Energy Frontiers Research Centers
Room: A8 - Session EN-WeM

Energy Frontiers Research Centers
Moderator: E.S. Aydil, University of Minnesota

10:40am **EN-WeM9 EFRC: Science of Precision Multifunctional Nanostructures for Electrical Energy Storage**, ***G.W. Rubloff***, University of Maryland **INVITED**

Current technology for electrical energy storage (EES) imposes profound limits on needed advances in energy capture, its efficient utilization, and its impact on the environment. Renewable sources with time-varying output (e.g. solar, wind) require storage mechanisms, while electric vehicles with environmental as well as energy benefits need better storage mechanisms to enable longer distances and faster recharge than expected commercially in the short term. Our EFRC is aimed at providing the scientific underpinnings for a new generation of nanostructure solutions to enable EES devices with dramatic improvements in power (10-100X) and energy density (10X). We believe such advances are possible by suitable design of heterogeneous nanostructures that provide facile, repeatable and bidirectional transport of ions and electrons between high capacity nanostructures (e.g. nanowires) and remote contacts to the external world, while stabilizing efficient charge storage components during charge cycling. Multifunctional nanostructures will be investigated which combine efficient charge storage materials (metal oxides, Si) with low-dimensional carbon for accelerated charge transport to storage nanostructures and mechanical robustness during cycling, with focus synthesis in precise, well-controlled configurations as needed in massive arrays. Fundamental electrochemistry at the nanoscale will be explored experimentally and theoretically, enhanced by the development of new MEMS instruments for nanoscale in-situ observations of electrochemical phenomena and structural change during charge cycling. The EFRC is led by the University of Maryland in partnership with Sandia and Los Alamos National Laboratories, the University of California Irvine, the University of Florida, and Yale University. The effort benefits from research facilities and infrastructure of the Maryland NanoCenter, University of Maryland Energy Research Center, and the Center for Integrated Nanotechnologies at Sandia and Los Alamos.

11:20am **EN-WeM11 Research at the Center on Materials for Energy Efficiency Applications (CMEEA)**, ***J.E. Bowers***, University of California Santa Barbara **INVITED**

As a result of the energy crisis facing the United States, the scientific enterprise must offer solutions, based on fundamental research and engineering, that will ensure sustainable energy resources for the US over the long term. The Center on Materials for Energy Efficiency Applications (CMEEA) addresses this critical challenge by focusing on fundamental research in the three key areas of photovoltaics, thermoelectrics, and solid state lighting. CMEEA is composed of 22 senior scientists and additional graduate and undergraduate students at UCSB, NREL, LANL, UCSC and Harvard. CMEEA will take a comprehensive, integrated approach to dramatic improvement in photovoltaic technology, anticipating lower cost manufacturability with organic solar cells, higher performance epitaxial photovoltaics for concentrated PV and truly novel materials and device structures in the longer timeframe that will address both higher efficiency and lower cost. New thermoelectric materials with higher efficiencies are critically important for power generation and waste heat recovery. Material breakthroughs would allow a variety of new applications, such as an attractive compact alternative to internal combustion engines and solid state refrigerators. We are proposing a variety of metal/semiconductor nanocomposites that will allow us to modify the three intrinsic material properties important for high efficiency. Research in solid-state lighting will focus on the dramatic drop in efficiency in the yellow-green region by using nonpolar materials to reduce leakage due to the QCSE and due to the Auger effect.

Authors Index

Bold page numbers indicate the presenter