Supporting Information

Nickel oxide nanopetals decorated 3D nickel network with enhanced pseudocapacitive properties

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Calculation

Calculation of the loading mass of the active materials

The calculation principle about the loading amount of active NiO was mainly based on the mass changes during the course of thermal decomposition. The as-anodized nickel foams (2*2 cm^2) were dried and weighted. After calcination, we weighted the samples again and calculated the weight loss of each sample. The loading amount of NiO on the Ni foam was determined according to the following reaction: $NiC_2O_4{\cdot}2H_2O + O_2 \rightarrow NiO + 2H_2O + 2CO_2$. The calculated average loading mass of NiO nanopetals on nickel foam obtained through calcination at 480 ^oC has been weighted to be 1.5 mg cm^{-2}.

Calculation about the optimal mass ratio of m+(NiO)/m-(AC)

It is known that the charge between the two electrodes of a supercapacitor should be balanced following the relationship $q_+ = q_-$ so as to obtain a good electrochemical performance.[S1] The charge stored by each electrode usually depends on the specific capacitance C (F g^{-1}), the voltage range ΔV (V) and the mass of the electroactive material m (g), and the related equation is given as follows:[S2]

$$q = C \times \Delta V \times m \tag{1}$$

In order to obtain $q_+ = q_-$, the mass balance will be expressed as follows:[S2]

$$\frac{m_+}{m_-} = \frac{C_- \times \Delta V_-}{C_+ \times \Delta V_+}$$

(2)

Where '+' and '-' denote the positive and negative electrode respectively.

To determine the mass ratio of our NiO//AC asymmetric supercapacitor, typical CV curves were obtained for the NiO electrode and AC electrode at a scan rate of 50 mV s^{-1} in the 2 M KOH aqueous solution (**Fig. S6**). The specific capacitance of the NiO electrode was calculated as 352.72 F g^{-1}. The specific capacitance of the AC electrode was 81.4 F g^{-1}. Based on the specific capacitance values and the potential windows of the two electrodes, the optimal mass ratio of m+(NiO)/m-(AC) was determined to ~0.51 for the present NiO//AC asymmetric supercapacitor.

Supplementary Figures (Fig. S1-S7)

Supplementary Videos (Video S1)

