Composite Electrolytes to Stabilize Metallic Lithium Anodes

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

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Technical Approach:

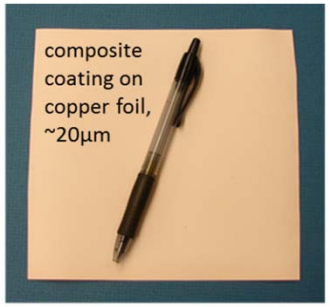
- Compare solvent-free melt and slurry processing methods to fabricate polymer electrolyte composites with a large (>50vol.%) loading of ceramic electrolyte.
- Investigate the resistance of polymer-ceramic interfaces formed as bilayers and composite mixtures.
- Evaluate cycling and stability versus Li metal

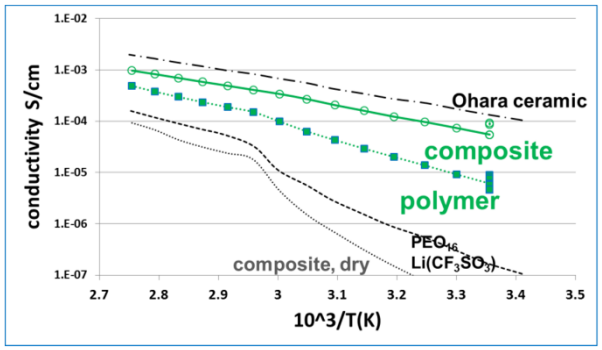
Status:

- Highly conductive polymer-ceramic powder composites and bilayers were obtained using dry melt composites when treated with DMC vapor.
- New slurry coating methods have been developed for large area membrane fabrication.

Technology:

Composite from slurry





Conductivity of a melt processed composite, 50vol.% ceramic

Objectives:

- Identify the key design strategies that should be used to prepare composite electrolytes to meet the challenging combination of physical and chemical and manufacturing requirements to protect and stabilize the lithium metal anode

Deliverables: A thin composite electrolyte, 100cm^2 X <100µm, that protects lithium during cycling

Funding:

— Duration - 4 yrs

— DOE - $400,000 FY15

Milestones:

- Q1: Quantify the plasticizing molecules introduced by gas adsorption or synthesis
- Q2: Prepare ceramic-polymer composite sheets with a coating expected to be stable with Li metal vapor deposition and cycling.
- Q3: Fabricate composites with a bimodal size distribution of ceramic particles
- Q4: Map uniformity of composite by nanoindentation and by profiling the cycled Lithium.