call for abstracts

deadline Nov. 9, 2020

May 23 – 28, 2021 | Vancouver, BC, Canada

14TH PACIFIC RIM CONFERENCE ON CERAMIC AND GLASS TECHNOLOGY

GLASS & OPTICAL MATERIALS DIVISION MEETING (GOMD 2021)

PACRIM14
Hyatt Regency Vancouver

GOMD 2021
Fairmont Hotel Vancouver

The American Ceramic Society
www.ceramics.org

ceramics.org/pacrim14

14TH PACIFIC RIM CONFERENCE

GLASS & OPTICAL MATERIALS

A World of Science and Technology

PACRIM 14

INTRODUCTION

The **PACIFIC RIM CONFERENCE ON CERAMIC AND GLASS TECHNOLOGY (PACRIM)** is a biennial conference held in collaboration with the ceramic societies of the Pacific Rim countries: The American Ceramic Society (ACerS), Chinese Ceramic Society, Ceramic Society of Japan, Korean Ceramic Society, and the Australian Ceramic Society. ACerS hosted the first PACRIM conference in Honolulu, Hawaii in 1993. PACRIM conferences have since been held in Australia, Korea, Japan, China, Canada, and the U.S. They have earned a distinct reputation as a premier forum for presentations and discussions on state-of-the-art and emerging topics in ceramics and glass technologies. The 14th PACRIM conference (PACRIM14) returns to Vancouver, British Columbia, Canada, on May 23–28, 2021.

We anticipate strong participation of colleagues from cooperating societies, including CerSJ, KCerS, CCS, AusCerS, and other ceramic societies from around the world. ACerS Glass and Optical Materials Division (GOMD) will host its division meeting at PACRIM14. GOMD organizers have planned several key symposia.

PACRIM14 will provide a unique forum for knowledge exchange and sharing, and facilitate the establishment of new contacts from all over the world. The technical program will cover a wide range of exciting and emerging topics organized into a track system that includes Multiscale Modeling, Simulation, and Characterization; Innovative Processing and Manufacturing; Nanotechnology and Structural Ceramics; Multifunctional Materials and Systems; Ceramics for Energy Systems; Ceramics for Environmental Systems; and Biomaterials, Biotechnologies, and Bioinspired Materials. The 42 symposia planned within the seven tracks will identify global challenges and opportunities for various ceramic technologies.

Several special symposia are planned, including the **6th International Richard M. Fulrath Symposium on Emerging Ceramic Technologies for Sustainable Development**. The Richard M. Fulrath Award program was established to promote friendships between Japanese and U.S. researchers and scholars. The theme of this year's Fulrath Symposium is Frontiers of Ceramics for a Sustainable Society.

To engage and promote future leaders in the field of ceramics science and technology, a Young Investigator Forum is being organized. The theme of this exciting symposium is **Next-generation Materials for Multifunctional Applications and Sustainable Development, and Concurrent Societal Challenges in the New Millennium**. This symposium will provide a platform for young researchers from around the world to present their ideas, discuss their research, and network with peers.

To promote diversity in the science, technology, engineering and mathematics (STEM) community, a special symposium is planned with the theme, **Advancing the Global Ceramics Community: Fostering Diversity in an Ever-Changing World**. This special topic symposium will bring together researchers at all stages of their careers from different backgrounds, including women and underrepresented minorities to discuss issues at the forefront of ceramic science and engineering research related to retaining, supporting, and recognizing diversity in the ever-evolving workplace.

I sincerely invite all of you to take advantage of this opportunity to join us in Vancouver to actively participate in this conference. PACRIM14 will provide an excellent forum for interactions and friendships with participants from various continents who are involved in research, development, engineering, manufacturing, and application of ceramics and glass materials.

I look forward to your participation at PACRIM14 and I am sure this conference will inspire and enrich you.

PROGRAM CHAIR, PACRIM14
Michael C. Halbig
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call for abstracts deadline Nov. 9, 2020

ON CERAMIC AND GLASS TECHNOLOGY DIVISION MEETING (GOMD 2021)

ABSTRACT SUBMISSION INSTRUCTIONS

- Visit www.ceramics.org/PACRIM14 to review session topics.
- Select "Submit Abstract" to be directed to the Abstract Central website.

Abstract title plus text total character limit (including spaces) is 1,500 characters. If you have questions, please contact Marilyn Stoltz at **mstoltz@ceramics.org** or **+1 614-794-5868**.

2020-2021 GOMD OFFICERS

Chair: **John Mauro**, Pennsylvania State University

Chair-elect: **Sabyasachi Sen**, University of California Davis

Vice Chair: **Gang Chen**, Ohio University

Secretary: **Joseph Ryan**, Pacific Northwest National Lab

President's Council of Student Advisors Delegate: **Nathan McIlwaine**, Virginia Polytechnic Institute and State University

HOTELS

Please note that two hotels have been contracted for adequate program spacing. The hotels are located within walking distance of each other.

HYATT REGENCY VANCOUVER (PACRIM14)
655 Burrard Street
Vancouver, BC, Canada V6C 2R7
T +1 604 683 1234
vancouver.hyatt.com

FAIRMONT HOTEL VANCOUVER (GOMD2021)
900 W. Georgia Street
Vancouver, BC, Canada V6C 2W6
T +1 604-684-3131
Toll-free 1-800-441-1414
Rates: $309.00 CAD
Cut-off: April 29, 2021

PROGRAM CHAIRS, GOMD 2021

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INTRODUCTION

Join the **GLASS & OPTICAL MATERIALS DIVISION** in Vancouver for **GOMD 2021**—a joint event with PACRIM 14. The GOMD program features over 22 sessions organized in five symposia: Fundamentals of the Glassy State; Optical and Electronic Materials and Devices; Glass Interactions with its Environment; Glass Technology and Cross-Cutting Topics; and a Jonathan Stebbins Honorary Symposium.

Technical sessions consisting of both oral and poster presentations, led by technical leaders from industry, national laboratories, and academia, will provide an open forum for glass scientists and engineers from around the world to present and exchange findings on recent advances in various aspects related to glass science and technology.

Students are encouraged to enter their presentations in the annual student poster competition for professional recognition and cash awards. Students attending GOMD 2021 are also invited to attend a career networking event with mentors from industry, national laboratories, and academia about career opportunities and other topics in a casual environment. GOMD 2021 will provide a unique opportunity for students to learn, interact, and win awards!

The GOMD Executive Committee, program chairs, and volunteer organizers sincerely hope you will join us at GOMD 2021 to find new collaborative opportunities and exchange ideas in the international glass community.

We look forward to seeing you in Vancouver!

MULTISCALE MODELING, SIMULATION, AND CHARACTERIZATION

S1: Characterization and Modeling of Ceramic Interfaces: Structure, Bonding, and Grain Growth

The development of new ceramic materials for virtually any application field requires a detailed understanding of ceramic microstructure formation, especially the atomic-scale description of grain boundaries and interfaces. Significant progress has been made for both the atomic-resolution characterization of interface structures as well as multi-scale computational modelling of grain boundaries. These developments sparked a series of new discoveries in the field of ceramic interface science, including the mapping of varying space charge configurations, dynamic transitions between grain boundary configurations, the mechanistic description of grain growth, etc. This symposium will discuss recent advances in interface characterization and modeling, and review the broader field of ceramic interface topics with a focus on mechanistic descriptions of interface phenomena at grain boundaries, domain boundaries, surfaces, heterophase interfaces, etc.

Proposed sessions

- Advances in interface characterization and modeling
- Grain boundary and interface structures
- Microstructure evolution and grain growth
- Interface dynamics (in-situ observations)
- Correlation of interfaces with macroscopic properties

Organizers

– **Klaus van Benthem**, University of California Davis, USA benthem@ucdavis.edu
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– **Katsuyuki Matsunaga**, Nagoya University, Japan kmatsunaga@numse.nagoya-u.ac.jp
– Sung-Yoon Chung, KAIST Institute, Republic of Korea

S2: Frontier of Modeling and Design of Ceramics and Composites

As we approach the new era of explosive generation of big data and creative concept of high-throughput modeling and design, artificial intelligence, and machine learning, we may envisage a completely different paradigm for advancing new knowledge and discovery of ceramic materials. This symposium will focus on the frontiers of modeling advancements on the fundamental understanding and improvement of ceramic performances, the discovery of new ceramic materials, and the design of structural ceramic components. A broader perspective will be discussed on key challenges and opportunities for modeling-related science and technology in accelerating materials innovation and creating sustainable development. Key topics include high throughput design and characterization, informatics and machine learning, and modeling of ceramics and composites with different approaches in both computational research and experimental measurements across the length and time scales—to further optimize their behavior and facilitate design of new structural and functional ceramics and composites with tailored properties.

Proposed sessions

- High-throughput design and characterization
- Informatics and machine learning
- Multi-scale modeling of processing, microstructure, and performance
- Modeling of structure and property of ceramics and composites
- Modeling defects and amorphous matter
- Modeling of surfaces, interfaces, and grain boundaries at multiple scales

Organizers

– **Jingyang Wang**, Institute of Metal Research, Chinese Academy of Sciences, China, jywang@imr.ac.cn
– Wai-Yim Ching, University of Missouri-Kansas City, USA
– Hyung-Tae Kim, Korean Institute of Ceramic Engineering and Technology, Korea
– Kwang-Ryeol Lee, Korea Institute of Science and Technology, Korea
– Bin Liu, Shanghai University, China
– Jian Luo, University of California San Diego, USA
– Katsuyuki Matsunaga, Nagoya University, Japan
– Isao Tanaka, Kyoto University, Japan
– Gerard L. Vignoles, University of Bordeaux, France
– William J. Weber, University of Tennessee, USA

S3: Advanced Structure Analysis and Characterization of Ceramics

The symposium will cover recent developments in structure analysis and characterization of inorganic crystalline and amorphous materials, such as X-ray, neutron, synchrotron, and electron diffraction, electron microscopy, X-ray/neutron total scattering, vibrational spectroscopy (IR/Raman), NMR, XAFS, and related tools. New insights from in-situ or in-operando studies are of interest, as well as integration of first-principles calculations and complex data modeling methods. These techniques enable one to study not only static and long-range periodic structures, but also dynamic and short-and/or intermediate-range structures. Multi-scale characterization from the atomic to nanoscale dimensions is of interest as it is becoming more important in understanding the synthesis and performance of ceramic materials.

ON CERAMIC AND GLASS TECHNOLOGY

Proposed sessions

- X-ray, neutron, synchrotron and electron diffraction, total scattering, and PDF studies
- Electron microscopy and probe microscopy
- Spectroscopy tools including X-ray (XAFS), NMR, EPR, and vibrational spectroscopy
- In-situ time-resolved analysis
- Structure and chemistry characterization at multiple length scales
- Data modeling, global optimizations, statistical treatment of data

Organizers

– **Scott T. Misture**, Alfred University, USA, misture@alfred.edu
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– **Masatomo Yashima**, Tokyo Institute of Technology, Japan yashima@cms.titech.ac.jp
– Chunlin Chen, Institute of Metal Research, Chinese Academy of Sciences, China
– Toru Asaka, Nagoya Institute of Technology, Japan

INNOVATIVE PROCESSING AND MANUFACTURING

S4: Novel, Green, and Strategic Processing and Manufacturing Technologies

The properties and performance of materials largely depend on their processing and manufacturing routes. Manufacturing processes carefully designed with sufficient understanding of forming/sintering behaviors lead to reliable performance of components and products of large size and complex shapes. Recently developed new processing and manufacturing technologies of ceramic materials and systems give us unique properties which cannot be achieved from conventional routes. On the other hand, we should take into account at least two critical issues in making materials and products. One is that the technologies are "green" or environmentally benign, to avoid generation of elements and compounds hazardous to human health and environments and protect the global environment by preserving energy during fabrication. The other is that they are "strategic," using few or even no rare natural resources for stable production. Keeping these aspects in view, the aim of this symposium is to discuss advances in processing and manufacturing technologies for a wide variety of ceramic and related materials.

