

Mechanical & Materials Engineering

Pierson Graduate Seminar

Co-Sponsored by the Nebraska Center for
Materials and Nanoscience

Advanced Synthesis and Characterization of Energy Storage Materials

Meng Gu, PhD

Pacific Northwest National Laboratory (PNNL)
Richland, WA

Thursday, March 20, 2014 | 3:30 pm | 357 Scott Engineering Center

Maximizing the usage of renewable energy will reduce our reliance on dwindling natural resources and environmental pollution. Batteries are an important enabling technology for renewable energy, portable electronics, and modern transportation systems such as hybrid electric vehicles. However, limitation of current materials has to be overcome if long-life and low-cost batteries are to be built. In my talk, I will focus on the study of the Li-ion/Na-ion batteries using a combination of advanced synthesis and characterization methods. The advances in the aberration-corrected scanning / transmission electron microscopy have enabled the study of physical structure, chemical composition, bonding of complicated chemical substance at the atomic scale and in three dimensions. Therefore, the electron microscopy plays a critical role in providing key feedbacks on the design of new batteries and origin of battery failures. For instance, three-dimensional x-ray energy dispersive spectroscopy tomography was developed during my study of $\text{Li}_{1.2}\text{Ni}_{0.2}\text{Mn}_{0.6}\text{O}_2$ cathode materials and used to accurately locate and quantitatively analyze the Ni-segregated regions in one single nanoparticle. Furthermore, state of the art *in-situ* microscopy methods open the door for the study of the dynamic changes of the electrodes during electrochemical cycling. The first operando study of silicon anode nanostructures in a closed-liquid-cell battery will be presented in detail. The information obtained during the *in-situ* characterization experiments can be used to direct the development of new electrodes and enhance the capacity and life of batteries.

Bio

Meng Gu received his B.S. degree (2008) in materials science and engineering in Shanghai Jiao Tong University in China and Ph.D. degree (2011) in materials science in the University of California Davis. His Ph.D. research centered on the growth and atomic scale characterization of complex oxide thin films using pulsed laser deposition and aberration corrected scanning transmission electron microscopy (STEM). After joining EMSL PNNL in 2011, his research shifted to the study of energy-related materials including batteries materials, and catalysis, metal-oxide electronics. He has developed the first operando setup of a nano-battery for *in-situ* TEM observations and three dimensional chemical imaging using X-ray energy dispersive spectroscopy (XEDS) tomography. His expertise include Li-ion Batteries, oxide thin films, TEM, STEM, electron energy loss spectroscopy, XEDS, focused ion beam, STEM/XEDS tomography, He-ion microscopy, etc. Dr. Gu has recently joined Dow Corning as a senior analytical scientist since February 2014 focusing on Cryo-TEM study of soft materials and solar energy. He has 46 peer-reviewed journal publications and 10 meeting abstracts and proceedings. His publications are highlighted by U.S. DOE, PNNL, SLAC national lab, London Center for Nanotechnology, Imperial College London and other social media after joining PNNL. He has served as session co-chair in the MRS 2012Fall meeting in the PP2: imaging chemical bonding session.

For more information, contact Dr. Li Tan at 402-472-4018 or litan4@unl.edu.