Mechanistic Investigation of the Rechargeable Li-Sulfur Batteries

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

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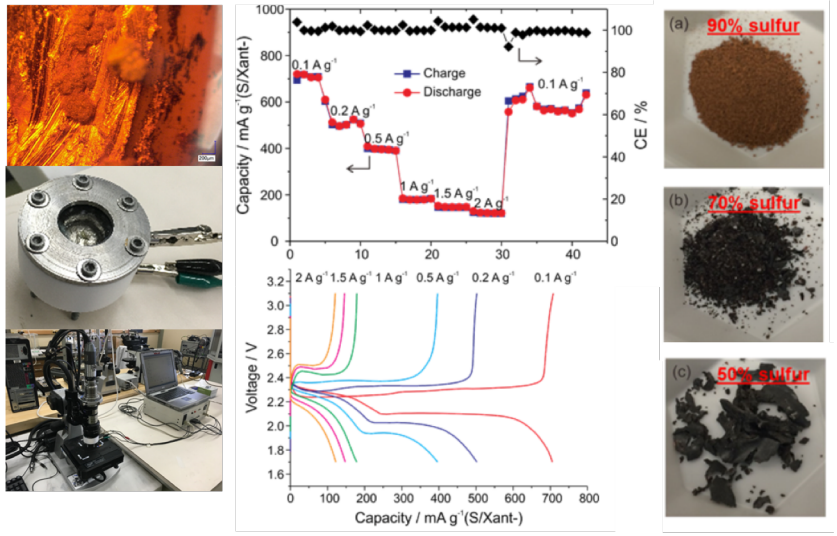
Objective: Mitigation of the "shuttle effect" through *in-situ* electrochemical mechanistic investigations of the sulfur redox reaction; synthesis of composite sulfur compounds; engineering design of electrode manufacturing processes to suit for the new composite cathode materials.

Impact:

- Further understand Li-S mechanism.
- Mitigate the "shuttle-effect".
- Enable long cycle life polymeric sulfur cathode.
- Develop creative electrode making processes.

In-situ study of Li deposition; polymeric sulfur compounds and their performance in Li-S cell



Accomplishments:

- First quantitative and qualitative determination of dissolved polysulfide ions in Li-S electrolyte.
- Comprehensive investigation of Li-S redox reaction mechanism.
- Comprehensive investigation of the polysulfide interaction with Li-anode and the inhibitors for the "shuttle effect".
- Synthesized polymeric sulfur compound with high rate and good cycle performance.
- Developed Li containing anode which does not react with the dissolved polysulfide ions.
- Developed an *In-situ* electrochemical-laser confocal microscopic technique to study Li anode protection.

FY19 Milestones:

- Literature review and molecular design of polymeric sulfur compounds.(Q1)
- Synthesis of polymeric sulfur compounds. (Q2)
- Designs of electrode manufacture process and continuation of the synthesis of polymeric sulfur composites. (Q3)
- Demonstration of the design of the electrode manufacture processes and tests of the synthesized polymeric sulfur materials.(Q4)

FY19 Deliverables: Quarterly and final Reports.

Funding:

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