

Supporting Information

A solid-state Matryoshka doll-like microwave method for one-step rapid synthesis of composites of NiSe₂ and nitrogen-doped porous carbon for sodium storage

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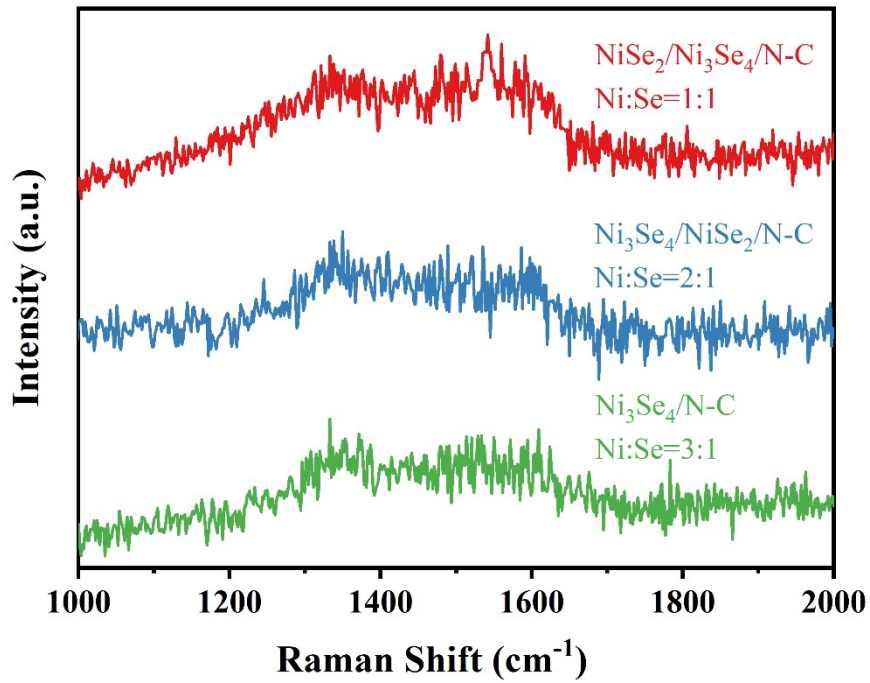


Figure S1. Raman patterns of samples with different mass ratios of Ni/Se: NiSe₂/Ni₃Se₄/N-C, Ni₃Se₄/NiSe₂/N-C and Ni₃Se₄/N-C.

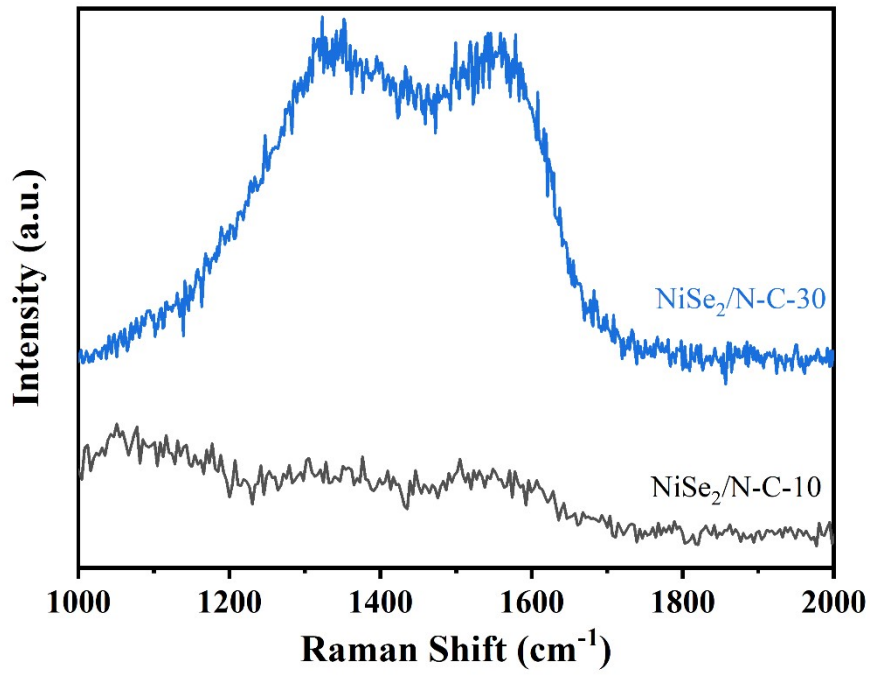


Figure S2. Raman patterns of samples with different microwave time: NiSe₂/N-C-10 and NiSe₂/N-C-30.

