

## *Supplementary information*

# **Electrochemical conversion of $\text{Ni}_2(\text{OH})_2\text{CO}_3$ into $\text{Ni}(\text{OH})_2$ hierarchical nanostructures loaded on carbon nanotube paper with highly electrochemical energy storage performance**

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### **Experimental details**

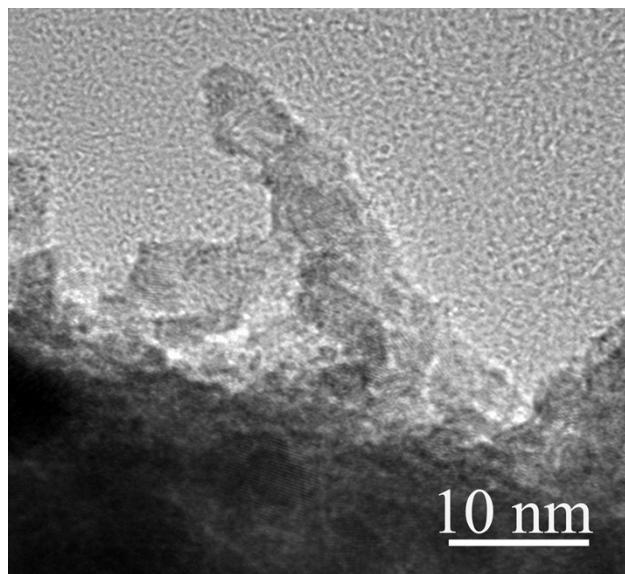
**Materials.** MWCNT paper was prepared by dispersion-vacuum filtration method as reported in Ref (J. Phys. Chem. C, 2012, 116 (6), 3903), which showed the paper morphology and length distribution of MWCNTs in this CNT paper. The pristine CNT paper with a thickness of about 0.1 mm has a square resistance of  $2.2 \Omega \square^{-1}$ , thus the calculated in-plane electrical conductivity is  $4600 \text{ S m}^{-1}$ .

**Synthesis.**  $\text{Ni}_2(\text{OH})_2\text{CO}_3$  was grown on CNT paper by a chemical deposition method. Typically,  $\text{NiCl}_2$  were dissolved in 20 ml water with a concentration of 1 M, and a piece of CNT paper was immersed into the solution. At last, 0.62 g urea was solved into the solution. The mixed solution was put into a glass bottle and its top was screwed. The bottle was put into an oven with the temperature of 80 °C for 24 h. After that, the CNT paper was taken out and washed by water and alcohol. The washed paper was dried at 60 °C in air. Carbon fiber paper and nickel foam was deposited  $\text{Ni}_2(\text{OH})_2\text{CO}_3$  by the same method. RGO/ composite was prepared by replacing the water for solving  $\text{NiCl}_2$  into GO aqueous dispersion with a concentration of 2 mg/ml.

