Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Heterogeneous Interface Designing of Bimetallic Selenides Nanoboxs Enables Stable Sodium Storage

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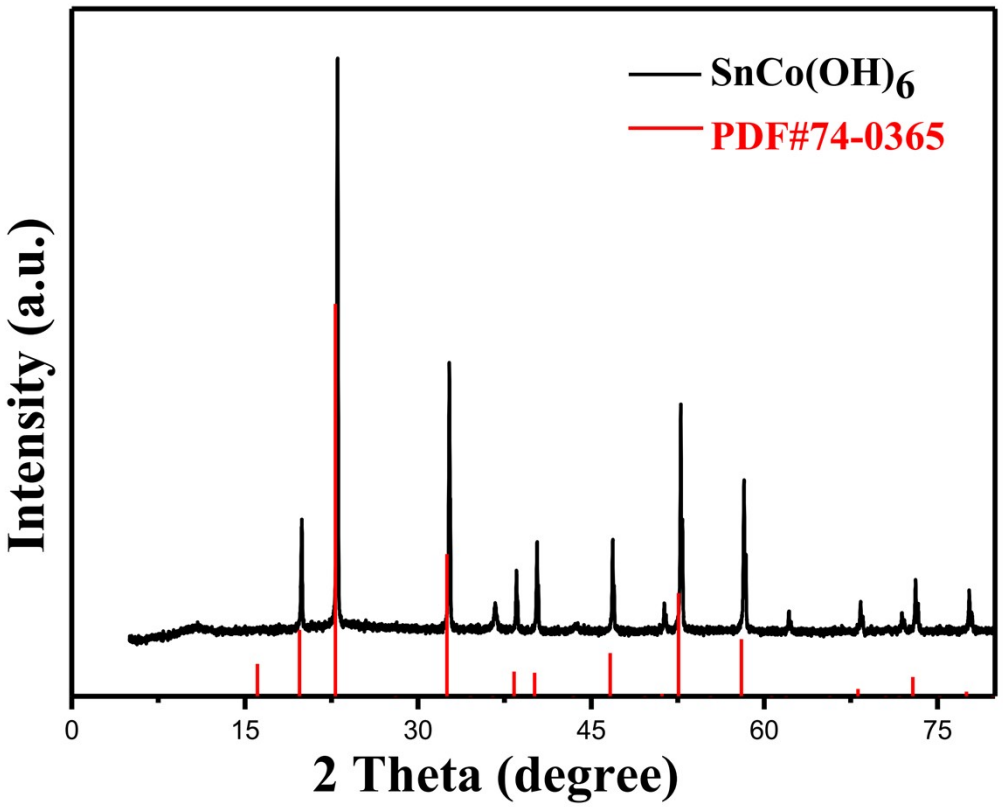

Figure S1. XRD patterns of $SnCo(OH)_6$.