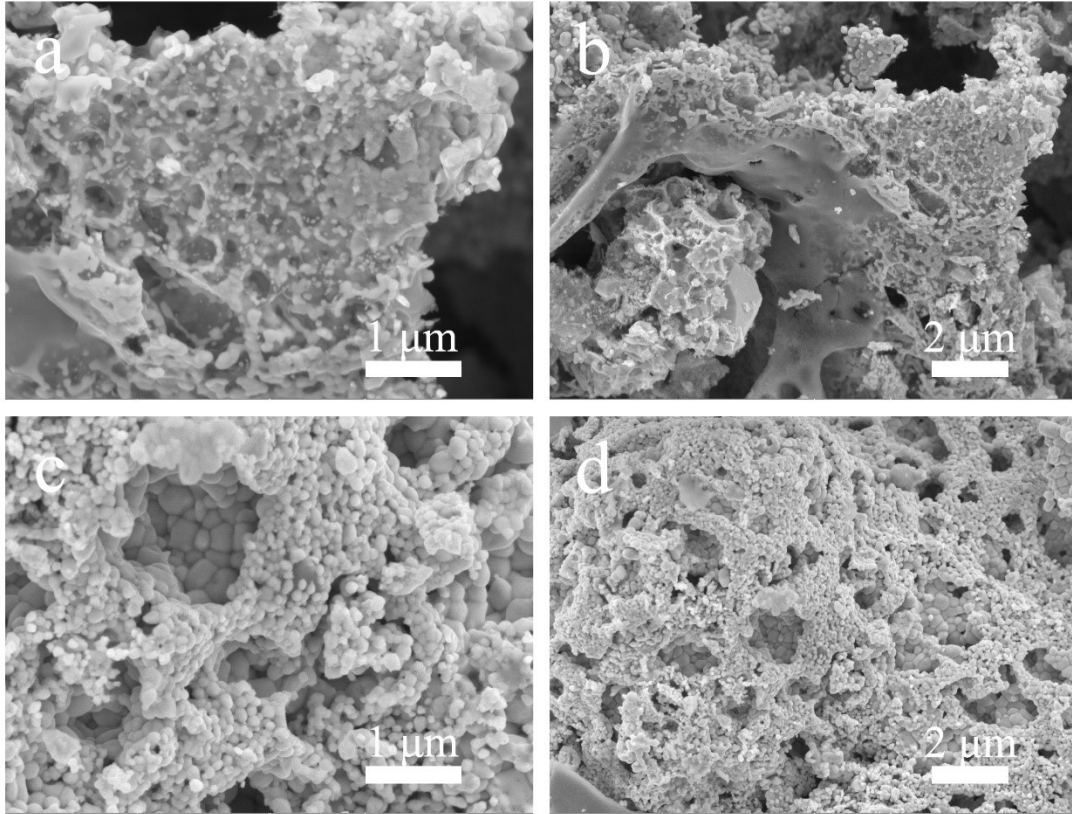


Figure S3. SEM images of samples with different time, a-b) $\text{NiSe}_2/\text{N-C-10}$ and c-d) $\text{NiSe}_2/\text{N-C-30}$.