Proposed sessions

- Novel forming/sintering technologies, near-net shaping
- Advanced composite manufacturing technologies, hybrid processes
- Microwave or microwave assisted processing
- SPS, high density plasma processing, plasma assisted processing
- Aqueous synthesis and processing, colloidal processing
- Design-oriented manufacturing and processing
- Joining, integration, machining, repair, and refurbishment technologies
- Green manufacturing; global environmental issues and standards

Organizers

– **Tatsuki Ohji**, National Institute of Advanced Industrial Science and Technology, Japan, t-ohji@aist.go.jp
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– Samuel Bernard, CNRS, France
– Eugene Medvedovski, Endurance Technologies Inc., Canada
– Richard D. Sisson, Jr., Worcester Polytechnic Institute, USA
– Tohru S. Suzuki, National Institute for Materials Science, Japan
– Richard Todd, University of Oxford, UK
– Naoki Wakiya, Shizuoka University, Japan
– Changan Wang, Tsinghua University, China
–Weimin Wang, Wuhan University of Technology, China
– Yiquan Wu, Alfred University, USA

S5: Polymer Derived Ceramics (PDCs) and Composites

The conversion of polymers directly into ceramics offers unusual scientific and technological opportunities. 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 chemistry and molecular architecture of the precursors and the high temperature processing adopted. Unusual porous structures can also be produced from them. Potential applications range from energy and environment, to medicine, sensors, aerospace, and defense.

This symposium addresses 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 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 welcome. Participation of young researchers is especially encouraged.

Proposed sessions

- 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 nanocomposites
- Polymer-derived ceramics for clean energy applications
- Application of PDCs in various engineering fields

Organizers

– **Paolo Colombo**, University of Padova, Italy, paolo.colombo@unipd.it
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– **Yuji Iwamoto**, Nagoya Institute of Technology, Japan iwamoto.yuji@nitech.ac.jp
– Samuel Bernard, IRCER - University of Limoges, France
– Raj Bordia, Clemson University, USA
– Dong-Pyo Kim, Pohang University of Science and Technology, Korea
– Peter Kroll, The University of Texas Arlington, USA
– Xingang Luan, Northwestern Polytechnical University, China
– Philippe Miele, University of Montpellier, France
– Gurpreet Singh, Kansas State University, USA
– Gian Domenico Sorarù, University of Trento, Italy
– Zhaoju Yu, Xiamen University, China
– Yiguang Wang, Beijing Institute of Technology, China
– Yingde Wang, National University of Defense Technology, China

S6: 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 applications in high-technology clean energy and energy-saving industries for a sustainable society. To realize these attributes, powder design and synthesis, suspension control, and structural control of granulated feedstock, green body, and sintered ceramics must be well understood and carefully engineered. This symposium focuses on advanced powder processing and manufacturing technologies in the following areas.

Proposed sessions

- 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
- Advanced recycling technology
- Characterization of particle and powder

Organizers

– **Makio Naito**, Joining and Welding Research Institute, Osaka University, Japan, m-naito@jwri.osaka-u.ac.jp
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– Fiqiri Hodaj, Grenoble Institute of Technology, France
– Yuji Hotta, National Institute of Advanced Industrial Science and Technology, Japan
– C.C.Huang, Hosokawa Micron Powder Systems, USA
– Toshihiro Ishikawa, Tokyo University of Science, Yamaguchi, Japan
– Jian Luo, University of California San Diego, USA
– Taeseup Song, Hanyang University, Korea
– Tohru S. Suzuki, National Institute for Materials Science, Japan
– Satoshi Tanaka, Nagaoka University of Technology, Japan
– Chiharu Tokoro, Waseda University, Japan
– Wei-Hsing Tuan, National Taiwan University, Taiwan
– Jingxian Zhang, Shanghai Institute of Ceramics, China

S7: Synthesis, Processing, and Micro-structural Control of Materials using Electric Currents, Magnetic Fields and/or 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 increase processing efficiency. Of particular note is the widely spread (and continuously increasing) use of techniques 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 in Hawaii. The success of these symposia provided evidence of the continued worldwide growth of research and development activities in this field. The symposium provides 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 sessions

- Fundamental investigations on electric current/field and pressure on materials processing
- Effects of current/field on defects and microstructure
- Modeling and simulation studies of current activated densification
- Consolidation of nanocrystalline materials using pressure and electric fields

- Property evaluation of materials processed using electric currents including thermal, mechanical, optical, electrical, and magnetic properties
- Field activated synthesis
- Flash Sintering

Organizers

– **Javier E. Garay**, University of California San Diego, USA jegaray@ucsd.edu
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– Takashi Goto, Institute for Materials Research, Tohoku University, Japan
– Manshi Ohyanagi, Ryukoku University, Japan

S8: Porous Ceramics: Innovative Processing and Advanced Applications

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 brings together the technical community to share recent advances in the general understanding or methodologies pertaining to forming, characterization, modeling, and engineering of porous materials of ceramics, glass, glass-ceramics, and carbon. Porous materials can be based on various morphologies including, but not limited to, foams, syntactic foams, honeycombs, fibrous, 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, and storage) and environmental protection (filtration, catalyst, adsorption, and sensor). The symposium will foster an opportunity for knowledge sharing and networking for technological leaders within industry, national institutions, and academia involved in processing and applications of porous materials, including, but not limited to, areas of ceramics, chemistry, mechanics, fluid dynamics, modeling and simulation, and application engineering.

Proposed sessions

- Innovative processing route for porous ceramics
- Micro- or meso-porous ceramics and hierarchical porosities
- Additive manufacturing and shape forming technique of porous ceramics
- Sol-gel or polymer-derived porous ceramics
- Ceramic membranes
- Characterization, simulation, and modeling of porous ceramics
- Catalytic performance of porous ceramics
- Porous ceramics for thermal management, environmental, energy, functional, biological, and lightweight structural applications

Organizers

– **Manabu Fukushima**, National Institute of Advanced Industrial Science and Technology, Japan, manabu-fukushima@aist.go.jp
– **Paolo Colombo**, Università di Padova, Italy, paolo.colombo@unipd.it
– **Yu-ping Zeng**, Shanghai Institute of Ceramics, Chinese Academy of Sciences, China, yuping-zeng@mail.sic.ac.cn
– Samuel Bernard, IRCER – CNRS-University of Limoges, France
– Tobias Fey, Universität Erlangen-Nürnberg, Germany
– Miki Inada, Kyushu University, Japan
– Young-Wook Kim, University of Seoul, Republic of Korea
– Alberto Ortona, University of Applied Sciences and Arts of Southern Switzerland, Switzerland
– Akihiro Shimamura, National Institute of Advanced Industrial Science and Technology, Japan

S9: Additive Manufacturing and 3D Printing Technologies

Additive manufacturing and 3D printing technologies are globally recognized as novel fabrication processes for advanced materials and components with multifunctional structures. These technologies offer tremendous potential for design innovations and customization, complex part fabrication, rapid prototyping, and distributed digital manufacturing. Through processing, three-dimensional models are designed and created according to theoretical concepts using computer software, and two-dimensional cross sections are created by slicing operations automatically. In lithographic processing, high-resolution beams are scanned on a spread of ceramic/metal powder beds with or without resin binders to form solid planes of two-dimensional cross sections. In deposition processes, paste materials with ceramic/metal particles dispersed in binder systems are fused from nozzles moving freely in three dimensions to create composite structures. In printing processes, binder materials are sprayed from fine nozzle holes to join ceramic/metal powders using practical precision equipment. Various functional components of dielectric lattices to control electromagnetic waves, bio-materials components for medical applications, and ceramics electrode with large surface area could also be developed. Large scale structural components for aerospace and other high temperature applications can be fabricated with internal cooling path networks formed without casting molds. Thanks to additive manufacturing, it is now possible to design for function and not for manufacturing; nonetheless, each technique needs special design adjustments to boost products' efficiency. This symposium focuses on superiority of design, efficient processing, and perspicuous evaluations in additive manufacturing and 3D printing processes. In addition, various topics related to starting materials, characterization tools, NDE and in-situ monitoring of processes, qualification and certification, cost, and applications will also be discussed.

Proposed sessions

- Laminated object manufacturing/green tape stacking
- Selective laser melting/sintering (SLM/SLS)
- Fused filament fabrication (FFF)
- Binder jetting and powder bed fusion processes
- Vat photopolymerization/stereolithography
- Direct writing and ink-jet printing technologies
- Multi-material and hybrid printing techniques
- Materials and process characterization tools
- Qualification, certification, standards, and property database
- Design with/for additive manufacturing
- Applications of AM materials and components

Organizers

– **Soshu Kirihara**, Osaka University, Japan, kirihara@jwri.osaka-u.ac.jp
– **Mrityunjay Singh**, Ohio Aerospace Institute, USA mrityunjaysingh@oai.org
– **Michael Halbig**, NASA Glenn Research Center, USA michael.c.halbig@nasa.gov
– Hui-Suk Yun, KIMS, Korea
– Martin Schwentenwein, Lithoz GmbH, Austria
– Alberto Ortona, SUPSI, Switzerland
– Giorgia Franchin, Università di Padova, Italy
– Tyrone Jones, Army Research Laboratory, USA
– Arnaldo Moreno Berto, ITC, Spain
– Zhangwei Chen, Shenzhen University, China

S10: Sol-Gel Processing and Related Liquid-Phase Synthesis of Ceramics

Ceramic materials synthesized via liquid-phase route offer great advantages such as controlled compositions and broad range of materials shapes. A large variation in morphologies including nanoparticles, fibers/nanorods, nanosheets/films and monoliths is an important basis for materials with superior functionalities. The classical sol-gel processing has been developed as a versatile way of preparing glass/ceramics via pre-formed gels by subsequent drying/calcination. The introduction of structure-directing additives (agents), typically surfactants working as sacrificial templates, has become popular to further design the nanostructure of materials utilizing specific interactions among the constituents in the synthesis solution. A vast family of mesoporous materials is one of the successful examples; many of them have found attractive applications such as adsorbent, catalyst, catalyst-supports, electrochemical materials, and medical devices.

This symposium offers a platform for researchers from academia and industries to explore novel synthetic strategies for obtaining materials with highly designed structure/property via sol-gel and related liquid-phase processes. Material compositions will not be strictly limited to ceramics, but will include organic-inorganic hybrids such as organosiloxanes, metal-organic frameworks, and carbon-ceramics composites.

Proposed sessions

- Sol-gel process
- Liquid-phase synthesis
- Nano/meso-scale templating method
- Hierarchical structuring method
- Powders, fibers, films, monoliths, and gels
- Porous low-density materials (aerogels)
- Nanoparticles, nanofibers, nanorods, and nanosheets

Organizers

– **Kazuki Nakanishi**, Nagoya University/Kyoto University, Japan, dknakanishi@imass.nagoya-u.ac.jp
– Hiromitsu Kozuka, Kansai University, Japan

– Yoshiyuki Sugahara, Waseda University, Japan
– Andrei Jitianu, City University of New York, USA
– Byeong-Soo Bae, KAIST, South Korea

S11: 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 alternately stacked layers of the positively charged metal hydroxide nanosheets (charged layers) and interlayer anions with binding field. In hydroxide nanosheets, metal ions with different valence are self-assembled in-plane. These periodic structures are formed under the ambient atmosphere. Over the last decade, research on LDHs has been developing in several fields and applications, in both fundamental and applied aspects of these materials. However, communication between 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 sessions

- 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
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– Kentaro Teramura, Kyoto University, Japan
– Jae-Min Oh, Dongguk University, Korea
– Andrei Jitianu, City University of New York, USA

S12: Specific Reaction Field and Material Fabrication Design

Today, traditional material processing is becoming saturated and it is increasingly difficult to fabricate innovative materials. For this to happen, innovative fabrication design is needed. One method includes the use of specific reaction fields, such as ultrasonic, microwave, laser, supercritical fluid, implosion, hydrothermal, solvothermal, etc. 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 specifically affect nucleation, atom diffusion, and growth in material fabrication. Thus, specific reaction fields are very important for innovative material design, processing, and new material fabrication. In this session, new material and material processing using specific reaction fields will be discussed for material fabrication design. New material, strange structure, nanoparticle, film, bulk, 3D, morphology control, sintering, function, etc. are also included.

