Supporting Information for

# Rational Design of Layered $SnS_2$ on Ultralight Graphene Fiber Fabrics as Binder-Free Anodes for Enhanced Practical Capacity of Sodium-Ion Batteries

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## Supplementary Figures and Table

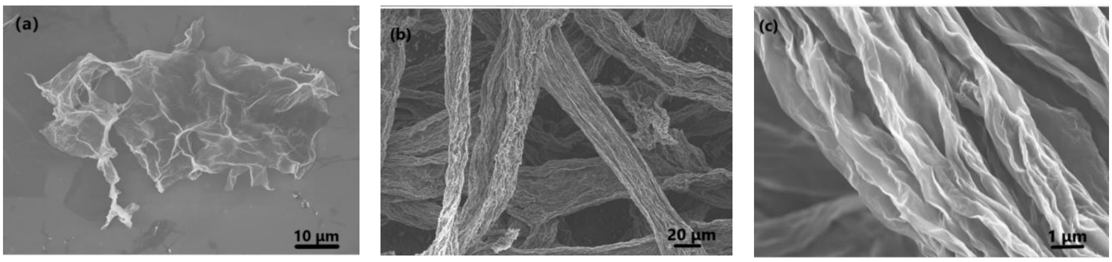


**Fig. S1** SEM images of **a** GO, and **b, c** rGF

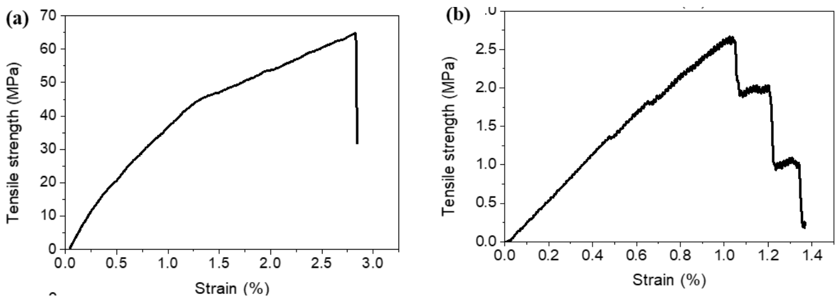


**Fig. S2** The tensile strength of **a** rGF fiber and **b** rGF fabric. In the tensile experiment, the length of rGF fiber is 0.5 mm, and the size of fabric is 20 mm long, 5 mm wide, 14 μm thick

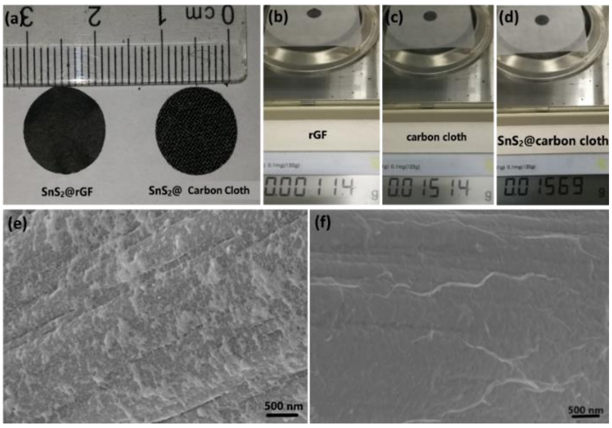


**Fig. S3 a** Optical photo of $SnS_2$@rGF and $SnS_2$@carbon cloth electrode. The weight of **b** rGF and **c** carbon cloth electrode, **d** $SnS_2$@carbon cloth electrode. SEM photos of the **e** $SnO_2$@carbon cloth and **f** $SnS_2$@carbon cloth. In **Fig. S3a–d**, the diameter of all samples is 12 mm. It can be told obviously whether there is $SnS_2$ attached; rGF fabric samples are much lighter than the carbon cloth samples