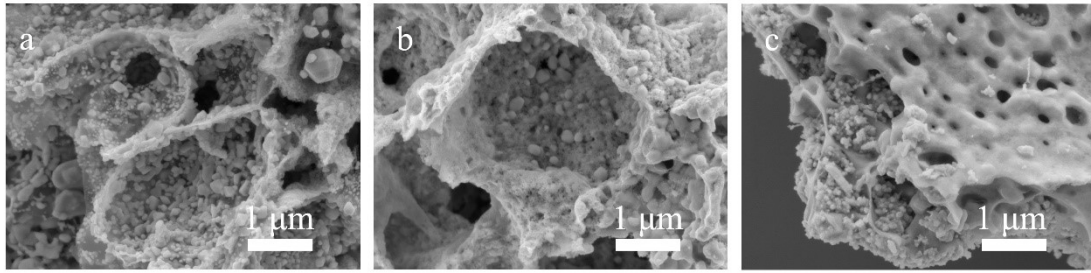


Figure S4. SEM images of samples with different mass ratios, a) $\text{NiSe}_2/\text{Ni}_3\text{Se}_4/\text{N-C}$, b) $\text{Ni}_3\text{Se}_4/\text{NiSe}_2/\text{N-C}$ and c) $\text{Ni}_3\text{Se}_4/\text{N-C}$.

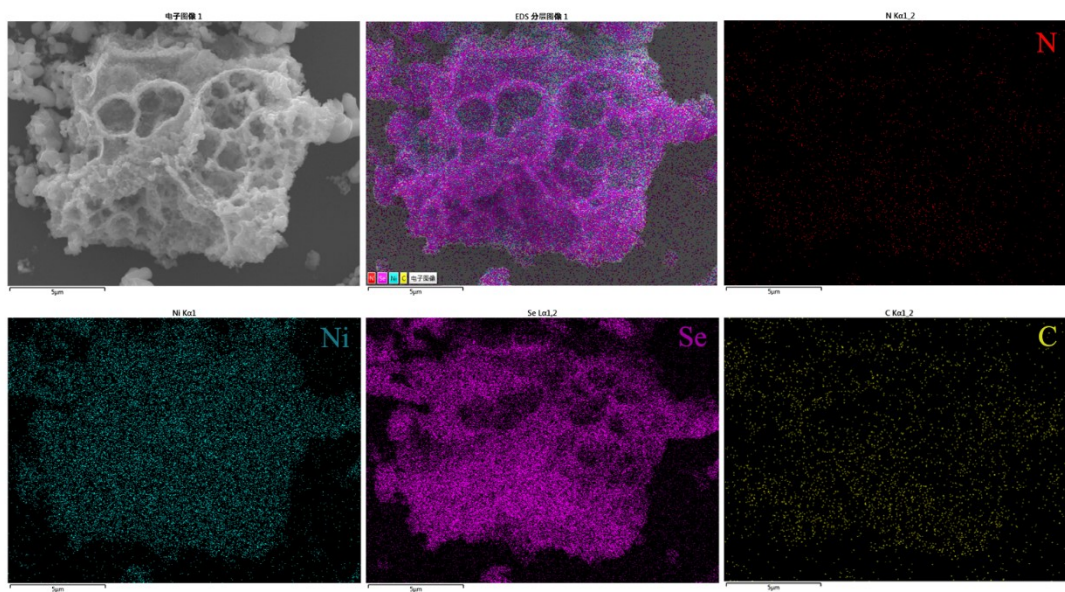


Figure S5. Elemental mapping images of NiSe₂/N-C.