Proposed sessions

- 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
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– Takahiro Nakamura, Tohoku University, Japan
– Takashi Shirai, Nagoya Institute of Technology, Japan
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– 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
– Masaki Kubo, Tohoku University, Japan

NANOTECHNOLOGY AND STRUCTURAL CERAMICS

S13: Novel Nanocrystal Technologies for Advanced Ceramic Materials & Devices

Recent progress in nanocrystal technologies for advanced ceramic-based materials and devices has great impact on a wide range of research fields and industries, 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. A precise control of size, morphology, nanostructure, and interface-structure of nanomaterials is strongly demanded to enhance properties and characteristics of ceramic-based materials and devices in various applications: electronics, photonics, sensors, catalysts, energy renewable and storage devices, and so on. This symposium focuses on synthesis and characterization of nanocrystals and nanocomposites, fabrication of 1D-, 2D-, and 3D-assemblies, coating films, bulk ceramics by nanocrystals, and applications and functional devices using nanocrystals. Characterization, calculation, and fundamental study of nanocrystals, their assemblies, and composites will also be of interest to understand mechanisms of advanced and anomalous properties of designed nanomaterials and nanoarchitectures.

Proposed sessions

- Synthesis of nanocrystals and nanocomposites
- Fabrication of 1D-, 2D-, and 3D-assemblies, coating films, and bulk ceramics by using nanocrystals
- Interface and colloid science of nanocrystals
- Characterization techniques of nanocrystals and nanostructured architectures
- Fundamental study and advanced properties of isolated and assembled nanocrystals
- Applications and functional devices using nanocrystals
- Calculations and nanomaterial design

Organizers

– **Bryan D. Huey,** University of Connecticut, USA
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S14: Functional Nanomaterials for Energy Harvesting and Solar Fuels

Functional nanomaterials with intrinsically new and tailored properties are key elements for developing sustainable solutions for energy harvesting. This symposium will focus on new energy technologies and advanced nanodevices such as the emerging class of inorganic-organic hybrid perovskites, next-generation photocatalysts, solar hydrogen production devices, and eco-friendly multifunctional optoelectronic devices such as quantum-dot LEDs and flexible electronic devices.

Chemically processed functional nanomaterials have emerged as key materials to develop high performance flexible and stretchable optoelectronic devices for next generation display and energy harvesting applications. Perovskite solar cells (PSCs) manifest disruptive materials innovation in the field of energy harvesting due to their promising photoconversion efficiencies (> 25%), low cost, and easy solution processability. However, progress in device efficiency, long-term environmental stability, and lead-free technologies are essential for commercial uptake and deployment of perovskite solar cells. Photoelectrochemical (PEC) water splitting has emerged as a competitive technology being capable of converting solar energy directly into chemical energy using stable and efficient photocatalysts for solar hydrogen production. Recent developments based on novel materials and systems have led to significant advances in the fundamental understanding of light-induced charge dynamics and related interfacial chemical reactions and efficiencies as well as performance stability of such new systems that will be discussed in this symposium.

This international forum will present technological advances in functional materials for energy harvesting to meet the challenges of sustainable energy and environment technologies. Interested individuals are invited to contribute by submitting abstracts along the following topics.

Proposed sessions

Innovative processing of functional nanomaterials for optoelectronic devices

- Understanding of interface-driven functionalities and multi-material heterostructures
- Synthesis, functionalization, and assembly of nanomaterials and nanocomposites
- Integration of functional nanomaterials into eco-friendly multifunctional devices (energy storage, flexible display, optoelectronic and bioelectronic devices, etc.)
- Scaled-up production of nanomaterials and integration into energy harvesting devices

Functional metal oxide nano- and heterostructures for photocatalysis and solar fuels

- Inorganic nanomaterials for artificial photosynthesis
- Molecular and semiconductor catalytic materials and systems for CO_2 reduction
- Nanostructured oxide and nanocomposites for excitonic solar cells

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Advanced materials for next generation photovoltaic devices

- Frontiers of organic, inorganic, and hybrid perovskite solar cells
- Solar cell architectures and materials requirements
- Next generation electron and hole transport materials
- Hybrid interfaces and nanocrystalline junctions
- Charge generation, trapping, and transport
- Optoelectronic devices based on nanoparticle, nanowires, and composites

Organizers

– **Sanjay Mathur**, University of Cologne, sanjay.mathur@uni-koeln.de
– Tohru Sekino, Osaka University, Japan
– Soo-Wohn Lee, Sun Moon University, Korea
– Flavio de Souza, Universidade Federal do ABC, Brazil
– Yasuhiro Tachibana, RMIT University, Australia
– Gunnar Westin, Uppsala University, Stockholm, Sweden
– Yoshitake Masuda, AIST, Japan
– N. V. Ravi Kumar, IIT Madras, India
– Daniel Chua, National University of Singapore, Singapore
– Emanuel Ionescu, TU Darmstadt, Germany
– Shashank Mishra, University of Lyon, France

S15: Engineering Ceramics and Ceramic Matrix Composites: Design, Development, and Applications

Engineering ceramics and ceramic matrix composites (CMCs) offer unique combinations of properties that have the potential to fulfill demanding material needs in structural and functional applications, such as those in the aerospace, automotive, energy generation, environment, transportation, optical systems, 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 degree of penetration of these materials into the marketplace. Successful entry of engineering ceramics and composites into the marketplace depends on consistent development of materials with improved properties, thus providing solutions for engineering conditions with special requirements. In addition, the development of novel methods to advance computationally driven materials design and validation of modeled structure/property relationships are needed to accelerate ceramic materials development and lower costs. This symposium will provide a broader forum for scientists and engineers around the world to present and discuss recent advances and developments in areas of processing, characterization, and applications of engineering ceramics and CMCs.

Proposed sessions

- Innovative processing routes and synthesis methods
- Fibers, preforms, interfaces/interphases and matrices
- Processing-microstructure-mechanical properties correlation
- Sintering and microstructure control
- Advanced design, processing, and manufacturing of CMCs
- Fracture mechanics of ceramics and composites
- Thermal, electrical, and optical properties
- Environmental effects and thermo-mechanical performance
- Tribological performance of ceramics and composites
- Nondestructive evaluations
- Energy generation and environmental applications
- Design, reliability, and life prediction modeling of devices and components
- Novel computational approaches to enhance materials performance and predictability
- Characterization of damage and failure mechanisms
- Applications

Organizers

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– Walter Krenkel, University of Bayreuth, Germany
– Hagen Klemm, Fraunhofer Institute for Ceramic Technologies and Systems, IKTS, Germany
– Hua-Tay Lin, Guangdong University of Technology, China
– Gerard L. Vignoles, University of Bordeaux, France
– Laifei Cheng, Northwestern Polytechnical University, China

S16: Advanced Structural Ceramics for Extreme Environments

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 ceramics and composites are needed. Some critical challenges include thermal/chemical stability, complex shape forming, thermal shock resistance, radiation tolerance, and damage tolerance. This symposium will focus on computational and experimental studies in areas such as design of new materials, synthesis, 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 sessions

- High entropy ceramics
- MAX phases, MXenes, and related compounds
- Oxide-, carbide-, boride-, and nitride-based ceramics and composites
- New precursors for powders, coatings, and matrix or fibers of composites
- Novel synthesis and processing methods (bulk, coatings, and thin films)
- Materials design, new compositions, and composites
- Structure-property relationships at room and elevated temperatures
- 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

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– Guo-Jun Zhang, Donghua University, China
– Hailong Wang, Zhengzhou University, China
– Yoshio Sakka, National Institute for Materials Science, Japan
– Theresa Davey, Tohoku University, Japan
– Sea-Hoon Lee, Korea Institute of Materials Science, Korea
– Bai Cui, University of Nebraska–Lincoln, USA
– Carolina Tallon, Virginia Polytechnic Institute and State University, USA
– Diletta Sciti, Institute of Science and Technology of Ceramics-CNR, Italy
– Luc J Vandeperre, Imperial College London, UK

S17: 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 surfaces in terms of physical, mechanical, thermal, chemical, optical, electrical, electronic, and 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, intermetallics 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. This symposium will identify current key issues, effective approaches, and future outlook for functional coating technologies and applications through comprehensive discussion on the following proposed topics.

Proposed sessions

- 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

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– Kentaro Shinoda, National Institute of Advanced Industrial Science and Technology, Japan

S18: Advanced Wear Resistant Materials: Tribology and Reliability

There is an urgent need for materials for triboactive and demanding applications. We need to design and understand the behavior of materials for reliable functions in extreme environments and conditions, such as high temperature, high mechanical stresses, and high cycles. Engineers need a new toolbox for determining advanced materials for functional applications such as different types of bearings, contact-based devices, gears, high temperature devices, furnace components, auxiliary power units (APUs), turbo-components, and other components in extreme environments. This

symposium invites scientists, academics, postdoctoral researchers, and students to contribute high quality research in this area.

Proposed sessions

- Green tribology
- Sustainability and agriculture-based materials
- Current progress in non-oxide ceramics
- Advances in nanotechnology
- Thermal and cold sprayed coatings
- Additively manufactured materials and layers
- Mathematical modeling for understanding the mechanical behavior of materials
- Different types of materials development for tribology research

Organizers

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– Akira Miura, Hokkaido University, Japan

– Enrico Bernardo, University of Padova, Italy

– Stephen Berkebile, Army Research Lab, USA

– Yongsheng Zhang, Lanzhou Institute of Chemical Physics, CAS, China

– Yuelei Bai, Harbin Industrial University, China

– Zhenying Huang, Beijing Jiaotong University, China

S19: Geopolymers: Low Energy and Environmentally Friendly Ceramics

Refractory inorganic polymers can be made at ambient temperatures and pressures from powder and liquid to form a paste of low viscosity. These materials, called geopolymers, include alkali metakaolin-based, alumino-silicates, silico-aluminate phosphates, or stoichiometric geopolymers (which convert to single phase ceramics upon heating), as well as other chemically bonded, inorganic compounds. The use of biological materials as starting compounds or as reinforcements in composites demonstrates the eco-friendly and sustainable nature of these materials. Novel potential applications of such composites include fire and corrosion-resistant coatings; thermal insulation; porous materials; structural ceramic composites containing ceramic, metal, organic, or biological reinforcements; nano-zeolites for liquid and water purification; and infrastructure and construction materials. The nanoparticulate nature of geopolymers also provides a low energy processing route to ultra-refractory ceramic powders or versatile forming methods, including 4D printing. Waste materials such as fly ash and slag can be used to make alkali activated cements and will also be discussed.

Proposed sessions

- Synthesis, processing microstructure
- Mechanical properties, thermal shock resistance
- Composites
- Phosphates and other inorganic analogues
- Geopolymer-derived processing routes
- Conversion to ceramics
- Use of waste materials to make alkali-activated geopolymers and cements
- Coatings (fire resistant, acid resistant)
- Waste encapsulation
- Sustainable materials
- Novel applications

Organizers

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– Don Seo, Arizona State University, USA

– Henry A. Colorado, Universidad de Antioquia, Medellin, Colombia

– Ruy sa Ribeiro, INPA-National Institute for Amazonian Research/ Structural Engineering Laboratory, Brazil

MULTIFUNCTIONAL MATERIALS AND SYSTEMS

S20: Multiferroic Materials, Devices, and Applications

Multiferroic materials, especially magnetoelectric materials, have received increasing scientific interest because of their rich physics and great potential applications, not only in spintronic technologies. They are just on the cutting edge of materials science. Recently, great progress has 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, devices, systems, and possible applications. This symposium also welcomes discussions about multiferroics with unconventional couplings beyond magnetoelectric materials.

Proposed sessions

- Fundamental issues and frontiers of multiferroics
- Emergent phenomena: spin/charge textures in multiferroics
- Multiferroic thin films
- Multiferroic composite and superlattices
- Type-I multiferroics and $BiFeO_3$-based ceramics
- Type-II multiferroics
- Single-phase R-T multiferroic new systems
- Calculations and theoretical predictions on multiferroics
- Devices, systems, and applications of multiferroic materials
- Multiferroics beyond magnetoelectric materials

Organizers

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– Laurent Bellaiche, University of Arkansas, USA
– Jun-Ming Liu, Nanjing University, China
– Ramamoorthy Ramesh, University of California Berkeley, USA

S21: 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, worldwide experts in different topics will be invited to introduce their most recent activities. The broad scope of the session ensures a wide overview of state-of-the-art issues on crystalline materials to stimulate interdisciplinary discussions and collaborations in a wide range of fields.

