic-based materials are critical to advancing nuclear energy systems, commercial radiological devices, and waste treatment and immobilization solutions. Nuclear materials, whether for power generating technologies or waste immobilization, must operate in extreme environments. Components for nuclear reactors and fuels must operate in ultra-high temperature, pressure, and radiation fields. The wastes generated from these processes must be immobilized for long durations, and the materials used to do so will be exposed to dynamic corrosion environments. Improved understanding of the design and performance of all nuclear materials is paramount to their application and development, and is needed to advance developments in the field. This symposium will focus on the impacts of composition, processing, and radiation on material properties such as structure, mechanical robustness, and resistance to corrosion. The advanced characterization techniques and emergent modeling and simulation methods that have been developed to evaluate these materials will also be discussed.

This symposium is endorsed by the ACerS Nuclear and Environmental Technology Division and the Glass and Optical Materials Division. Papers are solicited on a wide variety of topics related to materials aspects in nuclear energy and waste immobilization using experiment, theory, and simulation.

<PROPOSED SESSION TOPICS>

•Ceramics for nuclear fission applications including structural applications
•Effects of corrosion on ceramic stability and radiation damage tolerant ceramics
•Innovative fabrication methods for nuclear reactor components and waste forms
•Advanced innovations in the characterization of materials for nuclear applications
•Predictability of material properties and behavior using synergistic simulations and experiments
•Corrosion resistance and performance of waste form materials
•Novel applications in hazardous and radioactive waste treatment and remediation
•Materials for advanced sensor applications

<ORGANIZERS>

Kevin Fox, Savannah River National Laboratory, USA
Phil Edmonson, Oak Ridge National Laboratory, USA
Nicolas Clavier, Marcoule Institute for Separation Chemistry, France
Russell Hand, University of Sheffield, England
Yaohiro Inagaki, Kyushu University, Japan
Joseph Ryan, Pacific Northwest National Laboratory, USA
Jake Amoroso, Savannah River National Laboratory, USA
Karl Whittle, University of Liverpool, England
Masato Kato, Japan Atomic Energy Agency, Japan
Tahashi Nozawa, National Institutes for Quantum and Radiological Science and Technology, Japan

Symposium 27:
Synthesis and Processing of Materials using Electric Currents and Pressures

Electric fields and currents are powerful processing parameters in addition to the temperature and time available in traditional sintering. Applications of electric current have been leveraged to produce materials with unique properties and/or increase processing efficiency. Of particular note is the widely spread (and continuously increasing) use of the technique often referred to as Spark Plasma Sintering (SPS), Field Assisted Sintering Technique (FAST) and Current Activated Pressure Assisted Densification (CAPAD) among others. This symposium is in the spirit of previous symposia on SPS that were held in conjunction with past PACRIM meetings beginning with Pacrim7, Hawaii. The success of these symposia provided evidence of the continued worldwide growth of research and development activities in this field. The symposium is aimed at providing a forum for scientists and engineers to present and discuss results of various observations on a wide variety of topics related to current assisted processing and synthesis of materials. Experimental and modeling papers covering both fundamental as well as application-oriented studies are solicited.

<PROPOSED SESSION TOPICS>

•Fundamental investigations on electric current/field and/or pressure on materials processing
•Modeling and simulation studies of current activated densification
•Consolidation of nanocrystalline materials
•Property evaluation of materials processed using electric currents including thermal, mechanical, optical, electrical and magnetic properties
•Field activated Synthesis
•Flash Sintering

<ORGANIZERS>

Takashi Goto, Institute for Materials Research, Tohoku University, Japan
Olivier Guillon, Forschungszentrum Jülich GmbH, Germany
Javier E. Garay, University of California, San Diego, USA
Manshi Ohyanagi, Ryukoku University, Japan
Yasuhiro Kodera, University of California, San Diego, USA

Symposium 28:
Photo-functional Inorganic Materials

In the last decade, significant progress has been reported on the synthesis and characterization of photo-functional inorganic materials such as photovoltanics, phosphor, photocatalyst, glass, laser, photonic crystal and pigment. This session will provide a lively discussion of recent research and development activities on photo-functional inorganic materials. The session will cover all phases between the basic research and industrialized materials. For this purpose, We will invite several prominent guest speakers in the different topics. The aim of session "Photo-functional Inorganic Materials" is Hot interactive discussion. Session topics include, photovoltanics, phosphor, photocatalyst, glass, laser, photonic crystal, pigment optical semiconductors, scintillation material, transparent ceramics.

