Sulfur nanoparticles-coated graphene oxides composites for high-rate lithium sulfur batteries

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Lithium sulfur battery (Li-SB) offers several advantages such as very high energy density, low-cost, but, it suffers from serious degradation of reversible capacity due to the dissolution of the reaction intermediates, lithium polysulfides, into the electrolyte. To solve the limitation, there are many study using graphene-based materials due to their high mechanical strength and conductivity. Compared to graphene, GO has various oxygen functional groups enhancing reaction with lithium polysulfide. Here, we investigated the positive effects of graphene oxide (GO) coated with sulfur nanopaticles (SNPs) in different ratios as a cathode material. We have observed a smaller drop of capacity in this sulfur cathode at higher current density. Furthermore, the mechanistic origin of the improvement of reversibility, as confirmed through CV, Raman spectra and electrochemical impedance spectroscopy, can be explained by the stabilization of sulfur in the lithium polysulfide intermediates by the oxygen functional groups of GO to prevent further dissolution. Our findings suggest that the use of SNPs-coated graphene oxide composites is a promising route to significantly improve the reversibility at higher current rate.