Supporting Information

Synthesis of Nickel Chalcogenide Hollow Spheres Using L-Cysteine-assisted Hydrothermal for efficient supercapacitor electrode

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Supplementary Equations

$$NiS_2 + H_2O + \frac{1}{2}O_2 \rightarrow Ni(OH)_2 + 2S \quad \text{(S-1)}$$

$$NiS + H_2O + \frac{1}{2}O_2 \rightarrow Ni(OH)_2 + S \quad \text{(S-2)}$$

$$NiSe_2 + H_2O + \frac{1}{2}O_2 \rightarrow Ni(OH)_2 + 2Se \quad \text{(S-3)}$$

The reversible redox reactions were as follows:

$$Ni(OH)_2 + OH^- \leftrightarrow NiOOH + H_2O + e^- \quad \text{(S-4)}$$

$$NiO + OH^- \leftrightarrow NiOOH + e^- \quad \text{(S-5)}$$

Supplementary Figures

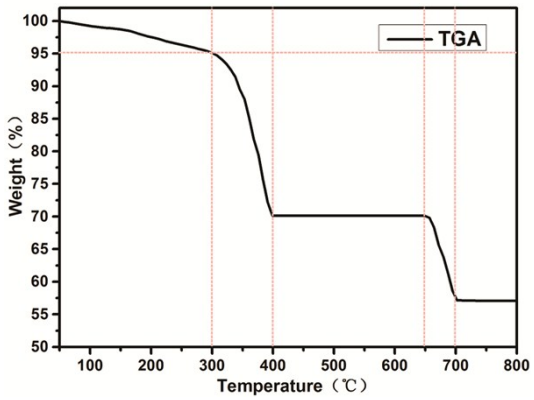

Fig. S1 TG cure of NiS_2 in air from 50 ℃ to 800 ℃ with a heating rate of 10 ℃ min^{-1}.

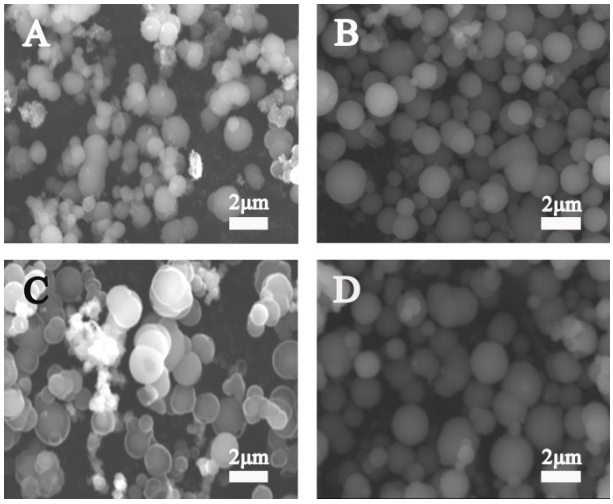

Fig. S2 SEM images of the product during prepare NiS_2 at different time: (A)8h; (B)12h; (C)16h; (D)20h.

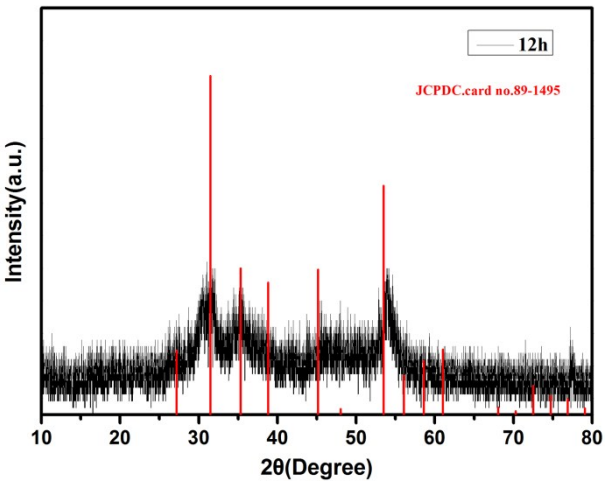

Fig. S3 XRD pattern of the product NiS_2 (12h).