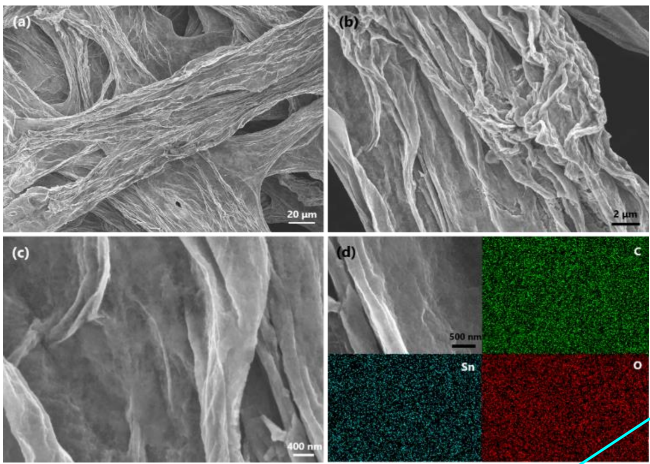


**Fig. S4 a-c** SEM images, **d** elemental mapping images of the $SnO_2$@rGF

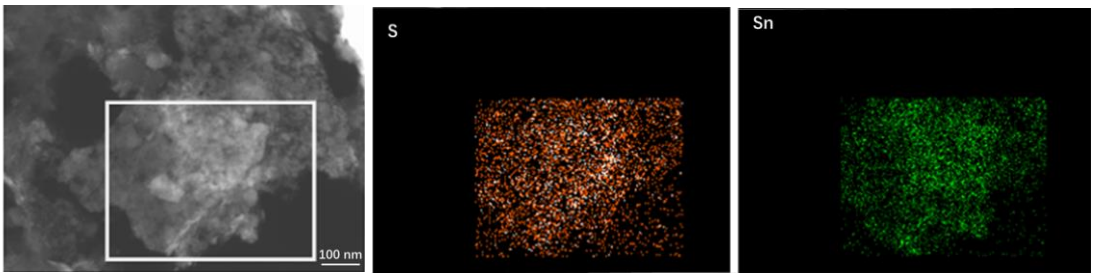


**Fig. S5** EDX-STEM images of $SnS_2$@rGF

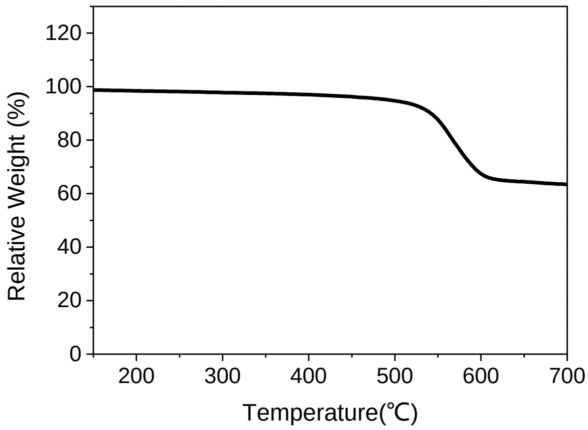


**Fig. S6** Thermogravimetric analysis (TGA) prifile of $SnS_2$@rGF composites

In $O_2$ atmosphere, the $SnS_2$@rGF was heated to 700 °C, then turn into $SnO_2$. The remaining mass was 60.05 wt%, the mass percentage of $SnS_2$ was calculated by Eq. S1:

$$\text{Mass Percentage} = \frac{\frac{M_{SnS_2}}{M_{SnO_2}} * 0.6005}{1} * 100\% = 67.2\% \qquad \text{(S1)}$$