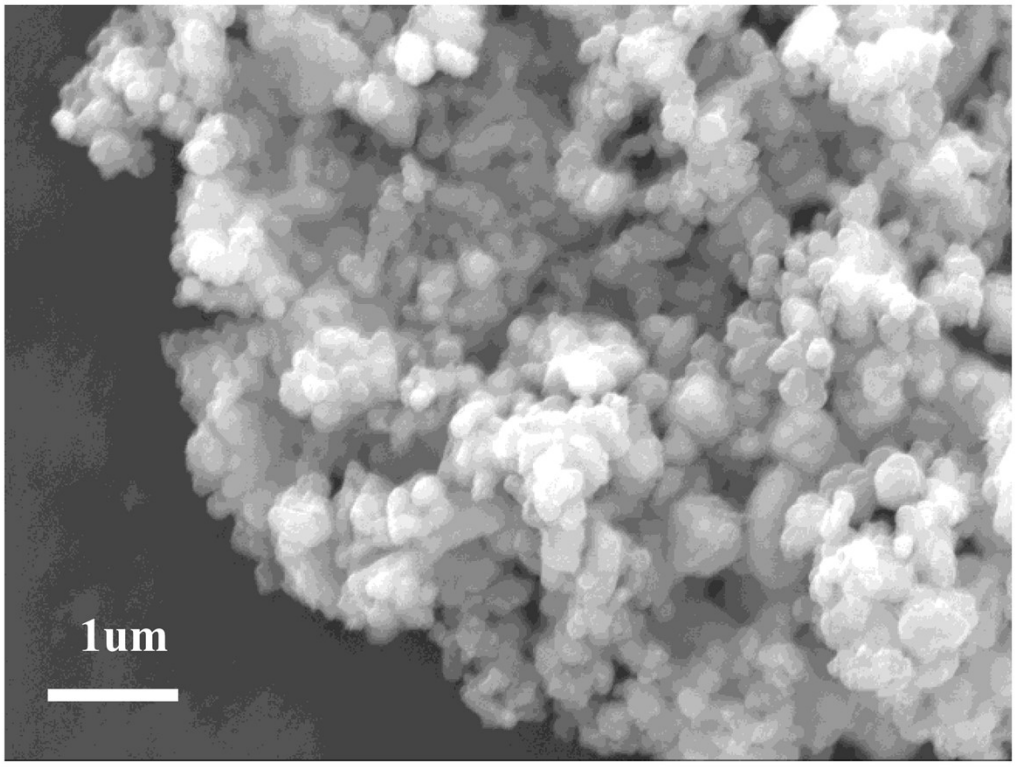

Figure S2. FESEM image of $SnSe_2/CoSe_2$ without PDA shell.

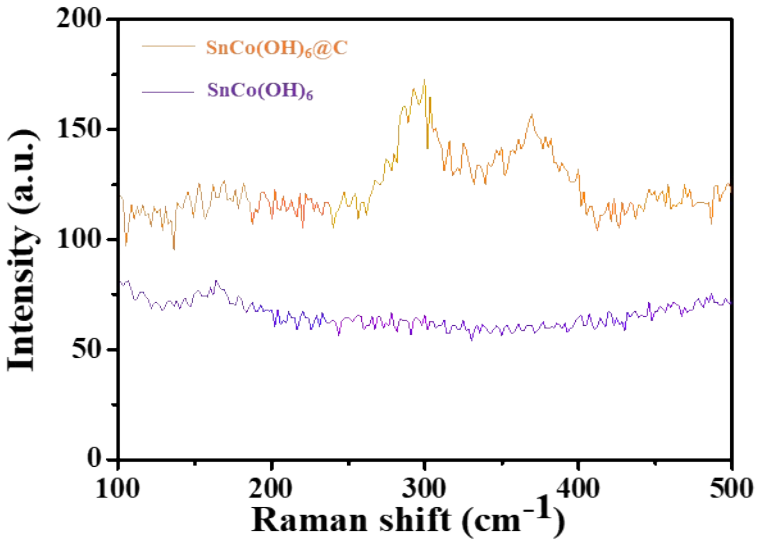

Figure S3. Raman spectras of $SnCo(OH)_6$@C and $SnCo(OH)_6$.