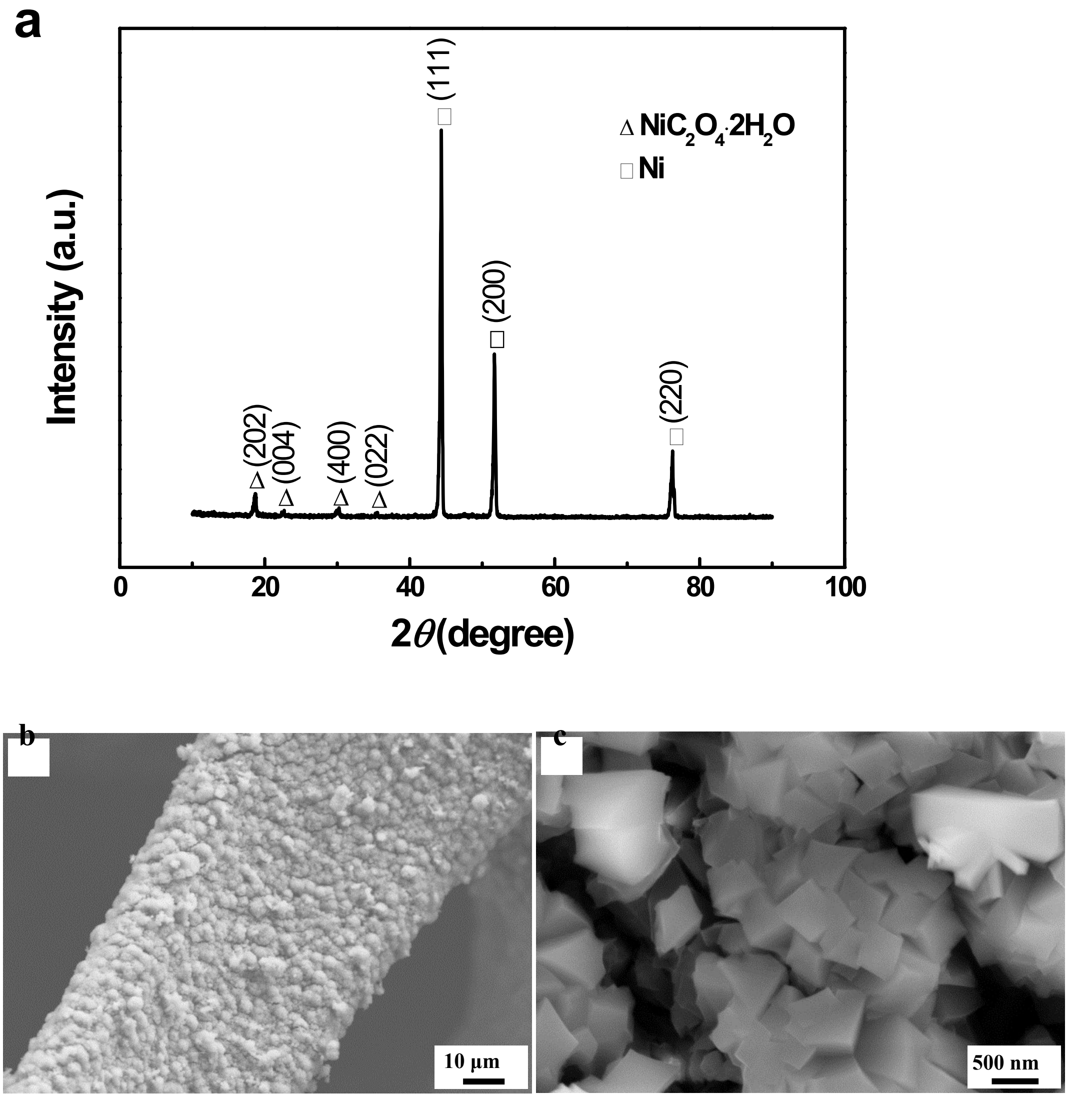

Fig. S1. Characterization of the anodized nickel foam: (a) XRD pattern of the nickel oxalate hydrate @ nickel foam; (b) and (c) SEM images at different magnifications.

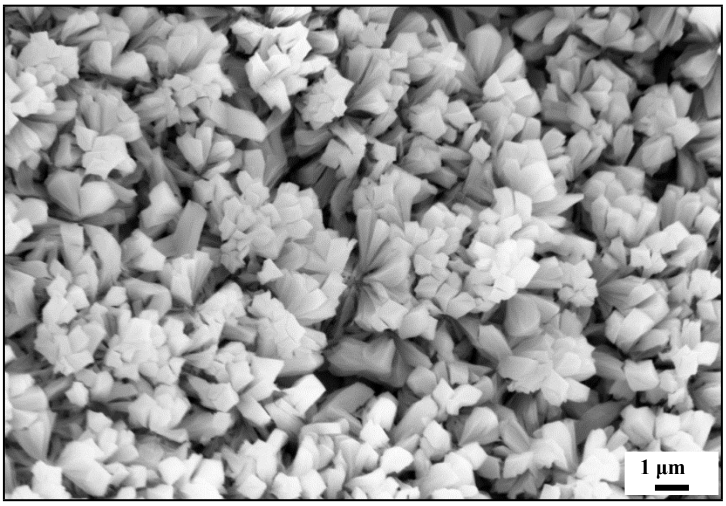

Fig. S2. SEM image of the NiO electrode obtained through calcination of the anodized nickel foam at 400 ^oC.

