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Thiol-Based Electrolyte Additives for High-Performance Lithium-Sulfur**Batteries**

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Abstract:

The discharge and charge mechanisms of the Li-S battery involve the formation of soluble lithium polysulfide species that can diffuse through the battery and cause issues related to capacity fade and poor Coulombic efficiency. In order to control the behavior of the lithium polysulfides, thiol-based electrolyte additives such as biphenyl-4,4'-dithiol (BPD) were used to enhance capacity retention in lithium-sulfur batteries by controlling polysulfide dissolution. *In situ* Raman spectroscopy, *in situ* UV-vis spectroscopy, and electrospray ionization mass spectrometry show that an additional sulfur reduction process observed at ~ 2.1 V vs Li/Li⁺ as a result of BPD addition is associated with the formation of BPD-short chain polysulfide complexes such as BPD-S_n anion ($1 \leq n \leq 4$). The interaction between BPD and short chain

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