Proposed sessions

- Semiconductors
- Optical and scintillation materials
- Piezo/ferro-electric materials
- Transparent material
- Fundamentals such as phase diagrams and defect chemistry
- Crystalline quality

Organizers

– **Kiyoshi Shimamura**, National Institute for Materials Science, Shimamura.kiyoshi@nims.go.jp
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– Luisa E. Bausá, Autonomous University of Madrid, Spain
– Victoria Blair, U.S. Army Research Laboratory, USA
– Yoshihiko Imanaka, Fujitsu Laboratories Ltd., USA
– Taylor Shoulders, U.S. Army Research Laboratory, USA
– Kenji Toda, Niigata University, Japan
– Tetsuo Tsuchiya, National Institute of Advanced Industrial Science and Technology, Japan
– Yiquan Wu, Alfred University, USA
– James Wollmershauser, Naval Research Laboratory, USA
– Takayuki Yanagida, Nara Institute of Science and Technology, Japan
– Mariya Zhuravleva, University of Tennessee, USA

S22: Microwave Dielectric Materials and Their Applications

Microwave dielectric materials play a key role in modern microwave communication technologies because of their important applications as microwave resonators, filters, antennas, etc. In particular, millimeter-wave materials/devices are key to the 5G revolution. New devices with superior performance are currently being developed to respond to the requirement of increased channel capacity in ground-based cellular and satellite communications. Device performance is closely related to material characteristics, and in order to meet the specifications of present and future systems, improved or new microwave components based on dielectric materials and new designs are required. This symposium provides a forum for the worldwide microwave community from academia, government, and industry to discuss topics such as materials development, design, measurement techniques, devices, applications, technology trends, and market demands.

Proposed sessions

- Frontier of microwave dielectric materials and their applications
- Dielectric response of materials in millimeter and sub-millimeter wave range
- Ceramic materials and technology for microwave devices
- Modeling, simulation, and measurement
- Low-temperature co-fired ceramics (LTCC) and technologies
- Tunable dielectrics for microwave electronics
- Meta-materials and photonic crystals for microwave devices
- New film materials, integration technologies, and printed electronics
- Microwave absorbing materials
- Ferrites and magnetoelectrics
- High-frequency acoustic-wave devices
- Millimeter-wave materials for 5G applications
- Millimeter and sub-millimeter wave devices

Organizers

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– Eung Soo Kim, Kyonggi University, Korea
– Nate Orloff, National Institute of Standards and Technology, USA

S23: Transparent Ceramic Materials and Devices

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. Emphasis will also be placed on fundamental issues to advance our understanding and utilizations of advanced transparent materials and related devices applied to environment, healthcare, and energy.

Proposed sessions

- Functionality of transparent crystalline and amorphous materials
- Fundamental science 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 and magneto-optical transparent materials
- Crystalline and amorphous transparent laser materials
- Optical materials for bioengineering and sustainable energy
- Ceramic phosphors and their applications
- Crystal/ceramic fiber for solid state laser application
- Ultraviolet and mid-infrared application of optical materials
- Modeling and theory computation of optical materials

Organizers

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– 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, Wroclaw, Poland

CERAMICS FOR ENERGY SYSTEMS

S24: 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 electrical performance and performance stability as well as reduction in 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 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 sessions

- Oxygen ion and mixed conductors, conduction mechanisms, materials limitations
- Proton-conducting SOFCs
- Electrode materials and microstructural engineering, ceramic and metallic interconnects, degradation mechanisms, coatings
- Sealing materials, thermomechanical 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
- High temperature electrolysis; reversible solid oxide cells
- Prototype SOFC systems, commercialization plans, field test experience, and cost

Organizers

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– Tae Ho Shin, Korea Institute of Ceramic Engineering and Technology, South Korea
– Sebastian Molin, Gdansk University of Technology, Poland
– Yasunobu Mizutani, National Institute of Advanced Industrial Science and Technology, Japan
– Guntae Kim, Ulsan National Institute of Science and Technology, South Korea

S25: Direct Thermal to Electrical Energy Conversion Materials, Applications, and Thermal Energy Harnessing Challenges

Thermal energy conversion and harnessing are ultimate goals in terms of energy strategy and efficiency of our global society. 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 novel devices and applications 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 enable novel approaches toward higher efficiency and revolutionary technologies in thermal energy harvesting and heat management.

Proposed sessions

- 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 and their applications

Organizers

- **Michitaka Ohtaki**, Kyushu University, Japan, ohtaki@kyudai.jp
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- Jin-Sang Kim, Korea Institute of Science and Technology, Korea
- Holger Kleinke, Waterloo University, Canada
- Takao Mori, National Institute for Materials Science, Japan
- Min-Wook Oh, Hanbat National University, Korea
- Junichiro Shiomi, The University of Tokyo, Japan
- Kuei-Hsien Chen, National Taiwan University, Taiwan
- Xiaolin Wang, University of Wollongong, Australia
- H.-T. Lin, Guangdong University of Technology, China
- Gang Chen, Massachusetts Institute of Technology, USA
- Emmanuel Guilmeau, CNRS-CRISMAT, France
- Koji Miyazaki, Kyushu Institute of Technology, Japan
- Chunlei Wan, Tsinghua University, China
- Anke Weidenkaff, University of Stuttgart, Germany
- Yuri Grin, MPI-CPfS, Germany
- Mona Zebarjadi, University of Virginia, USA

S26: 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, and appropriate functional properties (optical, chemical and thermal properties) must also be taken into account.

This symposium will focus 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 and thermochemical energy storage materials; materials for solar fuels; materials-related aspects of solar process heat applications; structural and particulate materials for solar receivers and solar reactors; and materials and manufacturing of advanced CSP components.

Proposed sessions

- 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

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- Mirrors and mirror coatings (reflectivity, stability against pitting and delamination, self-cleaning surfaces, lifetime 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 driven carbon capture and utilization (CCU) processes

- Materials for (solar) thermochemical processes to produce H_2, CO, NH_3 or synthetic hydrocarbon fuels (metal oxide-based redox materials, catalysts, sulfur-based cycles, Cu-Cl cycle, etc.)

Organizers

– **Martin Schmücker**, German Aerospace Center, Germany martin.schmuecker@dlr.de

– **Dileep Singh**, Argonne National Laboratory, USA, dsingh@anl.gov

– Martin Roeb, German Aerospace Center (DLR), Institute of Solar Research, Germany

– Gözde Alkan, German Aerospace Center (DLR), Institute of Materials Research, Germany

– Tatsuya Kodama, Niigata University, Japan

– Wojciech Lipinski, Australian National University, Australia

S27: Advanced Materials and Technologies for Electrochemical Energy Storage Systems

During the last two decades, research groups in academia and industries around the globe have developed numerous cathode and anode materials and electrolytes that can be used in electrochemical storage systems for storing increasingly more energy per unit mass or unit volume. As a result of these advances, lithium-ion battery technology has evolved beyond the consumer electronics industry and is now making serious progress in the transportation industry. Still, challenges at the battery system level remain with regard to energy, power, cost, life, and safety. Also, the technology is slowly making landmark in other industries such as stationary storage systems for wind farms and solar plants. Improvements in materials design, electrodes architecture, and cell chemistry are required to extend the life, enhance the safety, and lower the cost of rechargeable lithium-ion batteries. A deeper understanding of the battery materials/property relationship, electrode/electrolyte interface phenomena, and cell failure mechanisms is also needed to face these challenges. The search for advanced high capacity electrode materials and the implementation of the very challenging lithium-sulfur and lithium batteries will be necessary to overcome the energy density shortfall in current lithium-ion batteries. Abstracts are solicited on the fundamental/theoretical and applied aspects of rechargeable lithium-ion batteries, lithium batteries, lithium-sulfur, and beyond lithium technologies, including sodium batteries, Mg/Ca/Al-based batteries and supercapacitors. We also invite abstracts on solid electrolytes (ceramic, polymer, and hybrid), all-solid-state-batteries, supercapacitors, hybrid capacitors, and recycling of battery materials. This symposium will allow for discussion among many groups involved in development and use on these technologies.

Proposed sessions

- Solid electrolytes for batteries
- All-solid-state batteries
- Advanced anode and cathode materials for lithium batteries
- Materials design, screening, and electrode architectures for lithium batteries

- Diagnostics and materials characterization for lithium batteries
- Electrode/electrolyte interface characterization for lithium batteries
- Applications-focused lithium batteries
- Lithium-sulfur battery technology
- Sodium batteries, potassium batteries, magnesium batteries, and calcium batteries
- Materials of capacitive energy storage (super-capacitors)
- Recycling of battery materials
- Stationary rechargeable batteries for grid, solar, and wind technologies

Organizers

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– Robert Dominko, National Institute of Chemistry, Slovenia
– XiangXin Guo, Qingdao University, China
– Kisuk Kang, Seoul National University, Korea
– Shirley Meng, University of California San Diego, USA
– Neeraj Sharma, University of New South Wales, Australia
– Naoaki Yabuuchi, Yokohama National University, Japan

S28: Atomic Structure and Electrochemical Property Diagnosis Toward Full Crystal Rechargeable Batteries

Rechargeable batteries, such as the lithium-ion battery, are indispensable to continuously support sustainable modern society, but further development of a battery system with much higher energy density and longer durability is still required. To improve rechargeable batteries, it is essential to understand the structural evolution of the bulk and interfaces between anode, cathode, and electrolyte materials during charge-discharge processes. However, a real battery cell has so many chemical components and complex structures, making it difficult to diagnose respective materials and their interfaces in an electrochemical process. We need to prepare a simple model battery composed of high-purity materials such as single crystals, thin films, and solid-state crystal electrolytes. This symposium will focus on investigations of the relationship between atomic structure and electrochemical property by using simple but high-quality battery materials. In addition to structure and property analyses, this symposium will cover growth methodology of high purity single crystals and thin films. The battery system is not only cation (lithium, sodium) but also anion (fluorine or sulfur) or the other multivalent-ion materials.

Proposed sessions

- Single crystal or thin film growth for anode and cathode materials
- Synthesis of anion battery materials
- Solid state crystal electrolytes
- Local atomic and electronic structure analysis by electron microscopy
- Electrochemical property analysis
- In-situ observations of battery materials in a charge-discharge process

Organizers

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– **Yumi H. Ikuhara**, Japan Fine Ceramics Center, Japan, yumi@jfcc.or.jp
– Miaofang Chi, Oak Ridge National Laboratory, USA
– Sung-Yoon Chung, Korea Advanced Institute of Science and Technology, Korea
– Rong Huang, East China Normal University, China

S29: Ceramics and Ceramic Matrix Composites for Next Generation Nuclear Energy

Advanced ceramics and ceramic matrix composites (CMCs) are attractive for next generation nuclear energy systems, as they increase the operating temperature window to allow higher thermal efficiency. Ceramics and CMCs have been used or proposed as fuels forms, cladding, or structural materials for light water and advanced reactors. As such, considerable research has been dedicated around these systems. These materials also contribute to enhanced safety of nuclear systems, including light water reactors, due to their high temperature capability. Moreover, the use of these materials mitigates long-term waste disposal due to low-activation. Processing, properties, and testing of traditional glass and cementitious materials need to be expanded to meet the future needs of the nuclear industry. This symposium discusses current state of the art including processing, fundamental materials science issues, and practical aspects of their deployment.

