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Three-dimensionally ordered macro-/mesoporous carbon loading sulfur as high-performance cathodes for lithium/sulfur batteries

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Abstracts

Herein, we report a three-dimensionally (3D) ordered macro-/mesoporous carbon (3DOM-mC) as a sulfur supporter for rechargeable lithium/sulfur (Li/S) batteries. The 3DOM-mC is prepared by a dual-templating method via using silica crystal as hard template, triblock copolymer EO₂₀PO₇₀EO₂₀ as soft template and resol (phenol/formaldehyde) as the carbon source. The as-synthesized 3DOM-mC possesses a large BET surface area of 818.5 m² g⁻¹, ordered interconnected macropores and ordered mesopores on the macropore walls. The 3DOM-mC is then composited with sulfur to obtain the sulfur/3DOM-mC (S/3DOM-mC) hybrids by a simple solvothermal synthesis process. In Li/S batteries, the S/3DOM-mC composite shows a high initial discharge capacity of 1042 mAh g⁻¹, with 703 mAh g⁻¹ remaining after 100 cycles at 0.2 C. Furthermore, at a high rate of 2.5 C, it can still deliver a high capacity of 357 mAh g⁻¹, with a capacity recuperability of 85% as the current back to 0.5 C. The great electrochemical performance is attributed to its unique hierarchical structure with 3D ordered interconnected macropores that can provide the rapid mass transport and ordered mesopores that can trap polysulfides via physisorption.

Keywords: Ordered macro-/mesoporous structure; Sulfur/carbon composite cathode; Lithium/sulfur battery; Dual-templating method

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