Lithium Dendrite Prevention for Lithium Batteries

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

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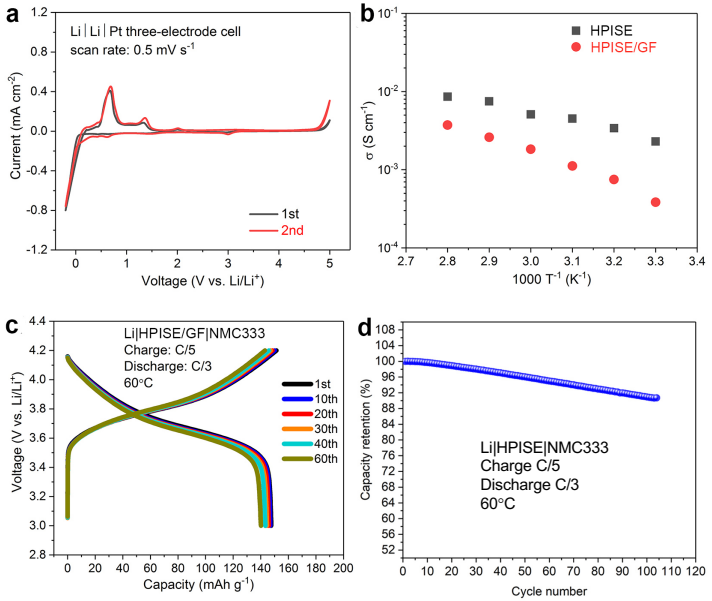
Objective:

- To enable lithium (Li) metal as an effective anode in rechargeable Li-metal batteries for long cycle life at practical current density.

Impact:

- Develop polymer-in-salt electrolytes. Understand the effects of lithium salts and polymer types on ionic conductivity, electrochemical stability, Li Coulombic efficiency (CE), Li anode morphology, and battery performances in Li||NMC cells.
- Develop hybrid polymer-in-salt composite electrolytes (HPISCEs). Enable all solid-state Li||NMC cells with good safety and stability.

HPISE shows good electrochemical performances



Accomplishments:

- Developed LiTFSI-LiBOB/carbonate electrolytes through optimizing solvent composition and adding additive mixtures to increase Li CE to 98.1% and improve long cycling stability.
- Developed $LiPO_2F_2$ as additive in conventional $LiPF_6$-carbonate electrolyte to increase Li CE, decrease polarization and enhance cell cycling stability.
- Investigated effects of separators on Li CE and cycling stability and demonstrated polyethylene to be most stable with Li metal.
- Developed a hybrid polymer-in-salt electrolyte (HPISE) and demonstrated its good performances.

FY19 Milestones:

- Investigate effects of high-concentration electrolytes on Li CE and deposited Li morphology. (Q1)
- Investigate effects of polymers in hybrid electrolytes on Li CE and deposited Li morphology. (Q2)
- Develop an HPISCE with Li CE >98% and oxidation potential up to 4.4 V. (Q3)
- Achieve over 100 cycles for Li||NMC532 batteries using HPISCE. (Q4)

FY19 Deliverables:

- Quarterly reports and annual report

Funding:

— FY19: $400K, FY18: $400K, FY17: $340K