Novel Cathode Materials and Processing

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

PI/Co-PI: Jason Croy (ANL)/Michael Thackeray (ANL)

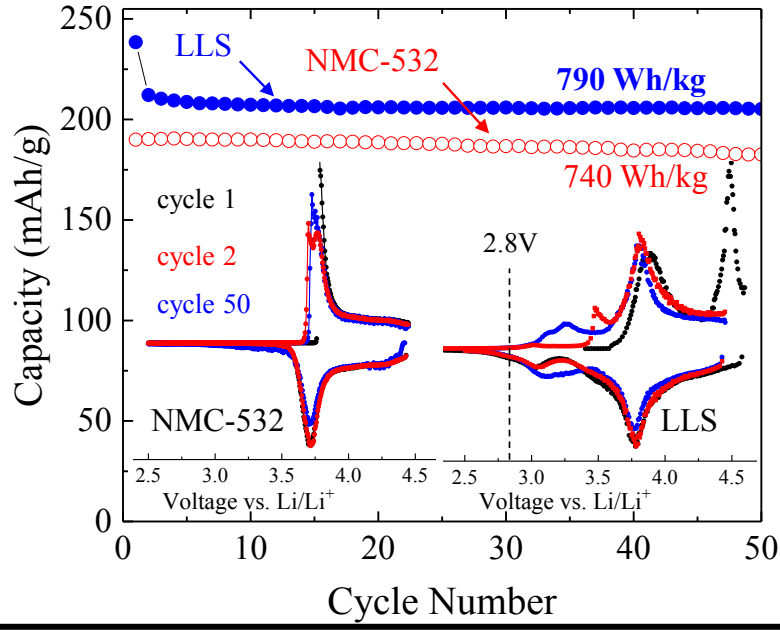
Objective:

- Develop low-cost, high-energy and high-power, Mn-oxide-based cathodes
- Improve the design, composition and performance of advanced electrodes with stable architectures and surfaces
- Understand atomic-scale electrochemical and degradation processes to enable the rational design of new materials

Impact:

Advancement of DOE goals for safe, cost-effective, high-energy batteries by selective engineering of nano-domain structures in Li- and Mn-rich cathode materials

High-Energy, Mn-Rich, Layered-Layered-Spinel



Accomplishments:

- Developed high energy Mn-rich, layered-layered-spinel (LLS) cathode that gives stable cycling and high specific-oxide energy densities of >750 Wh/kg_{oxide}
- Identified a series of phosphate-based materials that show promise for improving cathode surface stability, impedance rise with cycling, and rate performance
- Developed novel surface treatments that, when applied to LLS cathode materials, enabled discharge energies, at high rates, comparable to a nickel-rich, benchmark, NMC-532 electrode

FY 18 Milestones:

- Optimization of particle size distribution and density (e.g., Wh/L), using co-precipitation reactors, of Mn-rich, LLS, $y\{xLi_2MnO_3 \bullet (1-x)LiMO_2\} \bullet (1-y)LiM_2O_4$ (M = Mn, Ni, Co) cathode compositions that can deliver ~800Wh/kg_{oxide}
- Electrochemical validation of surface-modified, LLS cathodes in graphite, full-cell configurations

FY18 Deliverables:

Quarterly reports; Synthesis, characterization, and scale-up of advanced Mn-based cathodes and their electrochemical evaluation

Funding: FY18: $450K, FY17: $500K, FY16: $500K