A Li⁺-conductive Porous Carbon/Polyacrylonitrile/Sulfur Composite for Li-S Batteries

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In this paper, we proposed a new Li⁺-conductive porous carbon for polyacrylonitrile/sulfur (PAN/S) electrode to solve the problem of intermediates dissolution in Li-S batteries during the reaction process. The highly dispersed Li⁺-conductive carbon (PANC@BP) was prepared by coating the high specific surface BP2000 with 10% polyacrylonitrile pyrolysis carbon. A composite sulfur electrode with a solid-solid reaction mechanism was constructed by dispersing PANC@BP into PAN/S composite. Electrochemical test results showed that the prepared PANC@BP had a realizable capacity of 50 mAh g⁻¹ after 150 cycles with a voltage interval of 1.0-3.0 V at a current density of 100 mA g⁻¹. Based on the total mass of the composite material, the initial reversible specific capacity of the PANC@BP/PAN/S composite electrode was 745 mAh g⁻¹, maintained 701 mAh g⁻¹ after 80 cycles, indicating an excellent cycling stability and a high reversible specific capacity. With oxidized β-cyclodextrin as binder and copper foil as the collecting conductor, the cycling performance of PANC@BP/PAN/S composite electrode had been significantly improved. The discharge specific capacity maintained 661 mAh g⁻¹ after 300 cycles. Compared with discharge specific capacity of 948 mAh g⁻¹ in the first cycle, electrode capacity retention was 72.0%, and compared with the reversible discharge specific capacity in the second cycle, the retention was 95.1%.

Keywords: Li⁺-conductive carbon, Solid-solid reaction mechanism, polyacrylonitrile/sulfur electrode, Electrical properties

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