Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Supporting Information

Tessellated-like N-doped carbon/ $CoSe_2$ as trap-catalyst sulfur hosts for room-temperature sodium-sulfur batteries

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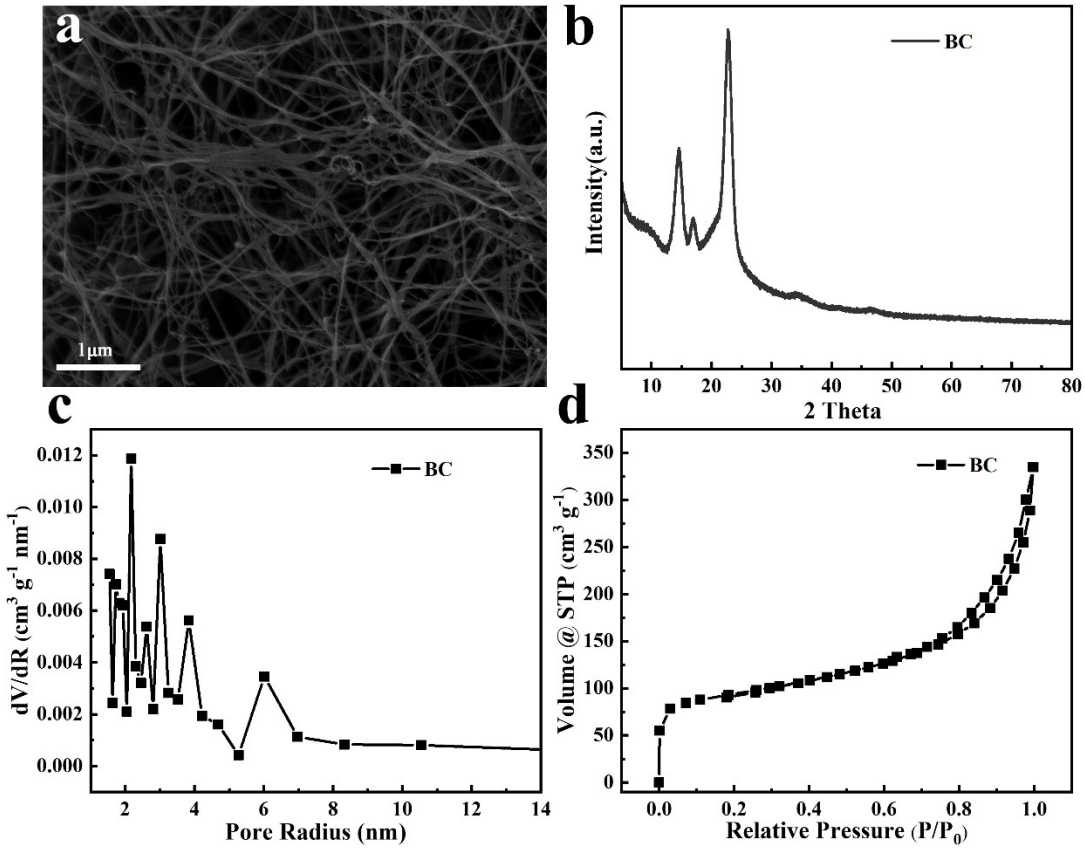

Fig. S1. Physical characterizations of BC: a) FESEM images, b) XRD pattern, and c,d) Pore-size distribution and N_2 adsorption/desorption curves.

