Supporting Information

Engineering $NiCo_2S_4$ nanoparticles anchored on carbon nanotubes as superior energy-storage material for supercapacitors

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1. Detailed Electrochemical Experiment

The electrolyte was prepared by dissolving 6 M KOH with an appropriate amount of distilled water, and then transfer it to a 1000 mL volumetric bottle, stir evenly and set the volume to 1000 mL. The working electrodes were prepared by coating slurry composed of active materials, acetylene black as conductive, and poly-(tetrafluoroethylene) (PTFE) as a binder in a mass ratio of 8:1:1 on Ni foam (1 cm × 1 cm) and drying at 80 °C (Firstly, the mixed slurry composed of active material, PTFE (1 wt % suspension in water) and acetylene black were ultrasonically dispersed in 15 mL ethanol and then dried in an 80 °C vacuum oven to form homogeneous paste. Secondly, the obtained uniform paste was coated on Ni foam using a scraper to prepare the working electrode. The loading mass of the active material is 1.5∼2 mg cm^{-2}.

2. Evaluations of Electrochemical Properties

The mass specific capacitance was estimated related to the literatures from GCD curves on the basis of equation[1-2]:

$$C_{sp} = I \times \Delta t \ / (\Delta V \times m) \quad (1)$$

Where I (A) is current, Δt is the discharge time (s), m (g) is the quality of the activated materials, ΔV is the charge-discharge voltage window (V). The quality of electrode materials need to be matched to keep the charge balanced that satisfied the correlation of $q^+ = q^-$. The equation for calculating the energy density is as follows:

$$E = \frac{1}{2} CV^2 \quad (2)$$

Where C is the total supercapacitor discharge specific capacitance and V is the potential window. The power density is calculated using the following equation:

$$P = E/\Delta t \quad (3)$$

Where E is the energy density and Δt is the discharge time.

References

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