Hierarchical worm like CoS_2 composed of ultrathin nanosheets as anode material for lithium-ion battery

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Experimental section

Synthesis of worm like CoS_2. All reagents used in the experiment were of analytical grade. In the typical procedure, 0.5 mmoL of cobalt acetate tetrahydrate, 1.5 mmoL of L-cysteine were dissolved in 5 mL of distilled water and 15 mL of isopropanol. After stirring for 30 min, the resultant solution was transferred into a 25 mL of Teflon-lined stainless steel autoclave and held in the oven at 180 ^{o}C for 12 h. Then the precipitates were collected by filtration, washed thoroughly with deionized water and ethanol for several times. Finally, the products were dried in a vacuum oven at 80 ^{o}C for 12 h.

Materials characterization. The composition of the as-prepared products was characterized using a Rigaku D/max-2550pc device equipped with Cu Kα radiation (λ = 0.15406 nm). The morphology and structure were determined by FEI Quanta 200F field emission scanning electron microscopy (FESEM) and FEI Tecnai G2 S-Twin transmission electron microscopy (TEM). Nitrogen adsorption isotherms and the Brunauer-Emmett-Teller (BET) surface area were recorded on Quantachrome NOVA-

3000 system at 77 K.

Electrochemical Measurements. The electrochemical performances of the worm like CoS_2 were investigated using CR2025 coin-type cells at room temperature. The working electrode was fabricated using active material (worm like CoS_2), conductive agent (acetylene carbon black), and polymer binder (polyvinylidene fluoride, PVDF) in a weight ratio of 70:15:15. The prepared slurry was pasted onto a copper foil substrate and dried in a vacuum at 100 ^oC for 12 h. The lithium foil was used as the counter electrode and the reference electrode. Celgard 2400 was used as separator, and 1 M $LiPF_6$ in ethylene carbonate (EC)/dimethyl carbonate (DMC)/diethyl carbonate (DEC) (1:1:1 in volume) as the electrolyte. The coin cells were assembled in an argon-filled glovebox. The electrochemical performance measurements were performed on a NEWARE battery test system at different current rates in the voltage ranging from 0.01 to 3.0 V. Electrochemical impedance spectra (EIS) were performed on CHI660E electrochemistry workstation in the frequency range from 0.1 MHz to 0.01 Hz.

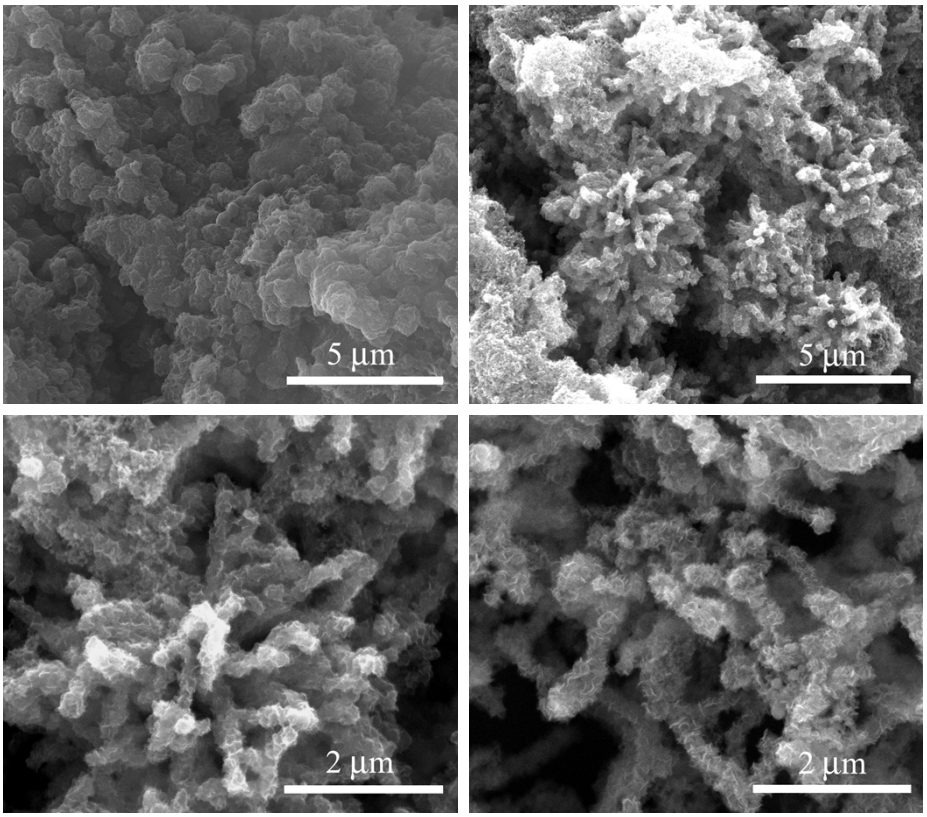

Fig. S1 FESEM images of the products obtained after reaction for (a) 2 h, (b, c) 4 h, (d) 8 h.

