Supplementary Information for

Atomic Layer Deposition Assisted Construction of Binder-Free Ni@N-Doped Carbon Nanospheres Films as Advanced Host for Sulfur Cathode

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Supplementary Figures and Table

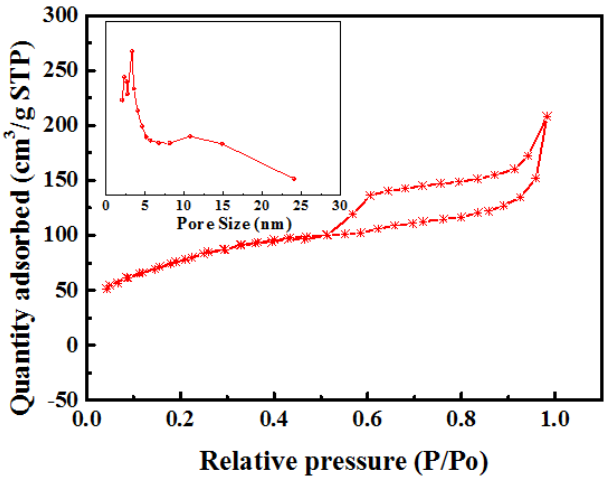

Fig. S1 Adsorption-desorption isothermal curves of N-CNSs films (pore size distribution in inset)

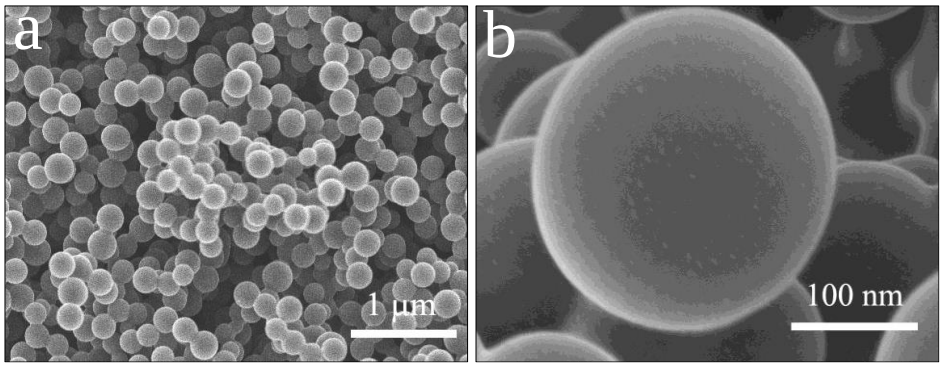

Fig. S2 a, b SEM images N-CNSs/S films

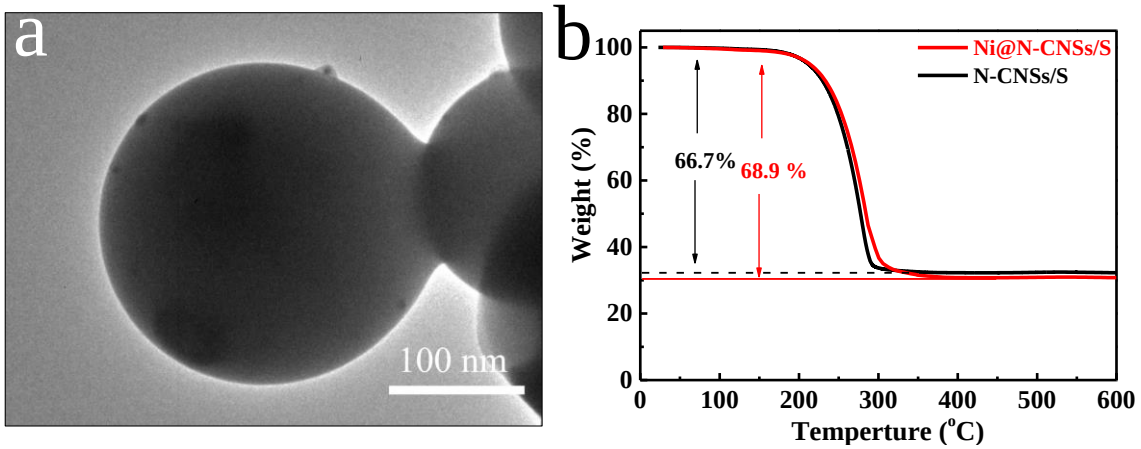

Fig. S3 a TEM images N-CNSs/S. **b** TGA curves of Ni@N-CNSs/S and N-CNSs/S electrodes