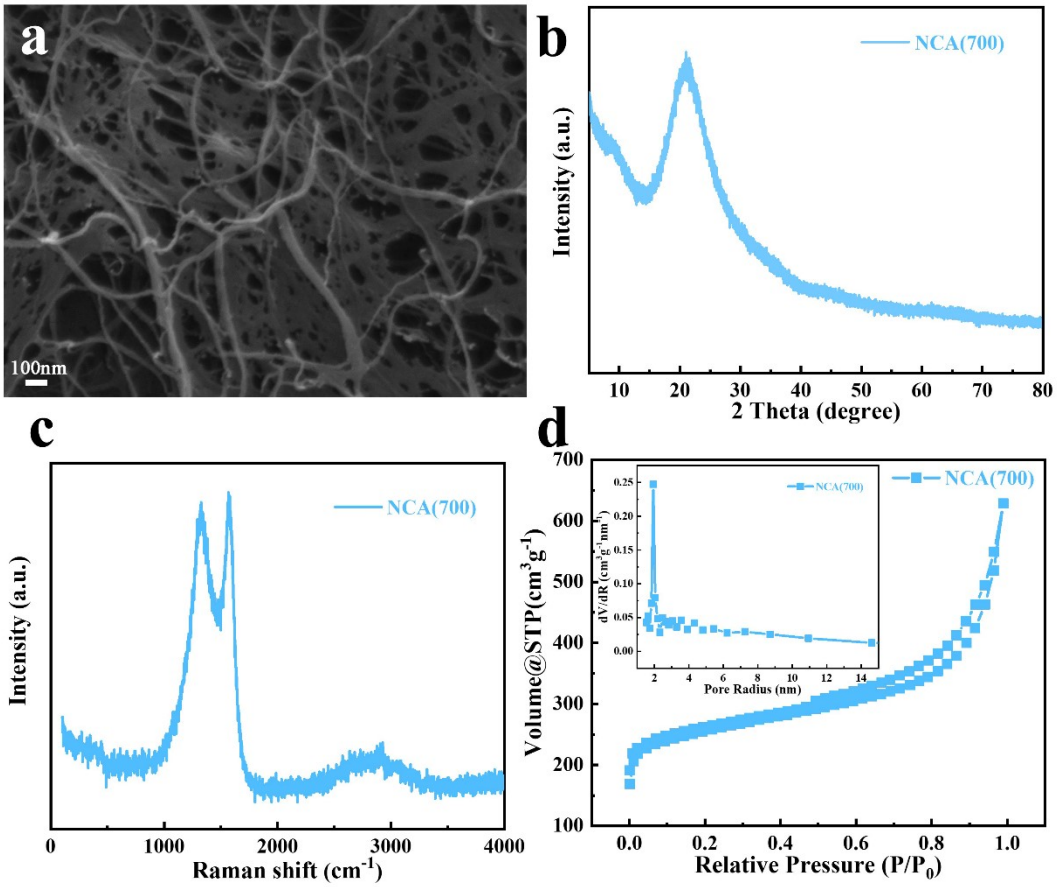

Fig. S2. Physical characterizations of NCA(700): a) FESEM images, b) XRD pattern, c) Raman spectrum, and d) Pore-size distribution and N_2 adsorption/desorption curves.

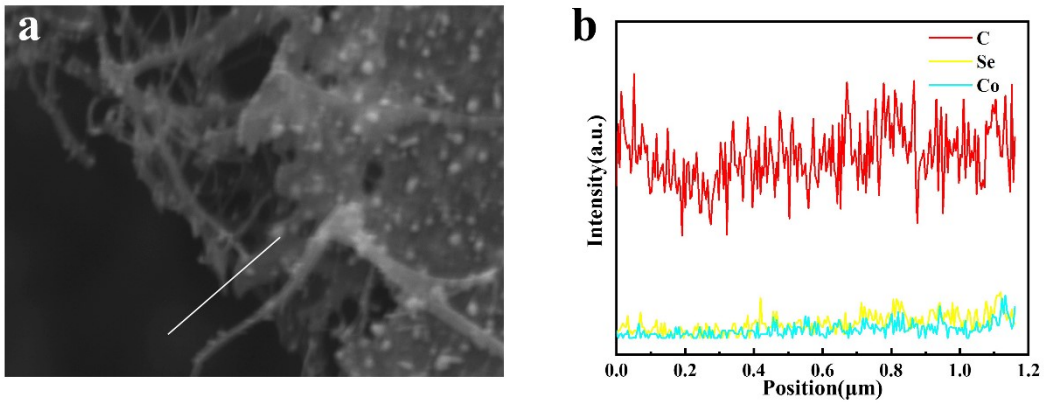

Fig. S3. a) FESEM images of NCCS, and b) linear elemental distribution.

