Development of Novel Electrolytes and Catalysts for Li-Air Batteries

**PI/Co-PI:** Khalil Amine, and Larry A. Curtiss,

**Technical Approach:**
- Use integrated experimental/theoretical approach to develop new electrolyte and catalyst for lithium air
- Use Experimental synthesis and state-of-the-art characterization to understand lithium air behavior
- Use high level computational studies to explain behavior of electrolyte and catalyst

**Status:**
- Discovered new metal and metal oxide catalysts on carbon supports that significantly reduce the charge overpotentials. Efficiencies of 80-90% achieved with capacities of up to 1000 mAh/g.

**Objectives:**
- Understand the role of electrolyte and catalyst in morphology of discharge product
- Understand the role of morphology of discharge product on charge potential
- Use understanding for predictive electrolyte and catalyst design
  - increase lifetime
  - increase efficiency
  - Increase capacity

**Technology:**
- Demonstrated that metal catalyst can significantly reduce charge overpotentials:
  - The performance of Li-O₂ cells using Pd nanoparticles on ZnO coated carbon is shown in the figure.

**Deliverables:** Increased efficiency and increased cycle life of lithium air through new catalyst design and electrolyte additives

**Funding:**
- Duration - 3 yrs
- Total - $1200 K
- DOE - $1200K

**Milestones:**
- Q1 : Development of new cathode materials based on Pd nanoparticles with reduced charge overpotentials.
- Q2 : Investigations of effect of mixed salts
- Q3 : Computational studies of electrolyte stability with respect to superoxide species and salt concentrations
- Q4 Investigation of effect of salt concentrations in electrolytes