Molecular-Level Engineering of Electrodes and Interfaces in High Energy Density Li-Sulfur Batterie

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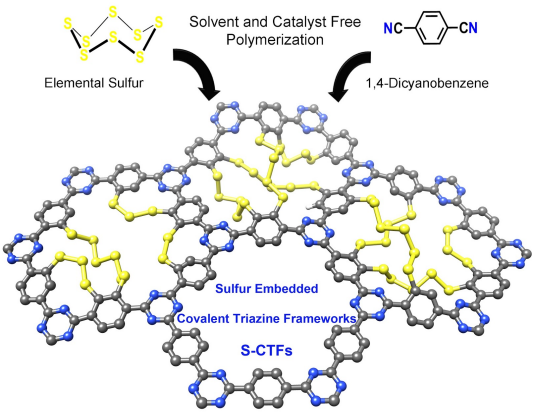
Lithium–sulfur (Li–S) batteries have emerged as viable alternatives to current commercial lithium ion batteries (LIBs), especially targeting medium- and large-scale applications because of their unparalleled theoretical energy density in gravimetric consideration (i.e., 2600 Wh kg^{-1}).[1] Sulfur is among the most abundant elements worldwide as it is mainly being produced as a by-product from the purification of natural gas and oil. This involuntary production of sulfur leads to global supply surplus; thus, there is a growing interest in the scientific community for the direct utilization of elemental sulfur toward high value applications, and Li–S batteries are well-aligned along such direction. We introduced elemental sulfur-mediated synthesis of microporous polymers under catalyst- and solvent-free conditions. These polymers showed high sulfur contents up to 87wt% and used as active electrode materials for Li-S batteries.[2,3] these polymers also enabled the efficient stabilization of Li-polysulfides, thus suppressing their dissolution into the electrolyte and leading to an exceptional cycling stability for Li-sulfur batteries. More recently, we also developed new liquid/gel electrolytes and additives, which were shown to the increase sulfur utilization while stabilizing the Li metal surface, thus enabling cycling under lean electrolyte conditions. [4,5]



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