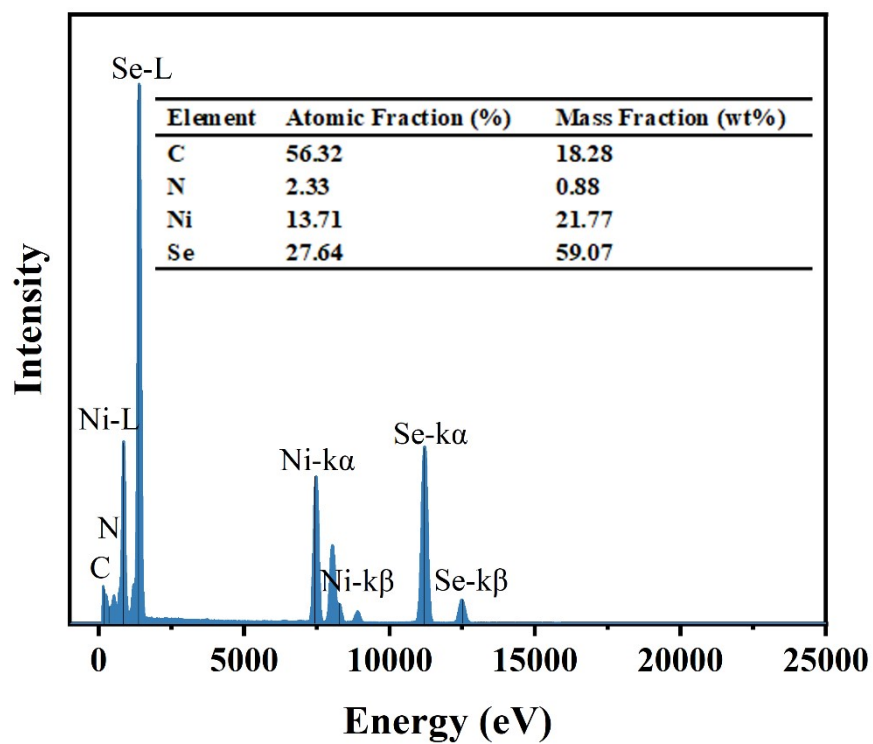


Figure S6. EDS of NiSe₂/N-C.

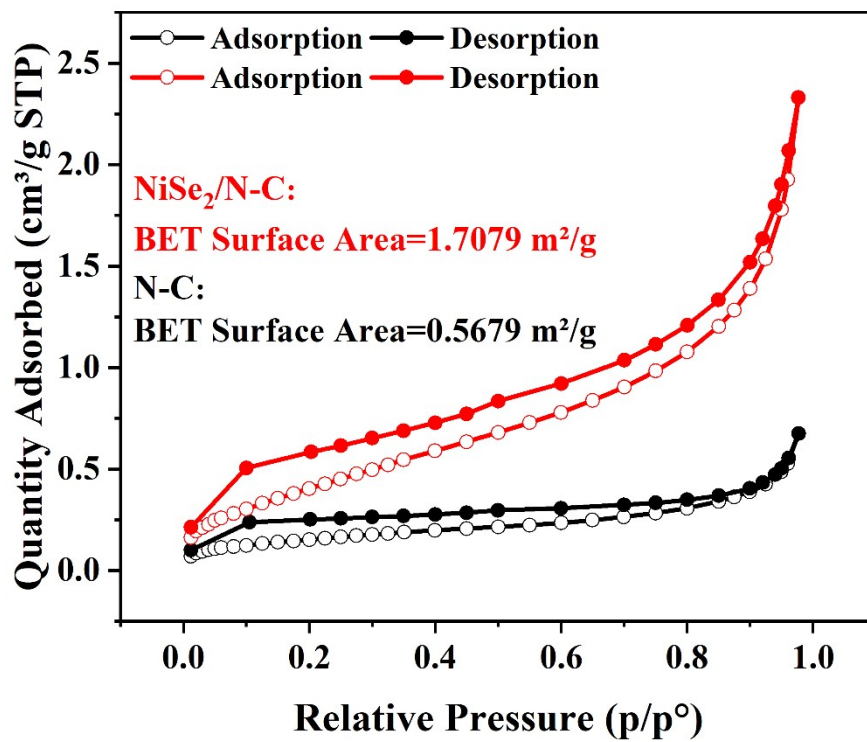


Figure S7. The N₂ adsorption-desorption isotherms.

