Supporting Information

A railway-like network electrode design for room temperature Na-S battery

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Supplementary Figures

**Fig. S1.** Formation mechanism of S@CNT/NPC composite.

**Fig. S2.** FESEM images of ZIF-8 (a) and NPC (b).
Fig. S3. FESEM images (a-b) of CNT/ZIF-8.

Fig. S4. FESEM images (a-c) of CNT/ZIF-8 with different content of CNTs.
Fig. S5. Thermogravimetric analysis (TGA) under oxygen atmosphere.

Fig. S6. XRD patterns of the ZIF-8, NPC and S@NPC composite.
Fig. S7. FESEM elemental mapping images of C (b), S (c), and N (d) of S@CNT/NPC composite.

Fig. S8. Raman spectrum patterns of pure S.
Fig. S9. Thermogravimetric analysis (TGA) of S@CNT/NPC composite and S under nitrogen atmosphere.

Fig. S10. XPS survey spectrum of CNT/NPC composite.
Fig. S11. XPS results of survey (a) and N 1s spectrum (b) of S@CNT/NPC composite after cycling.

Fig. S12. N$_2$ adsorption-desorption isotherms and the pore size distributions (a,b) of CNT/ZIF-8.
Fig. S13. \( \text{N}_2 \) adsorption-desorption isotherms and the pore size distributions (a,b) of NPC.

<table>
<thead>
<tr>
<th>Sample name</th>
<th>BET area (m(^2) g(^{-1}))</th>
<th>Pore volume (cm(^3) g(^{-1}))</th>
</tr>
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<tbody>
<tr>
<td>CNT/ZIF-8</td>
<td>959</td>
<td>0.487</td>
</tr>
<tr>
<td>CNT/NPC</td>
<td>2480</td>
<td>1.011</td>
</tr>
<tr>
<td>S@CNT/NPC</td>
<td>20</td>
<td>0.101</td>
</tr>
</tbody>
</table>

Fig. S14. Comparison of BET performance between CNT/ZIF-8, CNT/NPC and S@CNT/NPC composite.
Fig. S15. (a) Thermogravimetric analysis (TGA) and (b) Discharge–charge curves at 0.5C of S@CNT/NPC composite electrode with 43% sulfur.

Fig. S16. Nyquist plots of the S@CNT/NPC composite electrodes before and after cycling.
Fig. S17. Discharge-charge cycling performance of CNT/NPC composite electrode at 0.5C.

Fig. S18. TGA curve of the S@NPC composite under N₂ atmosphere (a), CV curves of the S@NPC composite (b).
**Fig. S19.** FESEM images of S@CNT/NPC after cycles.

**Fig. S20.** Comparison of decay rate per cycle for S@CNT/NPC composite with references.