2010-2011

Graduate Seminar Series

The Department of Mechanical Engineering – Engineering Mechanics

Proudly Presents

Dr. Ming Au

Savannah River National Laboratory

Dr. Ming Au is a Principal Scientist at Savannah River National Laboratory where he leads advanced battery strategic program. His scientific interests and research activities include advanced batteries, hydrogen storage and nanostructured materials and applications. He received Certificate of Recognition from NASA for his innovation in lithium batteries in 2000. He holds eleven US patents and three pending patents in energy related nanostructured materials and has published 40 papers in peer- review journals as the primary author. Dr. Au earned undergraduate degree in Materials Science and Engineering from Dalian University of Technology and a graduated degree in Materials Science and Engineering from Zhejiang University in China. He was promoted as a Professor and certified as Ph.D equivalent by State Education Committee of China in 1991. He jointed faculty of Carnegie Mellon University as a visiting professor and pursue his career success in United States since 1992.

Thursday, Sept. 9, 2010 4:00 – 5:00 p.m. Room 112, ME-EM Bldg.

Nanostructured Metals and Metal Oxides for High Capacity Li-Ion Batteries

Currently, carbon base anodes are being used for Li-ion rechargeable batteries through Li ion intercalation process. The theoretic capacity is limited at 372 mAh/g. The volume expansion and breakdown of solid electrochemical interface (SEI) of carbon anodes during overcharging is one of the reasons of thermal runaway and fire ignition. Searching for new anode materials that possesses higher energy storage capacity and inherent fire safety is not only scientist's passion, but the mandate of industries and customers, particularly for plug-in hybrid vehicles and portable power sources.

It is found that metals and metal oxides can host Li ions through conversion process that changes lattice structure of metal oxides or forms metal alloys. The theoretic capacity of metal oxides and metals is in the range of 500 ~ 4000 mAh/g. The volume of some metal oxides will shrink down during conversion with less mechanical stress. The metal oxides do not react with polymer electrolyte and generate exceed heat. The aligned nanostructure, such as nanorods, creates large inter-rods space that is capable to store the charges and accommodates the volume expansion caused by conversion. It is expected the aligned nanorods of metal oxides will offer high energy and power density and inherent safety. Growing free standing nanostructured anode materials on current collectors directly without additives and binders represent a new trend of anode fabrication with simplified process and low cost.

This presentation will introduce several approaches for synthesis of the aligned nanorods and hollow nanoporous spheres, show their structural features and discuss their applications in Li-ion battery.

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