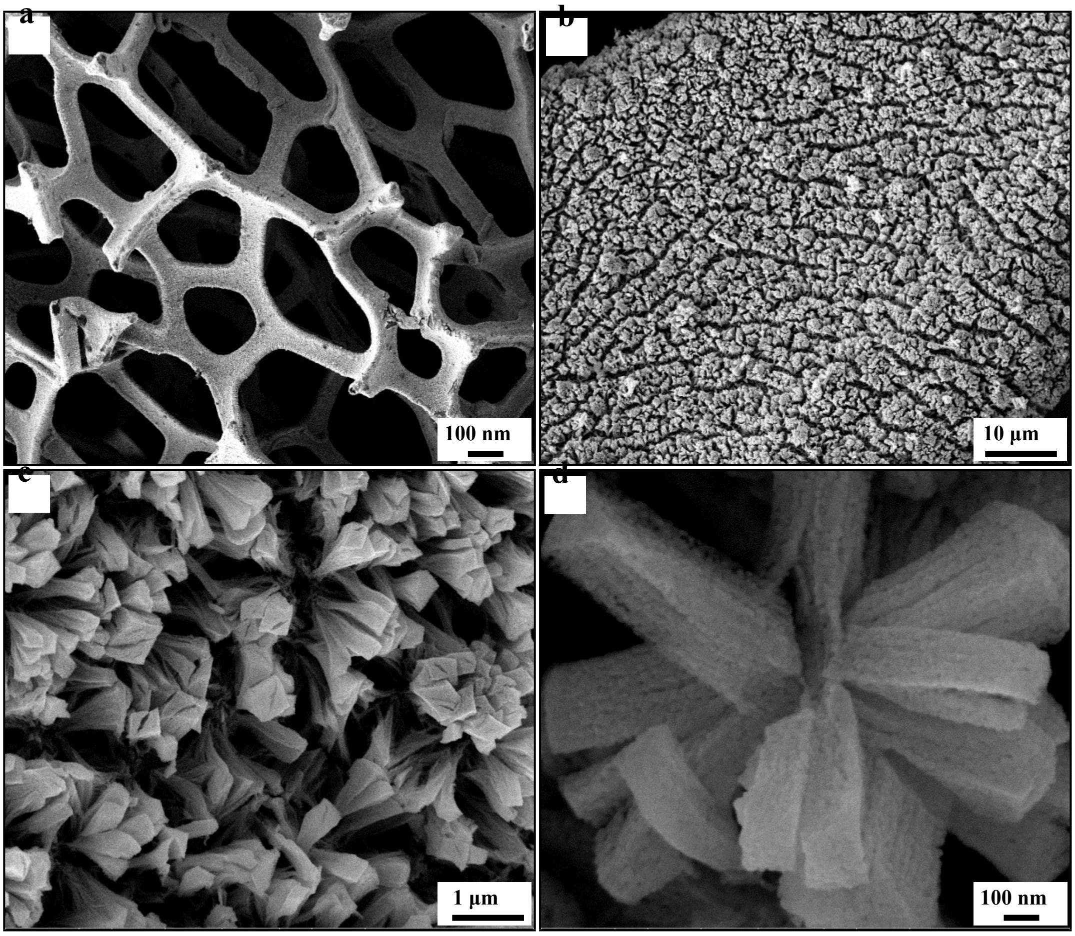

Fig. S3. SEM images of the NiO electrode obtained through calcination of the anodized nickel foam at 480 ^{o}C.

