Electronic Supplementary Material (ESI) for Dalton Transactions.

Support Information

Optimized crystal orientation for enhanced reaction kinetics and reversibility of SnSe/NC hollow nanospheres towards high-rate and long-cyclic lithium/sodium storage

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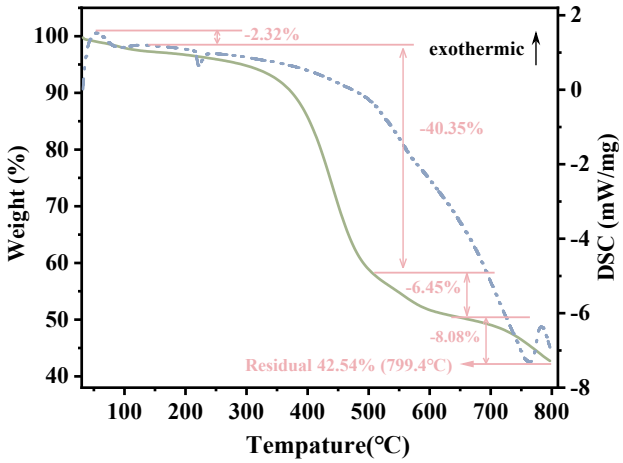

Fig. S1. The DSC curve of SnSe/NC.

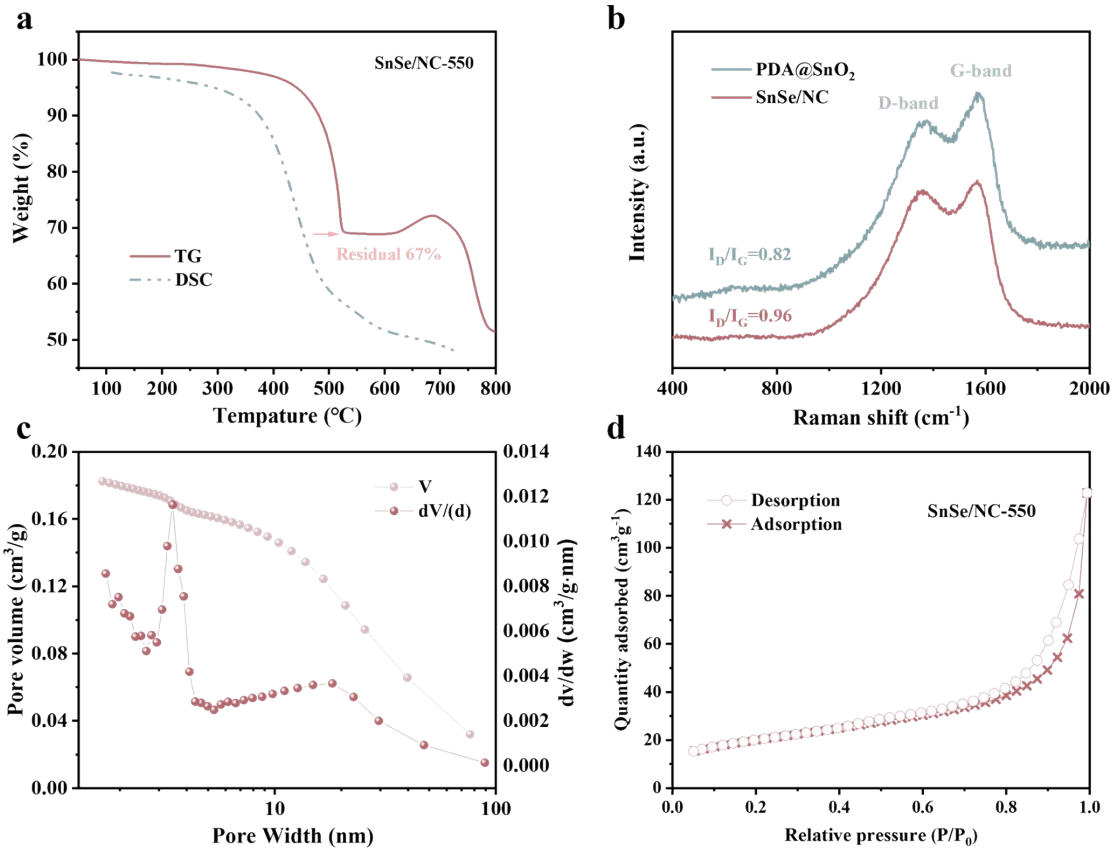

Fig. S2. Structural characterizationof SnSe/NC. (a) Thermogravimetric analysis TGA curve. (b) Raman spectrum. (c, d)Nitrogen adsorption-desorption isotherms and the corresponding pore size distribution.