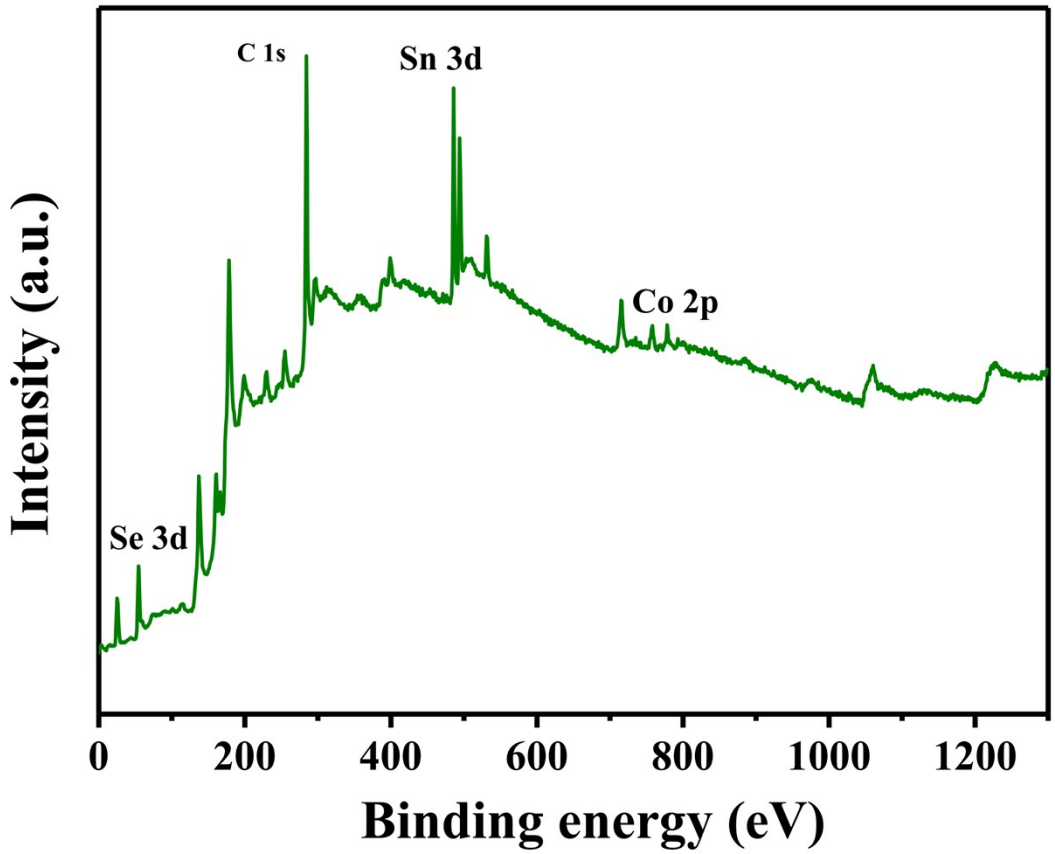

Figure S4. XPS full spectra of $SnSe_2/CoSe_2$@C composite.

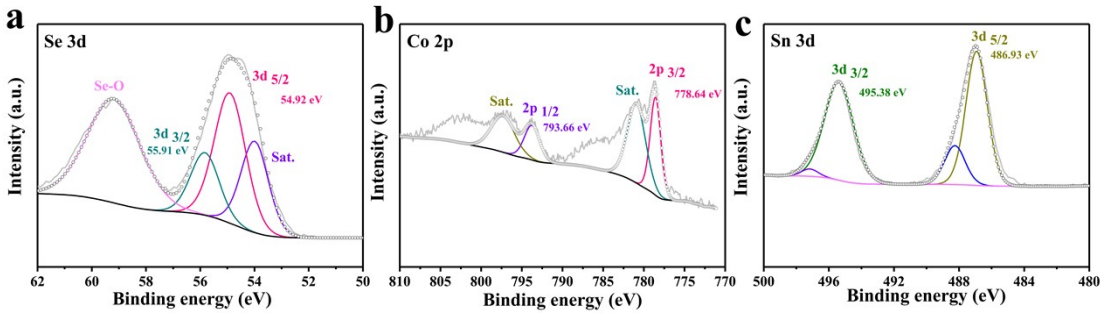

Figure S5. XPS spectra of $SnSe_2$-$CoSe_2$ composite (a) Se 3d. (b) Co 2p (c) Sn 3d.

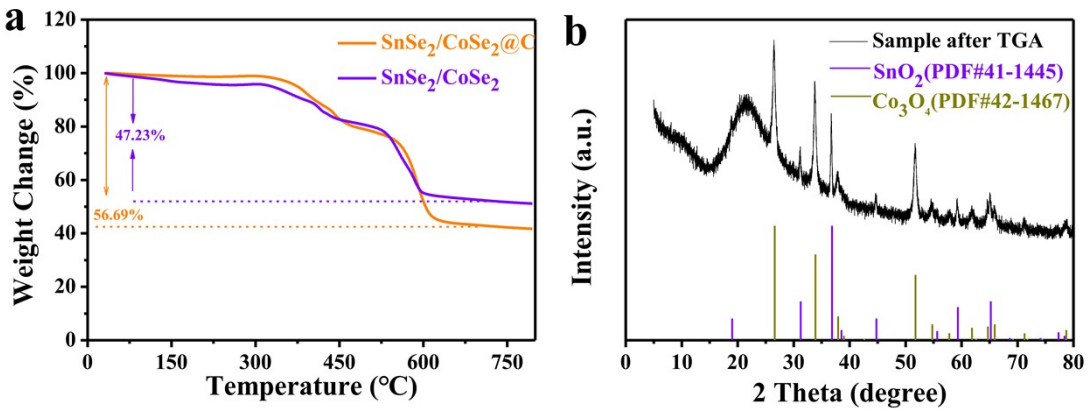

Figure S6. (a) TGA curves of $SnSe_2/CoSe_2$@C composite. (b) XRD curves after TGA test.

As shown in **Figure S6a**, the weight changes of the $SnSe_2/CoSe_2$@C and $SnSe_2/CoSe_2$ are 56.69 and 47.23% in the TGA test, respectively. In detail, the weight of the material does not change before about 300 °C, but as the temperature continues to rise, the weight shows a slow downward trend until it stops at about 450 °C. This process is attributed to the oxidation as the materials are heated in air, forming metal oxide and selenium dioxide, respectively. Continue to heat, the weight of the material drops sharply and stabilizes when it reaches about 610 °C. This process is due to the combustion of carbon to produce carbon dioxide and gasification of selenium dioxide. The XRD patterns of residue after TGA are shown in **Figure S6b**, which confirm the existence of SnO_2 (PDF#41-1445) and Co_3O_4 (PDF#42-1467)

Contacting the reported works, the reaction process that may occur in the TGA test is as follows:

1. 30~300 °C：No change.

