Supporting Information:

A facile phase transformation method for the preparation of 3D flower-like β-$Ni(OH)_2$/GO/CNTs composite with excellent supercapacitor performance

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Synthesis of α-$Ni(OH)_2$/GO/CNTs composites

20 mg GO and 20 mg CNTs was dispersed into 30 mL diethylene glycol (DEG). Then $NiCl_2•6H_2O$ (0.475g, 2 mmol) was dissolved into the GO&CNTs DEG dispersion. After 10 mL of 2 M NaAc DEG solution was added into the dispersion, the mixture was stirred for 1h at room temperature. Finally, the mixture was transferred into a 50 mL Teflon-lined stainless-steel autoclave for 10 h solvothermal reaction at 180 ºC. The final product was collected by centrifuge and rinsing with ethanol.

Transformation from α-$Ni(OH)_2$/GO/CNTs composite to β-$Ni(OH)_2$/GO/CNTs composite

40 mg α-$Ni(OH)_2$/GO/CNTs composite was dispersed into 40 mL of NaOH aqueous solution (1~10 mmol L^{-1}). Then the dispersion was sealed into a 50 mL Teflon-lined stainless-steel autoclave for hydrothermal reaction at 180 ºC for several hours. The final product was collected by centrifuge and washing with ethanol.
Samples of α-$Ni(OH)_2$ and β-$Ni(OH)_2$ were synthesized under the same condition but with no GO or CNTs added. All the products were dried at 80 º C overnight.

Materials characterization

Powder X-ray diffraction (XRD) measurements were carried out using a Bruker D8 X-ray diffractometer with Ni-filtered Cu-K a radiation (40 kV, 40 mA). Transmission electron microscopy (TEM) was performed on a JEOL JEM-2100F transmission electron microscope. Field emission scanning electron microscopy (SEM) images were acquired on a S-4800 field-emission scanning electron microscope operated at 1.0 kV. Thermal gravimetric analysis (TGA) data were recorded at a heating rate of 10 ºC min^{-1} in air by a simultaneous thermogravimetry/differential thermal analyzers (DTG-60H).

Electrochemical measurements

The working electrode was prepared as followed. First, active material powder, acetylene black and PTFE, with a weight ratio of 80:10:10, were mixed; then the mixture was pressed into a film and dried in oven at 80 ºC overnight. Then the film was cut into small pieces. Finally, the working electrode was prepared by pressing one small piece (about 1 mg) onto nickel foam at a pressure of 10 MPa. The electrochemical tests were conducted on a CHI 660D electrochemical workstation. The electrochemical studies of the individual electrode were performed in a three-electrode cell, where Pt foil serves as the counter electrode and a Ag/AgCl electrode serves as the reference electrode. 1 M KOH aqueous solution was used as the electrolyte.

Theoretical specific capacitance of β-$Ni(OH)_2$ was calculated by the following equation:

$$C = \frac{Q}{\Delta V} = \frac{96485/92.7}{0.55} = 1892$$

Equation S1

Where ΔV is the voltage window, Q is the electric charge per 1 gram $Ni(OH)_2$.
The energy density d_e can be calculated by the following equation:

$$de = \int UIdt \qquad \textbf{Equation S2}$$

Where U is the voltage between electrodes, I is the discharge current density.

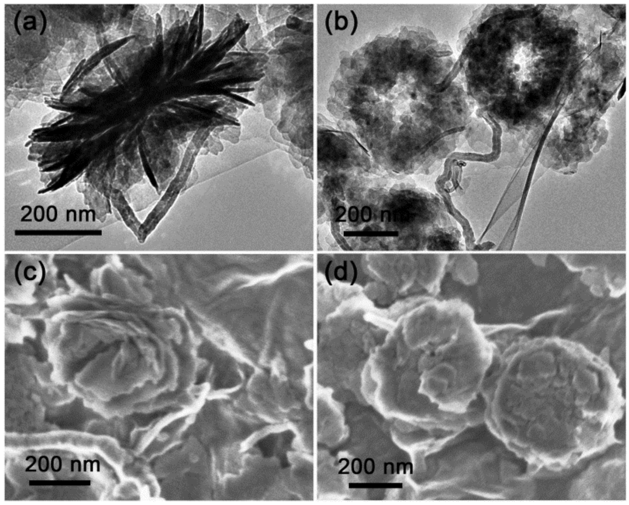
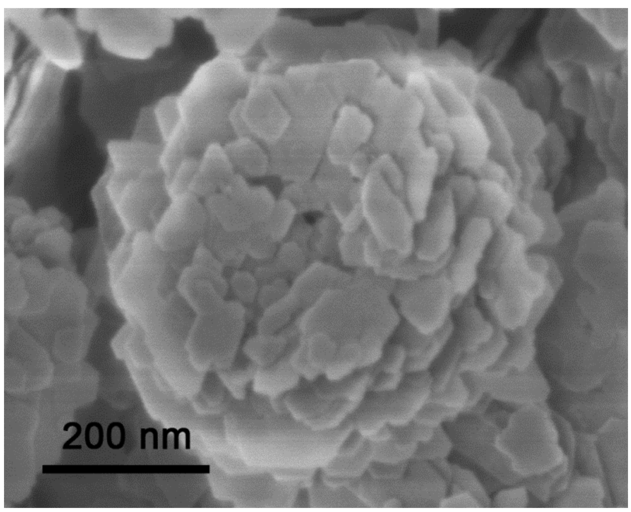


Fig.S1 (a, b) TEM and SEM images of β-$Ni(OH)_2$/GO/CNTs composite after 1 h hydrothermal reaction; (c, d) TEM and SEM images of β-$Ni(OH)_2$/GO/CNTs composite after 10 h hydrothermal reaction.



