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Core-shell structured MoS₂@S spherical cathode with improved electrochemical performance for lithium-sulfur batteries

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To suppress shuttling effect and improve electrochemical performance of the sulfur cathode for lithium-sulfur batteries, core-shell structured MoS₂@S spherical cathode has been synthesized through a chemical route using MnCO₃ as template. The MoS₂ shells consist of MoS₂ nanosheets. For comparison, MoS₂/S cathode has also been synthesized through melting and diffusion of sulfur to commercial MoS₂ powders. The electrochemical performance of the MoS₂@S and MoS₂/S cathodes have been evaluated using cyclic voltammetry, discharge/charge cycling, electrochemical impedance spectroscopy coupled with impedance fitting. The electrochemical performance of the MoS₂@S spherical cathode has been much improved compared with that of MoS₂/S. The capacity of the MoS₂@S spheres can reach 1185.7 mA h g⁻¹ at 0.2 C and 955.1 mA h g⁻¹ at 1 C with initial-cycle coulombic efficiency of 90%. The capacity fading of each cycle is 0.1% during 200 lithiation/delithiation cycles. The MoS₂@S spherical cathode with high cyclic capacity and stability is promising cathode candidate for lithium-sulfur batteries.

Keywords: core-shell particle; electrochemical property; electrode; MoS₂; Sulfur

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