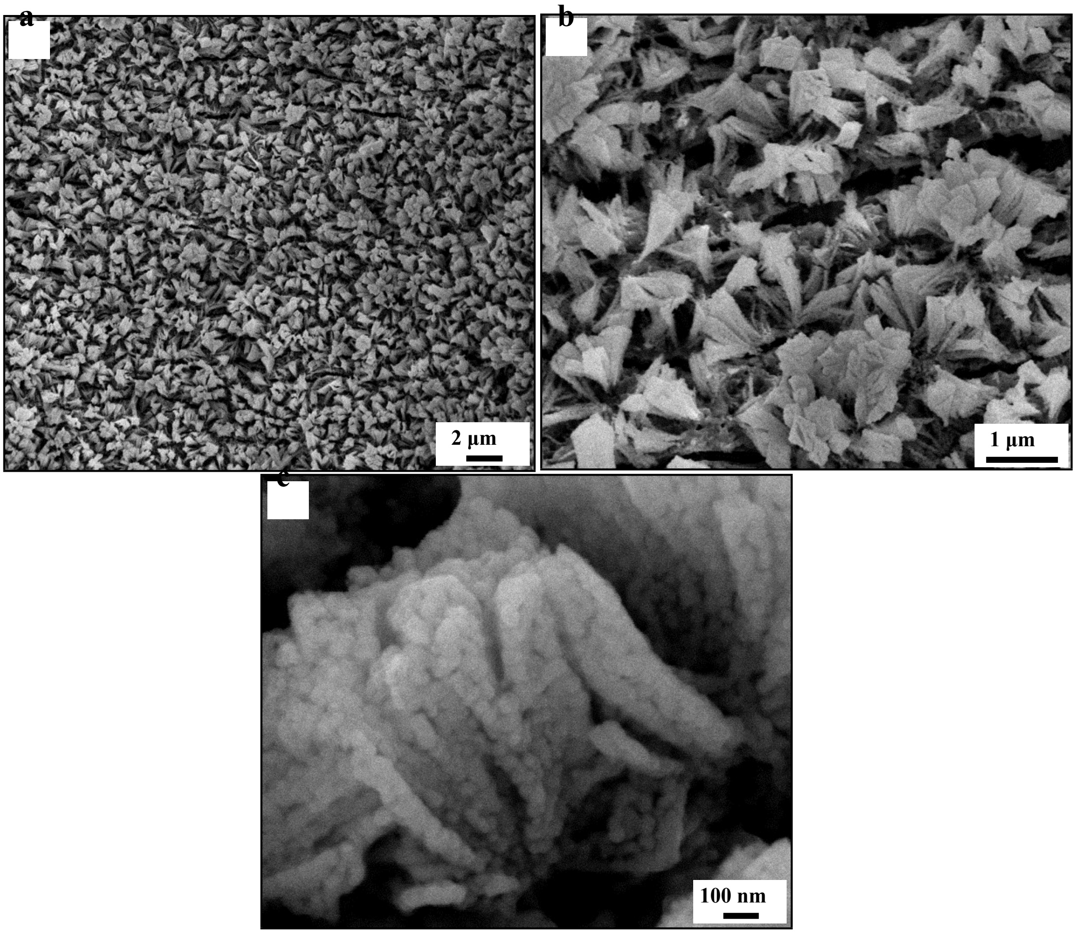

Fig. S4. SEM images of the NiO electrode obtained through calcination of the anodized nickel foam at 550 °C.

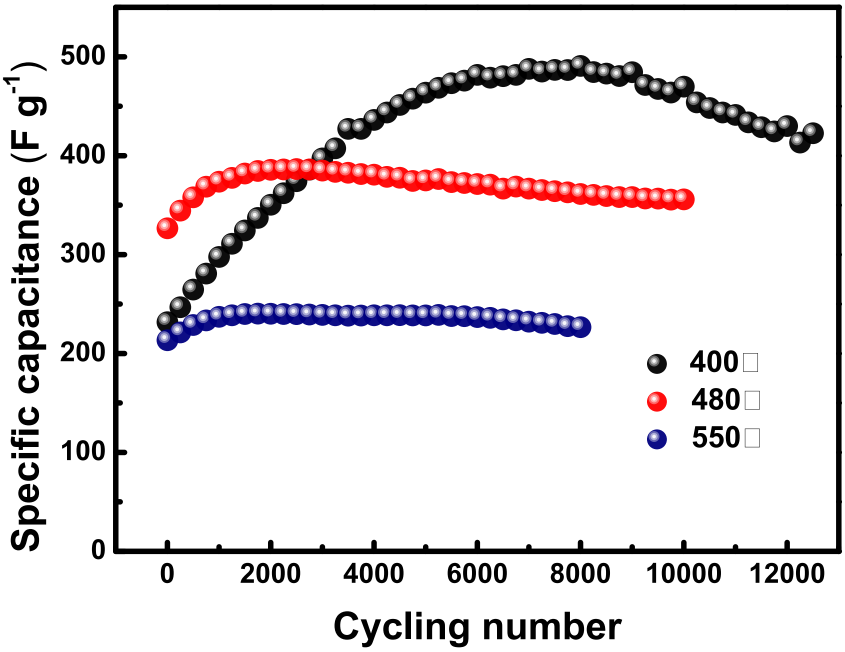

Fig. S5. Cycling performance of the NiO electrodes obtained through calcination of the anodized nickel foamat different temperatures. The cycling performance was evaluated by CV measurements in the 2 M KOH solution at the scan rate of 50 mV s^{-1}.

