

Supporting Information

Assembly of porous NiO nanowires on carbon cloth as a flexible electrode for high-performance supercapacitors

Yi-Hang Peng, Mei-Xia Guo, Fu Shao, Si Liu, Quan Zhu and Shao-Wei Bian**

College of Chemistry, Chemical Engineering and Biotechnology, Donghua University, Shanghai 201620, PR China.

1. Experimental

1.1 Synthesis

1.1.1 Materials

All chemical reagents were analytical pure grade and directly used without further purification. The carbon cloth (W1002) was cleaned ultrasonically in acetone, ethanol and deionized water for 10 min respectively, and then dried at 50 °C in a vacuum oven.

1.1.2 Preparation of NiO/carbon cloth electrode

In a typical preparation process of the flexible NiO/carbon cloth (NiO/CC) electrode, 0.005 mol of NiCl₂·6H₂O and 0.003 mol of urea were dissolved in 25 mL deionized water under stirring for 30 min. Then the aqueous solution was transferred into a Teflon-lined stainless steel autoclave containing a piece of clean carbon cloth. The sealed autoclave was maintained at 100 °C for 8 h in an oven. After cooling down to room temperature naturally, the resulting sample was collected, washed by

deionized water and dried in a vacuum oven at 50 °C. Finally, the NiO/CC electrode was obtained by calcining the sample at 300 °C for 2 h in N₂.

1.1.3 Preparation of NiO electrode

Typically, 0.005 mol of NiCl₂·6H₂O and 0.003 mol of urea were dissolved in 25 mL deionized water under stirring for 30 min. Then the aqueous solution was transferred into a Teflon-lined stainless steel autoclave. The sealed autoclave was maintained at 100 °C for 8 h in an oven. After cooling down to room temperature naturally, washed by deionized water and dried in a vacuum oven at 50 °C. The dried product was then calcinated at 300 °C for 2h in N₂.

The working electrode containing 3.6 mg active materials (as-prepared NiO) was prepared by mixing the as-prepared NiO, polyvinylidene fluoride in a mass ratio of 9:1 in a required amount of 1-Methyl-2-pyrrolidinone, and stirring for 24h. Then, dropped the aqueous solution on clean nickel foam and dried in a vacuum oven at 50 °C for 12h.

1.2 Characterization

SEM and TEM images were taken on a Hitachi S-4800 scanning electron microscopy and a JEOL JEM-2100F high-resolution transmission electron microscopy, respectively. The NiO content was quantitatively analyzed by inductively coupled plasma optical emission spectrometer (Prodigy ICP-OES). Powder XRD pattern was collected on a Rigaku D/Max-2550PC X-ray diffractometer with Cu Ka radiation.

1.3 Electrochemical measurements

The cycle voltammetry (CV) and galvanostatic charge/discharge (GCD) curves of electrode materials were measured in a three-electrode system using a CHI 660E electrochemical workstation (CHI, Shanghai, China). The NiO/CC and NiO electrode with a size of 1×1 cm was directly used as the working electrode. A saturated calomel electrode and platinum wire were used as the reference and counter electrodes, respectively. All electrochemical measurements were performed in 2 M KOH aqueous electrolyte at room temperature.

The specific capacitance, energy density and power density were calculated based on the following equations (1) and (2), respectively:

$$C = \frac{1}{m \cdot v \Delta V} \int I(V) dV \quad (1)$$

$$C = \frac{I \cdot \Delta t}{m \cdot \Delta V} \quad (2)$$

Where I is the constant discharging current (A/g), m is the active materials (g), v is the scan rate (mV/s), ΔV is the potential window during the discharge process, Δt is the discharge time.

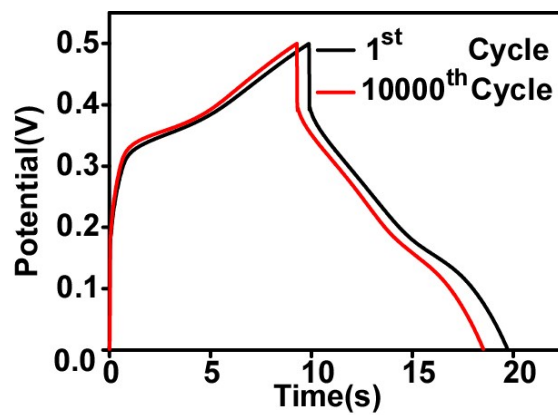


Figure S1. Typical GCD curves of NiO/CC electrode during 10000 cycles.