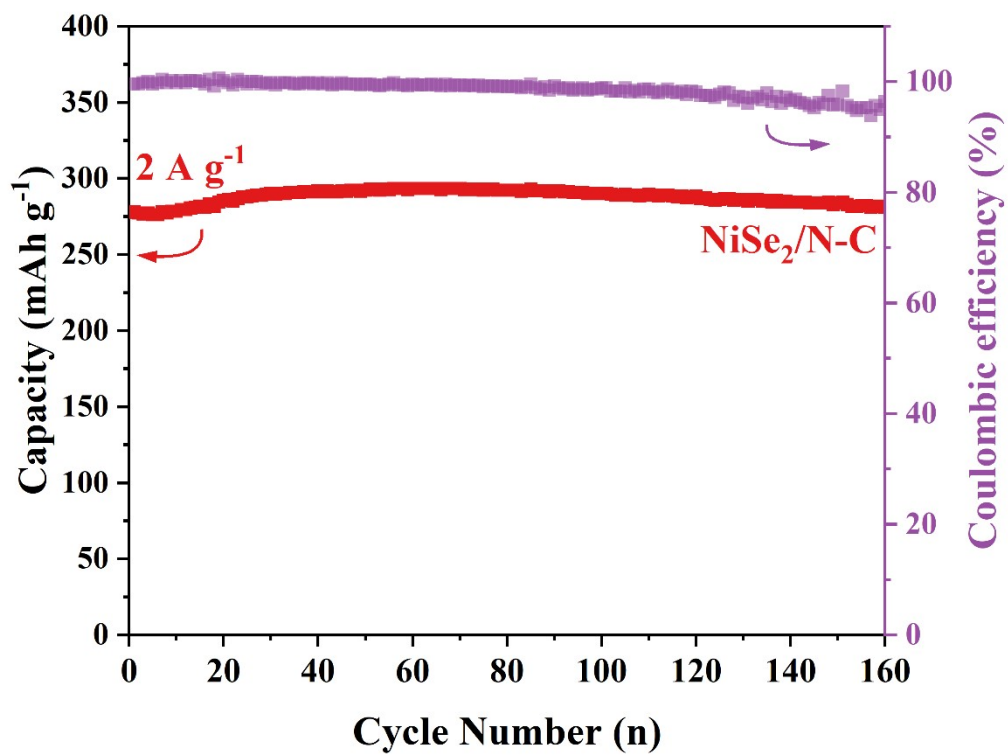


Figure S8. the cycling performance of NiSe₂/N-C at 2 A g⁻¹.

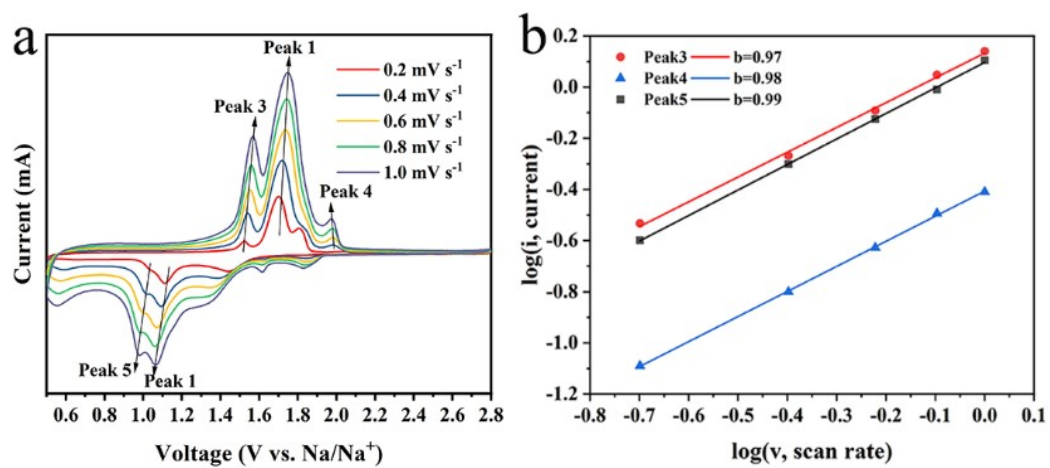


Figure S9. a) CV curves at different scan rates. b) The linear relationship of $\log(v)$ and $\log(i)$.

