CALL FOR PAPERS

Submit your abstracts by February 12, 2018

Materials Challenges in Alternative and Renewable Energy (MCARE 2018)

August 20 - 23, 2018

Sheraton Vancouver Wall Centre Hotel | Vancouver, BC, Canada

ceramics.org/mcare2018

Hosted and organized by:

The American Ceramic Society
www.ceramics.org

Also organized by:

KIChE
The Korean Institute of Chemical Engineers

Materials Challenges in Alternative

August 20 - 23, 2018 | Sheraton Vancouver Wall Centre Hotel

Introduction

Materials Challenges in Alternative Renewable Energy (MCARE) 2018, organized by The American Ceramic Society, and Korean Institute of Chemical Engineers is a premier forum to address opportunities of emerging material technologies that support sustainability of a global society. MCARE 2018 brings together leading global experts from universities, industry, research and development laboratories, and government agencies to collaboratively interact and communicate material technologies that address development of affordable, sustainable, environmentally friendly, and renewable energy conversion technologies. This innovative international conference features plenary and invited talks, thematically-focused technical sessions, and poster presentations, enabling participants to network and exchange ideas with professional peers and acclaimed experts. The conference atmosphere engages and promotes participation of students and early stage researchers. MCARE 2018's scientific and technical scope includes discussions, idea exchange, and learning about new advances and research results in materials, energy, and environmental technologies.

Interested researchers from academia, national laboratories, industries, and start-up companies working in the technology areas listed in this Call for Papers should submit abstracts.

Sheraton Vancouver Wall Centre

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Phone: (604) 331-1000
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Rates: Single/Double $245 CAD*
(not to exceed $197 USD depending on exchange rate)

Cut-off: on or before July 26, 2018

Organizing co-chairs


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Abstract Submission Instructions

Visit **www.ceramics.org/mcare2018** to submit your 200-word abstract. Select "Submit Abstract" to be directed to the Abstract Central website. Please contact Marilyn Stoltz at mstoltz@ceramics.org or 614-794-5868 with questions.

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AND RENEWABLE ENERGY (MCARE 2018)

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SYMPOSIUM 1

MATERIALS FOR SOLAR FUEL PRODUCTION AND APPLICATIONS

Solar fuel production in an artificial system offers an opportunity for generating renewable transportation fuels to replace fossil resources. Sunlight is used to split water into hydrogen and oxygen, or produce carbon-based fuels from carbon dioxide and water. A central theme of this symposium is the recent progress and scientific challenges of integrating the light absorbers and catalysts into subsystems, with the goal of achieving closed photo(electro)chemical cycles, CO_2 reduction (or proton reduction), and H_2O oxidation in the single integrated system. A solar fuel can be produced when and where sunlight is available, and stored and transported for later usage. Various systems made of engineered materials have been developed to reduce proton to hydrogen or carbon dioxide to carbon-based fuels, including photoelectrochemical (PEC) cell, photocatalytic system, and solar cell-based method. This special session will bring experts together from the different fields of state-of-art technologies of solar fuel production, which will foster the scientific exchange.

Session topics

- Photoelectrochemical (PEC) system for solar fuel production
- Photocatalytic water splitting
- Photocatalytic carbon dioxide reduction
- Solar cell-PEC hybrid system for solar fuel production
- New catalysts for solar fuel generation

Organizers

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SYMPOSIUM 2

ADVANCED ELECTROCHEMICAL MATERIALS FOR ENERGY STORAGE

Batteries convert chemical energy into electrical energy and represent a multibillion dollar industry. The state-of-the-art electrical energy storage systems are not able to meet the requirements for energy-efficient use in transportation, grid, and commercial technologies. New concepts in materials design for battery technology are sought to overcome the current limitations of performance and lifetime. More critical insight is required to both in terms of material structures, as well as interfacial reactions to produce next-generation electrode materials and battery cells enabling higher energy densities, high power densities, and longer cycling abilities. This symposium explores novel energy storage materials and technologies that are critical to making the current energy storage systems more effective. In addition, abstracts are sought on supercapacitors and flexible batteries for self-powering small electronics. Abstracts are sought in fundamentals, modeling, mechanisms, materials design, screening, electrode architectures, diagnostics and materials characterization, and electrode/electrolyte interface characterization.

