**Solid electrolytes for solid-state and lithium-sulfur batteries**

**PI:** Jeff Sakamoto (University of Michigan)

**Technical Approach:**
- Control atomic and microstructural defects in solid state electrolytes and correlate their concentration with the critical current density (CCD)
- Quantify the role(s) that each defect plays in controlling the CCD

**Status:**
- Correlated the effect of surface treatment with the CCD
- Using XPS, EIS, and computation analysis, it was determined that a surface treatment must be used to reduce the Li-LLZO interfacial resistance to increase the CCD
- The % porosity, was controlled by varying the densification temperature
- No obvious correlation was between CCD and the volume % porosity

**Objectives:**
- Enable advanced Li-ion solid-state and lithium-sulfur EV batteries using LLZO solid-electrolyte membrane technology.
- Demonstrate LLZO membranes can withstand current densities approaching ~1 mA/cm² (commensurate with EV battery charging and discharging rates).
- Demonstrate low area specific resistance (ASR) between Li and LLZO must be achieved to achieve cell impedance comparable to conventional Li-ion technology (~10 Ohms/cm²).

**Deliverables:** Deliver LLZO membrane technology to enable Li metal anodes.

**Funding:**
Duration: 3 years
FY15 Budget: $416K (DOE)

**Milestones:**
- **Q3:** Experimentally evaluate critical current density based on surface contamination (LiOH, Li₂CO₃) and surface roughness
- **Q4:** Correlate the critical current density based on the pore size and volume fraction of porosity

**Technology:**
- Development and integration of solid ceramic oxide electrolyte membrane technology to enable the use of Li metal anodes and sulfur cathodes in batteries