



Submission Deadline—November 1, 2017

## Wide Energy Gap Semiconductors: Material Issues and Device Implications

Wide energy gap semiconductors, as distinct from their more conventional counterparts, silicon and gallium arsenide, offer considerable promise for novel electronic and optoelectronic device applications. Due to their higher polar optical phonon energies, the saturation electron drift velocities exhibited by these materials tend to be higher. In addition, the dielectric constants, both static and high-frequency, associated with the wider energy gap semiconductors tend to be smaller than with conventional semiconductors. These factors favor improved electron device performance. Another benefit is their great tolerance to high applied electric field strengths, the breakdown field of a semiconductor material increasing with the magnitude of its energy gap. The high thermal conductivities and resistance to radiation offered by some of these materials further contribute to their appeal.

The past three decades have seen numerous developments in the wide energy gap semiconductor field, both at the materials level and in the range of device applications now offered. This Focus Issue will present results corresponding to both traditional wide energy gap semiconductors, and some of more recent interest. An emphasis will be placed on the material properties of these semiconductors, and the role that such properties play in defining the range of device applications possible. The range of materials considered will include, but is not limited to, silicon carbide and its polytypes, the III-V nitrides, oxide-based semiconductors, and some more recently developed wide energy gap semiconductor materials.

### Contributed articles are sought in the following areas:

- ◆ Advances in the growth of the wide energy gap semiconductors
- ◆ Developments in the processing of the wide energy gap semiconductors
- ◆ New device applications possible as a result of the distinct material properties associated with newer wide energy gap semiconductors
- ◆ Material properties and how they are distinct from their more conventional counterparts
- ◆ Brief overviews of developments in the field over the past three decades
- ◆ Brief perspectives on future opportunities for the wide energy gap semiconductors

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## Stabilization of Organic Electronic Materials and Devices

The unique properties of organic semiconductors grant unrivaled potential for highly efficient, low-cost, and sustainable optoelectronic applications, e.g., in light and power generation, sensor technology, and electronic circuitry. Semiconducting polymers and small molecules can be scaled up to satisfy industrial needs and be processed onto plastic substrates using high throughput technologies. This makes a technological and economic breakthrough in the near future possible.

Despite the widespread potential, organic electronics face important challenges. A critical factor in the overall cost assessment is the lifetime of a final product. The current generation of organic electronics offers limited stability and need to be encapsulated using costly barrier materials. A fundamental understanding of the processes governing performance decay paired with innovative material approaches is essential for enhancing the longevity of organic optoelectronic devices and thus guaranteeing market readiness. This Focus Issue will address both mechanistic aspects that determine the lifetime of materials and devices as well as future strategies with practical relevance for increasing the lifespan and reliability of organic electronics.

### Contributed articles are sought in the following areas:

- ◆ Fundamental degradation mechanisms in active materials and finished devices (photophysical and spectroscopic studies)
- ◆ Novel material concepts leading to enhanced intrinsic material stability (materials design, predictive simulations, materials synthesis, etc.)
- ◆ Extrinsic material concepts for stabilizing organic electronics materials (stabilizing additives, optimal microstructure, crystallinity, etc.)
- ◆ Realization of stabilization approaches in device structures with practical relevance

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# CALL FOR PROPOSALS

## **PROPOSALS** are now being accepted for *JMR* Focus Issues to be published in 2019. **SUBMISSION DEADLINE—JANUARY 31, 2018**

Although each regular issue of *JMR* covers a range of materials research topics, Focus Issues are devoted entirely to a single topic and are published several times a year. Focus Issues allow the journal to comprehensively examine the current research in a particular area of interest to *JMR* readers. See [www.mrs.org/jmr-focus](http://www.mrs.org/jmr-focus) for previously published and planned Focus Issues.

### **Lead a Focus Issue on your area of expertise!**

Proposals should provide:

- **PROPOSED TOPIC**  
Topics should be interdisciplinary materials research and focused on the science of the field. Focus Issues should cover emerging and progressing fields in materials or topics that would benefit from comprehensive coverage.
- **PROPOSED GUEST EDITOR NAMES AND FULL CONTACT INFORMATION**  
Three to four guest editors, representing the diversity of The Materials Research Society®, are required. Guest editors should be knowledgeable in the field of the proposed topic, able to present a balanced view of the topic, organized, and able to meet deadlines. Previous editorial experience is a plus.
- **OVERALL SCOPE**  
Describe the Focus Issue topic in one or two paragraphs, and why a Focus Issue is important at this time. Evaluation will be based on scientific value, presentation quality and plans to attract cutting-edge papers in the field.
- **PROPOSED SCHEDULE TO PRODUCE THE ISSUE**  
During what quarter of 2018 (January-March / April-June / July-September / October-December) do you prefer to organize the Focus Issue? For 2019 publication, the Call for Papers should be released by *JMR* at least 12 months before the publication date.

Visit [www.mrs.org/jmr-focus-proposals](http://www.mrs.org/jmr-focus-proposals) for more information and guidelines regarding successful proposals. **Submit your proposal to the JMR Editor-in-Chief at [jmr@mrs.org](mailto:jmr@mrs.org) no later than January 31, 2018.**

Focus Issue topics for 2019 will be selected by the Editor-in-Chief and Associate Editors by February 28, 2018.

