Composite Electrolytes to Stabilize Metallic Lithium Anodes

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**Objective:**
- Prepare composite electrolytes to meet the challenging requirements to protect and stabilize the lithium metal anode;
- Understand the lithium ion transport at the interface between polymer and ceramic solid electrolytes.

**Impact:**
- Design rules developed for this study will guide formation of composites with alternative and improved component phases as they become available.
- A thin, yet robust solid electrolyte membrane will enable use of metallic Li anodes for improved energy density.

**Accomplishments:**
- The area specific resistance of the polymer-ceramic interface resistance is quantified to be 1600 Ω. We were able to decrease the interface resistance to zero within experimental error by adding DMC.
- When the composite electrolyte was coated with a thin polymer electrolyte to form the contact to the Li metal, the cathode LiFePO₄’s theoretical capacity was realized with good cycling stability over more than 20 cycles.
- A new composite electrolyte has been formulated with a promising room temperature conductivity of 10⁻⁴ S/cm. Preliminary results indicate good stability when cycling with Li contacts.

**FY19 Milestones:**
- Quantify thermal and mechanical properties of composite gel electrolyte. (Q1)
- Fabricate full cell with μm-scale Li film. Target discharge capacity: 120 mAh g⁻¹ at 0.1 mA/cm² for 20 cycles. (Q2)
- Expand composite materials portfolio to include non-PEO type of polymer electrolytes. (Q3)
- Fabricate full cell with materials identified in Q3. (Q4)
- Collaborate with German team on Li-polymer interface. (Q4)

**FY19 Deliverables:** Demonstrate cycleability of full battery using non-PEO based composite electrolytes with thin Li anode.

**Funding:**
- FY19: $400,000, FY18: $400,000, FY17: $400,000