Optimization of the composite cathode for Li-sulfur batteries

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Abstract

Li-sulfur batteries represent a promising energy storage system due to their large theoretical capacity (1675 mAh/g), safety, and nontoxicity. Despite the long-term effort, fundamental issues remain to be solved before their commercialization. Along with the non-conductivity of elemental S and large volume changes during redox reactions, the main problems are related to the initial formation of highly soluble lithium polysulfides (PS). The cathode architecture represents a scientific challenge. It must contain an electronically conductive additive with special morphology permitting the electrochemical reduction of non-conductive sulfur and buffering volume changes during its reduction to soluble higher polysulfides (PS) and their oxidation back to elemental sulfur. Conductive carbonaceous materials with various morphology have been demonstrated to enhance the performance of sulfur-based cathode composites. Further improvement of this system represents using an additional inorganic component for the efficient immobilization of PS. As the inorganic additives can be used transition metal oxides[1-3], suboxides[4], nitrides[5] or sulfides[6].

In our presentation, we demonstrate the effect of the TiO_2 top layer prepared by our facile fabrication protocol on the charge capacity of the sulfur/composite cathode in the Li-sulfur battery. The TiO_2 top layer on the cathode increases its charge capacity by 40-60% as compared to the cathodes with titania-free materials.

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