Superior Electrochemical Performance of Ultrasmall SnS$_2$ Nanocrystals Decorated on Flexible RGO in Lithium-ion Batteries

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Experimental details:

Preparation of pristine SnS$_2$

2 mmol SnCl$_4$•5H$_2$O, 4 mmol thioacetamide (TAA) was added into the 50 mL deionized water and was vigorous stirred with reflux at 95 °C for 8 h. The mixture cooled to room temperature. The product was collected by centrifugation, washed several times using ethanol and dried in a vacuum oven at room temperature.

Preparation of SnS$_2$@C composites

2 mmol SnCl$_4$•5H$_2$O, 4 mmol thioacetamide (TAA) was added into the 50 mL deionized water and was vigorous stirred with reflux for 8 h at 95 °C. Then 1 g glucose was added into the mixture solution and was vigorously stirred for 0.5 h. The mixture solution was sealed in a 60 mL Teflon-lined stainless-steel autoclave, and heated at 180 °C for 2 h to carbonize. After cooling to room temperature naturally, the product was collected by centrifugation, washed several times using ethanol, and then dried in a vacuum oven at room temperature.

Preparation of multiwalled carbon nanotubes coated by SnS$_2$ (MWCNT@SnS$_2$)

50 mg of multiwalled carbon nanotubes (MWCNTs) was suspended in 50 mL ultrapure water and sonicated for 2 h. Then 2 mmol SnCl$_4$•5H$_2$O and 4 mmol thioacetamide (TAA) was added into the solution and was vigorous stirred with reflux for 8 h at 95°C. After cooling to room temperature naturally, the product was collected by centrifugation, washed several times using ethanol, and then dried in a vacuum oven at room temperature.
Scheme 1 A synthetic of SnS$_2$ nanocrystals arrays on RGO nanosheets.

Fig. S1 SEM images of (a) pristine SnS$_2$, (b) SnS$_2$@C, (c) MWCNT@SnS$_2$.

Fig. S2 Energy-dispersive X-ray spectrum of the ultrasmall SnS$_2$ nanocrystals@RGO.

Fig. S3 Photographs of SnS$_2$ nanocrystals@RGO substrate electrode.
**Electronic Supplementary Information**

**Fig. S4** Electrochemical impedance spectra of the SnS$_2$ nanocrystals @RGO, pristine SnS$_2$, SnS$_2$@C and MWCNT@SnS$_2$ electrodes.