Title : Porous Organic Polymers Containing Redox-Active Disulfide as Electrode Materials for High-Performance Lithium-Sulfur (Li-S) Batteries

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Major : Chemistry

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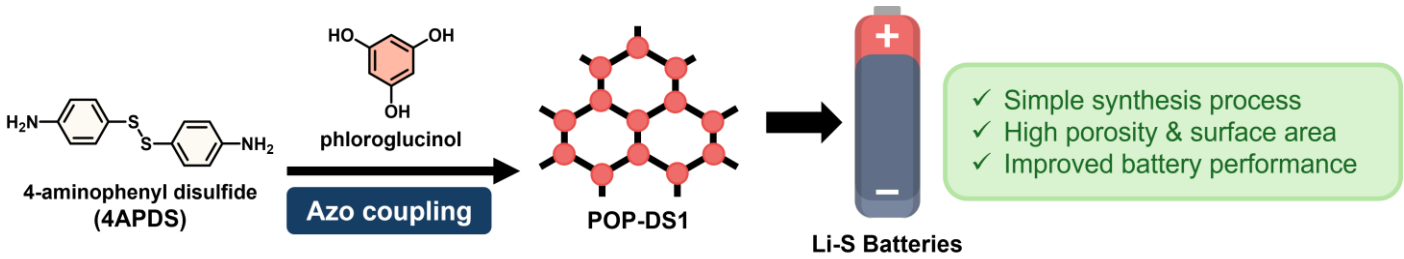
ABSTRACT

Using disulfide-derived polymers in lithium-sulfur batteries (Li-S) could mitigate the shuttling effect, leading to high-performance Li-S batteries. However, challenges remain in their complicated synthesis process and unsatisfying capacity retention, which still presents opportunities for improvement. We hypothesized that anchoring disulfide linkages in a porous organic polymer (POP) employing simple azo coupling could address the solubility issue of the electrodes and enhance cycling stability. In this work, POP-DS was successfully synthesized via a simple azo coupling reaction between 4,4'-aminophenyl disulfide (4APDS) and phloroglucinol. The structures and chemical bonding of the synthesized POPs were characterized using FT-IR, Raman, and ^{13}C CP/MAS NMR spectroscopy. The battery performance of POP-DS was evaluated using CR2016 coin cells. POP-DS demonstrated improved rate performance (185 mA h g^{-1} at a current density of 50 mA g^{-1}) and enhanced cycling stability compared to the 4APDS precursor. Interestingly, the capacities of POP-DS increased upon cycling, presumably indicating material activation. The operating mechanism will be discussed based on post-mortem analysis using several spectroscopic techniques. We anticipate that incorporating disulfide linkages into POPs could be an effective strategy to mitigate the polysulfide shuttle, paving the way for the development of high-performance organic electrodes for Li-S batteries.



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