Lithium Batteries with Higher Capacity and Voltage

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

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Technical Approach:

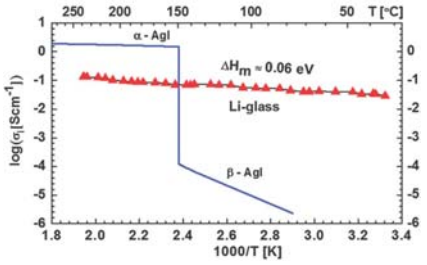
- Development of solid Li^+ electrolytes stable on contact with metallic Li and having a conductivity $\sigma > 10^{-4}$ S cm^{-1} at 25 °C.
- Fabrication of the solid electrolyte as a mechanically strong, flexible, and thin membrane by incorporating the solid, if a glass or a ceramic, into a porous membrane.
- Testing the membrane for plating/stripping of metallic Li across it over a long cycle life.
- Fabrication and testing all-solid-state batteries.

Status:

- Completed development of a cross-linked polymer membrane showing reasonable stability on impregnation by a molten-nitrate electrolyte.
- Impregnated a glass electrolyte into a glass fiber membrane to create a mechanically robust solid electrolyte. The glass electrolyte eliminates SEI formation.

Technology:

A new glass Li^+ electrolyte, $Li_{2.99-x}Ba_{0.005}H_xOCl$, will be tested as a solid electrolyte to eliminate the SEI layer and dendrites.



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Objectives:

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

Deliverables: Cost-competitive, safe, rechargeable Li batteries of high-energy density

Funding:

Duration: 4 yrs (Yr 4)
FY16 Budget: $174K (DOE)

Milestones:

- **Q1:** Fabricate and test glass-fiber and cross-linked polymer membranes impregnated with Li^+ glass electrolytes.
- **Q2**: Test cycle life of plating/stripping Li across Li^+ glass electrolyte. Go/No-Go: Discontinue if plating/stripping has a poor cycle life with a charge/discharge rate below 0.5C at 25 °C.
- **Q3**: Test and optimize volumetric energy density of an all-solid-state cell with Li^+ glass electrolyte.
- **Q4:** Compare all-solid-state cell with a cell having a similar cathode and a liquid catholyte.