Nanoscale Interfacial Engineering for Stable Lithium Metal Anodes

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

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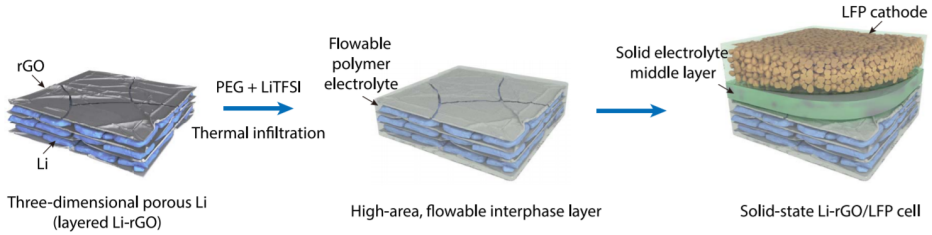
Objective: Enable Li metal anodes by suppressing dendrite formation and reducing side chemical reactions via developing chemically and mechanically stable interfacial layers between lithium metal and electrolytes.

Impact:

- Li metal anode is critical to enable high energy batteries for electric vehicles.
- Understanding and designing materials for plating and stripping mechanism can have high impact for battery materials without a host.

Three-Dimensional Lithium Metal Anode with Flowable Interphase for Solid-State Batteries



Accomplishments: (FY17)

- Developed a series of coating materials for Li metal stabilization, including solid-polymer composite, self-healing flowable polymer, strain-hardening polymer, and LiF coating via gas phase reaction
- Developed novel Li metal-host material composites via overlithiation method that enabled high operating current densities (up to 20 mA cm^{-2})
- Performed detailed studies on the nucleation and growth behavior of Li metal under different conditions
- Demonstrated efficient solid-state Li metal batteries using three-dimensional Li metal composite anode

FY 18 Milestones:

- Further improve the efficacy of Li metal protection layers
- Improve the Coulombic efficiency >99.5%
- Demonstrate > 800 cycles of Li metal anode with stable host and interphase

FY18 Deliverables: Quarterly reports, battery cells meeting the desired deliverables

Funding:

— FY18: $450,000, FY17: $450,000, FY16: $450,000