Studies on High Capacity Cathodes for Advanced Lithium-Ion Systems

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

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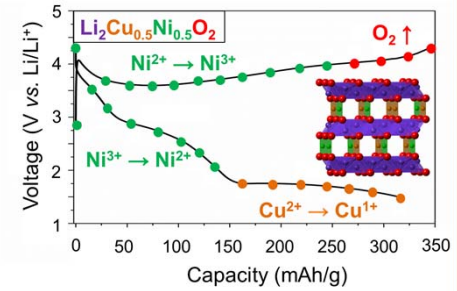
Technical Approach:

Design and synthesis of high voltage, high capacity cathodes will be guided by *state-of-the-art* characterization. Synthetic approaches include anionic substitution and advanced coatings. Diagnostic tools include a suite of microscopic and spectroscopic techniques.

Status:

Current efforts focus on partial fluorination of high capacity $Li_2Cu_xNi_{1-x}O_2$ cathodes to improve stability at high voltage.

Technology: Mechanisms of electrochemical activity and degradation of $Li_2Cu_xNi_{1-x}O_2$ cathodes were systematically studied using a combination of X-ray and neutron diffraction, in situ Raman spectroscopy, in situ XANES, electrochemistry, and gas evolution measurements.



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Objectives:

- Design new synthetic approaches for high voltage cathodes
- Develop advanced diagnostic tools to characterize degradation mechanisms in High V cathodes

Deliverables: Develop new cathode materials that have high capacity, use low cost materials, and meet the DOE road map in terms of safety and cycle life

Funding:

Duration: 3 yrs. Start: 10/1/15. FY 16 Budget - 400K

Milestones:

- **Q1:** Synthesize three $Li_2Cu_xNi_{1-x}O_2$ compositions ($0.4 < x < 0.6$)
- **Q2:** Fluorinate $Li_2Cu_xNi_{1-x}O_2$
- **Q3:** Identify the role of Ni and F in obtaining reversible redox capacity at higher voltage using XANES, microscopy, and XPS studies
- **Q4:** Stabilize Ni-rich compositions with input from electrochemical and gas evolution measurements