Spherical ordered mesoporous carbon/sulfur nanocomposite as cathode for high-performance lithium-sulfur batteries

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Sulfur is one of the most plentiful elements on earth at present, lithium sulfur batteries have become one of the most widely studied lithium ion battery systems due to the high theoretical energy density (~2500 W h/kg) and the high theoretical specific capacity (~1673 mA h/g), as well as their safety and low cost. We designed a spherical ordered mesoporous carbon/sulfur nanocomposite (S-OMC/S) as cathode for lithium-sulfur batteries. The mesoporous pores are wonderful hosts to contain sulfur to trap the long-chain lithium polysulfides and prevent them from dissolving in electrolyte. Spheroidal ordered mesoporous carbon was synthesized by direct carbonization of silica/triblock copolymer P123/butanol composites using P123 and butanol as the structure-directing agents and carbon precursors. The S-OMC/S nanocomposites were prepared by melt-diffusion method, elemental sulfur was mixed by grinding with S-OMC composites with the ratio of 3:1. The compound was heated up to 155 ºC for 10 h in a volumetric flask which is filled with argon. A high initial discharge capacity of 1589 mAh/g was achieved for the S-OMC/S electrode in first cycle at 0.25 C, and the composite maintains 788 mAh/g after 50 cycles at 2.5 C while the coulombic efficiency still remains ~98%.