Lithium Batteries with Higher Capacity and Voltage

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

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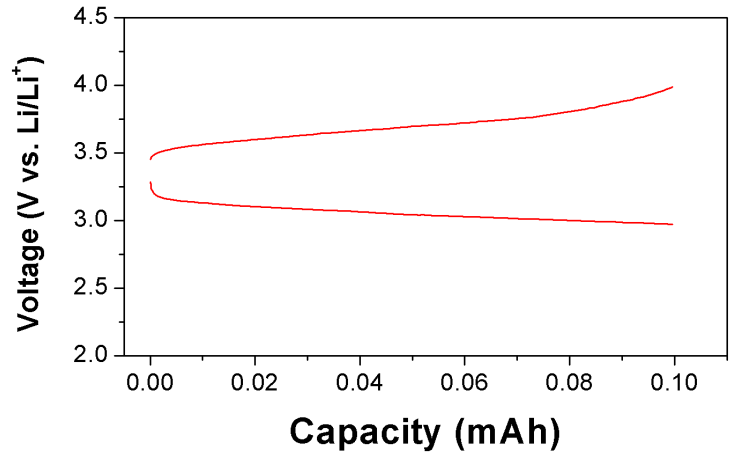
Objective:

To develop an electrochemically stable alkali-metal anode that can avoid the SEI layer formation and the alkali-metal dendrites during charge/discharge.

Impact:

- Overcome the formation of alkali-metal dendrites to enable a safe electrochemical cell
- Avoid the SEI formation to enable a long-term reversible cycling

Charge/discharge voltage curves of the Cu/Li solid-state battery cell



Accomplishments:

- Developed a new Cu//Li solid-state cell.
- Developed multi-layer and dual-salt gel polymer electrolyte membranes.
- Investigated the effect of carbon black in the catholyte composite on the electrochemical reversibility.
- Developed a graphene-coated Cu current collector for Li plating/stripping
- Developed a PEO-based dry polymer electrolyte membrane with $LiZr_2(PO_4)_3$ filler.

FY 19 Milestones:

- Test a new low-cost ceramic separator concept with a liquid electrolyte and an alkali metal anode
- Test redox energies and cyclabilities of novel NASICON-structured cathode materials in a Na-ion battery
- Synthesis and evaluation of solid sulfide electrolytes
- Investigate oxygen redox chemistry for reversible high-voltage Na^+ intercalation.

FY19 Deliverables: Demonstration of the feasibility of electrochemical cells that are safe and low-cost with a long cycle life at a voltage $V > 3.0$ V.

Funding:

— FY19: 120,000, FY18: 50,000, FY17: $348,000