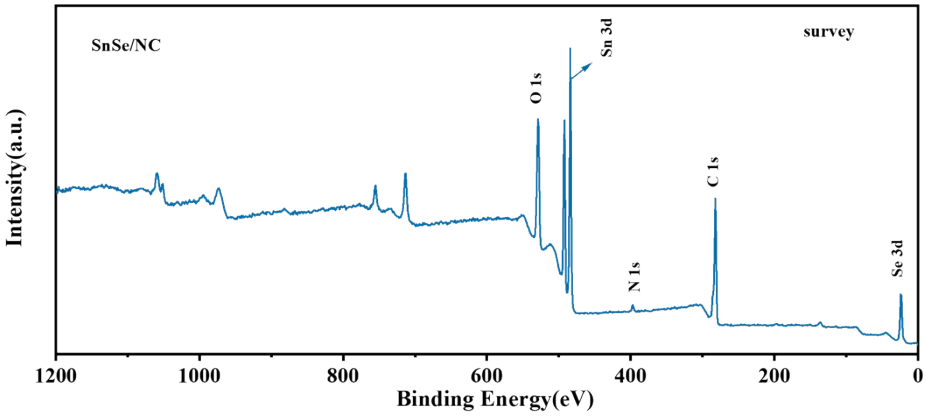

Fig. S3. XPS full spectrum of SnSe/NC hollow nanospheres.

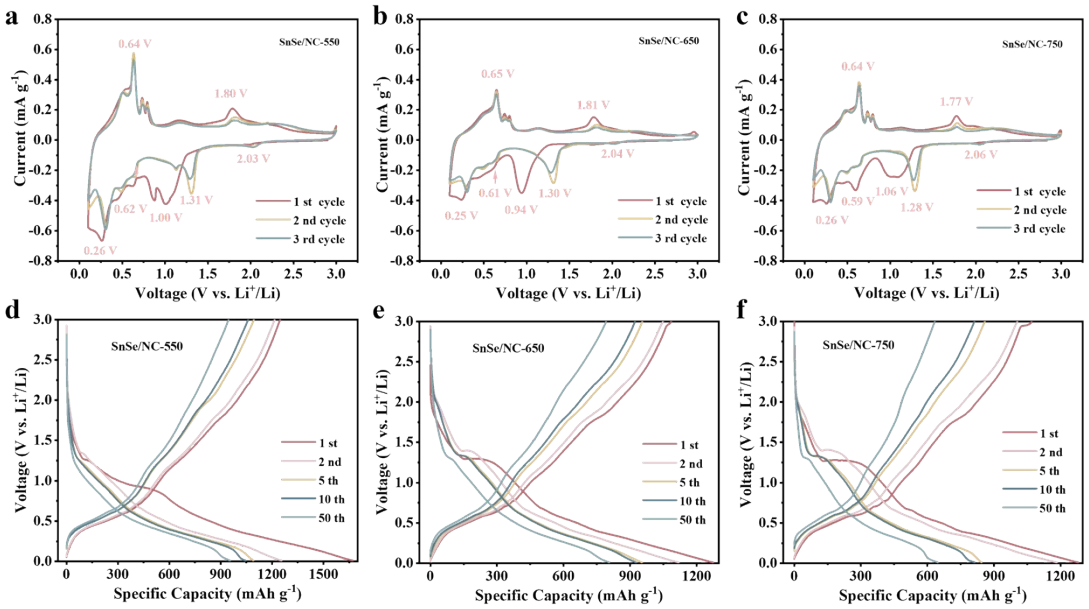

Fig. S4. (a-c) CV curves for the first three turns of CV at 0.1 mv s^{-1} scanning rate for SnSe/NC-550, SnSe/NC-650 and SnSe/NC-750. (d-f) GCD curves of three crystal surface characteristics at a current density of 300 mA g^{-1}.

