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Authors: Songpu Cheng, Xiaohong Xia, Hongbo Liu, Yuxi Chen

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Core-shell structured MoS_2@S spherical cathode with improved electrochemical performance for lithium-sulfur batteries

Songpu Cheng, Xiaohong Xia, Hongbo Liu, Yuxi Chen*

College of Materials Science and Engineering, Hunan University, Changsha 410082, China

* Corresponding author. Prof., Ph.D.; Tel.: +86 731 88664018; Fax: +86 731 88823554.

E-mail address: yxchen@hnu.edu.cn (Y.X. Chen).

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To suppress shuttling effect and improve electrochemical performance of the sulfur cathode for lithium-sulfur batteries, core-shell structured MoS_2@S spherical cathode has been synthesized through a chemical route using $MnCO_3$ as template. The MoS_2 shells consist of MoS_2 nanosheets. For comparison, MoS_2/S cathode has also been synthesized through melting and diffusion of sulfur to commercial MoS_2 powders. The electrochemical performance of the MoS_2@S and MoS_2/S cathodes have been evaluated using cyclic voltammetry, discharge/charge cycling, electrochemical impedance spectroscopy coupled with impedance fitting. The electrochemical performance of the MoS_2@S spherical cathode has been much improved compared with that of MoS_2/S. The capacity of the MoS_2@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 MoS_2@S spherical cathode with high cyclic capacity and stability is promising cathode candidate for lithium-sulfur batteries.

Keywords: core-shell particle; electrochemical property; electrode; MoS_2; Sulfur