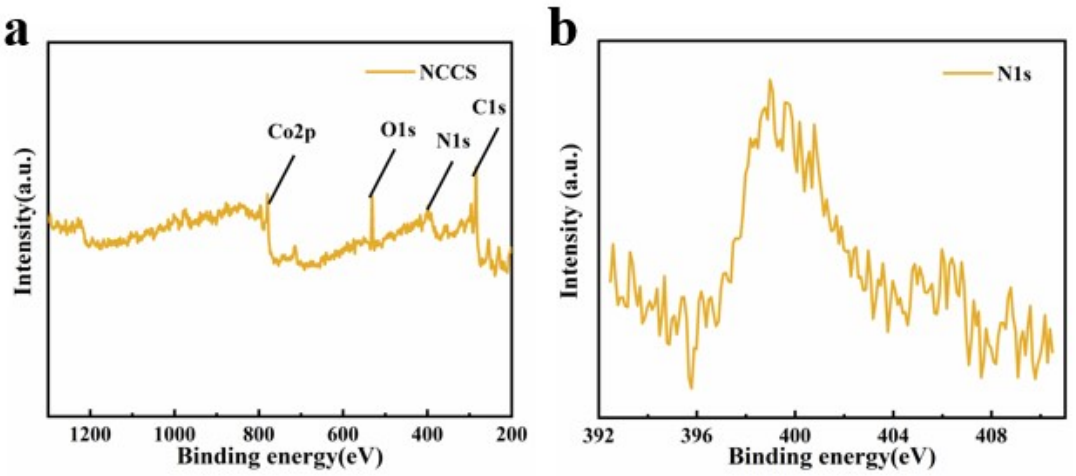

Fig. S4. a) XPS full spectrum of NCCS, and b) the precise spectrum of N1s.

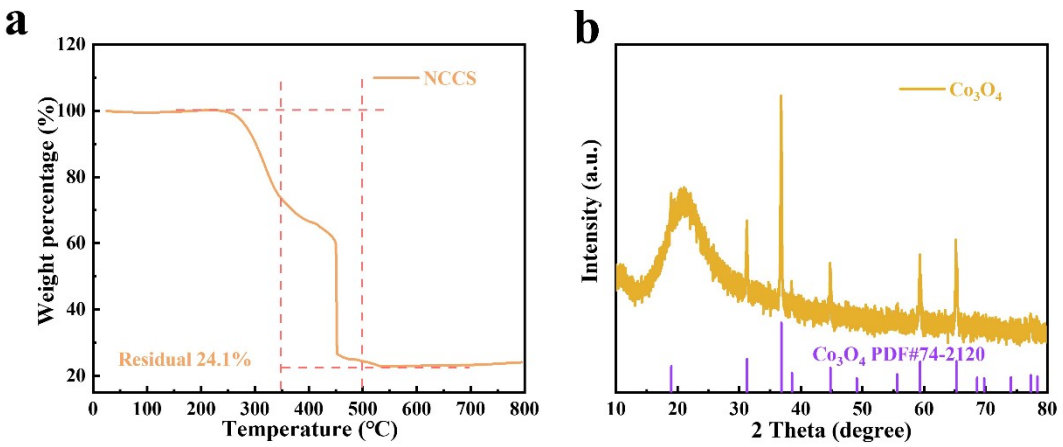

Fig. S5. (a) TGA and DSC curves of NCCS under O_2 condition, and (b) XRD pattern of TGA tested residual.

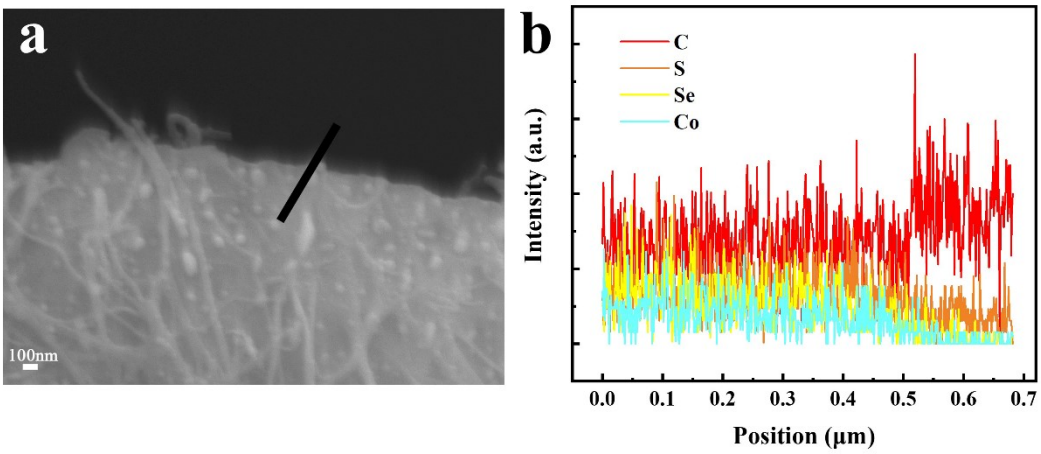

Fig. S6. a) FESEM images of NCCS@S, and b) linear elemental distribution.