<PROPOSED SESSION TOPICS>

photovoltanics, phosphor, photocatalyst, glass, laser, photonic crystal, pigment optical semiconductors, scintillation material, transparent ceramics.

<ORGANIZERS>

Kenji Toda, Niigata University, Japan
Toshiyuki Masui, Tottori University, Japan
Tomokatsu Hayakawa, Nagoya Institute of Technology, Japan
Koji Inoue, Mie Prefecture Industrial Research Institute, Japan
Jun-ichi Hamagami, Kanto Gakuin University, Japan
Yuichiro Kuroki, Salesian Polytechnic, Japan
Dae-Ho Yoon, Sungkyunkwan University, Korea
Ru-Shi Liu, National Taiwan Univeristy, Republic of China

Symposium 29:
Liquid-mediated structuring of ceramics and organic-inorganic hybrid materials

Liquid-mediated structuring (LMS) of ceramics and organic-inorganic hybrid materials has been achieved using various techniques such as the sol-gel process and the soft chemical process. LMS processes are suitable for fabricating ceramic materials with various shapes, including particles, fibers, films and monoliths. LMS processes are also applicable for preparation of various kind of nanomaterials including a family of organic-inorganic hybrids. The LMS is therefore related to various background disciplines; organometallic chemistry, inorganic chemistry, coordination chemistry and solid-state chemistry as well as ceramic science and hybrid science. This symposium will bring together experts from various fields in chemistry and materials science.
Although basic concepts of LMS have been recognized as one of the important ideas of developing novel materials, the LMS is still growing and expanding to evolutionary fields of materials science. The goal of this symposium is therefore to present and discuss recent advances in LMS of ceramics and organic-inorganic hybrid materials, ranging from new synthetic methods to application of resultant materials with nano/meso/macro and hierarchical structures.

<PROPOSED SESSION TOPICS>

•Sol-gel process
•Liquid-mediated process
•Nano-scale structuring process
•Meso-scale structuring process
•Powders, fibers, films, monolith and gels
•Porous materials
•Nanoparticles, nanofibers, and nanosheets

<ORGANIZERS>

Enrico Bernardo, University of Padova, Italy
Kiyofumi Katagiri, Hiroshima University, Japan
Il-Doo Kim, KAIST, Republic of Korea
Sanjay Mathur, University of Cologne, Germany
Minoru Osada, Nagoya University, Japan
David Portehault, CNRS, France
Jun Shen, Tongji University, China
Atsushi Shimojima, Waseda University, Japan
Yoshiyuki Sugahara, Waseda University, Japan

Symposium 30:
Advanced Materials and Processing for Power Electronics Application

Power electronics(SiC, GaN, Ga_2O_3), which is a key technology for energy saving, is applicable to a wide range of fields such as electricity, electronic devices, industrial equipment, automobiles, railroads, and the like, and great growth is expected in world markets. For further expansion of the market of power electronics, it is indispensable to develop high performance heat resistant passive components, high performance heat dissipation insulating substrate, bonding technology, wiring technology, etc. at the same time as development of high performance power devices and modules. To realize power devices in the next-generation, I n this symposium, we will discuss about the development of the various high heat-resistant parts, and evaluation technologies for improving reliability or, a power electronics application.

<PROPOSED SESSION TOPICS>

•Electro-ceramics and applications
•High temperature electronic materials
•High temperature passive component
•Highly heat-resistant resistor
•Multi layered ceramic capacitor (MLCC)
•Circuit board (ceramic circuit board)
•Metalized heat-dissipating substrate
•Metalized ceramic substrate
•Advanced characterization techniques, properties and reliability testing
•Modeling, simulation for life time prediction

<ORGANIZERS>

Tetsuo Tsuchiya AIST, Japan
Kiyoshi Hirao AIST, Japan
Balu Balachandran Argonne National lab, USA
Yoshinobu Nakamura University of Tokyo, Japan
Hiroaki Takeda Tokyo Institute of Technology, Japan
Tomohiko Nakajima AIST, Japan
Toru Sugawara Osaka University, Japan

Symposium 31:
Porous Ceramics: From Innovative Processing to Advanced Applications and Functionalities

