Development of Novel Electrolytes and Catalysts for Li-Air Batteries

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

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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

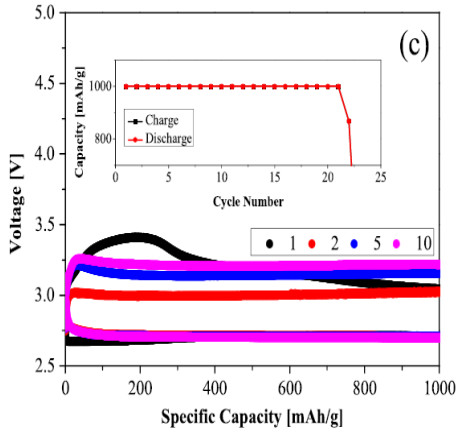
Status:

- 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.

Technology:

Demonstrated that metal catalyst can significantly reduce charge overpotentials:

The performance of Li-O_2 cells using Pd nanoparticles on ZnO coated carbon is shown in the figure.



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

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