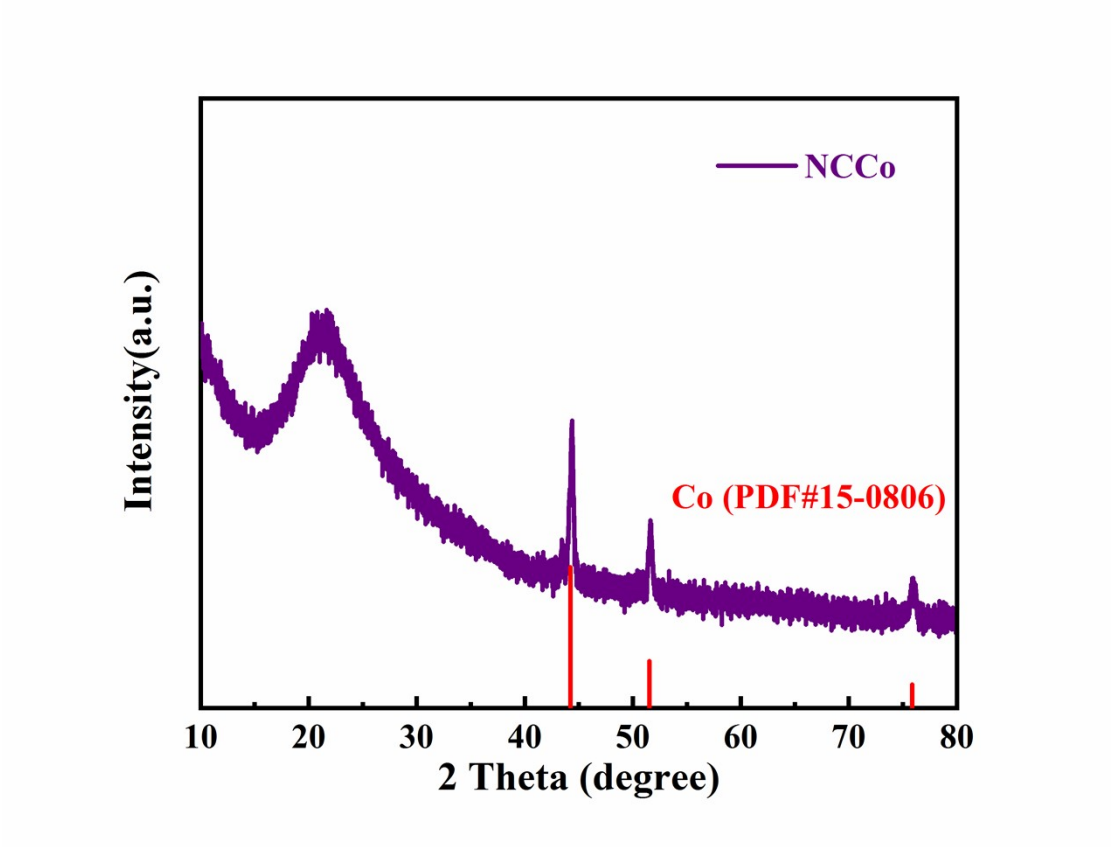

Fig. S7. XRD pattern of NCCo (NCCS before selenazation).

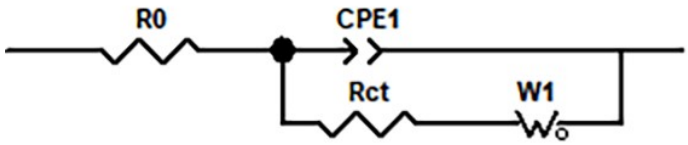

Fig. S8. Corresponding fitting circuit diagram.