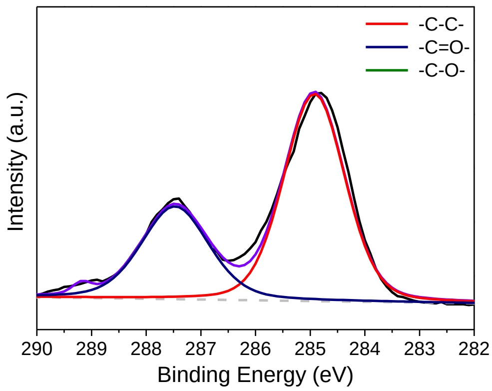


**Fig. S7** XPS spectra C1s region of GOF

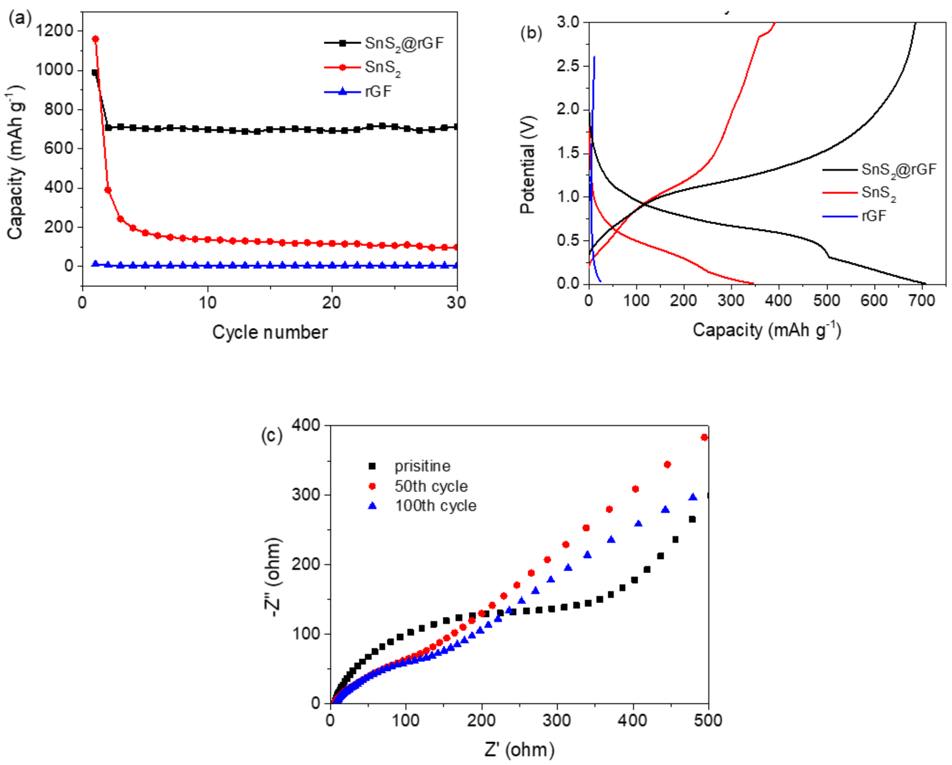


**Fig. S8 a** cycle rate and **b** 2rd discharge-charge curves of the $SnS_2$@rGF, $SnS_2$, and rGF electrode at a current rate of 0.5 A $g^{-1}$. **c** pristine, $50^{th}$ cycle, and $100^{th}$ cycle in a frequency range of 100 kHz to 0.1 Hz with AC voltage amplitude of 5 mV