2. 300~450 °C：Chemical reaction between materials and oxygen to

produce SnO_2, Co_3O_4, and SeO_2. The chemical reaction formula may be described as:

$$3SnSe_2/CoSe_2 + 17O_2 \rightarrow 3SnO_2 + Co_3O_4 + 12SeO_2 \quad (1)$$

3. 450~610 °C: Gasification of selenium dioxide and combustion of carbon.

4. 600~800 °C: Residual metal oxide.

The proportion of carbon in the material can be calculated by the following equation:

$$56.69\%m = 47.23\%\ mn + m(1-n) \quad (2)$$

In the formula, m, n and $(1-n)$ respectively represent the total mass of the $SnSe_2/CoSe_2$@C and the proportion of $SnSe_2/CoSe_2$ and C in $SnSe_2/CoSe_2$@C.

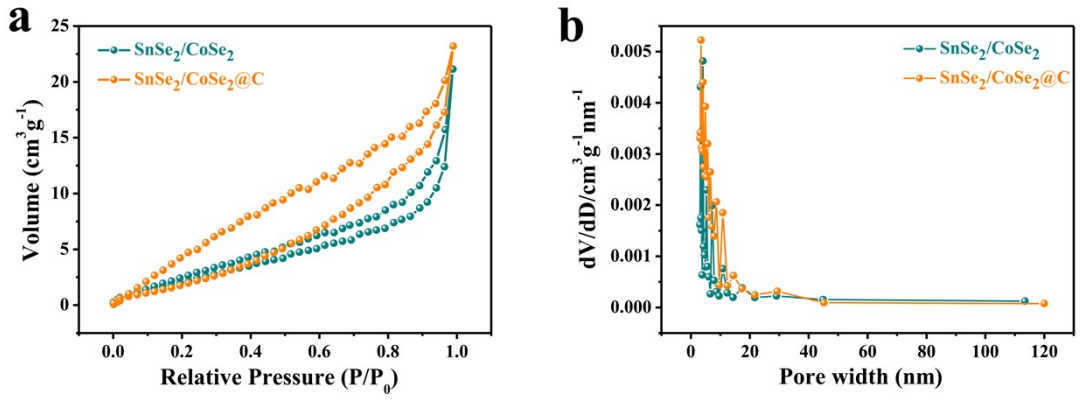

Figure S7. The N_2 adsorption-desorption isotherms and pore volume of $SnSe_2/CoSe_2$@C and $SnSe_2/CoSe_2$.