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Submission Deadline—January 1, 2018

## Soft Magnetic Materials: Synthesis, Characterization, and Applications

A push for greater efficiency and decreased size in power electronics and electrical machines demands higher performing soft magnetic materials. In order to be competitive, advanced soft magnetic materials must be affordable and their production volume needs to meet the anticipated demand. This drive for higher efficiency and diminished size, weight, and power (SWaP) is fueled in part by the development and adoption of wide bandgap (WBG) semiconductors. WBG devices enable very fast switching (1 kHz to as high as 10 MHz), high voltage operation, and high temperature operation in both power electronics and electrical machine drives. Researchers in the field of soft magnetics must rise to this challenge and create soft magnetic materials with high magnetic flux densities and low electrical losses, while also improving the theoretical assessment of magnetic behavior and energy losses, at these elevated switching frequencies.

This JMR Focus Issue will include the latest research on soft magnetic materials for next-generation power electronics, as well as in electrical machines, and coverage of advanced characterization techniques that will be vital to understanding both the nanostructure and dynamical properties in soft magnetic materials. This behavior of soft magnets on small length and short time scales will ultimately govern their behavior in inductors, transformers, motors, and generators.

### Contributed articles are sought in the following areas:

- ◆ New bulk and composite soft magnetic materials
- ◆ Developments in the synthesis and fabrication of soft magnetic materials
- ◆ Advanced characterization techniques relevant to soft magnets
- ◆ Implementation of soft magnetic materials in power electronics and electrical machines
- ◆ Modeling and simulation of soft magnetic materials
- ◆ Overviews of the field of soft magnetic materials
- ◆ Perspectives on future opportunities in the field of soft magnetics

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Submission Deadline—February 1, 2018

## Interconnect and Interface Materials for High-Temperature Energy Conversion Technologies

One major roadblock to the wide-scale commercialization of state-of-the-art energy materials (e.g., SOFC, high-temperature PV, and high-temperature thermoelectrics) is the great difficulty involved with interfacing these materials with electrical interconnects in a way that results in low parasitic electrical losses and low degradation rates. Many of these materials consist of reactive and sometimes volatile elements from the chalcogen (including oxygen), pnictogen, and halogen groups, which tend to react strongly with metallic interconnect and interface materials that are usually desired for low Ohmic losses at the device level.

This *JMR* Focus Issue will cover advances in the synthesis, processing, and performance of both conventional alloys and unconventional compounds designed for use as electrical interconnects and interfacing materials for these high-temperature energy conversion technologies. Special attention may be given to work relating to experimental and theoretical assessment of the reaction and diffusion kinetics of these interface materials and the volatile, reactive species of energy materials.

### Manuscripts are solicited in the following areas:

- ◆ Development and performance of *in-situ*-formed diffusion barriers
- ◆ Modeling of high-temperature interface evolution (kinetics and properties evolution)
- ◆ Reaction kinetics of volatile “p-block” elements with transition metals and alloys
- ◆ Mechanical properties of interconnect-energy material interfaces
- ◆ Interface degradation mechanisms and mitigation
- ◆ Characterization and improvement of electrical and thermal contact/interface resistance

### GUEST EDITORS

**Tim C. Holgate**, Teledyne Energy Systems, Inc., USA

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**Neil Dasgupta**, University of Michigan, USA

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Submission Deadline—March 1, 2018

## Fundamental Understanding and Applications of High-Entropy Alloys

As an emerging field, research on high-entropy alloys now has attracted rising worldwide attention and interest from both academia and industry since 2004. The number of published papers increases rapidly each year, and there have been many dedicated conference symposia and workshops on high entropy alloys. Traditional physical metallurgy principles as well as novel processing methods have all been applied to high entropy alloys, and new materials with extraordinary properties have been reported. The high-entropy concept has been extended to ceramics, semiconductors, polymers, superconducting materials, etc. As a result, the field has advanced dynamically and rapidly in almost every aspect of materials science. This *JMR* Focus Issue will provide readers up-to-date information on high-entropy alloys regarding their fundamentals (e.g., formation, thermodynamics, kinetics, structures, defects, mechanical properties, functional properties, environmental properties) and applications (e.g., structural materials, coatings, nuclear materials, high-temperature materials).

### Contributed papers are solicited in the following areas:

- ◆ Thermodynamics: Phase diagrams, phase transformations (e.g., at high temperature and/or high pressure), thermochemistry measurements
- ◆ Kinetics: Diffusivities, high throughput diffusion multiples
- ◆ Computational modeling: First-principles, molecular dynamics, Monte Carlo, phase field, finite element methods, CALPHAD, continuum, empirical parameters, machining learning
- ◆ Defects: Vacancies, dislocations, stacking faults, twinning, grain boundaries, interfaces, surfaces
- ◆ Processing: Homogenization, additive manufacturing, rapid solidification, grain refinement, powder metallurgy
- ◆ Microstructure characterization: Neutron, synchrotron and x-ray scattering, transmission electron microscopy (TEM), high-resolution TEM, in situ TEM, atom-probe tomography
- ◆ Mechanical properties: Elasticity, plasticity, fracture, wear, creep, fatigue, high strain rate, nanoindentation
- ◆ Environmental properties: Corrosion, oxidation, irradiation
- ◆ Other high-entropy materials, such as oxides, carbides, borides, polymers, compounds

### GUEST EDITORS

**Michael C. Gao**, National Energy Technology Laboratory/AECOM, USA

**Peter K. Liaw**, The University of Tennessee, USA

**Daniel B. Miracle**, Air Force Research Laboratory, USA

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