

MRS Symposium Organizational Proposal

Submitted By Ewa Ronnebro at 5/15/2014 8:02:57 PM

Cluster: Energy and Sustainability

F15-080: Progress in Thermal Energy Conversion—Thermoelectric and Thermal Energy Storage Materials and Devices

This symposium will broadly cover current and emerging thermoelectric and thermal energy storage materials and devices. The first part of the symposium will focus on thermoelectric (TE) materials and the second part will focus on thermal energy storage (TES) materials with joint sessions in the middle to highlight topics that are of mutual interest/overlap for both TE and TES communities. The first part of this symposium will focus on thermoelectric materials and devices. A key focus will be on energy applications from direct solar conversion, waste heat conversion, cooling and vehicle applications. The symposium will focus on the significant renaissance in materials, their integration into devices and processes toward large scale production. Key is facilitating a rapid transition from basic science and to practical deployment across the broad range of emerging applications. Thermoelectric material categories should include both conventional materials (e.g., classic Se-, or Te-based, caged compounds and nanostructured multilayer/ composites) and unconventional materials like oxides, selenides and sulfides. Symposium contributions should address basic science issues or explore new phenomena (e.g., spin-Seebeck effect), or address obstacles confronting the development of practical applications from emerging materials. Discussion of synthesis, growth mechanisms and fabrication routes; methods to improve properties important for applications; and discussions that advance understanding of fundamental material science issues are also welcomed. The second part of this symposium will focus on thermal energy storage materials and devices. As the interest in renewable energies (solar, wind and water) is steadily increasing, thermal energy storage (TES) is an essential breakthrough research area to achieve dispatchable power, higher efficiency and lower cost. TES is an enabling technology in various areas and needed anywhere where there is an energy balance that can be more efficiently used in heating or cooling. This symposium will provide state of the art research on thermal energy storage materials and devices for various applications, bringing together scientists and engineers from various disciplines. Opportunities will be identified in the areas of buildings, transportation and in renewable energies. To enable TES, key is materials development and therefore the focus of the symposium is identifying materials for each application that need to store high energy densities at required temperature ranges. For instance, in a concentrating solar power (CSP) plant, the TES material has the benefit to be able to store excess energy for later use to generate electricity whenever needed and at peak times. Photovoltaic (PV) power can only produce electricity when the sun is shining and efficiency is limited. TES can be stored as sensible heat resulting in a temperature change, as latent heat at constant temperature or in thermochemical reversible reactions. Abstracts will be solicited in the following areas: high-temperature materials for CSP applications, thermal battery concepts with MOFs and metal hydrides for use on-board electric vehicles for driving range extension, TES for waste heat recovery, new materials for heat pumps, and new phase change materials for building applications.

Topics will include:

- Thermochemical energy storage for concentrating solar power: new materials and devices
- Thermal battery materials
- Phase change materials in building applications
- New materials for heat pumps
- Thermal energy storage in transportation
- Waste heat recovery
- New high ZT materials, computational materials design and experimental realization
- Thermoelectric cooling
- Applications for TE materials
- Synthesis and achieving multiple length scale materials on the nano and mesoscale
- Phonon and electron transport properties: intrinsic behavior within grains, crystals electron correlation; interface properties
- Spin-Seebeck effect, photothermal effects and topological insulators
- Integration of TE modules and functional devices
- Novel synthesis routes of TE, atomic layer control and self-assembly

Invited speakers include:

Luisa Cabeza	University of Lleida, Spain, Spain	Li Shi	The University of Texas at Austin, USA
Yogi Goswami	University of South Florida, USA	Vladan Stevanovic	CSM, USA
Sossina Haile	California Institute of Technology, USA	Evelyn Wang	Massachusetts Institute of Technology, USA
Justin Raade	Halotronics, USA	Bunsen Wong	General Atomics, USA
Christian Sattler	German Aerospace Lab (DLR), Germany		

Symposium Organizers

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Keywords

High-Level Keywords: Energy,

Keywords: Thermoelectric, Thermal, Energy Storage, Photovoltaic, Metal-organic Framework (MOF)

Comments

MRS has not previously had a topic specifically dedicated to thermal energy storage (TES), but with the much intensified efforts and increased funding, we believe that now is an excellent timing to have a symposium that is focused on TES materials. Key is to identify materials with high energy densities that can perform adequately in the required temperature ranges for various applications. This symposium will high light the material research that is being performed and bring together researchers from multiple disciplines. The lead organizer, Dr. Ewa Ronnebro of PNNL, previously organized a Spring MRS Symposium on "Recent Developments in Materials for Hydrogen Storage and Carbon Capture Technologies" in 2011. She also organized a Gordon Research Conference in 2013 on Metal Hydrogen Systems.