

Electronic Supplementary Information

Binder-free cathodes based on sulfur-carbon nanofibers composites for lithium-sulfur batteries

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1. Experimental

1.1 Synthesis of FCNFs

FCNFs were prepared by heating 100mg CNFs (80-100 nm) in 100mL 8M HNO₃ solution at 95°C under constant stirring for 12 hours. Then, they were rinsed in distilled water until the filtrates' pH value reached 7.0.

1.2 Synthesis of S-FCNFs nanocomposite

32 mg of FCNFs was suspended in 200 ml of H₂O and stirred for 2 h to form a stable FCNFs dispersion. Then, 20mL solution containing of 1.0 g Na₂S₂O₃·5H₂O were mixed into the FCNFs. After 2 hours' stir and dispersion, 0.2M HCl was slowly added at the rate of 1ml min⁻¹ until the solution's pH value reached 2.0. The formed S-FCNFs precipitate was filtered and washed with nano pure water several times in order to eliminate salts and impurities. Finally, S-FCNFs film was obtained by filtration.

1.3 Materials characterization

Transmission electron microscopy (TEM) images were obtained by using a FEI Tecnai G² F30 operating at 200 kV. Samples for TEM analysis were prepared by placing a drop of the water dispersion of the sample on a lacey Formvar/carbon copper grid (200 mesh, Ted-Pella). The weight percentage of sulfur in the composite was determined by thermogravimetric analysis (TGA) using a DSC 141 Simultaneous DSC-TGA instrument (TA Instruments)

2.4 Preparation of Cathode and Electrochemical Evaluation:

The sulfur cathode was prepared by directly pressing a small piece of the freestanding S-FCNFs nanocomposite onto a piece of nickel mesh. The total material loading densities were 8.0 mg cm^{-2} . 2032 type coin cells were assembled in an argon-filled glove box with lithium foil as the anode. The separator was purchased from Cellgard (model 2400). The electrolyte was 0.1 M lithium nitrate and 1.0 M lithium bis-trifluoromethane sulfonylimide in 1,3-dioxolane and 1,2-dimethoxyethane (volume ratio 1:1). Galvanostatic measurements were conducted using a LAND CT2001A battery test system between 1.5 V and 3.0 V (vs Li^+/Li).