Session topics

- Lithium batteries
- Sodium batteries
- Magnesium batteries
- Lithium-air batteries
- Lithium-sulfur batteries
- Redox flow batteries
- All-solid-state batteries
- High temperature batteries
- Flexible batteries
- Supercapacitors

Organizers

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SYMPOSIUM 3

MATERIALS CHALLENGES IN PEROVSKITE AND NEXT GENERATION SOLAR CELLS

Recently, advanced materials and technologies for perovskite and next-generation solar cells have been exploited to develop economically viable, high-performance solar cells. Organo-metal trihalide perovskites have revolutionized the field of thin film solar cells due to their meteoric rise of power conversion efficiency of a record value 22.1%. These materials exhibit salient properties such as strong light absorption from the visible into the near-infrared spectral region, long carrier diffusion length, and tailorable optoelectronic properties through compositional engineering of halides and cations. These properties are subservient to the formation and nature of the crystals, morphology, and growth. One of the most fantastic features

of organo metal trihalide perovskite is its ability to self-assemble between precursors of solid-solid, vapour-vapour, vapour-solid, co-solution, solid-solution phases into high quality crystalline powder or thin films at near ambient conditions. Despite the high efficiency and excellent opt-electronic properties, the biggest problem of organo-metal trihalide perovskite is stability under heat and light soaking conditions. This symposium will focus on the key issues and phenomena that are at the frontier of understanding and materials development in perovskite solar cells and next generation solar cells, addressing, but not limited to, the following topics.

Session topics

- Materials and issues for perovskite solar cells
- Fundamental understanding of the materials properties using theory and experiments
- Role of interface interactions
- Design of alternate stable perovskite
- Novel charge transporting materials
- Crystal growth kinetics
- Device stability issues
- Materials and technologies for quantum-dot sensitized solar cells
- Materials and technologies for organic and bulk heterojunction solar cells
- Materials and technologies for ferroelectric solar cells
- Materials and technologies for CIGS solar cells

Organizers

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SYMPOSIUM 4

Ferroelectrics and multiferroics for energy generation, conversion and storage

Converting available energy from the environment can enable sustainable energy supplies for electric loads including sensors, handheld devices, and radio transmitters. Ferroelectric or piezoelectric materials have the ability to transform mechanical strain energy into electric current or voltage. Magnetoelectric multiferroics show coupling between piezoelectric and magnetic orders that opens the possibility of novel sensors and mechanical-vibration or magnetic energy harvesting. This symposium addresses properties and functionalities of ferroelectrics and their relation to energy conversion and storage. Topics include ferroelectrics, antiferroelectrics, pyroelectrics, piezoelectrics, and nonlinear dielectrics for energy-related conversion and storage, with a focus on cost-effective synthesis and device fabrication using piezoelectric or multiferroic bulk, thin films, and nanocomposites. This symposium is intended to serve as a platform to facilitate exchange of novel ideas and results and to establish collaborations among material chemists, physicists, and device engineers in the field of alternative and renewable energies.