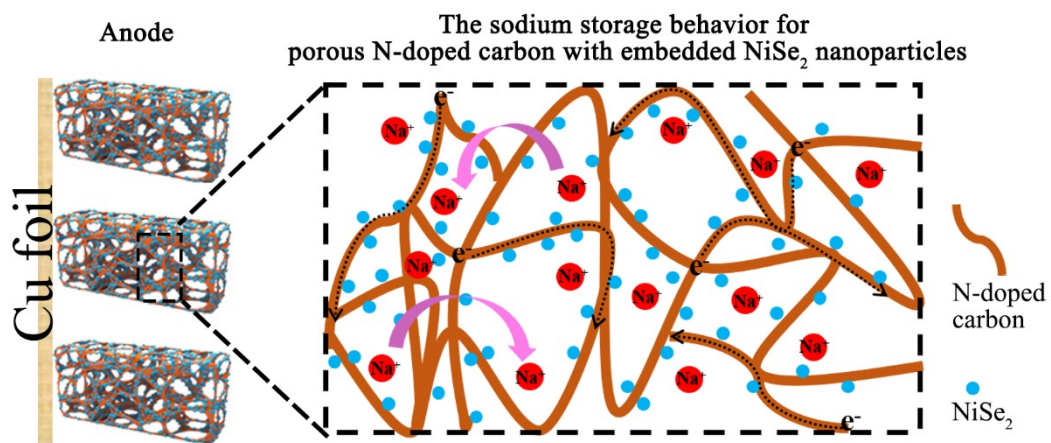


Figure S10. The mechanism of sodium storage behavior.

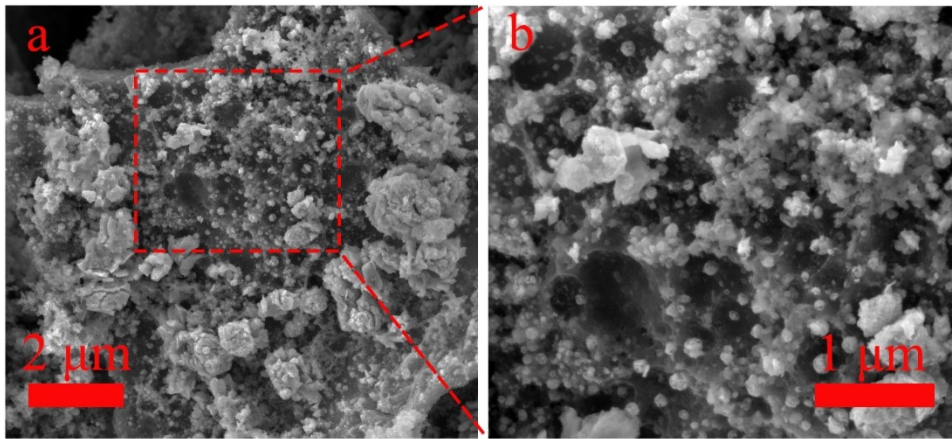


Figure S11. SEM images of the cycled NiSe₂/N-C electrode.

Table S1. R_s (Ω), R_1 (Ω), W (Ω) and R_2 (Ω) of NiSe₂/N-C electrode.

| Sample | R_s (Ω) | R_1 (Ω) | W (Ω) | R_2 (Ω) |
|----------------|--------------------|--------------------|------------------|--------------------|
| 1st cycle | 9.481 | 12.74 | 0.459 | - |
| 25th cycles | 8.46 | 12.79 | 0.440 | - |
| 200th cycles | 10.09 | 18.09 | 0.378 | - |
| Charge 0.8V | 8.499 | 14.75 | 0.164 | - |
| Charge 2V | 7.689 | 33.56 | 0.472 | - |
| Discharge 0.8V | 9.471 | 15.81 | 0.472 | 8.884 |
| Discharge 2V | 8.93 | 18.69 | 0.428 | 11.66 |

Table S2. DFT calculation results of adsorption energies.

| Species | E_{Na}/eV | $E_{\text{anode}}/\text{eV}$ | $E_{\text{sodiated anode}}/\text{eV}$ | $E_{\text{adsorption energy}}/\text{eV}$ |
|-------------------|---------------------------|------------------------------|---------------------------------------|--|
| NiSe ₂ | -1299.856444 | -164488.3032 | -165789.0962 | -0.936520295 |