Porous ceramics with various pore scales are utilized in many advanced engineering applications including filters, separations, insulations, membranes, catalytic supports, catalysts, absorbers, sensors and lightweight structural components. This symposium aims to bring together the technical community to share recent advances in innovative processing routes, characterization tools, properties, modeling of porous ceramics (oxide/non-oxide), glass, glass-ceramics, and carbon as well as hybrids, composites for any applications. Porous materials can be based on various morphologies including but not limited to foams, syntactic foams, honeycombs, fibrous, powders, cloths, thin films, bio-inspired, membranes, aero-gels, composites and additive manufacturing. Engineering applications can include thermal management or energy-related technologies (renewable energy, energy saving, energy conversion, heat exchange, gas and electrochemical energy storage), environmental protection (filtration, catalyst, adsorption and sensor). This symposium will be the ideal show case for the research activities of many groups involved in the processing, functionalization and applications of porous materials, bringing expertise in ceramic science, chemistry, mechanics, catalysis, fluid dynamics, modeling and simulation and application engineering.

<PROPOSED SESSION TOPICS>

•Innovative Processing Routes for Porous Ceramics
•Novel Powder Processing Routes for Porous Ceramics
•Precursor-based Routes for Porous Ceramics
•Additive Manufacturing of Porous Ceramics
•Micro- or Meso-porous Ceramics and components with Hierarchical Porosity
•Ceramic Membranes
•Characterization of the Structure, Simulation and Modeling of Porous Ceramics
•Mechanical properties of Porous Ceramics
•Other properties of porous ceramics
•Functionalities including thermal management, catalyst, environmental, energy, biological and lightweight structural applications

<ORGANIZERS>

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Paolo Colombo, Università di Padova, Italy
Takashi Shirai, Nagoya Institute of Technology, Japan
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Samuel Bernard, CNRS-Limoges, Limoges, France
Jian-Feng Yang, Xi'an Jiaotong University, China
Tobias Fey, Universität Erlangen-Nürnberg, Germany,
Miki Inada, Kyusyu University, Japan,
Young-Wook Kim, University of Seoul, Republic of Korea
Go Kawamura, Toyohashi University of Technology, Japan
Alberto Ortona, University of Applied Sciences and Arts of Southern Switzerland, Switzerland,
Yoshikazu Suzuki, University of Tsukuba, Japan
Akihiro Shimamura, National Institute of Advanced Industrial Science and Technology, AIST, Japan

Symposium 32:
Crystalline Materials for Electrical, Optical and Medical Applications

This session will provide a forum for the presentation and discussion of recent research and development activities on crystalline materials. The session will cover all aspects, from basic research and material characterization, through physicochemical aspects of growth, synthesis and deposition techniques, to the technological development of industrialized materials. For this purpose, world-wide experts in the different topics will be invited to introduce their most recent activities. The broad scope of the session assures a wide overview of the state-of-the-art issues on crystalline materials, aiming to stimulate interdisciplinary discussions and collaborations in a wide range of fields. Session topics include, semiconductors, optical and scintillation materials, pieze/ferro-electric materials, transparent material, and fundamentals such as phase diagrams and defect chemistry, crystalline quality.

<PROPOSED SESSION TOPICS>

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

<ORGANIZERS>

Kiyoshi Shimamura, National Institute for Materials Science, Japan
Noboru Ichinose, Waseda University, Japan
Nerine J. Cherepy, Lawrence Livermore National Laboratory, USA
Victoria Blair, U.S. Army Research Laboratory, USA
Yoshihiko Imanaka, Fujitsu Laboratories Ltd., Japan
Joanna McKittrick, University of California San Diego, USA
Takayuki Yanagida, Nara Institute of Science and Technology, Japan
Yiquan Wu, Alfred University, USA
Inka Manek-Honninger, Bordeaux University, France

Symposium 33:
Multifunctional Coatings for Structural, Energy and Environmental Applications

This symposium will provide an open forum for 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, suspension/solution precursor spray, cold spray, and aerosol deposition. Thermal and environmental barrier coatings for ceramic matrix composites, inter metallics and advanced superalloys to enhance the environmental stability and durability of aerospace and land-based gas turbines are also of interest. Particular emphases are on the integration of multilayered coatings, component design and performance through multi-scale modeling and experimental validation. The goal of this symposium is to identify current key issues, effective approaches, and future outlook for functional coating technologies and applications through comprehensive discussion on the following proposed topics.