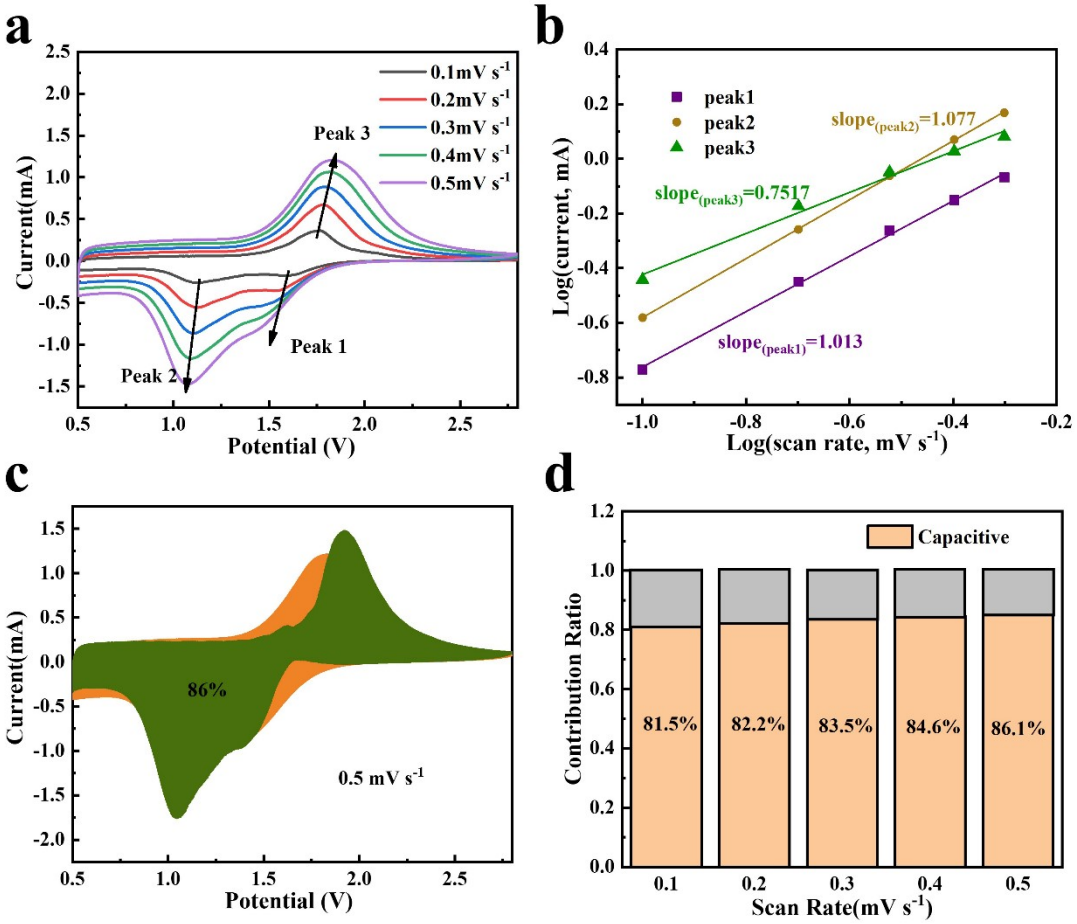

Fig. S9. (a) CV curves of NCCS@S at different scan rates from 0.1mV s^{-1} to 0.5mV s^{-1} after 100 cycling at 1C, (b) The fitted lines between log i and log v, (c) Capacitive contribution of NCCS@S at 0.5 mV s^{-1}, and (d) The percentage of capacitive contribution at different scan rates.

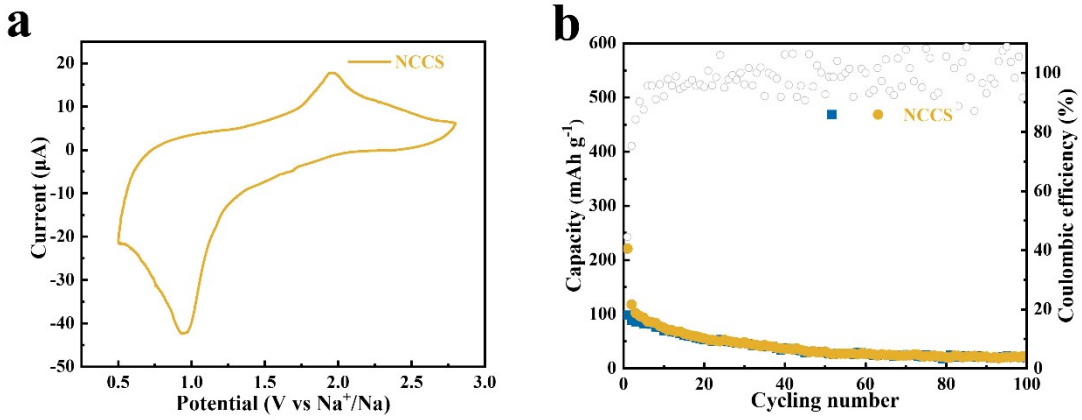

Fig. S10. a) Cyclic voltammetry curves at a scan rate of 0.1 mV s^{-1}, and b) Cycling performance of NCCS electrode at 1C.