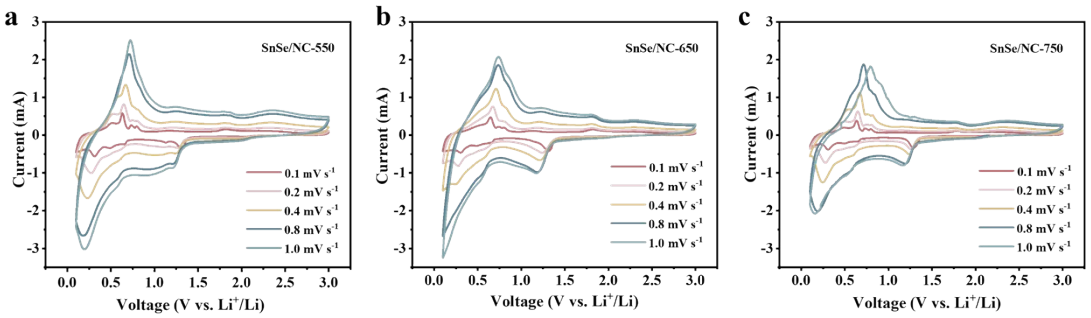

Fig. S5. (a-c) CV curves of SnSe/NC-550, SnSe/NC-650, and SnSe/NC-750.

Table S1. The fitted values of impedance for SnSe/NC-550, SnSe/NC-650 and SnSe/NC-750 before and after cycling.

Sample	Rs before（after）cycling	Rf before（after）cycling	Rct before（after）cycling
SnSe/NC-550	4.65 (13.12)	1.99 (60.84)	229.30 (9.25)
SnSe/NC-650	3.60 (42.10)	63.66 (18.25)	76.47 (90.39)
SnSe/NC-750	3.99 (21.95)	21.77 (14.56)	195.70 (45.39)

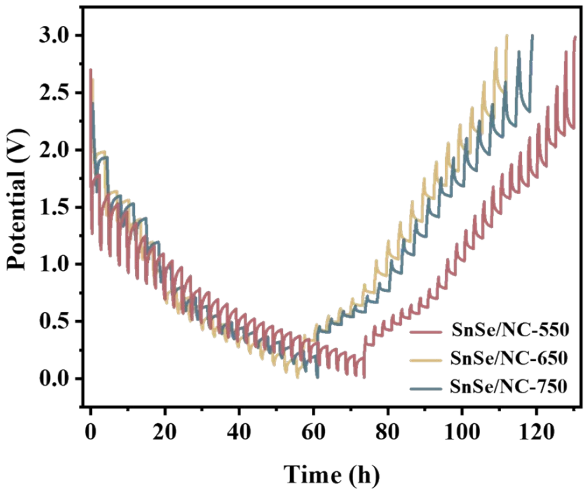

Fig. S6. GITT curves in the three electrodes at discharge/charge states.

GITT measurements: To activate the battery, five cycles at a current density of 300 mA g^{-1} were conducted on the LANHE tester, ending with the the charge process. To obtain the discharge curves of GITT, repeated discharge-relaxation processes at a current density of 50 mA g^{-1} were performed on the electrochemical station (CHI 660). The cut-off voltage is 0.01 V and all steps take 10 min. Similarly, the symmetrical charge curves were obtained by repeated charge-relaxation processes until a cut-off voltage of 3 V.

Calculation of D_{Li+} is according to the following formula：

$$D = \frac{4}{\pi\tau}\left(\frac{n_m V_m}{S}\right)^2\left(\frac{\Delta E_s}{\Delta E_t}\right)^2$$

Where D is the diffusion coefficient, τ is relaxation time, n_m is mole number, V_m is the molar volume of active material, S is electrode area, ΔE_s is the voltage change caused by an impulse, ΔE_t is the voltage change of galvanostatic charge-discharge.