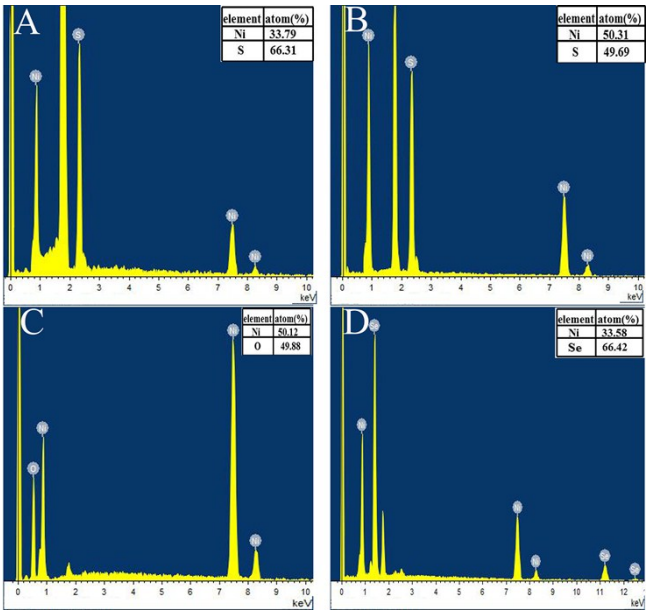

Fig. S4 EDS spectrums of the products: (A) NiS_2; (B) NiS; (C) NiO; (D) $NiSe_2$.

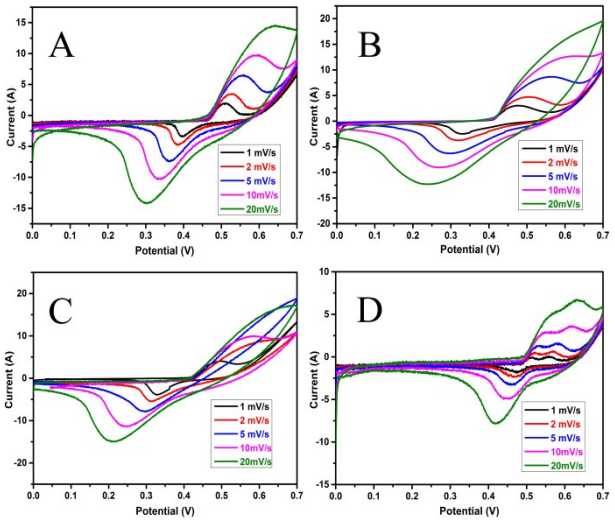

Fig. S5 CV curves of the electrodes at different scan rates: (A) NiS_2; (B) NiS; (C) NiO; (D) $NiSe_2$.

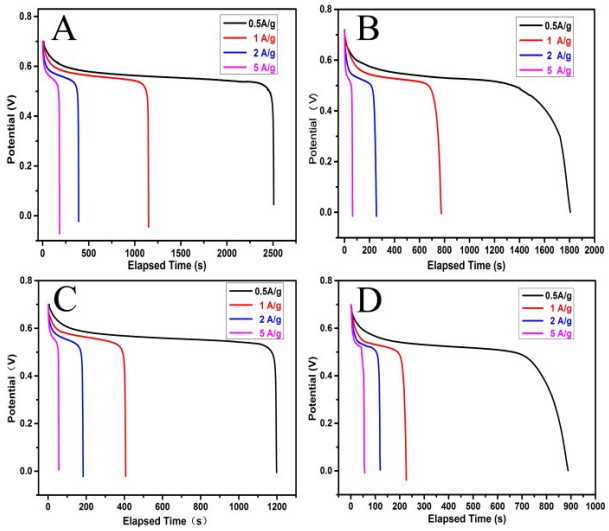

Fig. S6 discharge curves of the electrodes at various current densities: (A) NiS_2; (B) NiS; (C) NiO; (D) $NiSe_2$.

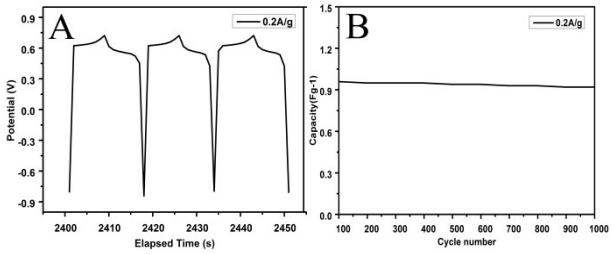

Fig. S7 (A) Charge-discharge curves of the bare Ni foam electrode; (B) specific capacitances of the bare Ni foam electrode at different cycles.

Table 1 Calculated electrochemical parameters for various working electrodes based on the proposed circuit.

Working electrode	R_e ($\Omega \cdot cm^2$)	R_{ct} ($\Omega \cdot cm^2$)	Z_w ($\Omega \cdot cm^2$)	CPE (F)
NiS_2	**1.107**	**0.573**	**5.042**	**9.964**
NiS	**0.912**	**0.628**	**7.681**	**10.702**
NiO	**0.725**	**1.033**	**3.302**	**14.790**
$NiSe_2$	**0.639**	**1.257**	**8.045**	**9.492**