Proposed sessions

- Material design, synthesis, and characterization
- Irradiation effects and post irradiation examination
- Chemical compatibility and corrosion
- Synergistic multi-scale modeling and experimental study on microstructure evolution and physical properties of ceramics in nuclear energy environments
- Test standards and design codes
- Joining and coating
- Vitrification technologies and radioactive waste immobilization
- Status of national and international programs
- Advanced manufacturing
- Accident tolerant fuels for LWRs

Organizers

– **Tatsuya Hinoki**, Kyoto University, Japan, hinoki@iae.kyoto-u.ac.jp
– **Ming Tang**, Clemson University, USA, mingt@clemson.edu

ON CERAMIC AND GLASS TECHNOLOGY

– **Yutai Katoh**, Oak Ridge National Laboratory, USA, katohy@ornl.gov
– Takaaki Koyanagi, Oak Ridge National Laboratory, USA
– Weon-Ju Kim, Korea Atomic Energy Research Institute, Korea
– Tieshan Wang, Lanzhou University, China
– Xianming Bai, Virginia Polytechnic Institute and State University, USA
– Peng Xu, Idaho National Laboratory, USA
– Erofili Kardoulaki, Los Alamos National Laboratory, USA
– Shaoming Dong, Shanghai Institute of Ceramics, China
– Sosuke Kondo, Tohoku University, Japan

S30: High Temperature Superconductors: Materials, Technologies, and Systems

The discovery of superconductivity in cuprates, pnictides, and related materials generated an outburst of research activity and exciting new discoveries—most recently in bilayer graphene and infinite-layer nickelates. However, a key challenge remains: the understanding of mechanisms of unconventional superconductivity, still under debate despite many relevant advances in research and materials development. Meanwhile, many new superconductors have emerged, including ruthenates, cobaltates, borides, borocarbides, doped fullerenes, intercalated graphite, hydrides, sulphites, and organic and heavy-fermion superconductors; accompanied by in-depth characterization of their physical properties via a variety of experimental approaches and successful applications in wires, tapes, processing in electronics, and novel nano-related technologies like nano-engineering. This symposium follows the scheme of similar ceramics and materials-related symposia: It will highlight discoveries of new superconductors, as well as progress in fundamental and technological studies of already known materials and phenomena. The focus will be on novel aspects, issues, and systems, yet attention will also be paid to all superconducting-related topics, including fundamental aspects of theory, advances in synthesis, functionalization and processing, and the latest progress in areas of the field effect, thin-film heterostructures, and novel devices at both small and large scale ranges, including new applications in quantum devices.

Proposed sessions

- Materials, structure, physical chemistry, and general properties
- New oxide superconductors (bulk materials, thin films, and interfaces)
- New iron pnictide and chalcogenide superconductors
- Theory and mechanisms (for normal and superconducting states)
- Vortex lattice physics
- Topological superconductivity and proximity effect
- Synthesis by novel methods and processing
- Power applications
- Low power applications and superconducting electronics

Organizers

– **John Wei,** University of Toronto, Canada, wei@physics.utoronto.ca
– **Davor Pavuna**, Ecole Polytechnique Federale de Lausanne, Switzerland, davor.pavuna@epfl.ch
– Riccardo Comin, Massachusetts Institute of Technology, USA
– Qijin Chen, University of Science and Technology of China, China
– Takasada Shibauchi, University of Tokyo, Japan

CERAMICS FOR ENVIRONMENTAL SYSTEMS

S31: Advanced Functional Materials, Devices, and Systems for Environmental Conservation, Pollution Control, and Critical Materials

With the rise of science and technology, there is a trend toward the expanding importance of ceramics, which not only resist thermal and chemical stability but also possess a wide variety of functions. However, seeking new functions is now routine, and development of safe and secure advanced ceramics for the next generation is necessary for environmental conservation. This symposium will cover a variety of topics related to novel and environmentally conscious ceramics. Topics for discussion include advanced functional ceramics such as environmental catalysts, semiconductors, porous materials, chemical sensors, optical materials such as mercury-free lamps (light emitting diodes), environmentally friendly pigments, and recovery and recycling of rare metals, critical materials, etc.

Proposed sessions

- 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
- Phosphors and optical ceramics for light emitting diodes (LEDs)
- Environmentally friendly pigments
- Recovery and recycling of rare metals
- Critical materials

Organizers

– **Nobuhito Imanaka**, Osaka University, Japan imanaka@chem.eng.osaka-u.ac.jp
– Taek-Soo Kim, Korea Institute of Industrial Technology, Korea
– Kazuyoshi Ogasawara, Kwansei Gakuin University, Japan
– Satoshi Wada, University of Yamanashi, Japan
– Hiroshi Masumoto, Tohoku University, Japan
– Shu Yin, Tohoku University, Japan

S32: Ceramics for Enabling Environmental Protection: Clean Air and Water

Environmental protection is one of the most important issues to conserve natural resources and the existing natural environment and, where possible, to repair damage and reverse trends. Due to pressures of overconsumption, population growth, and technology, the biophysical environment is being degraded, sometimes permanently. Most importantly, clean air and water are vital to our health, economic prosperity, and the environment. Historically, many ceramic materials to obtain clean water and air have been developed. This symposium brings together the technical community to share recent advances in the general understanding or methodologies pertaining to forming, characterizing, modeling, and engineering of ceramic materials regarding clean air and water. These types of ceramics can be based on various morphologies including, but not limited to, powder, membranes, fibers, films, some photocatalysts, composite materials, and applications. This symposium will foster knowledge sharing and networking for technological leaders within industry, national institutions, and academia involved in processing and applications of ceramics for enabling environmental protection, including, but not limited to, areas of ceramics, chemistry, mechanics, fluid dynamics, modeling and simulation, and application engineering.

Proposed sessions

- Innovative processing route and synthesis of ceramics for environmental protection
- Properties of ceramics for environmental protection
- Ceramic materials for water purification
- Ceramic materials for air purification
- Photocatalytic ceramics for environmental protection
- Ceramic membranes for water purification or air purification
- Ceramic-based sensors for environmental pollutant detection

Organizers

- **Toshihiro Ishikawa**, Tokyo University of Science, Yamaguchi (Sanyo-Onoda City University), Japan, ishikawa@rs.socu.ac.jp
- **Qi Li**, Southwest Jiaotong University, China, qiliuiuc@swjtu.edu.cn
- Dionysios D. Dionysiou, University of Cincinnati, USA
- Yongfa Zhu, Tsinghua University, China
- Weichang Hao, Beihang University, China
- Fan Dong, University of Electronic Science and Technology of China
- Chun-Hong Kuo, Institute of Chemistry, Academia Sinica, Taiwan, China
- Hiromi Yamashita, Osaka University, Japan
- Richard L. Valentine, University of Iowa, USA
- Edward S. Zhang, Griffith University, Australia

S33: Photocatalysts for Energy and Environmental Applications

There has been 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. Research, development, demonstration, and commercialization in this principal field have attracted global interest from academia, government research laboratories, and industry. The symposium will focus on the science of ceramic materials for energy and environmental technologies, and facilitate information sharing on the latest developments and industrial applications of photocatalysis. These techniques will be essential for generating renewable energy and eliminating environmental pollutants in future generations. This session will present the most current findings generated at laboratories of universities and research institutions, as well as in the field by practitioners.

Proposed sessions

- Photocatalytic water splitting
- Photocatalysts for environmental purification (water, air, soil)
- Solar fuels and artificial photosynthesis
- Photo induced self-cleaning coatings
- Photocatalytic antimicrobial materials
- Photocatalytic reactors and systems
- Photoelectrochemistry, photoelectrochemical cells
- Integrated photoelectrochemical conversion systems including perovskite solar cells
- Photocatalytic mechanism
- Fundamental research on nanostructured photocatalysis
- Computation and simulation on new photocatalytic materials

Organizers

- **Gang Liu**, Institute of Metal Research, Chinese Academy of Sciences, China, gangliu@imr.ac.cn
- **Lianzhou Wang**, The University of Queensland, Australia l.wang@uq.edu.au
- Ho Won Jang, Soule University, Korea
- Kazuhiko Maeda, Tokyo Institute of Technology, Japan
- Francesca Toma, Lawrence Berkeley National Laboratory, USA
- Roland Marschall, University of Bayreuth, Germany
- Dongling Ma, INRS, Canada

ON CERAMIC AND GLASS TECHNOLOGY

S34: Glass and Ceramics for Nuclear Waste Treatment and Sequestration

Effectively immobilizing radioactive waste in materials that will safely endure for hundreds to thousands of years relies on the treatment of waste and its incorporation into chemically and mechanically robust waste forms. Strategies are being developed to manage waste streams from current reactors and next generation systems (e.g., molten salt reactors), as well as recycling processes (e.g., PUREX, electrochemical reprocessing). Although commercialization of these reactors is decades away, it is desirable to create more efficient approaches that improve waste processing and expedite completion of large-scale nuclear waste sequestration. Achieving this goal will require development of new treatments and waste form approaches that are matched to specific isotopes and waste streams. Additionally, waste forms should effectively and safely meet isotope-specific requirements for long-term storage while ensuring minimal environmental risk. This symposium will bring together the technical community to share recent advances related to all aspects of nuclear waste treatment and sequestration, including solubility, complexation, speciation, separations, waste form matrices, species transport, environmental issues, water purification, and radiation effects in waste forms. The symposium will foster knowledge sharing and networking for technological leaders within industry, national institutions, and academia involved in treatment and sequestration of nuclear waste and related environmental issues.

Proposed sessions

- Separation of radionuclides from waste streams
- Salt separation technologies (e.g., dehalogenation, oxidative precipitation)
- Waste form matrices – synthesis and characterization
- Species transport in the environment
- Removal of radionuclides from aqueous environments
- Radiation effects in waste forms

Organizers

– **Hans-Conrad zur Loye**, University of South Carolina, USA zurloye@mailbox.sc.edu
– **Krista Carlson**, University of Utah, USA, krista.carlson@utah.edu
– **John McCloy**, Washington State University, USA john.mccloy@wsu.edu
– Kazuyoshi Uruga, Central Research Institute of Electric Power Industry, Japan
– Wooyong Um, Pohang University of Science and Technology, Republic of Korea
– Kai Xu, Wuhan University of Technology, China
– Brendan Kennedy, The University of Sydney, Australia
– Dan Gregg, Australian Nuclear Science and Technology Organisation, Australia

BIOMATERIALS, BIOTECHNOLOGIES, AND BIOINSPIRED MATERIALS

S35: Advanced Additive Manufacturing Technologies for Bio-applications; Materials, Processes, and Systems

Recent advancements in additive manufacturing (also known as 3D printing) technologies have attracted a lot of attention to their application in a variety of bio-medical components and devices because of the unique capability of fabricating complex or heterogeneous structures and custom-made parts. This symposium will address the latest achievements, trends, issues, challenges, and opportunities of additive manufacturing and related technologies of ceramics and other materials for bio-applications that are critically needed for future medical technologies. This symposium will provide an excellent forum to share ideas and visions on these technologies, and grow interaction and friendship among participants from academia and industry around the world. We invite all of you to take advantage of the opportunity to visit the great city of Vancouver and actively participate in this symposium.

Proposed sessions

- Materials for bioceramic additive manufacturing
- Novel processes for additive manufacturing for bio-applications
- Additive manufacturing systems for ceramics and other materials: stereolithography, fused deposition modeling, powder bed fusion process, inkjet printing, selective laser sintering, and emerging additive manufacturing technologies
- Multi-material additive manufacturing technologies
- 3D printed ceramic devices with bio-applications: orthopedic, maxillofacial, dental, etc.

Organizers

– **Hui-suk Yun**, Korea Institute of Materials Science (KIMS), Korea, yuni@kims.re.kr
– Paolo Colombo, University of Padova, Italy
– Julian R. Jones, Imperial College London, UK
– Martin Schwentenwein, Lithoz GmbH, Austria
– Cho-Pei Jiang, National Taipei University of Technology, Taiwan
– Xiaoyong Tian, Xi'an Jiaotong University, China

S36: Advanced Multifunctional Bioceramics and Clinical Applications

The last few decades have witnessed significant progress in the development of ceramics and glass for targeted clinical applications. A number of bioactive ceramics and bioglass, as well as their composites, both in bulk format or as coatings on metallic biomaterials, are being widely investigated. Ceramicists have pursued development of new multifunctional bioceramics while mimicking natural bone-like properties.

The field is now a gathering of various disciplines, including

ceramic engineering, biological, and medical sciences. It has seen the emergence of novel materials that have found critical medical applications, from bone replacement and healing to biodegradable drug delivery devices systems. And at its heart lies the science, where biomaterials interact with living cells and tissues. But it also goes far beyond that, where cutting-edge designs, biocompatibility, and products make it an engineering tool of the future. It is expected that ceramicists, clinicians, and industries develop a scientifically and socially conscious platform to foster development of materials in medicine within clearly defined and ethically responsible boundaries.

It appears to be an appropriate time for a symposium on the subject. The symposium needs to be of a multi-disciplinary nature with expertise on ceramics, biology, and medicine. Effective discussions on research collaborations are also important subjects for future international projects. A forum such as this conference will no doubt accelerate progress of ceramics for human healthcare applications.