Session topics

- Synthesis and processing of ferroelectrics and multiferroics
- Electromechanical phenomena of piezoelectric composites, actuators, sensors, and motors
- Lead-free ferroelectrics and piezoelectrics
- Nanoscale phenomena in ferroelectric and piezoelectric materials
- Multiferroic oxides, heterostructures, and thin films
- Ferroelectric photovoltaics
- Photovoltaic, photocatalytic, and electrochemical effects
- Pyroelectric, electrocaloric, and thermoelectric properties
- Modeling and simulation
- Energy conversion or storage using dielectrics, ferroelectrics and multiferroics

Organizers

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SYMPOSIUM 5

Materials challenges in direct thermal-to-electrical energy conversion and thermal energy harnessing for efficient innovative applications

Harnessing thermal energy is one of the ultimate goals in science and technology in our modern society. Challenges in materials design and synthesis have always been a key to exploit heat by direct thermal-to-electrical energy conversion and related technologies. Recent advances in nanotechnology have elicited unconventional thermal transport across nanostructured materials and nano-interfaces, opening a new direction to harness thermal energy. This symposium will highlight a combination of new ideas, new materials, and device concepts by focusing on novel processing and synthesis methods, materials, technologies, and applications related to direct thermal-to-electrical energy conversion and thermal energy harnessing. With a focus on thermoelectrics and thermionics and emphasizing thermal, electrical, and mechanical properties of new materials, and processing of those materials into device structures, this symposium will also highlight theoretical insight and materials innovations in unconventional heat transfer with higher efficiency in thermal energy harvesting and heat management.

The symposium includes theoretical studies of material transport properties, band structure, crystal chemistry, thermodynamic analysis,

and energy transfer. Experimental efforts will include new capabilities in solid-state synthesis, bulk materials, thin films, superlattices, nano-interfaces, and nanostructured materials, including recent advances in nanocomposites (nanomaterials or inherent nanostructures in bulk thermoelectric material matrices). It will also highlight advances in phonon engineering, phase transformation, thermal conductivity switching, and defect engineering in inorganic and organic solids. New developments in material property and device performance measurements and metrology will also be presented.

Session topics

- High-efficiency bulk thermoelectric materials
- Nanoscale thermoelectric materials
- Theoretical guidance to high-efficiency thermoelectric energy conversion
- Oxides and other materials with strong electron correlation
- New and emerging technologies for thermoelectric power conversion
- Thermoelectrics for harvesting solar and unused waste heat energy
- Thermionics and other related topics
- Synthetic strategies for preparing novel materials and compounds
- Thermoelectric nanocomposite materials
- Processing of bulk and thin-film nanostructured materials
- New ideas, new materials, and device concepts for thermal energy harnessing
- Phonon engineering and emerging thermal transport technologies
- Phonon transmission and scattering across nano-interfaces
- Materials property measurement and new metrology techniques
- Design, performance testing, fabrication, and processing of energy conversion devices
- Device performance requirements for future applications

Organizers

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SYMPOSIUM 6

Materials for Spectral Energy Conversion

Spectral conversion luminescent materials are potential candidates to increase the efficiency of solar cells as well as other environmentally relevant technologies, such as photocatalysis, solar fuels and artificial photosynthesis, where usually large parts of the solar spectrum do not contribute to the harvesting scheme and are lost for energy conversion. Downconversion or quantum cutting, luminescent downshifting, and upconversion are approaches to diminish these losses. Yet, while cutting edge research conducted around the globe led to promising achievements, remaining challenges (such as low quantum efficiency in nanomaterials, weak and/or narrow absorption, and broadband illumination under real sun conditions) have to be addressed in order to take full advantage of spectral conversion materials. In this context, the rational design of suitable optical materials is crucial for energy conversion enhancement, and approaches reach from novel host materials and dopant optimization for upconversion and downconversion materials to innovative hybrid materials, e.g. combing lanthanide-doped materials, QDs, organic dyes, carbon-based structures and photonic concepts. It is the scope of this symposium to provide an interdisciplinary platform for the presentation and discussion of recent achievements, developments and remaining challenges regarding the design, synthesis and characterization of spectral conversion materials as well as their assembly to more efficient devices. Session topics will focus on, but not be limited to:

- Materials for upconversion, downconversion / quantum cutting, luminescent downshifting
- Lanthanides, dyes and quantum confined nanomaterials for photovoltaic applications
- Spectral conversion for photo-catalytic and water-splitting applications
- Triplet-triplet annihilation photon-upconversion
- Development and synthesis of novel optical materials
- Smart assemblies and novel device design: Combining lanthanide-doped nanoparticles, QDs, carbon-based nano-structures, dyes etc. to enhance spectral conversion efficiency.
- Plasmonic / photonic manipulation of conversion processes
- Theoretical approaches and modeling
- Application-oriented approaches in spectral conversion
- Multifunctional spectral conversion materials: Applications beyond the energy sector

Organizers

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ABSTRACTS

SYMPOSIUM 7

Advanced materials for solid oxide fuel cells and high temperature electrolysis

Fuel cell technologies have attracted attention as a highly efficient power generation method. Among various types of fuel cells, solid oxide fuel cells have particularly high efficiency and flexibility in fuel. However, fundamental and applied research is essential to increase their performance and durability. Since similar materials are used, high temperature electrolysis cells have also attracted attention for efficient electrolysis cells, in particular, hydrogen production. This symposium will bring together leading researchers and technologists working in critical areas such as new materials, degradation processes, and systems engineering, to discuss state-of-the-art developments in solid oxide fuel cells and high temperature electrolysis.

Session topics

- Oxide proton conducting oxide fuel cells
- Electrolysis cells

Organizers

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SYMPOSIUM 8

Lifecycle considerations for energy materials

The goal of clean energy development and adoption is to reduce the environmental impacts associated with fossil fuel extraction, production, and consumption. However, sustainability aspects of clean energy technologies must also be studied and quantified to ensure new problems are not being introduced. This symposium invites broader system-level research looking at environmental impacts of clean energy systems, energy pay back times, and recycling technology development and assessment. Addressing sustainability challenges requires work that spans social and economic issues, as well, so topics such as economic feasibility, integration and grid issues, and adoption and penetration challenges are also invited.

Session topics

- Life-cycle assessment
- Energy/emissions pay back analysis
- Economic feasibility
- Integration, grid issues
- Adoption/penetration challenges
- Recycling and end-of-life technology and infrastructure development and assessment

Organizers

– **Gabrielle Gaustad, Rochester Institute of Technology, USA**
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SYMPOSIUM 9

Critical materials for energy

Materials with strategic importance to clean and alternative energy that may have potential issues in their supply are critical. Examples abound, including rare earth elements in wind turbines and electric vehicles, indium, tellurium, and gallium in photovoltaics, and lithium, cobalt, and graphite in batteries. Competing sectors like electronics, defense, and healthcare create increasing demand for these scarce resources and lead to significant price volatility that may impact manufacturers and consumers in the clean energy sector. This symposium invites research focusing on tackling critical material issues for clean and alternative energy.

Session topics

- Criticality assessment and case studies
- Exploration and resource estimation
- Extraction, refining, and processing techniques
- Recycling technology development and assessment
- Substitution research and development

Organizers

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SYMPOSIUM 10

Materials and process challenges for sustainable nuclear energy

Nuclear energy has the potential to become a sustainable innovative energy source when novel solutions can overcome accident potential and waste issues for the current fleet power plants. This symposium will focus on improved and advanced materials for alternative next generation reactor concepts, for structure components, and fuels that enable innovative nuclear power. With the advent of new reactor concepts, there is significant challenge to develop advanced materials to meet stringent requirements, i.e., high temperature and corrosive environments. Thus, a systematic approach of modeling, processing, characterization, and in-service performance testing is required to bring new materials in use.

