Nanoscale Interfacial Engineering for Stable Lithium Metal Anodes

**PI/Co-PI:** Yi Cui/Steven Chu (Stanford University)

**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.

**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 LiNO₃, Li polysulfide and other additives on the stabilization of lithium metal interface.

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