Proposed sessions

- Calcium phosphates
- Bioceramic coatings
- Bioglass
- Biomineralization
- Prosthetic infection
- Biological cell response
- Clinical translational research

Organizers

– **Bikramjit Basu**, Indian Institute of Science, Bangalore, India, bikram@iisc.ac.in
– Marc Bohner, RMS Foundation, Switzerland
– Jiang Chang, Shanghai Institute of Ceramics, China
– Christophe Drouet, Centre Inter-universitaire de Recherche et d'Ingénierie des Matériaux, Toulouse, France
– Ashutosh K. Dubey, Indian Institute of Technology (BHU), Varanasi, India
– Ashutosh Goel, Rutgers University, USA
– Miho Nakamura, University of Turku, Finland

S37: Material and Technology Needs for Medical Devices, Sensors, and Tissue Regeneration

Ceramics have a growing impact on medicine and dentistry. The primary challenge that guides development of new bioceramics is the demanding environment of the human body. Recent advancements in the field of bioceramics have involved the incorporation of bioactive ceramics in scaffolds for tissue engineering. The use of additive manufacturing to process ceramic implants with patient-specific features is also becoming more common. Novel bioceramic materials are being developed that will provide improvements in diagnosis and treatment of medical and dental conditions. In addition, development and use of nanostructured materials, bio-inspired materials, and biomimetic materials have generated considerable scientific interest. This symposium will allow for discussion among many groups involved in the development and use of bioceramics, including ceramic researchers, medical device manufacturers, and clinicians.

Proposed sessions

- Advanced processing of bioceramics
- Antibacterial surfaces
- Bioactive and resorbable ceramics
- Bio-inspired and biomimetic ceramics
- Biomineralization
- Dental biomaterials
- In vitro and in vivo characterization of bioceramics
- Magnetic nanoceramics for biomedical applications
- Materials for drug and gene delivery
- Mechanical properties of bioceramics
- Microstructured and nanostructured biosensors
- Nanostructured bioceramics
- Porous bioceramics
- Self-assembled biomaterials

Organizers

– **Roger J. Narayan**, UNC/NCSU Joint Department of Biomedical Engineering, USA, roger_narayan@unc.edu
– Chikara Ohtsuki, Nagoya University, Japan
– Markus Reiterer, Medtronic, USA
– Yuki Shirosaki, Kyushu Institute of Technology, Japan
– Min Wang, University of Hong Kong, Hong Kong
– Tim Woodfield, University of Otago, New Zealand
– Hui-suk Yun, Korea Institute of Materials Science, Korea
– Rizhi Wang, University of British Columbia, Canada
– Igor Zhitomirsky, McMaster University, Canada

S38: Nanotechnology in Medicine

Nanotechnology has begun to revolutionize all aspects of medicine including prevention, diagnosis, and treatment of numerous diseases. Due to their significantly higher surface area to volume ratios, nanomaterials have demonstrated significantly greater mechanical, optical, electronic, catalytic, reactive, magnetic, and biological properties than conventional or micron structured materials. This symposium will cover some of the more recent advances for incorporation of nanotechnology in medicine including, but not limited to, improved wearable and implantable sensors; approaches that use nanomaterials to prevent disease; approaches to improve the detection of viruses, bacteria, and other compounds important

for disease diagnosis; approaches that combine diagnostics with therapy (so called theranostics); approaches for the improved treatment of diseases including tissue engineering, regenerative medicine, anti-cancer, anti-inflammatory, anti-bacterial, anti-viral, etc.; toxicity of nanomaterials; tissue and cellular interactions with nanomaterials; synthesis of nanomaterials for medical applications; green nanomedicine; computational modeling of the use of nanotechnology in medicine; ethics in nanomedicine; and all research related to the use of nanotechnology in medicine.

Proposed sessions

- Nanoparticles, nanofilms, and coatings in therapy, diagnostics, and tissue replacement
- Nanotechnology routes for medical delivery
- Regenerative nanomedicine
- Advances in nanomaterial synthesis and characterization for medical applications
- Toxicity aspects of nanoparticles from biological perspectives
- Ethics and societal issues in nanotechnology applications in medicine
- Nanomaterials modeling in applications to biomedical sciences
- Sustainable (or green) medical material development for medicine
- Regulatory aspects of nanomedicine
- Nanomedicine for anti-viral and anti-bacterial applications
- Nanomedicine for anti-cancer applications

Organizers

– **Thomas J. Webster**, Northeastern University, USA
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– **Sudipta Seal**, University of Central Florida, USA
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– Lei Yang, Hebei University of Technology, PR China
– Dongwoo Khang, Gachon University, South Korea
– Nhiem Tran, Royal Melbourne Institute of Technology, Australia

S39: Biomimetics and Bioinspired Processing of Advanced Materials

Millions of years of evolution have produced very unique structures and specialized functions in all creatures on the earth to cope with the environment. Fascinating interfacial structures and functionalities have been observed in various natural species, which offer an excellent opportunity to design and process artificial advanced materials inspired from nature. It is believed that, when science and nature come together, plenty of novel materials with extraordinary properties and novel processing methods can be innovated. This symposium focuses on topics of the design of bioinspired advanced materials, innovation of bioinspired processing of materials, and applications of bioinspired materials in various fields, and intends to give a multidisciplinary overview of biomimetic approaches to engineering novel materials and systems. This symposium will also provide a discussion forum and idea exchange platform for researchers, students, and entrepreneurs to develop advanced materials with novel structures and functionalities.

Proposed sessions

- Bioinspired synthesis and processing of materials
- Synthesis and fabrication of bioinspired materials
- Bioinspired multifunctional surfaces and interfaces
- Emerging bioinspired low-dimensional nanomaterials
- Characterization and evaluation of bioinspired materials
- Mechanical properties of bioinspired materials
- Bioinspired materials for sustainable environmental applications
- Bioinspired materials for sustainable energy applications

Organizers

– **Ziqi Sun**, Queensland University of Technology, Australia
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– **Zhengyi Fu**, Wuhan University of Technology, China
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– Joaquin Ramirez-Rico, Universidad de Sevilla, Spain
– Jiang Chang, Shanghai Institute of Ceramics, Chinese Academy of Sciences, China
– Wolfgang Wagermaier, Max-Planck-Institute of Colloids and Interfaces, Germany
– Di Zhang, Shanghai Jiaotong University, China
– Zhaoyong Zou, Wuhan University of Technology, China

SPECIAL TOPICS

S40: 6TH International Richard M. Fulrath Symposium, "Frontiers of Ceramics for a Sustainable Society"

The Richard M. Fulrath Award was created in 1978 to promote technical and personal friendships among Japanese and American professional ceramic engineers and scientists, and encourage greater understanding among the diverse cultures surrounding the Pacific Rim. In its more than 40-year history, Fulrath Award recipients have made significant contributions to various areas of ceramic science and technology development, which is critically needed for a sustainable society. As an increasing global population strives to improve standards of living, demand for energy, healthcare, housing, transportation, and industrial products also grows rapidly. However, higher demand and production in these areas lead to a dramatic increase in overall consumption of resources and rate of pollution, leading to climate change that creates risk of irreversible changes in the ecosystem. New technologies and innovative solutions are required to address these needs. This symposium will address the critical role of advanced ceramic materials and technologies in solving various societal challenges. The technical program will cover a wide range of topics and identify key challenges and opportunities for various ceramic technologies in creating sustainable development.

All previous Fulrath Award recipients are invited to make presentations in their specific areas of interest, and highlight specific contributions they have made to better the lives of people and promote the technical exchange and friendships.

Proposed sessions

- Global resource management for sustainable development
- Advanced ceramic technologies in AI, IoT, and big data
- Emerging ceramic materials and technologies
- Ceramics for sustainable energy and environmental systems
- Global human health challenges
- Sustainable transportation and infrastructure
- Ceramic education, mentoring, and collaborations

Organizers

- **Michael C. Halbig**, NASA Glenn Research Center, USA michael.c.halbig@nasa.gov
- **Kiyoshi Shimamura**, National Institute of Materials Science, Japan, shimamura.kiyoshi@nims.go.jp
- M. Singh, Ohio Aerospace Institute, USA
- M. Naito, Osaka University, Japan
- Pelagia-Irene (Perena) Gouma, The Ohio State University, USA
- Y. Imanaka, Fujitsu Corporation, Japan
- Junichi Tatami, Yokohama National University, Japan
- Wataru Sakamoto, Chubu University, Japan

S41: Advancing the Global Ceramics Community: Fostering Diversity in an Ever-Changing World

More than ever, researchers in academia, government, and industry settings are quickly evolving to respond to global challenges, while supporting and enhancing productivity of all in non-traditional work situations. Diversity in the science, technology, engineering, and mathematics (STEM) community has been well understood to enhance and further technological breakthroughs by a variety of measures, including improving creativity and productivity of teams, as well as individual performance, resulting in significant impacts across all sectors.

The purpose of this special topic symposium is to bring together researchers at all stages of their careers from different backgrounds, including women and underrepresented minorities (i.e. based on race, ethnicity, gender identity, sexual orientation, nationality, and geographic location) to discuss issues at the forefront of ceramic science and engineering research related to retaining, supporting, and recognizing diversity in the ever-evolving workplace.

The special topic symposium will facilitate both technical and professional discussions to promote exchange of ideas essential to identifying emerging worldwide challenges in ceramic research and potential solutions, particularly related to enhancing diversity and participation in our technical community. Sessions will consist of a combination of individual presentations, panel, and roundtable discussions to maximize information exchange and dialogue among participants.

Proposed sessions

This interdisciplinary symposium will feature research and perspectives centered on a variety of thematic areas, including, but not limited to:

- Fostering international partnerships to address global challenges facing the ceramics research community
- Tech innovation at the vanguard of ceramic science and engineering
- Methods and tools for fostering and retaining broad diversity in STEM
- Case studies related to diversity, inclusion, and leadership
- Supporting nontraditional students during education and in entering the workforce
- Generational perspectives on employment and career paths in STEM
- The power of mentorship
- Strategies for work-life integration
- Career mobility and networks
- Flexible working practices in different sectors
- Promoting creativity and out-of-the-box thinking across teams

Organizers

- **Katalin Balázsi**, Institute for Technical Physics and Materials Science, Centre for Energy Research, Hungary balazsi.katalin@energia.mta.hu
- **Valerie Wiesner**, NASA Langley Research Center, USA valerie.l.wiesner@nasa.gov

ON CERAMIC AND GLASS TECHNOLOGY

– **Hui-suk Yun**, Korea Institute of Materials Science (KIMS), Korea yuni@kims.re.kr
– **Jie Zhang**, Institute of Metal Research, China, jiezhang@imr.ac.cn
– Rosalia Poyato, Instituto de Ciencia de Materiales de Sevilla (CSIC-US), Spain
– Kristin Breder, Saint-Gobain Research North America, USA
– Theresa Davey, Tohoku University, Japan
– Victoria Blair, CCDC Army Research Laboratory, USA
– Miki Inada, Kyushu University, Japan
– Lavina Backman, University of Virginia, USA
– Giorgia Franchin, University of Padova, Italy
– Jessica Krogstad, University of Illinois Urbana-Champaign, USA
– Scott McCormack, University of California Davis, USA
– Lisa Rueschhoff, Air Force Research Laboratory, USA

S42: Young Investigator Forum

Next-Generation Materials for Multifunctional Applications and Sustainable Development, and Concurrent Societal Challenges in the New Millennium

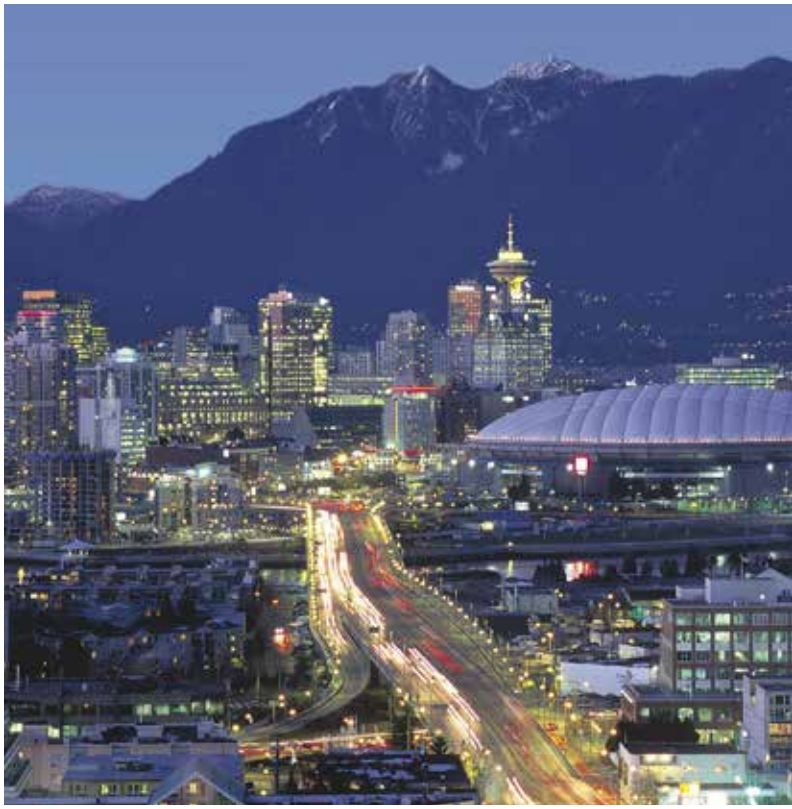
This symposium will focus on recent societal challenges in the new millennium, including, but not limited to, energy, health, and environmental aspects. Novel materials with multifunctional applications are needed to shift current materials research paradigms and bring forward solutions to some of today's biggest problems. Young scientists are well placed to play a significant role in leading these endeavors, and have demonstrated notable contributions in recent years. This symposium will bring together young researchers and scientists from around the world to discuss new approaches and challenges in materials synthesis, providing a platform for intensive exchange of ideas, knowledge, and networking. Young researchers, including students, postdoctoral researchers, young professionals, and early career researchers are invited to join this event.