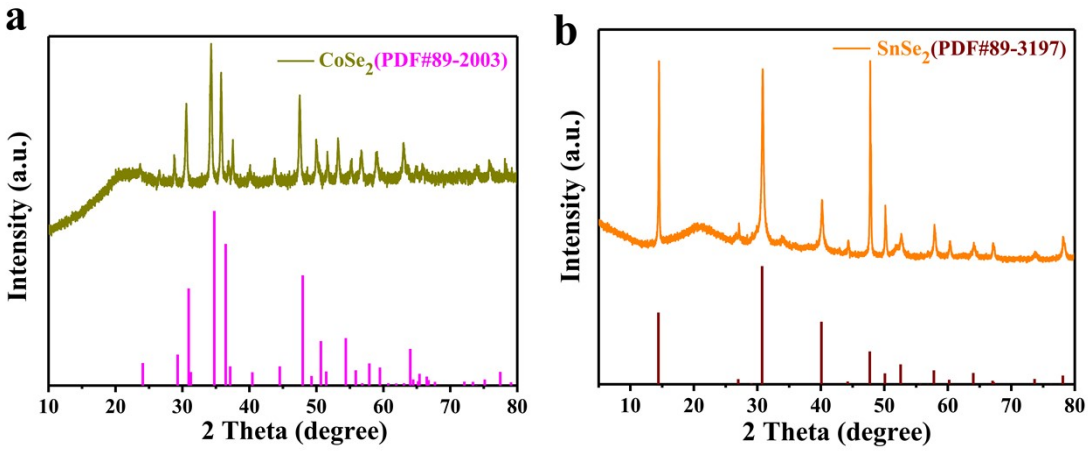

Figure S8. XRD patterns of (a) $CoSe_2$ and (b) $SnSe_2$

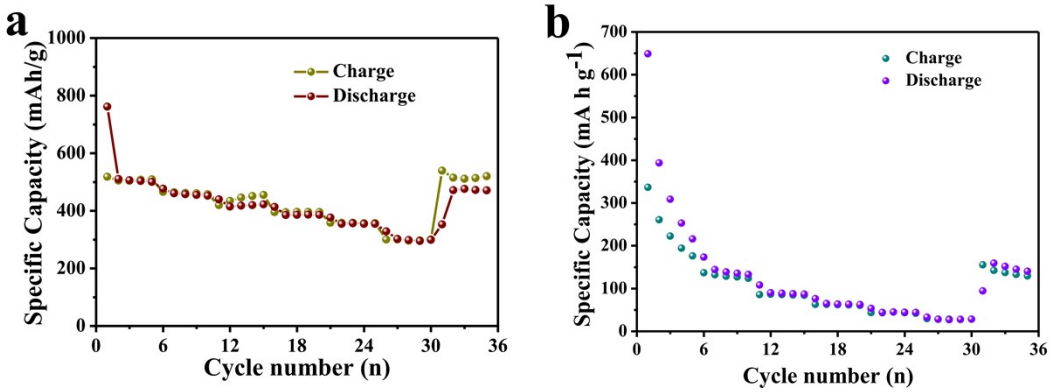

Figure S9. Rate performance of (a) $SnSe_2/CoSe_2$ and (b) $SnSe_2$-$CoSe_2$.

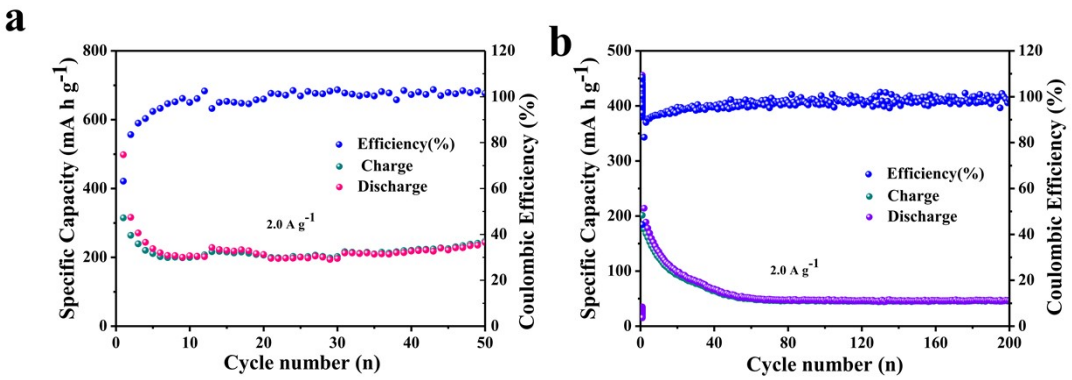

Figure S10. Cycle performance of (a) $SnSe_2/CoSe_2$ and (b) $SnSe_2$-$CoSe_2$.

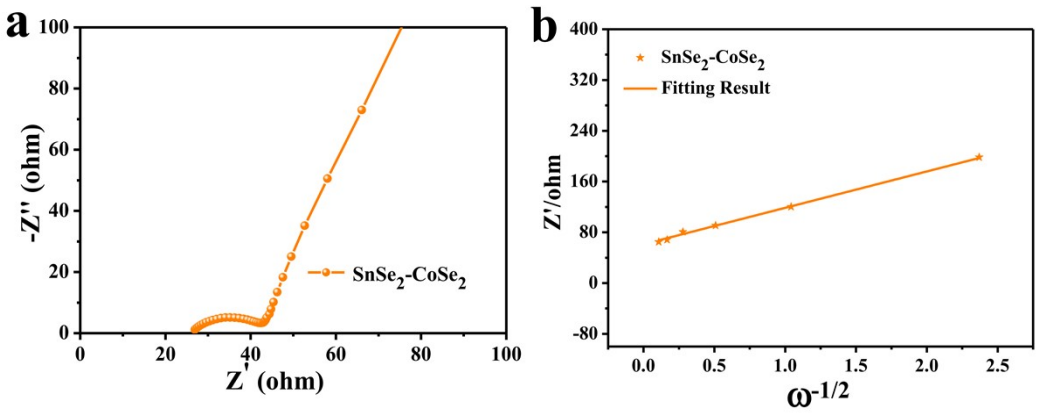

Figure S11. (a) The impedance test results and (b) fitting results of $SnSe_2$-$CoSe_2$.