2012-2013

Graduate Seminar Series

The Department of Mechanical Engineering – Engineering Mechanics

Proudly Presents

Dr. Chong-Min Wang
Environmental Molecular Sciences Laboratory
Pacific Northwest National Laboratory

Dr. Chongmin Wang is a senior scientist at Environmental Molecular Sciences Laboratory (EMSL) of Pacific Northwest National Laboratory (PNNL). He received his undergraduate education in physics and a Master degree in solid state science both from Lanzhou University in China. He received his Ph.D in Materials Science and Engineering from University of Leeds, United Kingdom in 1994. He worked at the Max-Planck-Institute for Metal Research in Stuttgart, Germany from 1994 to 1996 as an Alexander von Humboldt Research Fellow. In 1996/97, Dr. Wang worked as a research scientist at the National Institute for Research in Inorganic Materials. He was a research scientist in the Materials Research Center at Lehigh University from 1997 to 2001.

Dr. Wang joined PNNL in June 2001. He leads the EMSL's transmission electron microscopy (TEM) facilities. Dr. Wang has expertise on the atomic level characterization/visualization of materials structure and their physical and chemical behavior. He works on correlating materials structural and functional properties with atomic and electronic structure and chemical compositions, particularly nanomaterials related to energy conversion, storage, and sustainability. Currently, Dr. Wang's focus is on developing methods that enable in-situ atomic level observation of electrochemical process (energy conversion and storage such as lithium ion battery), and mechanical behavior (such as stress-strain, impurity/dopant segregation, grain-boundary or interface mediated mass transport, and defect clustering, radiation damage) using aberration corrected HRTEM and HR-STEM. These aspects of his research provide insight for correlating properties and structure at nanometer scale under dynamic operating conditions.

He is the recipient of the Rowland Snow Award from the American Ceramic Society, the Outstanding Invention Award from the Japanese Science and Education Committee, and a R&D100 award.

Dr. Wang pioneered the concept of a nanobattery using ionic liquid and a single nanowire for in-situ TEM studies. This research led to the receipt of the 2012 Microscopy Today Innovation Award of Microscopy Society of American.

Thursday, Nov. 8, 2012 4:00 – 5:00 p.m. Room 112, ME-EM Bldg.

Nanoscale designing towards high capacity, high power rate, long cycle life, and safe operation for lithium ion battery

We use lithium ion batteries daily as they power our everyday electronics such as cell phones, laptops, cameras, tools, and electrical cars, and potentially stationary storage. However, there are fundamental challenges that need to be addressed for these applications, such as capacity, power rate, cycle life, and safe operation. A range of materials has a high theoretical capacity, but in reality, this type of material cannot be used directly due to a fast capacity fade. It is believed that the capacity fading and short cycle life of the battery using this type of materials are directly related to the overall large volume expansion and anisotropic accommodation of the volume change. I will discuss the fundamental challenges and possible ways to counter act them. In particular, I will review some of the general nanoscale designing concepts for tailoring composite materials based on silicon and carbon as anode materials for high capacity and long cycle life. For the cathode materials, doping of transition metals has proved to be a viable way for high voltage and high capacity. However, the spatial distribution of the dopant ions appears to play a key role on the performance of the cathode materials. I will also present recent progress on the development of in-situ TEM capabilities for probing the structural evolution of both anode and cathode materials for lithium ion battery.

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