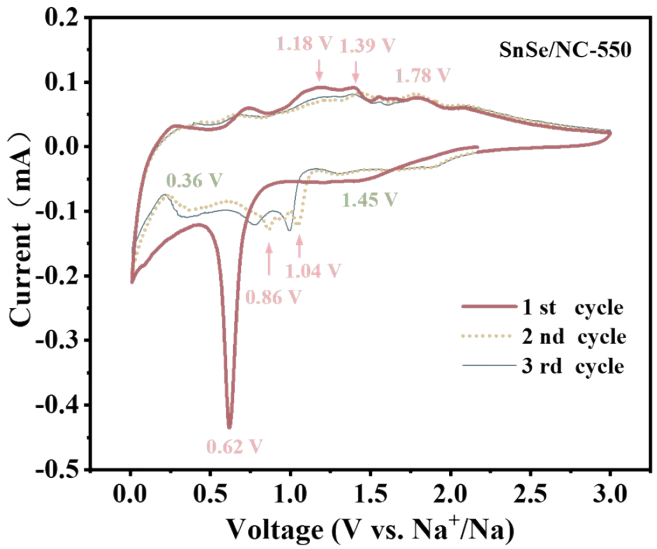

Fig. S7. The first three turns of the CV curve for SnSe/NC at a scan rate of 0.1 mV s^{-1}.

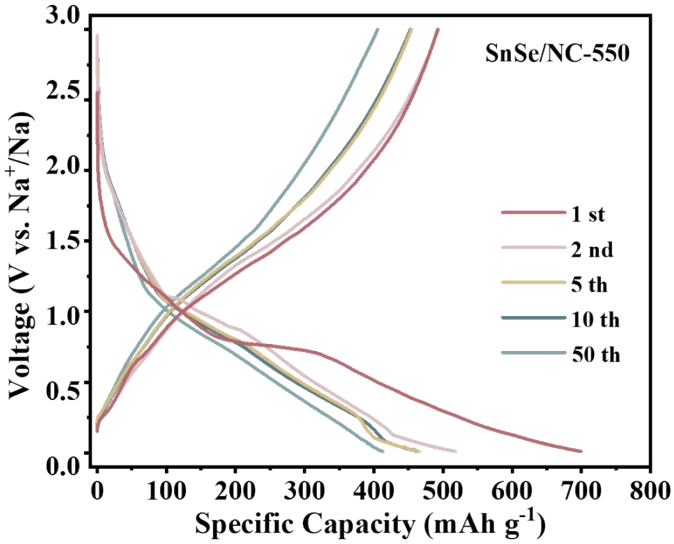

Fig. S8. The discharge/charge curves for the SnSe/NC-550 electrode at a current density of 100 mA g^{-1}.

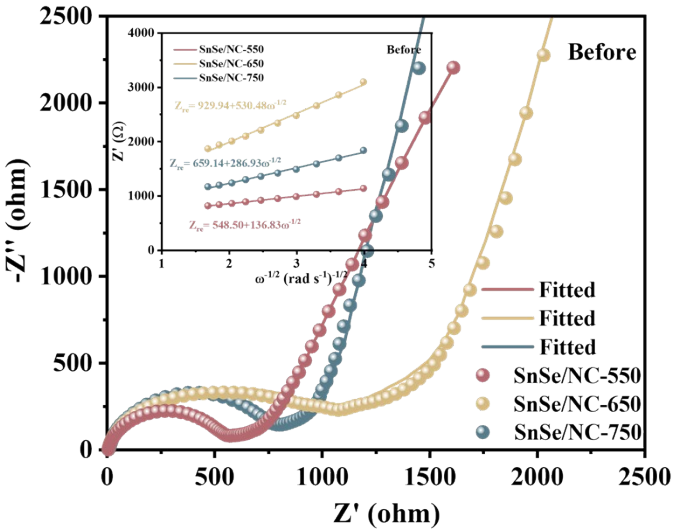

Fig. S9. EIS curves of SnSe/NC electrodes with three crystal features before cycling.

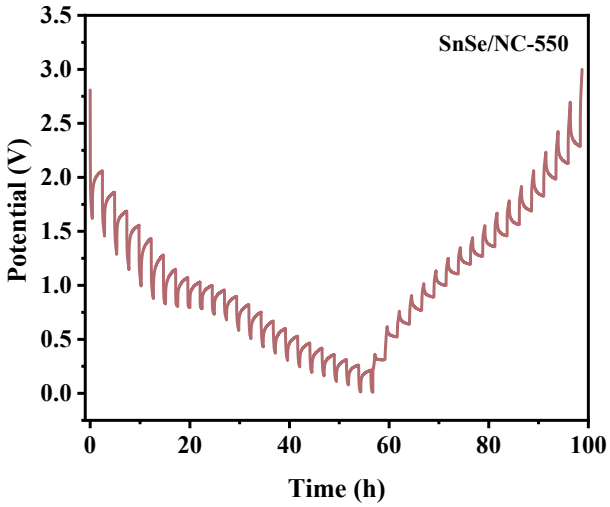

Fig. S10. GITT curves of sodium ions in the electrode at discharge/charge states.

