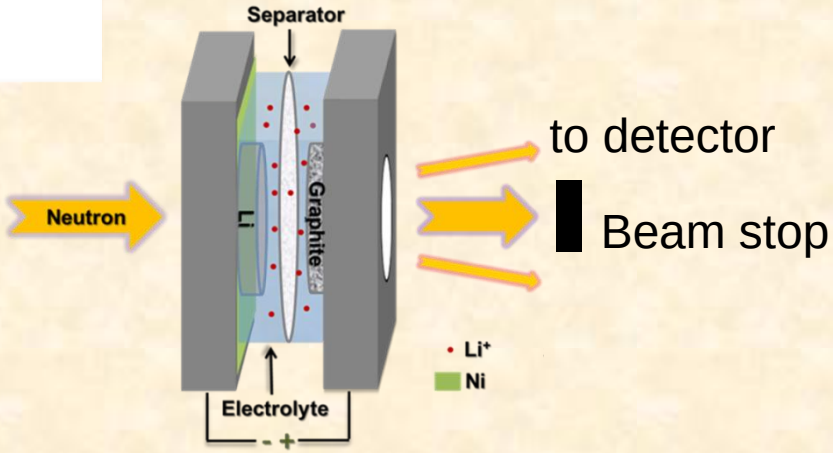
Neutron Scattering Study of Electrode Materials for Li-Ion Batteries

Howard Wang, Institute for Materials Research and Department of Mechanical Engineering, State University of New York, Binghamton, Ney York 13902



- Small angle neutron scattering (SANS) is particularly sensitive to the scattering length density of electrode materials due to lithiation and delithiation and the variation of surface areas.
- A specially designed battery cell containing graphite *vs.* Li was fabricated to enable both the battery operation and *in situ* SANS measurements.
- *In situ* SANS measurements were carried out to reveal structure variations of active materials in real time.

- The variation of integrated SANS intensity upon cyclic charge/discharge rises and falls synchronizing with charge states. This is due to the contrast variation induced by lithiation/delithiation.
- The amplitude of the SANS intensity variation becomes even larger as the charge transfer becomes shallower at higher cycling rates. The excess scattering is due to new surfaces from graphite particle fracturing, as confirmed by both morphology and electrochemical studies.
- Quantitative analysis of SANS data reveals the evolution of fracture surface areas in the electrode materials.