

SES 50th Annual Technical Meeting and ASME-AMD Annual Summer Meeting

July 28 - 31, 2013, Brown University

Mechanics in Materials Science

Symposium on lithium-ion batteries: when chemistry meets mechanics

Li-ion battery technology is an emerging field that dynamically couples electrochemistry and mechanics. The chemistry of lithiation and delithiation leads to rich phenomena of mechanics in electrodes, such as large deformation, structural transformation, plasticity, fracture and fatigue. Likewise, the stress field generated upon lithium insertion influences the kinetics of lithium transport and chemical reactions in a significant manner. Stress-induced mechanical degradation is one of the primary mechanisms of failure in commercial batteries and limits commercialization of high capacity electrodes.

The goal of this symposium is to elucidate the interplay between chemistry and mechanics in Li-ion batteries and to explore the role of mechanics in designing reliable electrodes. Session topics may include, but are not limited to:

- i) Experimental measurements of mechanical properties of electrodes as a function of the state of charge, and characterizations of mechanical stability of nanostructured electrodes associated with electrochemical processes,
- ii) Constitutive descriptions on the chemo-mechanical behaviors of electrodes, analysis of failure mechanisms in electrodes induced by deformation and stresses, and exploration of mechanics in design of reliable electrodes with prolonged cycle life,
- iii) Multiscale modeling on the kinetics of Li transport and electrochemical reactions, studies on the microscopic mechanism of deformation and structural transformation, and simulations of mechanical and chemical degradations.

This symposium aims to bring together experimentalists and theoreticians in the field to highlight the state-of-the-art progresses and to promote idea exchanges to advance the understanding of the concurrent chemical and mechanical processes in electrodes of Li-ion batteries.

The following speakers will contribute invited talks in the symposium: **Yi Cui, William D. Nix, Martin Bazant, Brian Sheldon, Gleb Yushin, Scott Mao, Reiner Moenig, and Yue Qi.**

Joost Vlassak, Harvard University.

Kejie Zhao, MIT

Vijay A. Sethuraman, Brown University

Siva Prasad Varma Nadimpalli , Brown University