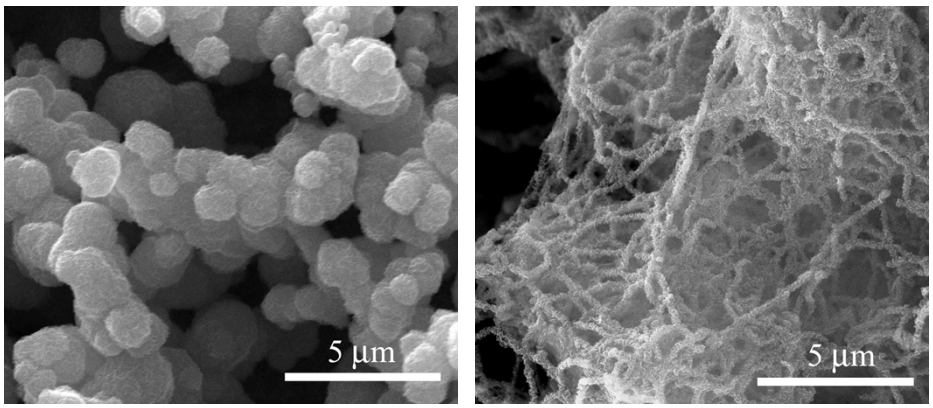

Fig. S2 FESEM images of the products obtained at different temperature: (a) 140 °C, (b) 200 °C.

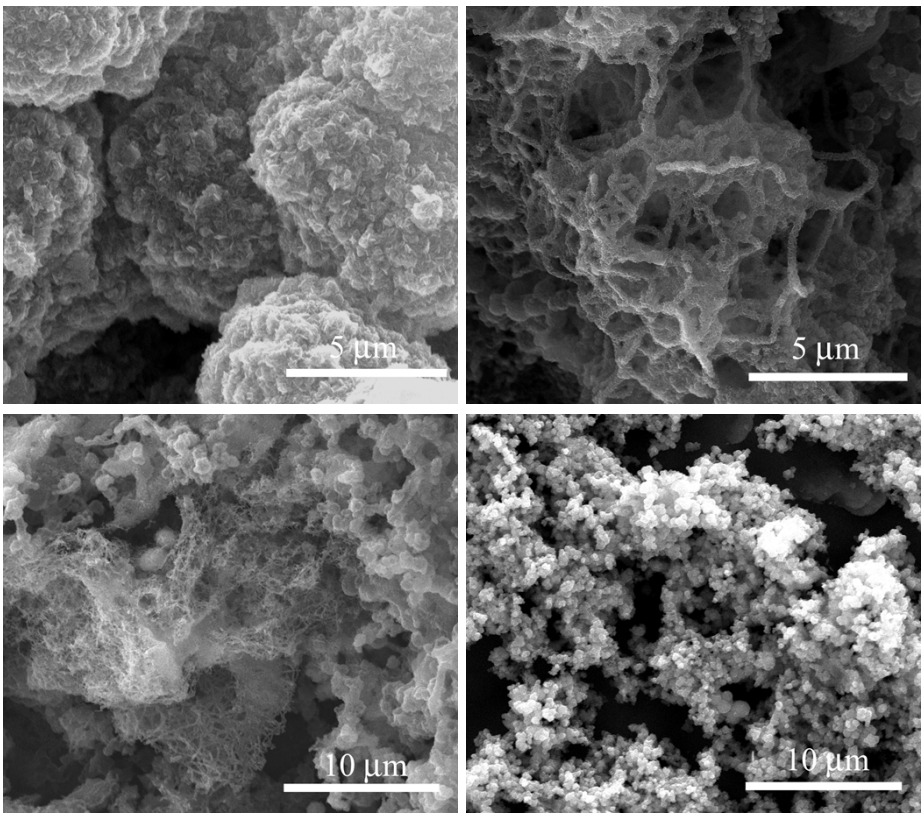

Fig. S3 FESEM images of the samples synthesized by a solvothermal reaction in a different volume ratios of water/ isopropanol (a) 0:20, (b) 10:10, (c) 15:5, (d) 20:0.