Session topics

- Modeling and simulation of radiation effects on structural materials
- High-temperature metals and alloys
- Advanced ceramics and composites

- Material performance in radiation environments
- Degradation mechanisms and lifetime predictions of material components
- Material behavior in accident environments
- Characterization of materials and nondestructive evaluations
- Heat transfer materials and coolants
- Materials and processes for radioactive waste containment and disposal
- Design and testing of waste forms
- Advanced fuels design and concept

Organizers

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– Jake Amorosso, Savannah River National Laboratory, USA

– Hua-Tay Lin, Guangdong University of Technology, China

– Josef Matyas, Pacific Northwest National Laboratory, USA

SYMPOSIUM 11

Sustainable, eco-friendly advanced materials and nanodevices

This symposium will focus on the development of new advanced materials, combinations of hybrid nanomaterials, low dimensional materials as well as nanoscale devices that focus on utilizing these designer materials in the development of a sustainable future in an environmentally friendly manner. Studies on the physical properties of advanced materials such as hybrid organic-inorganics as well as nanostructures of inorganic perovskites, composites incorporating novel organic and inorganic systems, polymers, nanostructured materials will be of particular interest. The organizers welcome both theoretical and experimental studies carried out on such materials and device platforms. Under nanoscale devices, studies related to energy harvesting in areas such as photovoltaics, piezoelectricity, triboelectricity and thermoelectricity as well as studies on nanobio devices are welcome. Studies related to energy storage and sensing, including integrated system platforms suitable for the field of Internet of Things (IOT), including autonomous sensing are also welcome.

Session topics

- Fundamental studies on advanced nanoscale materials for energy harvesting and storage
- Nanoscale triboelectric, piezoelectric, thermoelectric energy harvesting devices.
- Organic and hybrid materials systems for photovoltaics
- Photovoltaics based on hybrid and inorganic perovskite materials
- Novel materials and nanoscale sensor devices for wearable healthcare applications.
- Energy storage: new materials and devices
- Metal oxides: fundamental studies and applications.
- Integrated systems and IOT platforms: incorporation of new technologies into existing technologies and studies on combined sensors, energy harvesting and storage systems.

Organizers

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SYMPOSIUM 12

Young scientists forum on future energy materials and devices

Advanced materials, device research, and technological innovation are required to address the challenges of the 21st century and in particular, the issues associated with energy production, storage and transport, and renewable resources. The advancement of large-scale new energy technologies will require support from industry, and academia to overcome the limitations of today's existing technologies and to discover new materials and nanomaterials capable of further improving the limits. Game-changing breakthroughs in emerging materials, devices, and technologies such as novel batteries, liquid-metal systems, regenerative fuel cells, energy storage, and superconducting magnetic electrical storage are among future potential developments. The priority activities outlined in this symposium will focus on understanding and developing materials coupled with designing, developing, and demonstrating components and systems; however, there is also recognition that this work needs to be done in the context of strategic materials selection and innovative system design.

Session topics

- Energy production, conversion, and storage materials
- Energy production, conversion, and storage devices
- Energy production, conversion, and storage systems
- Energy transport systems

Organizers

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ABSTRACTS

SYMPOSIUM 13

Symposium on materials for super ultra low energy and emission vehicle

This symposium will aim at fundamental understandings and practical development of the exhaust gas purification system for the Super Ultra Low Energy & Emission Vehicle. Due to the modification of engine driving condition to achieve high fuel efficiency and low emission at the same time, the temperature of the exhaust gas decreases undesirably, which results in the decline of the performance of existing purification system. This symposium will deal with the upgraded catalysts and adsorbents to exhibit higher performance at the low temperature, and the mechanism of the sintering and the poisoning of the catalysts for preventing the deactivation of the catalysts and commercializing the purification system.

Session topics

- Catalysts for oxidation of CO, hydrocarbon, and NO
- Selective catalytic reduction (SCR) of NO using urea
- Catalyst for combustion of Particulate Matters (PM)
- Diesel particulate filter (DPF)
- Adsorbents of NOx, hydrocarbon
- Mechanism of catalyst sintering and poisoning
- Reduction or replacement of precious metals in automobile catalyst
- Establishment of control model

Organizers

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