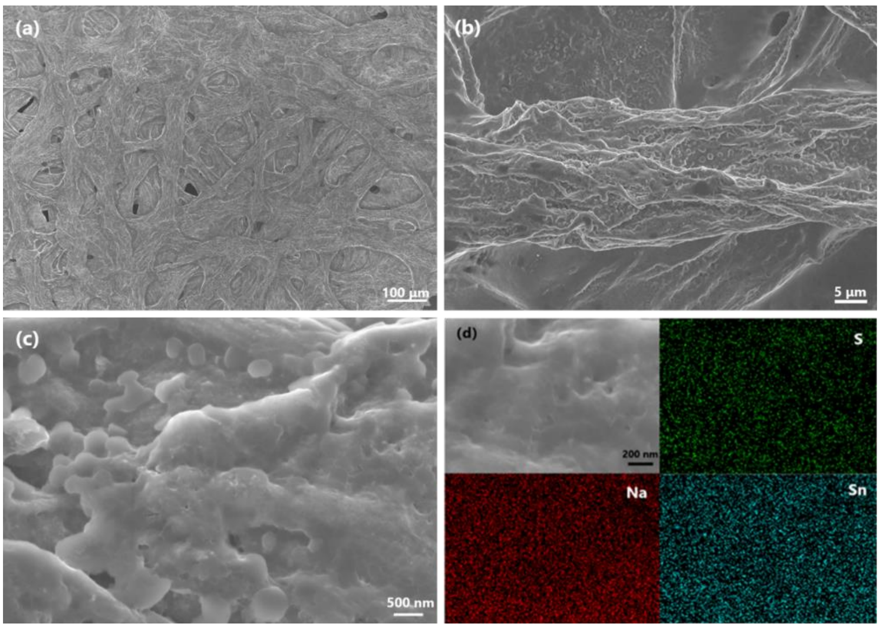


**Fig. S9 a-c** SEM images, and **d** elemental mapping images of the $SnS_2$@rGF after 100 cycles

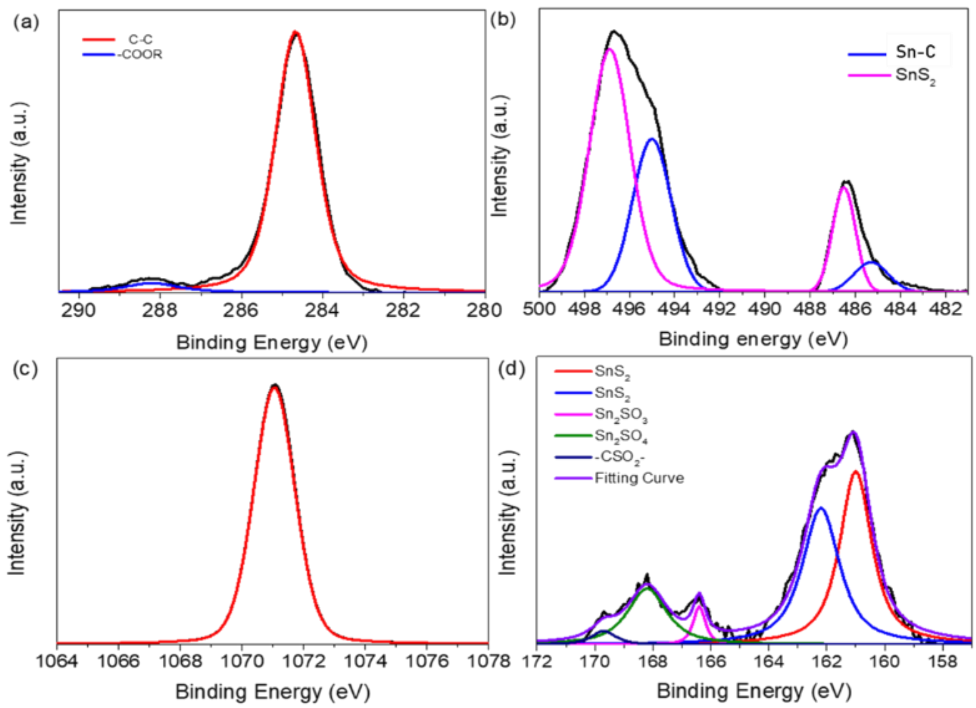


**Fig. S10** XPS spectra of $SnS_2$@rGF composites: **a** C 1s region, **b** S 2p region, **c** Na 1s region and **d** Sn 3d narrow scan spectra

**Figure S10b** shows that there is no peak corresponding to chlorine, so $Na^+$ doesn't exist with a form of Sodium Perchlorate.

**Table S1** Comparison of sodium storage performance of different anode materials at current rate of 0.2 A $g^{-1}$

| Refs. | Active Material | Substrate | If separated Current Collector | Current Collector | Electrolyte | Active Material Weight Percentage (%, including current collector) | Reversible Specific Capacity before 50 cycles (mAh $g^{-1}$) | Specific Capacity (mAh $g^{-1}$, including current collector) |
|---|---|---|---|---|---|---|---|---|
| [S1] | $SnS_2$ | Graphene, CNTs | yes | Copper foil | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | 32.24 wt% | 600 | 194 |
| [S2] | $SnS_2$ | Carbon hollow structure | yes | Copper foil | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | 24.82 wt% | 696 | 173 |
| [S3] | $SnS_2$ | Sea-sponge structure | yes | Copper foil | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | 21.17 wt% | 530 | 112 |
| [S4] | SnS | CNTs | yes | Copper foil | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | 24.82 wt% | 435 | 108 |
| [S5] | $SnS_2$ | graphene | yes | Ni foam | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with | No collector density data | 582 | / |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 5 wt% of FEC | | | |
| [S6] | $SnS_2$ | MWNTs, C | yes | Ni foam | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | No collector density data | 910 (0.1 A $g^{-1}$) | / |
| [S7] | $SnS_2$ | Carbon paper | no | / | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | Not mentioned | 1006 | / |
| [S8] | $SnS_2$ | Graphene nanoribbons | no | / | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | 52.5 wt% | 1032 | 542 |
| [S9] | SnS | Carbon nanofiber | Free-Standing 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | | | | 444 | / |
| [S10] | $SnS_2$ | graphene foam | No | / | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | Not mentioned | 900 | / |
| This work | $SnS_2$ | rGF fabric | no | / | 1 M $NaClO_4$ in PC and EC (1:1 by volume) along with 5 wt% of FEC | 67.2 wt% | 802 | 539 |

All these data in this blank is found in original papers. The radium of electrode which is not mentioned in some papers is postulated as 12 mm, which actually has no influence on the calculation. The specific capacity (including current collector) is calculated on the basis of Eq. S2:

$$\text{Specific Capacity} = \frac{\text{Reversible Specific Capacity Mentioned in Article}}{m_{active\ material} + m_{binder} + m_{collector}} \quad \text{(S2)}$$

Comparison of the estimated mass loading based on commonly employed CF cloth (CeTech, WOS1002), Al foil (15 μm), Cu foil (9 μm), and our rGF fabrics.

## Supplementary References


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