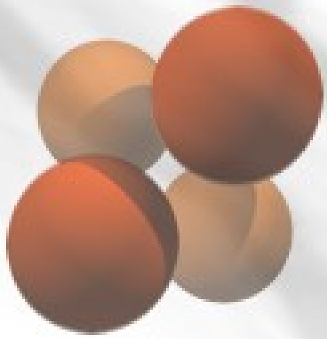

MSE SEMINAR

Materials Science and Engineering
Michigan Technological University

Tuesday, April 9, 2013
11:00 am – 12:00 pm
Room 610, M&M Building

Graduate Student Presentations

In-situ Lithiation/Delithiation Studies on Transitional Metal Oxides (TMOs) Using an Aberration-corrected Scanning Transmission Electron Microscope

YiFei Yuan
Graduate Student
Materials Science and Engineering Dept.
Michigan Technological University

Abstract

Transitional metal oxides (TMOs) were recently found to offer much higher charge capacity than traditional graphite anode in lithium ion battery (LIB) mainly via a so called conversion reaction mechanism. Most TMOs, however, suffer from large irreversible capacity loss and eventually poor cycle performance, preventing its commercialization. The formation of irreversible Li_2O phase in the redox reaction is believed to lead to the poor capacity retention in TMOs. The proposed research will investigate the formation of Li_2O and its stability during half-cell lithiation/delithiation cycles in cathode TMOs (FeO, Fe_2O_3 and Fe_3O_4) using an aberration-corrected scanning transmission electron microscopy (AC-STEM). The in-situ AC-STEM studies will be conducted inside a JEOL ARM 200CF using an electrical probe holder. Low-Angle Annular Dark Field (LAADF) and Annular Bright Field (ABF) imaging along with Electron Energy Loss Spectroscopy (EELS) will be applied specifically to trace the distribution and behavior of Li and O atoms. The results are expected to provide direct evidence of the compositional and structural change of TMOs and Li_2O during charging and discharging cycles.

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In-Situ Mechanistic Analyses of Electrode Materials for Sodium Ion Batteries

Jacob Kolar
Graduate Student
Materials Science and Engineering Dept.
Michigan Technological University

Abstract

As nanotechnology and system components have improved, sodium ion energy storage systems could fill a necessary niche for large scale storage applications. Thus, it is imperative to develop more efficient materials and to further understand the systems that have been recently evaluated. With recent advances in characterization methods, the proposed research is aimed at examining the mechanistic changes that occur during sodiation/desodiation of battery electrodes, via electrochemical studies and in-situ TEM characterization. Anodic and cathodic species will be examined in an effort to further understand the principles of insertion mechanisms. Correspondingly, electrode variations will be performed and characterized with the goal of improving system performance. The proposed variables to alter are geometrical constraints, chemical compositions, and crystallographic conditions.

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