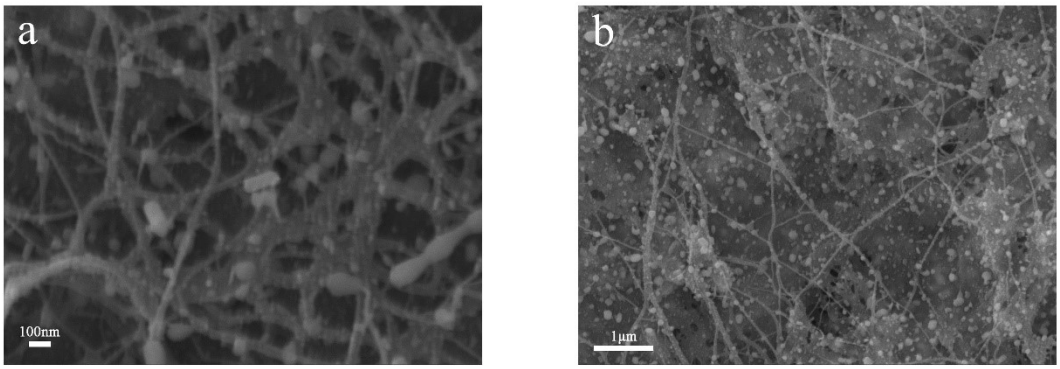

Fig. S11. FESEM images of NCCS@S after 100 cycling at 1C.