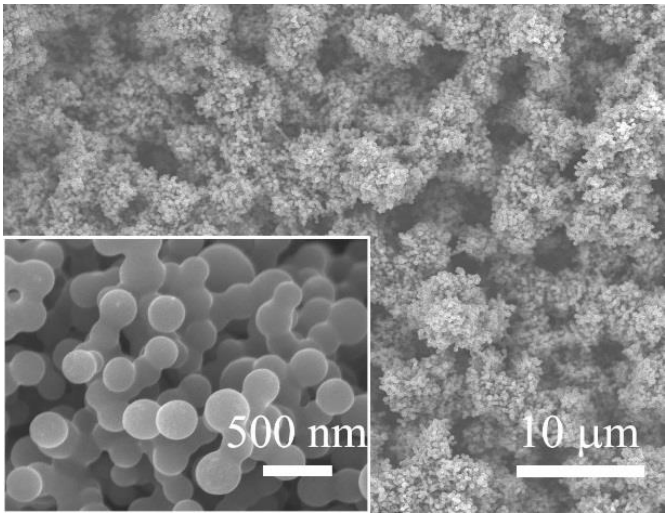

Fig. S4 SEM image of Ni@N-CNSs/S electrode after 200 cycles at 0.1 C

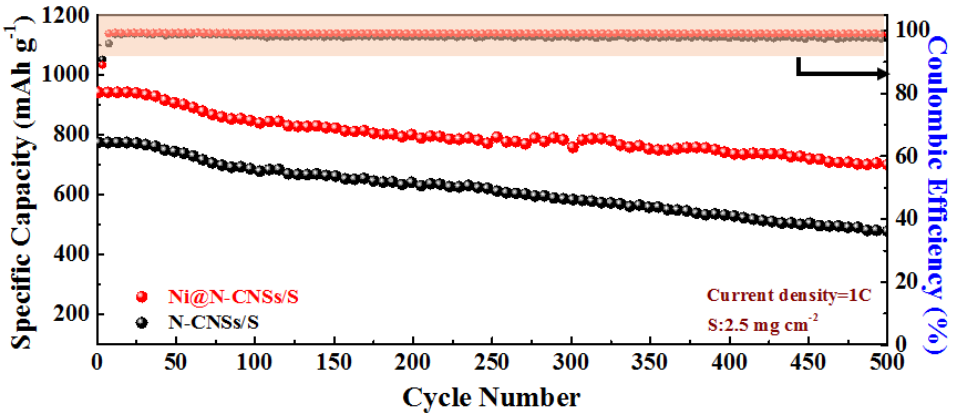

Fig. S5 Cycling performance and coulombic efficiency of N-CNSs/S and Ni@N-CNSs/S electrodes with S mass of 2.5 mg cm^{-2} at 1 C

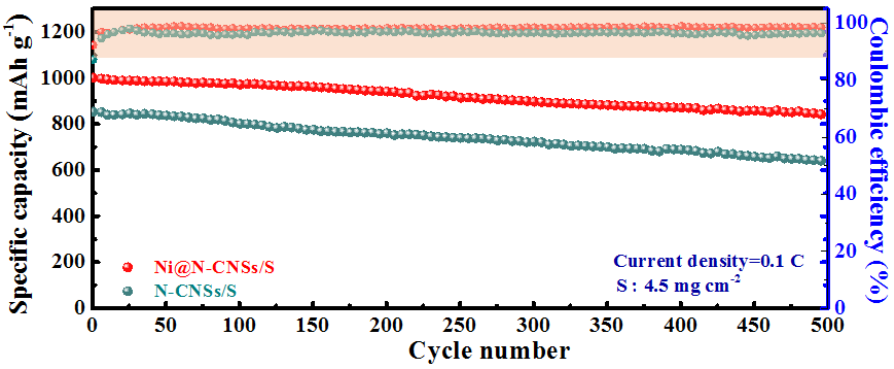

Fig. S6 Cycling performance and coulombic efficiency of N-CNSs/S and Ni@N-CNSs/S electrodes with S mass of 4.5 mg cm^{-2} at 0.1 C

