

Mesocrystal Co₉S₈ hollow sphere anode for high performance lithium ion batteries

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Experimental Section

Preparation of hierarchical Co₉S₈ hollow spheres

The Co₉S₈ hollow spheres were fabricated by a solvothermal method. In this procedure, 0.123 g of cobalt acetate, 0.16 g of thiourea, and 0.6 g of hexamethylenetetramine were dissolved in 2 mL of distilled water. After stirring for 1 h, the mixed solution was transferred into a 25 mL Teflon-lined stainless autoclave. Subsequently, 18 mL of pyridine was added into the autoclave. The autoclave was sealed and maintained at 180 °C for 12 h. After the autoclave was cooled to room temperature, the black precipitate was centrifuged, washed with distilled water and ethanol for several times, and dried at 80 °C overnight for further characterization.

Materials Characterization

The crystal phase of the product was characterized by Rigaku D/Max-2550pc X-ray powder diffraction (XRD, Cu-K α , λ = 1.5406 Å). The morphology was examined by field-emission scanning electron microscopy (FESEM, FEI Quanta 200F) and transmission electron microscopy (TEM, FEI Tecnai G2 S-Twin). Nitrogen

adsorption/desorption isotherm of the Co_9S_8 hollow spheres was detected on Quantachrome NOVA-3000 system at 77 K.

Electrochemical measurement

Electrochemical tests were performed using a CR2025-type coin cell. For the electrode preparation, 70wt % of Co_9S_8 hollow spheres, 15wt% of acetylene black, and 15wt% of polyvinylidene fluoride (PVDF) binder were mixed homogeneously in the N-methyl-2-pyrrolidinone (NMP). The obtained slurry was spread on Cu foil to form working electrodes and then dried in a vacuum at 100 °C for 12 h to remove the solvent. Lithium foil was used as the counter and reference electrode, Celgard 2400 as the separator and the 1 M LiPF_6 in 1:1 wt/wt ethylene carbonate/diethyl carbonate as the electrolyte. Coin-type cells were assembled in an argon-filled glove box with concentrations of moisture and oxygen below 1.0 ppm. The charge/discharge tests were performed on a NEWARE battery test system at a constant current density of 50, 100, 200 and 500 mA g^{-1} in the voltage range from 0.01 to 3.0 V. The Cyclic voltammograms test was conducted on electrochemical workstation (CHI660D, CH Instruments) in the potential range 0.01 to 3.0 V with a scan rate of 0.1 mV s^{-1} .

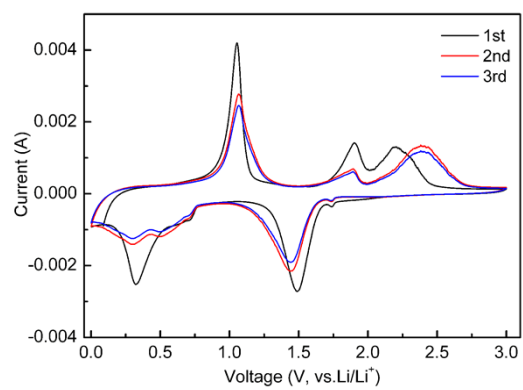


Fig. S1. Cyclic voltammograms of mesocrystal Co_9S_8 hollow spheres electrode.