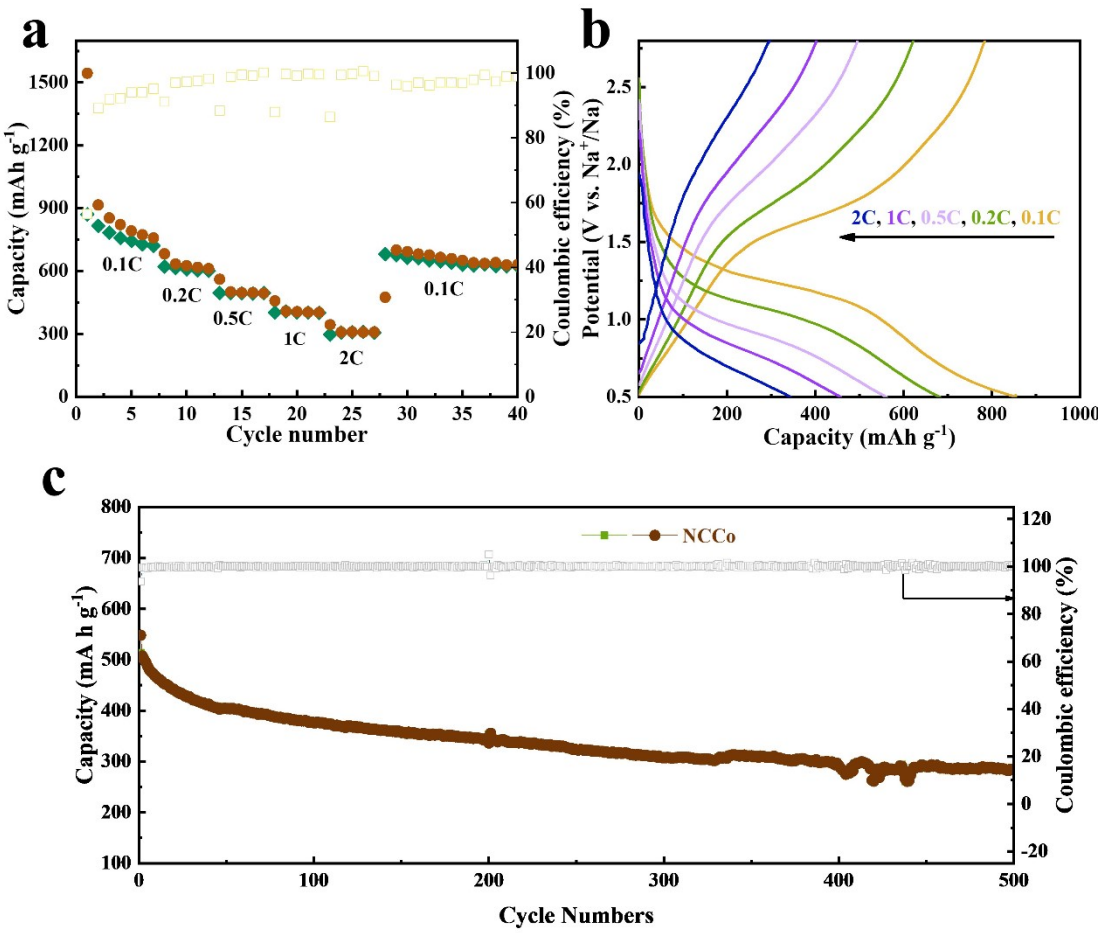

Fig. S12. a) Rate capacities of the NCCo@S cathodes, b) Voltage profiles, and c) Long cycling performance of NCCo@S electrode at 1C.

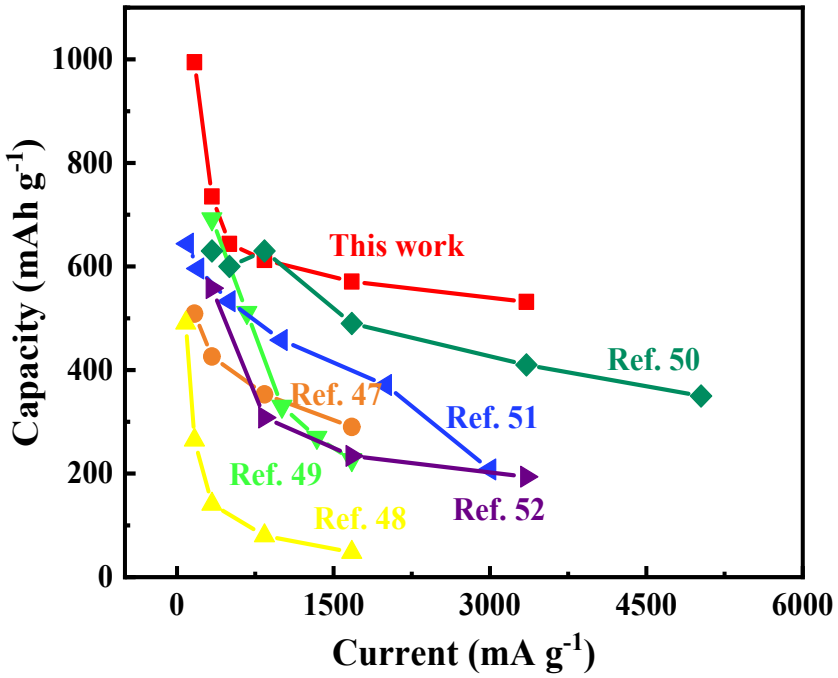

Fig. S13. Rate capabilities of NCCS@S compared to the references.

Tab. S1 Kinetic parameters of NC@S and NCCS@S obtained from equivalent circuit fitting.

Cathode material	Rct (Ω)
NC@S	106.36
NCCS@S	44.7

Tab. S2 The D_{Na+} values for the electrochemistry processes of NC@S and NCCS@S.

Anode material	Diffusion coefficient (cm^2 s^{-1})
NC@S	1.436×10^{-12}
NCCS@S	1.714×10^{-12}

1. R. Li, H. Peng, Q. Wu, X. Zhou, J. He, H. Shen, M. Yang and C. Li, Sandwich-like Catalyst-Carbon-Catalyst Trilayer Structure as a Compact 2D Host for Highly Stable Lithium-Sulfur Batteries, *Angew Chem Int Ed Engl*, 2020, **59**, 12129-12138.
2. L. Wang, Y. Ni, X. Hou, L. Chen, F. Li and J. Chen, A Two-Dimensional Metal-Organic Polymer Enabled by Robust Nickel-Nitrogen and Hydrogen Bonds for Exceptional Sodium-Ion Storage, *Angew Chem Int Ed Engl*, 2020, **59**, 22126-22131.