Microscopy Investigation on the Fading Mechanism of Electrode Materials

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

PI/Co-PI: Chongmin Wang (PNNL)

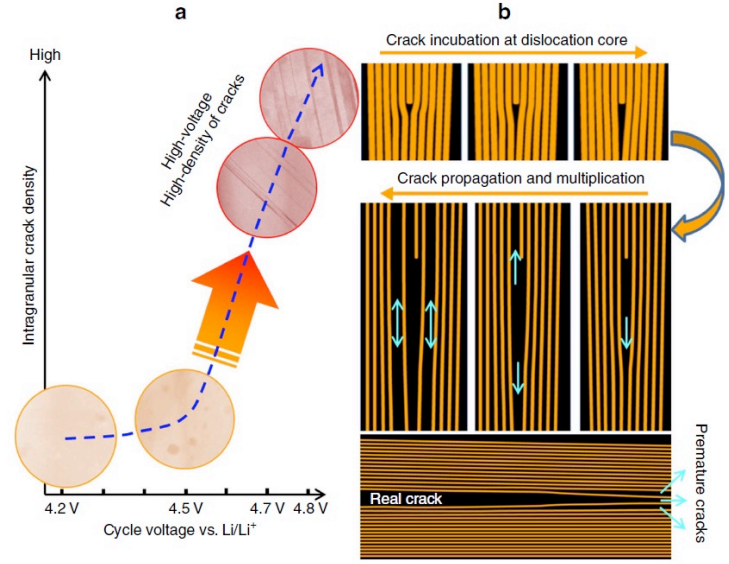
Objective:

- 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

Impact:

- Atomic level structural and chemical analysis and direct correlation with battery fading properties
- Guide the designing of electrode materials with tailored microstructure and chemistry for enhanced properties
- Insight as how to stabilize the lattice of cathode for longer cycling of the battery

Direct Correlation of Intragranular Cracks Formation with Cycling Voltage for the Layer Structured Cathode



Accomplishments:

- Capability: Developed In-Situ Environmental TEM Enabling the Controlled Gas Environment around the Sample
- Cathode: Detailed Study of Chemistry and Structure of Cathode-Liquid Electrolyte Interaction and Correlation with Fading.
- Discovered Intragranular Cracking is a Critical Barrier for the High Voltage Operation of Layered Cathode
- Directly Observed the Penetration of the Electrolyte into the Boundaries of the Large Aggregate of Cathode
- Li-Air Battery: In-situ ETEM Reveals the Reaction Mechanism of Li-air Battery System

FY 18 Milestones:

- Resolve the vacancy injection mechanism into the LM-NMC during the battery cycling and its correlation with battery fading mechanism
- The functioning mechanism of electrolyte additive on the solid-liquid interphase in NMC cathode
- Atomic level understanding of the mechanism of intergranular and intragranular cracking in NMC

FY18 Deliverables: Quarterly reports, quantitative analysis and establishment of structure-property relationship for guiding materials design

Funding:

— FY18: $300, FY17: $300, FY16: $300