Microscopy Investigation on the Fading Mechanism of Electrode Materials

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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Technical Approach:

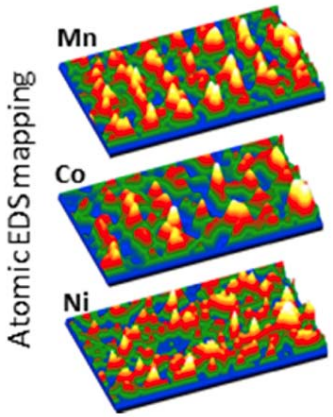
- Ex-situ, in-situ and operando S/TEM study on the structure, chemistry, and evolution of electrode materials at multiscale
- Direct correlation of structure and chemical evolution with battery property to guide designing of better electrode materials

Status:

Developed three generation of in-situ and operando S/TEM for diagnosis of fading mechanism of cathode and anode, SEI layer formation and evolution. Developing liquid SIMS technique for capturing molecular structure of SEI layer

Technology:

- STEM-HAADF imaging
- Atomic scale STEM-EDS and EELS mapping to reveal chemical distribution and structural evolution
- Close and open cell in-situ S/TEM probing structural and chemical evolution of electrode materials under operating condition.



Objectives:

- Microscopy investigation on the fading mechanism of the electrode materials
- Identifying structure-performance correlation and providing feed back to materials synthesis for better electrode materials

Deliverables:

Quantitative analysis and establishment of structure-property relationship for guiding materials design

Funding:

Duration: 3 yrs (Yr 1)
FY16 Budget: $300K (DOE)

Milestones:

- **Q1/Q2:** Complete multi-scale quantitative atomic level mapping to identify the behavior of Co, Ni, and Mn in NCM during battery charge/discharge.
- **Q3:** Complete quantitative measurement of structural/chemical evolution of modified-composition NCM cathode during cycling of battery.
- **Q4:** Complete the correlation between structure stability and charge voltage of NCM for optimized charge voltage.