Table S2. The fitted values of impedance for SnSe/NC-550, SnSe/NC-650 and SnSe/NC-750 before and after cycling

Sample	Rs before（after）cycling	Rf before（after）cycling	Rct before（after）cycling
SnSe/NC-550	5.27 (5.45)	512.50 (448.50)	146.40 (505.40)
SnSe/NC-650	0.94 (8.38)	274.60 (454.00)	596.90 (776.00)
SnSe/NC-750	4.90 (5.94)	651.20 (224.3)	28.49 (971.60)

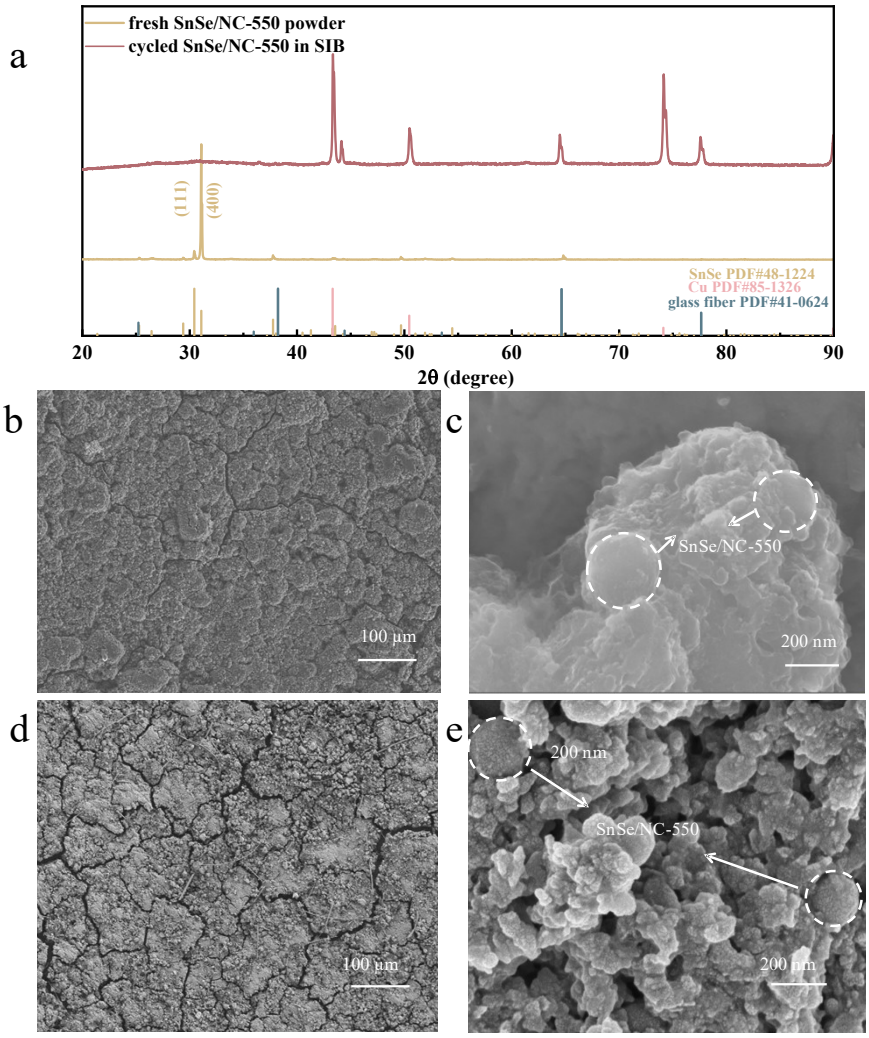

Fig. S11. Morphology and composition analysis of SnSe/NC-550 after 100 cycles. (a) XRD patterns. (b,c) SEM of electrode and powder in LIBs. (d,e) SEM of electrode and powder in SIBs