Nanoscale Interfacial Engineering for Stable Lithium Metal Anodes

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

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Technical Approach:

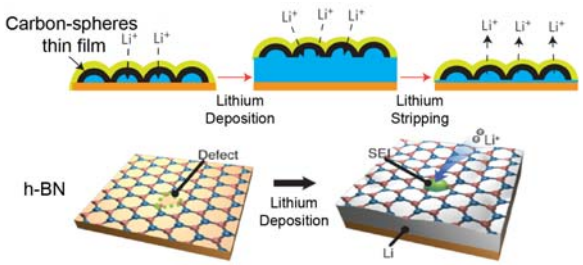
- Design and synthesize stable interfacial thin film for lithium metal anode.
- Optimize electrolytes composition for achieving high Coulombic efficiency at high current density.
- Mechanistic study of lithium nucleation and growth.
- Fabricate and test lithium metal anode based full cell.

Status:

- Developed artificial interfacial layers for lithium metal based on hollow carbon spheres, h-BN and graphene. Shown that much improved Coulombic efficiency and effective lithium dendrite suppression can be achieved.

Technology:

Schematic of hollow carbon spheres and h-BN interfacial thin film showing effective dendrite suppression and enhanced cycling efficiency.



Objectives:

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

Deliverables: Effective strategy for the sealing of pinholes in nanoscale interfacial layers. Understanding of the relative affinity of lithium for different materials.

Funding:

Duration: 3 yrs

FY16 Budget: $450k (DOE)

Milestones:

- **Q1:** Study the relative affinity of lithium for different materials.
- **Q2:** Demonstrate the effect of lithium affinity on the nucleation and growth behavior of li metal and cycling Coulombic efficiency on different materials.
- **Q3:** Demonstrate successful sealing of pinholes in h-BN thin film pinholes as measured by SEM Imaging and electrochemical testing.
- **Q4:** Study the effect of $LiNO_3$, Li polysulfide and other additives on the stabilization of lithium metal interface.