Proposed sessions

- Energy: advances in fundamental science of emerging energy materials including 3rd generation solar cells, photodetectors, fuel cells, batteries, solar fuels production
- Environment: sustainable materials, CO_2 capture and storage, water treatments, and membranes and filters for air treatment
- Health: diagnostics (imaging, sensing, and assays) and therapy (drug release, light-based photodynamic, and hyperthermic approaches) toward multifunctional theranostics
- COVID-19: materials for virological studies and their disease diagnostics
- Alternative synthesis approaches for advanced functional materials, including green chemistry, low-temperature, and sustainable use of resources and recycling
- Innovative manufacturing technologies, including green manufacturing and additive manufacturing
- Advanced glass-based materials for laser sources and non-linear applications
- Technology development and entrepreneurship, from laboratory to industrial scale
- Computational materials prediction and design toward new functional materials
- Global networking—Challenges and chances: Young scientists, accomplished scientists, and thinkers are invited to influence the career development of young professionals
- Young Investigator Forum speaking contest (PowerPoint karaoke)
- Poster awards

Organizers

– **Daniele Benetti**, INRS, Canada, daniele.benetti@emt.inrs.ca
– **Sahar S Mahshid**, University of Toronto, Canada, sahar.mahshid@utoronto.ca
– **Artiom Skripka**, INRS, Canada, artiom.skripka@emt.inrs.ca
– Eva Hemmer, University of Ottawa, Canada
– Surojit Gupta, University of North Dakota, USA



S1: FUNDAMENTALS OF THE GLASSY STATE

This symposium will provide a discussion forum on fundamental principles of glass science. Contributions covering experimental and theoretical developments in the field of glass science are welcome. Topics of interest include novel developments in the following sessions.

Glass Formation and Structural Relaxation

This session will address all fundamental aspects of glass formation, including experimental, modeling, and theoretical developments in our understanding of glass transition and relaxation. All glass-forming systems including oxide, non-oxide, metallic, and organic glass will be covered. Topics of interest include, but are not limited to, various relaxation phenomena and dynamical processes in the glass transition range including fragility, structural, and dynamical heterogeneity.

Organizers

– **Ozgur Gulbiten**, Corning Inc. USA, GulbitenO@corning.com
– **Sabyaschi Sen**, University of California Davis, USA sbsen@ucdavis.edu

Glass Crystallization and Glass-Ceramics

This session is devoted to advancing fundamental understanding of crystallization in glass and application in glass-ceramics and related materials. The session will cover experimental, analytical/characterization as well as numerical/modeling aspects of nucleation and growth in glass forming materials. Topics to be covered include, but are not limited to the following:

- Theoretical, simulation, and experimental studies of nucleation and crystal growth in glass and liquids
- The role of glass composition, structure, and nucleating agents on crystallization
- Amorphous phase separation and its role in influencing crystallization
- Novel methods and characterization techniques (ex-situ, in-situ) to understand crystallization
- Modeling and simulation techniques to elucidate crystallization glass forming ability of compositions
- Crystallization phenomena in organic and metallic materials
- Novel processing techniques for glass-ceramics
- Microstructure/property relationships in glass-ceramics
- Predicting glass-ceramic generation
- Applications of glass-ceramics

Organizers

– **Edgar Zanotto**, UFSCar, Brazil, dedz@ufscar.br
– **Matthew Mckenzie**, Corning, USA, McKenzieME@corning.com

Structural Characterizations of Glass

This session will present recent advances on structural aspects of glass, including short and medium range order and heterogeneities. Contributions that cover basic glass characterization and correlation between glass structure and glass properties are welcome. Contributions include, but are not limited to, various experimental techniques such as X-ray, neutron, and light scattering; X-ray absorption and emission spectroscopy; vibrational spectroscopy; magnetic resonance spectroscopy; and scanning probe microscopy.

Organizers

– **Doris Möncke**, Alfred University, USA, moncke@alfred.edu
– **Marcos de Oliveira**, Universidade de São Paulo (IFSC/USP), Brazil mjunior@ifsc.usp.br

Topology and Rigidity

Understanding structure–property relationships in glass is extremely challenging due to their disordered structure. Topology, connectivity, and homology concepts have enabled many breakthroughs, both from a fundamental perspective and practical standpoint in the area of glass science. This session will focus on recent advances in the field of composition-structure–property relationships of disordered materials through experimental, computational, and theoretical studies. Broad topics of interest include, but are not restricted to, topology and rigidity in glass; effect of extreme conditions on the atomic topology and connectivity; topological modeling applied to the prediction of glass properties; quantifying the medium-range order–composition relationships through persistent homology; quantifying short-range order–composition relationships through statistical mechanics; topology-based machine learning; and connectivity, topology, and homology beyond oxide glass (granular materials, gels, disordered solids, phase-change materials, proteins).

Organizers

– **N.M. Anoop Krishan**, Indian Institute of Technology Delhi, India krishnan@iitd.ac.in
– **Mathieu Bauchy**, University of California Los Angeles USA bauchy@ucla.edu
– **Morten Smedskjaer**, Aalborg University, Denmark mos@bio.aau.dk

Atomistic Simulation and Predictive Modeling of Glass

Modeling and simulation play an important role in materials research and in particular for glass, amorphous, and nanostructured materials due to their complex nature. This session will focus on computer simulations and modeling approaches to gain insight into the structures and properties of glass and glass-forming liquids. Of particular interest are recent development of classical and first principles methods including empirical potentials, efficient first

principles algorithms, and applications. Also welcome are numerical studies that help the interpretation of experimental data and structural validation using methods such as X-ray and neutron diffraction, solid-state NMR, and other spectroscopic techniques. Integrated computational material design of glass compositions using physics-based modeling and simulation methods will also be covered.

Organizer

– **Sushmit Goyal**, Corning Inc, GoyalS@corning.com

Data-based Modeling and Machine Learning for Glass Science

Data-driven modeling and artificial intelligence have attracted much attention in recent years to solve complex problems in the field of glass science. Specifically, machine learning has been successfully applied to outstanding problems such as predicting composition–property relationships, developing optimized glass compositions, accelerating glass modeling, and understanding fundamentals of glass transition. This session focuses on recent advances achieved using machine learning in the areas of glass science, technology, and modeling. Topics of interest include, but are not restricted to, the application of machine learning and artificial intelligence to develop composition-property relationships; design-optimized glass compositions; 3D printing and additive manufacturing of glass; advance computational modeling by developing machine-learned interatomic potentials and accelerating glass simulations; image processing; predicting the structure of glass; identifying key structural patterns/descriptors that govern glass properties; and understanding the fundamentals of the glassy state.

Organizers

– **Adama Tandia**, Corning Inc., USA, TandiaA@Corning.com

– **Mathieu Bauchy**, University of California Los Angeles, USA bauchy@ucla.edu

– **N.M. Anoop Krishan**, Indian Institute of Technology Delhi, India krishnan@iitd.ac.in

Mechanical Properties of Glass

This session will discuss the mechanical properties of disordered materials across multiple scales, while bridging the fields of metallic and nonmetallic glass. We will consider the structural origin of elasticity, plasticity, and fracture with the objective of designing glass with superior toughness, defect tolerance, and stiffness. Particular attention will be given to the identification of general, material-independent constitutive laws which may be used as guidelines to improve mechanical properties; the combination of experimental approaches and computational modeling of the stress-response of glass and early stages of damage infliction; and interplay between size and time effects, stress-corrosion, and the chemical aspect of fracture.

Contributions are especially invited on:

- Dynamic fracture and brittleness, or crack initiation, including application of in-situ techniques
- Slow crack growth and stress corrosion cracking, the underlying chemistry and transport phenomena in high stress fields
- Multiscale investigation of elasticity, plasticity, and hardness in relation to bulk topology through combining mechanical analyses with structural analyses
- Strategies for toughening inorganic oxide glass as well as metallic glass

Organizers

– **Satoshi Yoshida**, AGC Inc., Japan, satoshi.s.yoshida@agc.com

– **Morten Smedskjær**, Aalborg University, Denmark mos@bio.aau.dk

– **Tim Gross**, Corning Inc., USA, GrossTM@corning.com

– **Gustavo Rosales-Sosa**, Nippon Electric Glass Co. Ltd., Japan rgustavo@neg.co.jp

abstracts
GLASS & OPTICAL MATERIALS

Non-Oxide Glass and Glass-Ceramics

This session will present and discuss recent developments in both fundamental and applied research in chalcogenide, halide, metallic, phosphate, organic glass, and all other types of non-oxide glass and glass-ceramics.

Topics of interest include structural characterization, structure-property relationships, novel processing methods, compositional trends, and advances in physical properties such as optical, thermal, electrical, and mechanical behaviors.

Technological applications of glass and glass-ceramics will be covered, including the field of energy, sensing, optics, biomedical, phase change materials, and microelectronics.

Organizers

– **Catherine Boussard-Pledel**, Université de Rennes 1, France
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– **Laurent Calvez**, Université de Rennes 1, France
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Glass Under Extreme Conditions

This session will cover recent progress in understanding structure and properties of glass under extreme conditions, such as high pressure, high stress, high temperature, high radiation, highly reactive conditions, etc. Many manufacturing processes such as fiber drawing, laser writing, and irradiation aging are concerned with these conditions. New knowledge of glass structure and properties under extreme conditions can help design glass for these applications, as well as in utilizing such conditions to synthesize glass with superior properties. Experimental studies, novel in situ analysis methods, and computational approaches are within the scope of this session.

Organizers

– **Nadja Lönnroth**, Huawei Technologies, Finland
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– **Akihiro Yamada**, University of Shiga Prefecture, Japan
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– **Dominique de Ligny**, FAU Erlangen-Nürnberg, Germany
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S2: GLASS AND INTERACTIONS WITH ITS ENVIRONMENT – FUNDAMENTALS AND APPLICATIONS

This symposium is dedicated to fundamentals and applications of how glass is used in contact with specific environments, (e.g. with the human body), how glass surfaces and interfaces evolve or can be modified in different environments, and how glass can be used to contain other materials and prevent their release in the environment.

Bioglass

Ongoing research producing promising results for expanded use of various glass and glass-ceramics in bone regeneration and dental applications has inspired the investigation of a wide array of novel glass-based materials for contemporary applications, such as wound healing, soft tissue engineering, cancer treatment, and bacterial/fungal-resistance. This session will cover each of these areas, and will focus on examination of the compositions, processing methods, structures, and targeted cellular and biological responses of biomedical glass, which warrant their candidacy for further use across the medical fields.

