A Sulfur-Limonene based Electrode for Lithium-Sulfur Batteries: High-Performance by Self-Protection

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The lithium-sulfur battery is considered as one of most promising energy storage systems, and has received enormous attentions due to its high energy density and low cost. However, polysulfide dissolution and the resulting shuttle effects hinder its practical application unless very costly solutions are considered. Herein, we propose a sulfur-rich polymer termed sulfur-limonene polysulfide as powerful electroactive material that uniquely combines decisive advantages and leads out of this dilemma. It is amenable to a large-scale synthesis by the abundant, inexpensive and environmentally benign raw materials sulfur and limonene (from orange and lemon peels). Moreover, owing to self-protection and confinement of lithium sulfide and sulfur, detrimental dissolution and shuttle effects are successfully avoided. The sulfur-limonene based electrodes (without elaborate synthesis or surface modification) exhibit excellent electrochemical performances characterized by high discharge capacities (~1000 mAh g^{-1} at C/2) and remarkable cycle stability (average fading rate as low as 0.008% per cycle during 300 cycles).

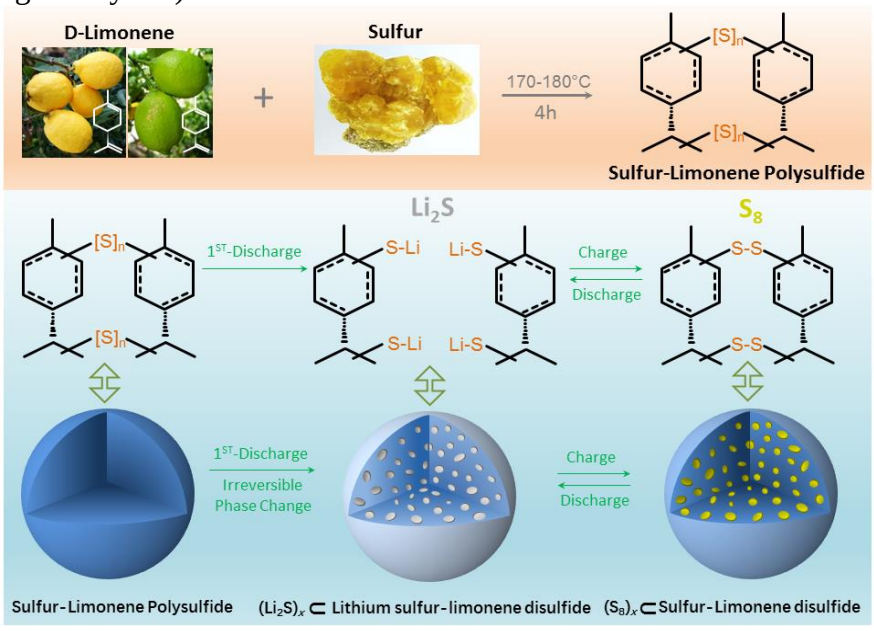

Figure. One-pot synthesis of sulfur-limonene polysulfide from d-limonene and sulfur; The electrochemical behavior of S-S chains, phase change and self-protection in proposed cathodes.

References:

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