$NiCo_2S_4$ Catalysts Grown on a Carbon Textile Interlayer for High Performance Li-S Battery

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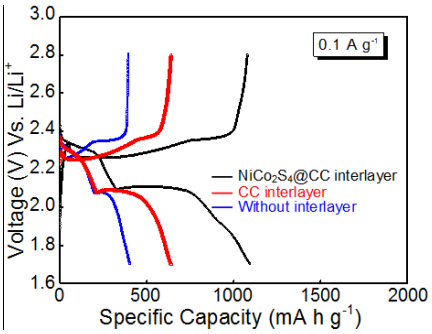
Sulfur (S) is one of the most attractive cathode candidate materials for next-generation of high-performance rechargeable lithium (Li) battery owing to its low cost and high theoretical specific capacity of 1672 mA h g^{-1}.[1] However, the practical applications of Li-S batteries are still impeded due to the poor performance. On the one hand, the orthorhombic S_8 with the most of natural abundance suffers from the poor electronic conductivity at room temperature, resulting in low active materials utilization. On the other hand, the dissolution of Li polysulfide (LiPS) in electrolyte and their migration from cathode to anode, leading to notorious shuttle effects, thereafter resulting in low coulombic efficiency, high self-discharge, and rapid degradation of capacity.[2] Intense efforts have been devoted to inhibiting polysulfide dissolution and/or capture of the polysulfides on the surface where the sulfur-reduction reaction can be reserved.[3] Initially, porous nanostructured metal oxides/sulfides, such as MoS_2[4] and Al_2O_3,[5] have been used as on-site absorption additives for LiPS. However, they suffered from poor active material utilization owing to the semi-conductive nature of these materials. Very recently, the transition metal oxides/sulfides with suitable redox potential have demonstrated to show strong chemical interaction with LiPS *via* polar redox reaction.[6] Based on the analysis above, we proposed the growth of metal conductive bimetal $NiCo_2S_4$ nanostructure on a carbon textile, aiming at optimizing the chemical effect of metal sulfides on confining LiPS.

Here, a multi-functional interlayer consisting of heterogeneous $NiCo_2S_4$ catalyst supported on carbon textile was applied for high-performance Li-S battery, where the carbon textile interlayers offer fast electron transportation between the cathode and LiPS, and provide strong chemical bonding to suppress the shuttle effect. Benefitting from the advantages, the Li-S battery with this functional interlayer exhibits greatly improved capacity and excellent cycling stability. $NiCo_2S_4$ is proved to be an outstanding catalyst used for hydrodesulfurization because of its strong adsorption of sulfur and sulphides.



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