

Polymeric Materials for Li Metal Batteries

U.S. DEPARTMENT OF

ENERGY

Energy Efficiency &
Renewable Energy

PI/Co-PI Yi Cui (Stanford, SLAC)/ Zhenan Bao (Stanford, SLAC)

Objective: Explore the rational polymer materials design to effectively suppress the dendrite growth, control volume change and manage side reactions related to lithium metal charge/discharge processes.

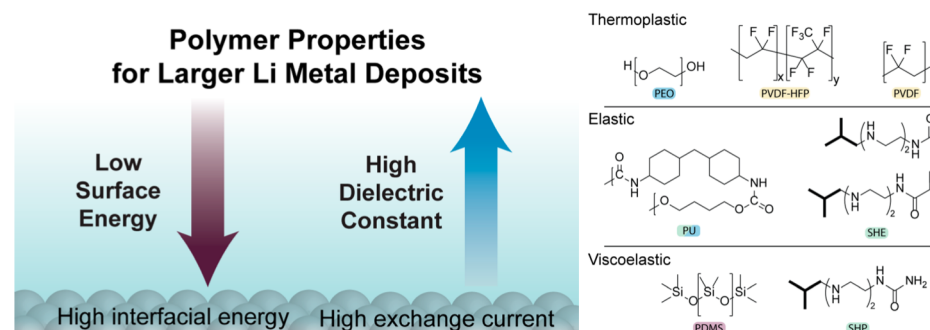
Impact:

- Improve cycling stability, Coulombic efficiency and current density of lithium metal anode
- Enable high-energy lithium-metal batteries for electric vehicles and at the same time reduce cost of batteries

Accomplishments:

- Design and synthesize a series of self-healing polymers (SHPs) with adaptive mechanical property
- Show the Li metal deposition morphology with self-healing polymer as protection layer
- Establish standard processing method for polymer coating and demonstrate improved cycling life for Li metal under SHP protection
- Additionally apply SHP to silicon anode and demonstrate enhanced performance (*Adv. Energy Mater.* 2018, 8, 1703138)

Systematically study the effects of different polymer coatings on electrodeposited Li metal and identify the intrinsic benefits from polymer coatings with low surface energy and high dielectric constant. (*J. Am. Chem. Soc.* 2018, 140, 11735–11744)



FY 19 Milestones:

- Identify at least two different types of SHPs with promise to suppress dendrites (Q1)
- Identify one SHP to suppress Li dendrites with current density at 1 mA/cm² and 150 cycles of stable Li cycling (Q2)
- SHP suppressing Li metal dendrite with current density at 2 mA/cm² and 150 cycles of stable Li cycling (Q3)
- SHP suppressing Li metal dendrite with current density at 3 mA/cm² and 150 cycles of stable Li cycling (Q4)

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

Funding:

— FY19: \$450,000, FY18: \$300,000, FY17: \$300,000