Organizers

– **Delia Brauer,** University of Jena, Germany, delia.brauer@uni-jena.de

– **Tim Keenan**, Alfred University, USA, keenan@alfred.edu

Nuclear Waste Immobilization

Topics in this session will address new developments and innovative applications for materials and materials processing methods for immobilization of nuclear and hazardous wastes. Progress in the processing and testing of materials for immobilization is critical to the efficient and successful treatment and disposal of nuclear waste around the world. This session will focus on characterization, testing, and modeling techniques that quantify and allow understanding of waste form behavior. Material forms of interest may include glass, ceramics, glass-ceramics, and other composite matrices.

Organizer

– **John Vienna**, Pacific Northwest National Laboratory, USA
John.Vienna@pnnl.gov

Dissolution and Interfacial Reactions

This session will focus on dissolution and degradation of glass and glass-ceramics in aqueous environments, including both longer time frame aspects of glass dissolution and the more immediate role of interfacial reactions between aqueous environments and glass (including hydrolysis reactions, cation inter-diffusion, and incorporation of water into the glass matrix). Studies which focus on glass surface and water reaction mechanisms, interfacial structures, and transport behaviors using either computational or experimental methodologies

are particularly encouraged. Elucidation of mechanisms and kinetics of glass degradation in studies conducted under various conditions are also welcome, for example those which investigate influence of solution composition, temperature, glass composition, reactive surface area, gel layers, secondary phases, environmental materials, and radiation on glass dissolution.

Organizers

– **Jessica Rimsza**, Sandia National Laboratories, USA jrimsza@sandia.gov

– **Louise Criscenti,** Sandia National Laboratories, USA ljcrisc@sandia.gov

Surfaces and Coatings

Glass surfaces remain an enduring area of scientific and technological challenges for applications of glass, and approaches to understand and customize surface and interfacial behaviors with glass modifications and value-added coatings represent a critical direction for glass's future. This session will focus on surfaces and interfaces in glassy- and film-related systems, with a scope that includes fundamental studies of intrinsic glass surfaces, structure-property relations at surfaces/interfaces, innovations in glass surface characterization, novel methods for modifying surfaces, emerging concepts around functional coatings on glass, and properties of glassy/amorphous thin films.

Organizers

– **Matthew Linford**, Bingham Young University, USA mrlinford@chem.byu.edu

– **Joy Banerjee**, Corning Inc., USA, banerjeej@corning.com

S3: OPTICAL AND ELECTRONIC MATERIALS AND DEVICES — FUNDAMENTALS AND APPLICATIONS

Optical and electronic materials and devices are of critical importance for applications, including sustainable energy, information technology, nonvolatile memory, sensing, medical diagnostics and treatment, and national defense. This symposium will address processing and properties of optical and electronic materials as well as design, fabrication, and performance of functional devices.

Laser Interactions with Glass

The field of light interaction with matter has attracted increased attention with advances in ultrashort pulse lasers and high-power fiber lasers, and the need to design and fabricate structures for use in low loss applications. New phenomena have been observed and new applications have been developed in which lasers are employed in diverse areas such as cutting, welding, and engraving of glass; fabrication of waveguides, gratings, micro-channels, etc. inside the bulk of glass; and most recently, 3D printing through additive or subtractive laser-assisted processing. Lasers have been shown to be versatile in other applications of phase change, in which glass or amorphous media are "converted" in a controlled way to crystalline or composites (glass-ceramics). These advances have been realized in optical phase change materials and laser-induced crystallization as seen in the fabrication of active single crystal architecture, strengthening of glass, and other applications where knowledge of not only material, but light/matter interaction mechanism is required. This session will focus on the most recent and advanced issues pertaining to the science and applications of laser-glass interactions, such as laser irradiation effects, compositional and structural changes, dynamics, and mechanisms of laser-induced modifications.

Organizers

– **Kathleen Richardson**, University of Central Florida USA, kcr@creol.ucf.edu

– **Casey Schwarz**, Ursinus College, USA, cschwarz@ursinus.edu

Charge and Energy Transport in Disordered Materials

Understanding and predicting of transport phenomena in disordered media is still an open problem for scientists in the field and are essential for development of more efficient and cheap materials for a broad range of applications, including energy storage. Increased application of glassy and nano-heterogeneous (glass-ceramics, nanostructured composites) materials in areas such as energy generation and storage (photovoltaics, fuel cells, thermo-electrics, batteries), thermal isolation or conduction media, low-loss dielectrics, and electronic conduction (microelectronics, nanoelectronics), has encouraged research into the fundamental nature and control of transport processes. This session will provide a general forum for discussion of the mechanisms, properties, and application of charge and energy transport phenomena in such disordered systems. Contributions on experimental, theoretical, and modeling aspects of these topics are encouraged. Topics of interest include, but are not limited to:

- New material synthesis and characterization
- Novel experimental methods and instrumentation
- Charge transport theory and modeling (ionic and electronic transport)
- Thermal transport (including photonic systems and processes)
- Computational modeling of energy and charge transport

Organizers

– **Caio Bragatto**, Coe College, USA, cbragatto@coe.edu

– **Ana C M Rodrigues**, UFSCar, Brazil, acmr@ufscar.br

Optical Fibers and Waveguides

The field of optical fibers application is not confined to telecommunication technologies. Optical fibers can be used in numerous other applications such as sensing, new laser source, biomedicine, defense, and security. This session will be an opportunity for discussions about the state-of-the-art and recent advances in the design, fabrication, characterization, and applications of innovative and exotic fibers.

Topics of interest include, but are not limited to:

- New optical fibers design
- Optical fibers for communication
- Microstructure optical fibers
- Optical waveguides for sensing
- Heavy metal oxide optical fibers
- Multicore fibers
- Multimaterial fibers
- Optical fibers for health
- Optical fibers for new laser sources
- Optical fibers for supercontinuum generation

Organizers

– **Younes Messadeq**, Université Laval, Canada
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– **Sylvain Danto**, ICMCB, University of Bordeaux, France
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Glass-based Optical Devices and Detector Applications

Glass is an important material for optical components and devices, given its excellent optical transparency and versatile processing. Novel oxide and non-oxide glass compositions and fabrication technology development have further enabled emerging applications such as light emission, infrared imaging, nonlinear optical signal processing, and sensing. This session will cover material synthesis and processing as well as device fabrication and applications of innovative device architectures including, but not limited to, molded optics, diffractive optics, thin film optical coatings, fiber-optic devices, metamaterials/metasurfaces, and integrated photonic components.

Organizers

– **Juejun Hu**, Massachusetts Institute of Technology, USA
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– **Hongtao Lin**, Zhejiang University, China, hometown@zju.edu.cn

Optical and Photonic Glass and Glass-Ceramics

Over the past decades, research on spectroscopic properties of rare earths and transition-metal doped materials has quickly grown in importance as rare-earth and transition-metal ions play a fundamental role in various optical applications, from telecommunication to sensing, and medical diagnosis to energy. Intense levels of research have been focused on development of new materials and designs. This session will cover topics on:

- Glass and transparent ceramic lasers
- Ceramic phosphors for solid-state lighting
- Wavelength converters for photovoltaic systems
- Nanoprobe phosphors for bio-photonics
- Energy transfer or light storage mechanisms in solids
- d-d, f-f and f-d transitions in glass and ceramics
- Optical amplifiers for telecommunication

Organizers

– **Laeticia Petit**, Tampere University, Finland, laeticia.petit@tuni.fi

– **Anna Łukowiak**, Polish Academy of Science, Poland
a.lukowiak@intibs.pl

S4: GLASS TECHNOLOGY AND CROSS-CUTTING TOPICS

Constant progress in glass technology and manufacture plays a key role in our society, and presents its own set of challenges and innovations: from raw materials to the melt, glass furnaces to sustainability of the process, and traditional forming processes to new techniques such as glass 3D printing. This symposium welcomes papers on these topics in the following sessions.

Sol-gel Processing of Glass and Ceramic Materials

Sol-gel processing uses low-temperature processing approaches to produce glass, ceramic, and hybrid organic-inorganic materials with high purity, excellent homogeneity, and well-controlled morphology. This session will focus on all aspects of sol-gel derived and nanostructured materials prepared by liquid synthesis, including:

- Sol-gel routes to bulk, film, glass coating, colloidal, nanoparticle, porous, and hybrid organic-inorganic materials
- Structural characterization using spectroscopic, scattering, and imaging techniques
- Computer simulations through molecular dynamics, Monte-Carlo, and reverse Monte-Carlo simulation methods
- New functionalities based on optical, electrical, thermal, mechanical, chemical, and biomedical properties
- New sol-gel materials and products for energy and other applications

DIVISION MEETING (GOMD 2021)

Organizers
– **Lisa Klein**, Rutgers University, USA, licklein@soe.rutgers.edu
– **John Kieffer**, University of Michigan, USA, kieffer@umich.edu

Challenges in Glass Manufacturing

The glass industry requires constant innovation to meet the needs for new compositions, new products, and greener and more efficient manufacturing processes. This session will cover the spectrum of new research, development, and engineering advances from the lab to the factory, including:

- Physics and chemistry of glass melting and forming – modeling and experiments
- Energy efficiency strategies
- New furnace designs and process control methods
- Furnace materials – new materials, corrosion, and wear studies
- New concepts for melting and forming
- Post-forming treatments

Organizer
– **Irene Peterson**, Corning Inc., USA, PetersonIM@corning.com

3D Printing of Glass

This session provides a forum for the exchange and discussion of current issues and trends in 3D printing of glass. The session will cover recent theoretical and experimental advances in processing and characterization of 3D printed glass for optical, architectural, and artistic applications. The session will also provide a forum to a broader audience for emerging technological applications of 3D printed glass. Contributions from academia, national laboratories, and industries that address recent advances and new applications are welcome. Topics include:

- Oxide and non-oxide glass
- Polymeric systems
- 3D printing methods
- Optical and electrical properties
- Glass structural characterizations

Organizer
– **SK. Sundaram**, Alfred University, USA, sundaram@alfred.edu

S5: HONORARY SYMPOSIUM FOR JONATHAN STEBBINS

This symposium honors Professor Jonathan F. Stebbins, Emeritus Professor of Geological Sciences and Professor, by courtesy of Materials Science and Engineering at Stanford University, for his pioneering investigations of the structure and physical properties of inorganic materials of geological and technological interest. For nearly four decades, Stebbins has worked on chemistry, temperature, and pressure effects on atomic structure of disordered minerals, glassy and molten silicates and oxides, and ceramics, through pioneering methods in nuclear magnetic resonance (NMR) spectroscopy. Stebbins has established connections between the atomic structure of materials at a microscopic level and their macroscopic properties such as viscosity, density, and heat capacity. The wealth of important results obtained from his research have benefited the geoscience community and are also highly relevant to the glass and ceramic industry.

This symposium brings together colleagues, former students, and collaborators of Stebbins to celebrate his outstanding teaching and research career by presenting their current research results. Presentations covering all aspects of inorganic materials, include, but are not limited to, structural characterization, structure-property relationship, novel NMR techniques, compositional trends, and advances in physical properties, thermodynamics, and transport properties. The symposium will consist of both invited and contributed talks.

Organizers
– **Jingshi Wu**, Corning Inc., USA, WuJ@corning.com
– **Sabyasachi Sen**, University of California Davis, USA sbsen@ucdavis.edu
– **Randall Youngman**, Corning Inc., USA YoungmanRE@Corning.com
– **Sung Keun Lee**, Seoul National University, Korea sungklee@snu.ac.kr
– **Scott Kroeker**, University of Manitoba, Canada scott_kroeker@umanitoba.ca

GOMD 2021 STUDENT ACTIVITIES

Poster session and student poster competition

As part of the tradition at GOMD 2021, students are invited to present their work as part of the GOMD student poster competition Best posters will be rewarded with cash awards.

Career networking event

Students and early career professionals attending GOMD 2021 are invited to attend a career networking event in which they will have the opportunity to network with professionals from industry, academia, and national labs to ask questions on diverse topics (work-life balance, career opportunities, etc.). in a casual environment.

call for abstracts

deadline Nov. 9, 2020

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GLASS & OPTICAL MATERIALS DIVISION MEETING (GOMD 2021)

Fairmont Hotel Vancouver

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