



MSE SEMINAR

Materials Science and Engineering
Michigan Technological University

Tuesday, April 22, 2014

11:00 am – 12:00 pm

Room 610, M&M Building

Design Nanostructures and Interfaces for Efficient Energy Conversion and Storage

John & Virginia Towers Distinguished Lecture Series

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Abstract

Nanostructured materials possess unique physical properties that are not found in their bulk counterparts, and some properties can be tailored by change the characteristic dimension of the nanomaterials. Devices and systems based on appropriately designed and fabricated nanostructures and nanomaterials can demonstrate remarkably enhanced performances. The large specific surface area and short diffusion distance can surely enhance the interface and transport kinetics, while the surface energy and defects will impact the phase transition and reaction thermodynamics. In this presentation, I will use three examples to illustrate how energy conversion and storage efficiency can be significantly improved through careful design and engineering of materials on the nanometer and micrometer scales and through surface chemistry modification. The first example is the manipulation and control of nanostructures and surface chemistry of porous carbon for supercapacitors. The second example is nanostructured electrodes for lithium-ion batteries. Nanostructured electrodes have demonstrated specific energy and specific power improvements with excellent cyclic stability. Further enhancement in energy density can be achieved through introduction of defects and modification of surface chemistry. Lastly I will discuss the nanostructured photoanodes for dye-sensitized solar cells, quantum dot-sensitized solar cells and inverted polymer solar cells, and the impacts of surface chemistry and morphology on the power conversion efficiency.

Bio: Dr. Guozhong Cao is Boeing-Steiner Professor of Materials Science and Engineering, Professor of Chemical Engineering, and Adjunct Professor of Mechanical Engineering at the University of Washington, Seattle, WA. He received his PhD degree from Eindhoven University of Technology (the Netherlands), MS from Shanghai Institute of Ceramics of Chinese Academy of Sciences, and BS from East China University of Science and Technology (China). He has published over 280 SCI journal papers, authored and edited 7 books, and presented over 200 invited talks and seminars. His current research is focused mainly on chemical processing of nanomaterials for energy related applications including solar cells, lithium-ion batteries, and supercapacitors. Dr. Cao can be reached at gzaoc@uw.edu or 206-616-9084.

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