Novel Chemistry: Lithium Selenium and Selenium Sulfur Couple

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

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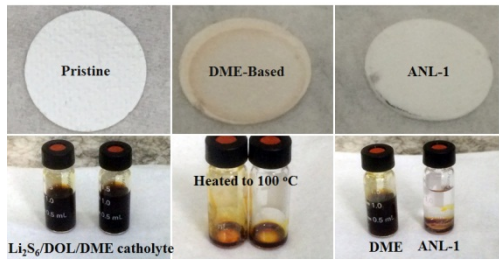
- ***Objective:*** The objective of this project is to develop a series of novel S_xSe_y cathode materials for rechargeable lithium batteries with high energy density and long cycle life as well as low cost and high safety

Impact:

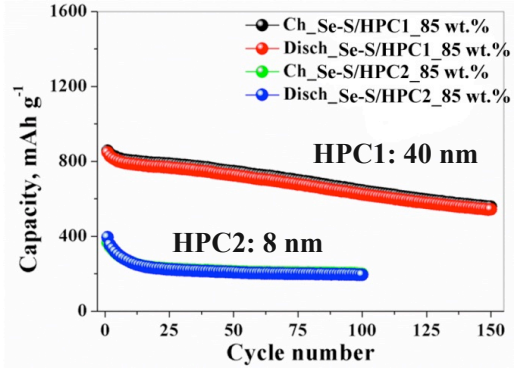
- The high electronic conductivity of Se active material can help to improve the reversible capacity, cycle stability and rate capability of S_xSe_y cathodes
- Manipulating the electrode-electrolyte interface in Li/S-Se chemistry can greatly affect the function mechanism and electrochemical performance

Novel electrolytes to manipulate the interfacial chemistry of Lithium/Selenium-Sulfur Battery

Suppressed polysulfides/polyselenides dissolution in novel electrolytes



Extend the optimum confinement pore size to large porous carbon with high pore volume



Accomplishments:

- Explored novel ether-based electrolytes to solve the dissolution of polysulfides/polyselenides
- Unraveled the working mechanism of S_xSe_y/C cathode in the novel ether-based electrolytes
- Reported a S-riched S_xSe_y/Ketjenblack cathode with high rate capability and long cycle life up to 250 cycles
- Investigated the effect of pore structures on the high loading S_xSe_y/C systems
- Extended the optimum confinement pore size from conventional micro/small-mesopores to large porous carbon and even macroporous carbon with high pore volume to achieve ultrahigh S_xSe_y loading to 85 wt.%

FY 18 Milestones:

- Explore novel electrolytes to further suppress the polysulfides/polyselenides dissolution
- Reveal the function mechanism of novel electrolytes by synchrotron X-ray probes and DFT calculation
- Overcome the poor electronic conductivity issue of high loading Se-X systems using highly conductive host with high pore volume or high specific surface area
- Develop high-performance S_xSe_y/carbon cathodes with a high loading of over 60 wt. %.

FY17 Deliverables: Quarterly reports, new electrolytes

Funding:

— FY18: $500K, FY17: $500K, FY16: $500K