Development of Novel Electrolytes and Catalysts for Li-Air Batteries

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

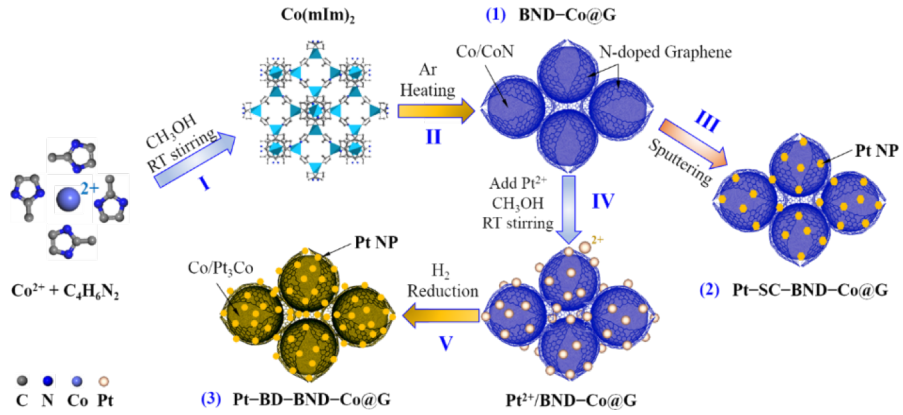
PI/Co-PI: Khalil Amine (Argonne), Larry A. Curtiss (Argonne), and Jun Lu (Argonne)

Objective:

- Understand the role of electrolyte and catalyst in the discharge product growth mechanism and charge mechanism in Li-O_2 batteries through experiment and theory

Impact:

- Control of discharge and charge processes can achieve increased efficiency, cycle life, and capacity
- Li-O_2 batteries can potentially achieve high energy densities for long range vehicles



Figur : Schematic of Pt modified MOF-derived catalysts. BND–Co@G = biphasic N-doped cobalt@graphene, Pt–SC–BND–Co@G = Pt surface-coating BND–Co@G, and Pt–BD–BND–Co@G = Pt bulk-doping BND–Co@G.)

Accomplishments:

- Ir clusters of precise numbers of Ir atoms were investigated as electrocatalysts in Li-O_2 batteries and the cluster size were found to have a large impact on the charge potential.
- Computations provided insight into how Ir clusters evolve with time during discharge to form Ir_3Li particles and the dependence on electrolyte
- Encapsulated Pt and Pt_3Co nanoparticles in nitrogen doped metal organic frameworks have given high specific capacities and a dramatic reduction in charge overpotentials in Li-O_2 batteries.

FY19 Milestones:

- Effect of morphology and composition of discharge products on electronic conductivity and performance.
- Investigation of modification of electrolyte salts on the Li-O_2 performance from experiment and theory
- Development of novel electrocatalysts for longer cycle life in Li-O_2 batteries

FY19 Deliverables: Quarterly reports, new catalysts that work in synergy with electrolytes

Funding: FY19: $500,000 FY18: $500,000 FY17: $400,000