Figu.S2 SEM image of β-$Ni(OH)_2$ after 10 h hydrothermal reaction. The nanosheets split into smaller ones.

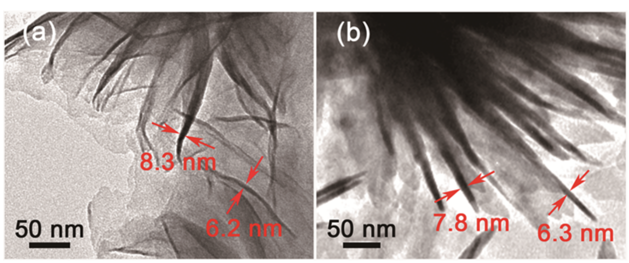


Fig.S3 (a, b) TEM images of $Ni(OH)_2$/GO/CNTs composites before and after 1 h hydrothermal reaction respectively.

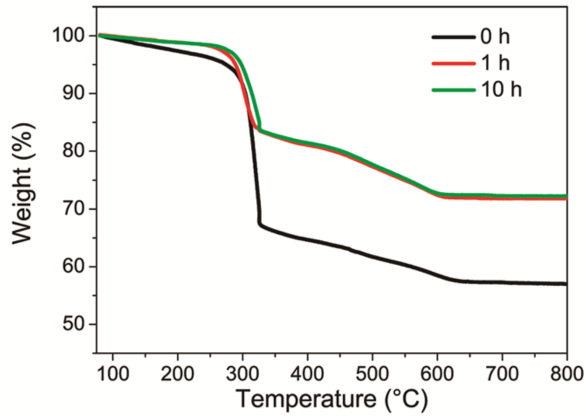


Fig.S4 TG curves of $Ni(OH)_2$/GO/CNTs composites before and after hydrothermal reaction: 0, 1 and 10 h. Their GO&MWCNTs contents are ~10, ~12 and ~12 wt%, respectively.

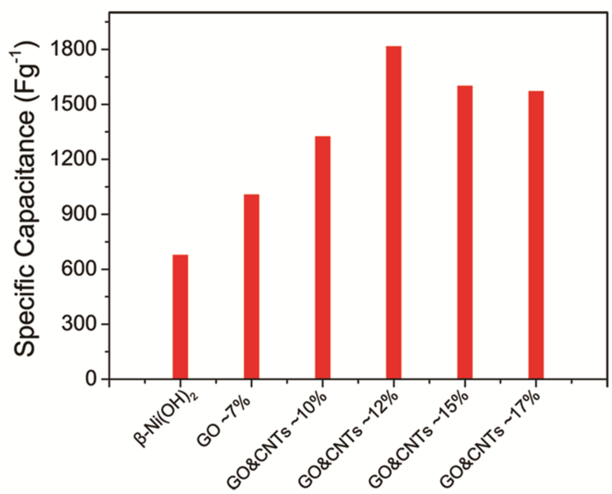


Fig.S5 Specific capacitances at 2 A g^{-1} of samples with different carbon contents: ~0, ~7, ~12, ~15 and ~17%, respectively. The specific capacitances were based on the mass of β-$Ni(OH)_2$.

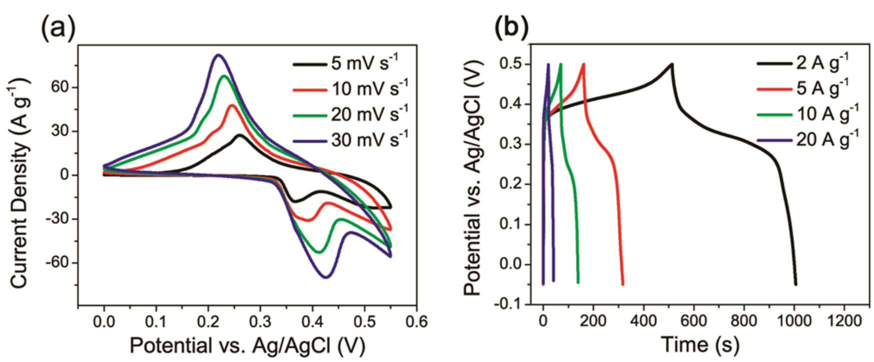


Fig.S6 Electrochemical characterizations of 3D flower-like β-$Ni(OH)_2$/GO/CNTs composite (1 h): (a) CV curves at various scan rates; (b) Galvanostatic charge/discharge curves at different current densities.