

Sulfur Cathodes for High Energy Li-S Batteries

U.S. DEPARTMENT OF

ENERGY

Energy Efficiency &
Renewable Energy

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Objective:

Develop high capacity sulfur cathodes with long cycle life. Novel sulfur nanostructures as well as multifunctional coatings will be designed and fabricated to overcome the issues related to volume expansion, polysulfide dissolution and insulating nature of sulfur.

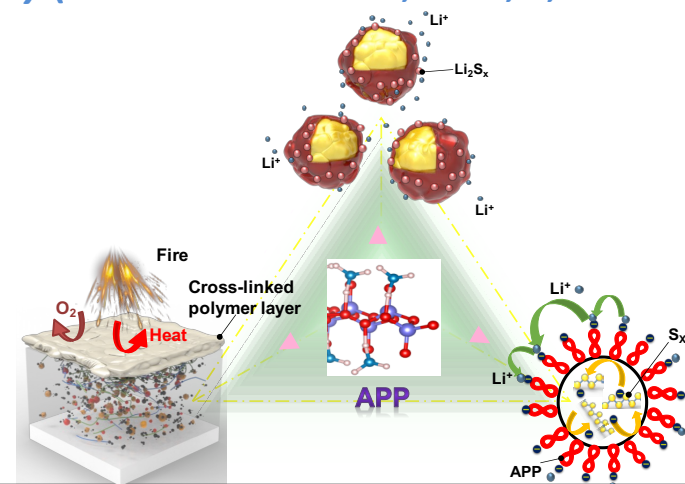
Impact:

- Sulfur cathodes for Li-S batteries have high specific energy for electric vehicles.
- Sulfur cathodes can offer potentially low-cost batteries to meet with the DOE cost target.

Accomplishments:

- Elucidate different adsorption mechanisms and probe possible adsorption species
- Develop multi-functional sulfur cathode binder capable of controlling the polysulfide shuttling and facilitating Li-ion transport
- Demonstrate the flame-retardant property of binder to improve safety and propose flame-retardant mechanism
- Build *in situ* characterization platform to monitor nucleation/dissolution of sulfur/ Li_2S_n

An aqueous inorganic polymer binder with strong polysulfide-trapping, favorable ion transfer, and flame-retardant property for safe and high-energy density Li-S battery (ACS Central Science, 2018, 4, 260-267)



FY 19 Milestones:

- Develop a non-invasive imaging method with sub-micron, sub-second resolution for Li-S battery in label-free, native organic liquid electrolyte
- Increasing the mass and the percentage of sulfur loading in the electrode with high capacity loading (200 cycles with 80% capacity retention, >5mg/cm² mass loading)
- To develop approaches to prevent the lithium dendrite growth on lithium metal anodes in Li-S batteries

FY19 Deliverables: Quarterly reports, battery cells meeting the desired deliverables

Funding:

— FY19: \$500,000, FY18: \$300,000, FY17: \$300,000