<PROPOSED SESSION TOPICS>

・Innovative coating technologies for various industrial products (automobiles, electronic devices, mechanical parts, etc.)
・Thermal and environmental barrier coatings
・Coatings resistant to CMAS, oxidation, corrosion, wear, erosion, and tribological loadings
・PVD, CVD, sol-gel technologies, etc.
・Thermal spray, suspension/solution precursor spray, cold spray, aerosol deposition, etc.
・Coatings for new functional applications
・Functionally graded coatings, nanostructured and multifunctional coatings
・Interface phenomena, adhesion and other fundamentals of coatings
・Technical issues and potential solutions of surface related properties and processes in industries
・Next generation production methods for surface engineering
・Surface modification for functional coatings
・Multi-scale modeling of coating properties and life predictions
・Materials and coatings database and artificial intelligence-based approach
・Advanced characterization and non-destructive evaluation methodologies for coatings

<ORGANIZERS>

Jun Akedo, National Institute of Advanced Industrial Science and Technology, AIST, Japan
Sanjay Sampath, Stony Brook University, USA
Makoto Watanabe, National Institute for Materials Science, NIMS, Japan
Lee Sung-Min, Korea Institute of Ceramic Engineering & Technology, Korea
Satoshi Kitaoka, Japan Fine Ceramic Center, JFCC, Japan
Frank Gaertner, Helmut Schmidt University, Germany
Javad Mostaghimi, Centre for Advanced Coating Technologies, University of Toronto, Canada
Hong-Ki Kim, Kwangwoon University, Korea
Hideki Kakisawa, National Institute for Materials Science, NIMS, Japan
Kentaro Shinoda, National Institute of Advanced Industrial Science and Technology, AIST, Japan

Symposium 34:
Analysis of Cultural Heritage: Discoveries and Understanding

This symposium will highlight the latest studies and the newest discoveries pertaining to the scientific study and analysis of cultural heritage, including ceramics, paintings, sculpture, archaeological finds and immobile works. This symposium will feature the newest findings surrounding the technology, engineering and materials associated with art, archaeology and cultural heritage, including studies of pigments, ceramics, glass, metals and organic materials. Also, submissions that explore innovative approaches to training and learning at the intersection of engineering, science, technology and cultural heritage are most welcome. All submissions that pertain to the scientific study of cultural heritage, or advance its understanding and preservation, will be considered.

<PROPOSED SESSION TOPICS>

<ORGANIZERS>

Darryl P. Butt, Dean, College of Mines and Earth Sciences, University of Utah, USA
Glenn Alan Gates, PhD, Conservation Scientist, Walters Art Museum, USA

Symposium 35:
Virtual Materials Design and Ceramic Genome

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

<PROPOSED SESSION TOPICS>

•Ceramic genome
•Novel simulation methods for materials processing and performance
•Multi-scale modeling approaches
•Modeling materials behavior under extreme/harsh environments (ultrahigh temperature, radiation, environmental damages and severe mechanical load and stresses)
•Model-aided design of thermal insulating and thermo-structural materials
•Modeling and design of new innovative ceramics for functional applications
•Prediction of the crystal structure and properties of new ceramics
•Prediction of the structure and properties of glass materials and defects
•Role of big data and informatics in accelerated ceramic technology development and applications

<ORGANIZERS>

Jingyang Wang, Institute of Metal Research, Chinese Academy of Sciences, China
Wai-Yim Ching, University of Missouri-Kansas City, USA
Isao Tanaka, Kyoto University, Japan
William J. Weber, University of Tennessee, USA
Gerard L. Vignoles, University of Bordeaux, France
Kwang-Ryeol Lee, Korea Institute of Science and Technology, Korea
Jian Luo, University of California San Diego, USA
Bin Liu, Shanghai University, China

Special Topics 1
Fulrath Memorial Symposium on Advanced Ceramics

To be announced

<ORGANIZERS>
Akira Ando, Murata Manufacturing Co., Ltd
and others (To be announced).

Special Topics 2
Women Researchers in STEM fields– Is it time to carrier up in society?

To be announced

<ORGANIZERS>
Committee for Gender Equality, The Ceramic Society of Japan