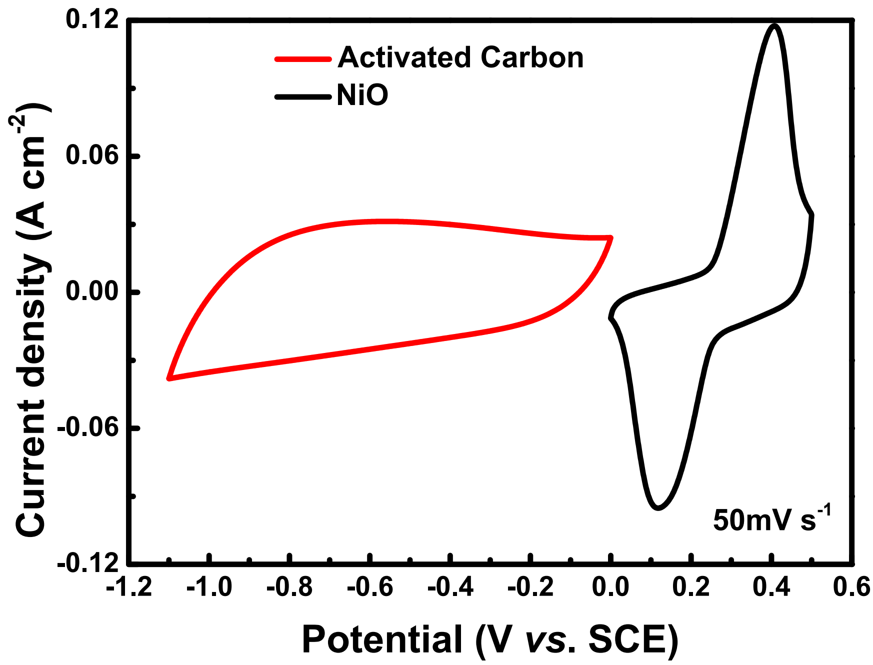

Fig. S6. Typical CV curves of the NiO and AC electrodes in the 2M KOH solution.

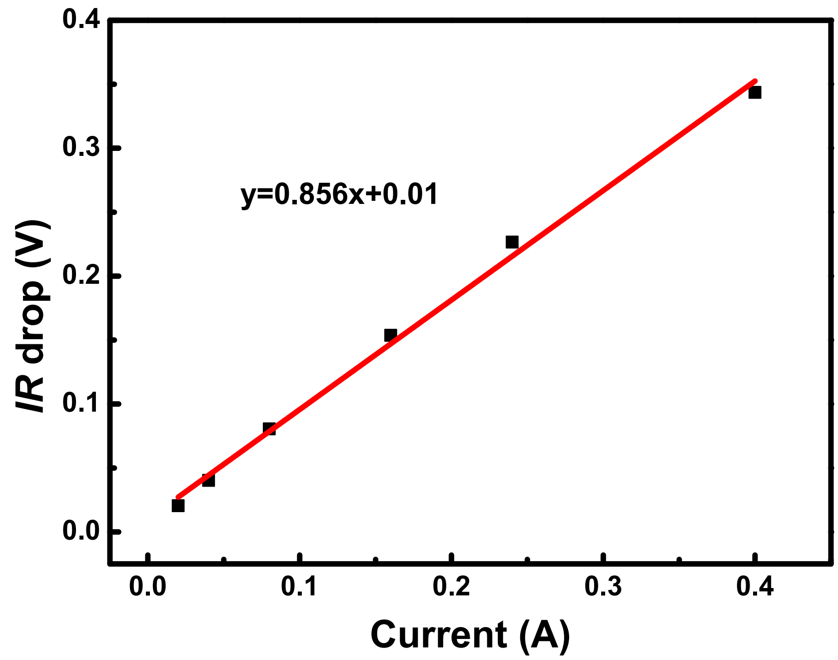

Fig. S7. Variation of IR drop with the total change in current of the charge-discharge measurement.

Supplementary Videos:

Video showing that two supercapacitors can power a mini fan for seconds.

Supporting References:

S1 H. B. Li, M. H. Yu, F. X. Wang, P. Liu, Y. Liang, J. Xiao, C. X. Wang, Y. X. Tong and G. W. Yang, *Nat. Commun.*, 2013, **4**, 1894.

S2 V. Khomenko, E. Raymundo-Piñero and F. Béguin, *J. Power Sources*, 2006, **153**, 183.