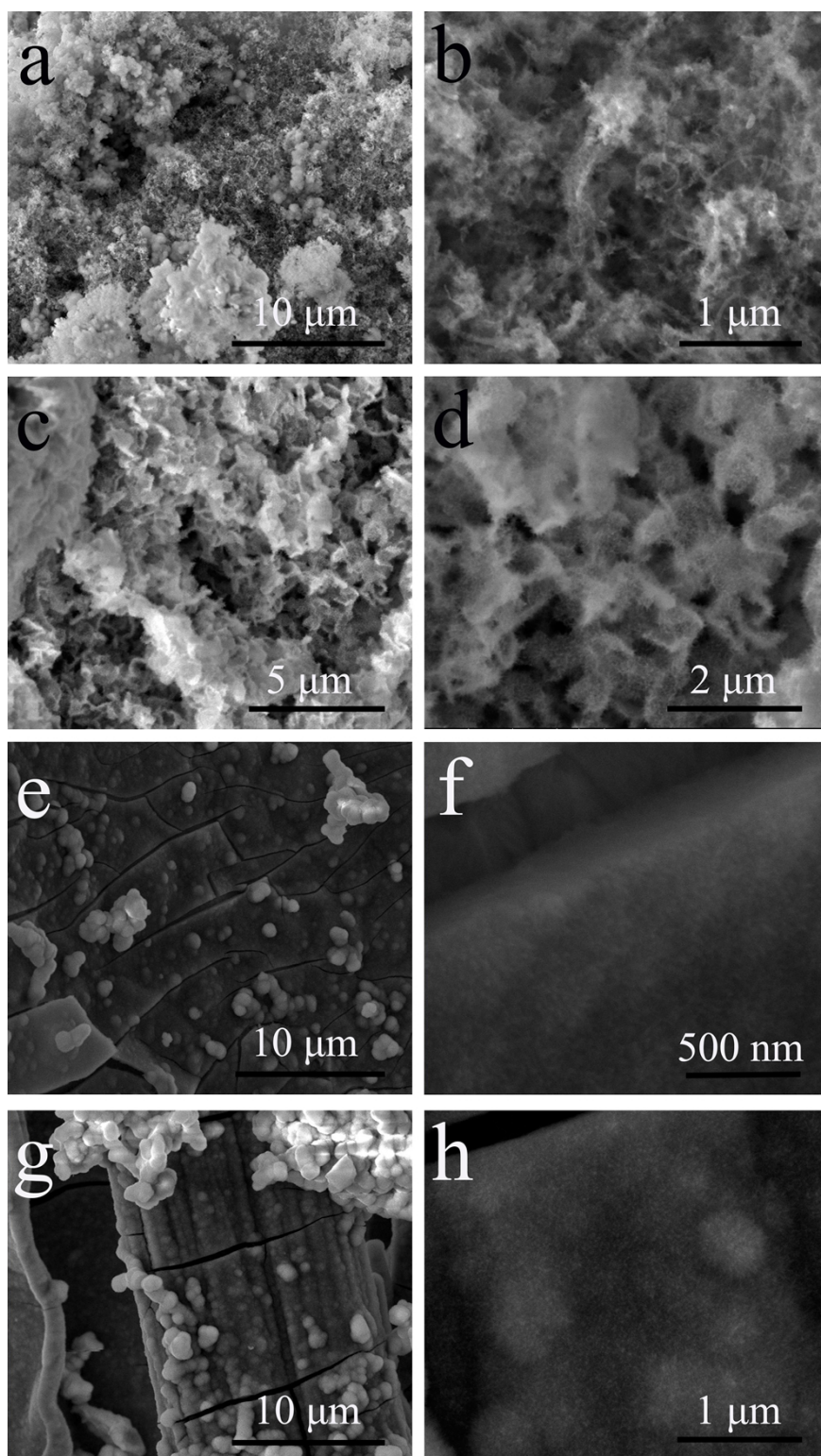
**Characterization and tests.** The morphologies of the samples were characterized by scanning

electron microscope (SEM, Quanta 400 FEG, FEI, with Apollo 40 SDD X-ray Energy Dispersive Spectrometer (EDS)) and transmission electron microscope (TEM, Tecnai G2 F20 S-Twin, FEI). The crystal structure of the samples was investigated by X-ray powder diffractometer (XRD, D8 Advance, Bruker AXS).

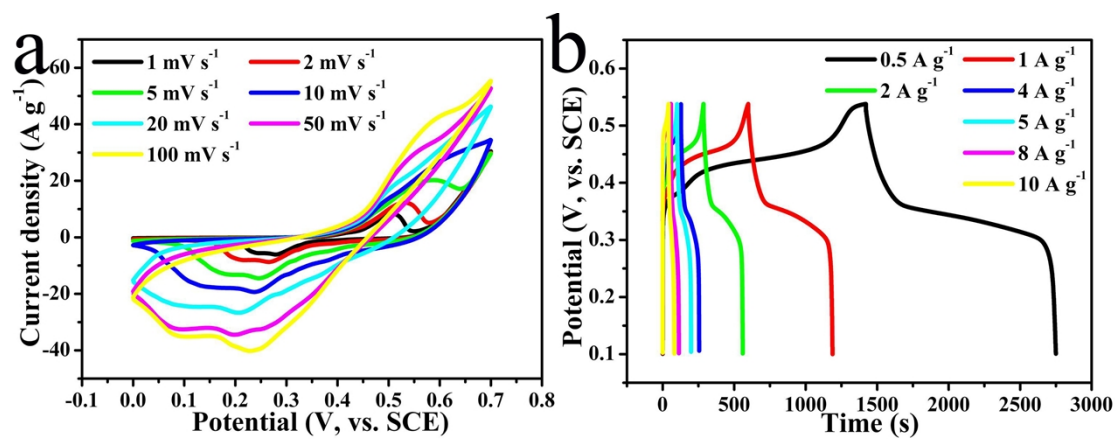
The electrochemical performance of the samples was studied in a three-electrode test system by using a CHI 660 electrochemical workstation. A platinum wire and a saturated calomel electrode (SCE) were used as the counter electrode and reference electrode, respectively. 6 M KOH aqueous solution was used as the electrolyte.



**Figure S1** HRTEM image of  $\text{Ni}_2(\text{OH})_2\text{CO}_3$  nanowires grown on CNT paper



**Figure S2** SEM images of  $\text{Ni}_2(\text{OH})_2\text{CO}_3$  nanowires grown on small-diameter CNTs (a,b), rGO nanosheets (c,d), nickel foam (e,f) and carbon fiber paper (g,h).



**Figure S3** CV curves (a) and charge/discharge curves (b) of converted Ni(OH)<sub>2</sub> nanosheet/CNT hybrid paper.