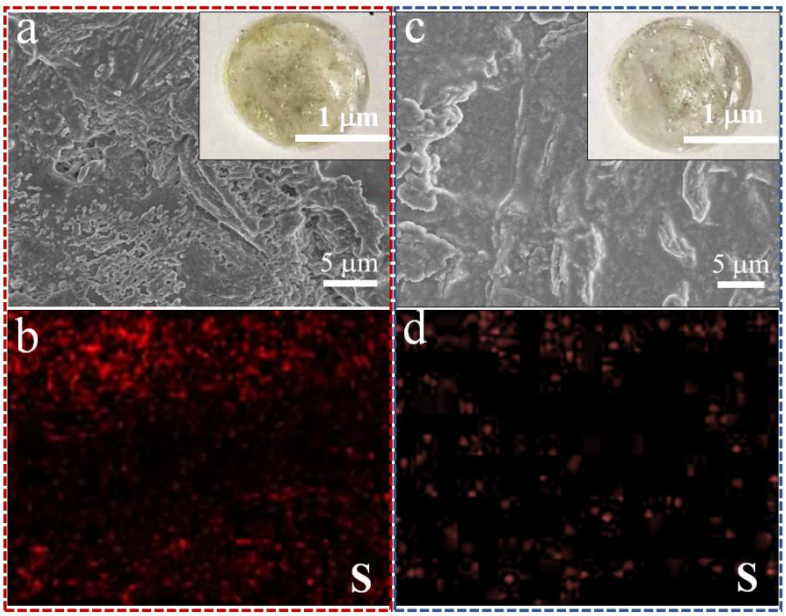

Fig. S7 SEM image and mapping image of S for cycled lithium anodes after 100 cycles at 0.1 C: **a, b** Cycled lithium anode with N-CNSs/S; **c, d** Cycled lithium anode with Ni@N-CNSs/S cathode (digital photos of cycled separators in inset)

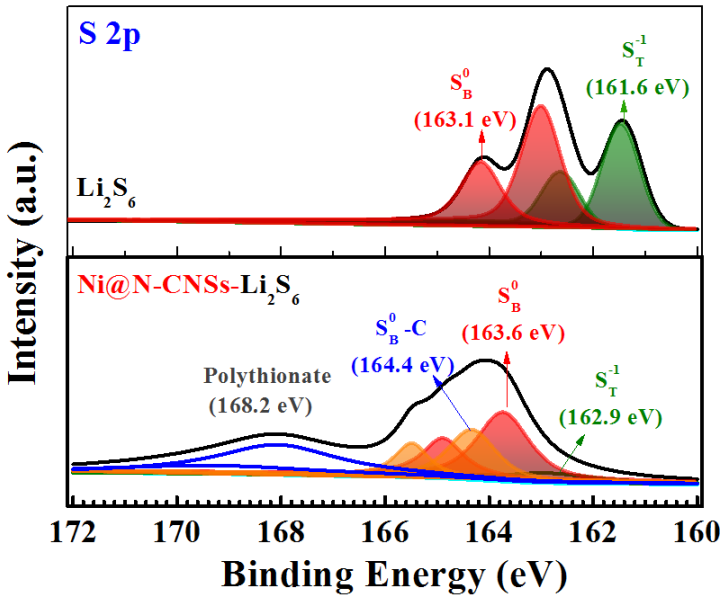

Fig. S8 XPS analysis of pristine Li_2S_6 and Ni@N-CNSs-Li_2S_6 samples: S 2p spectra

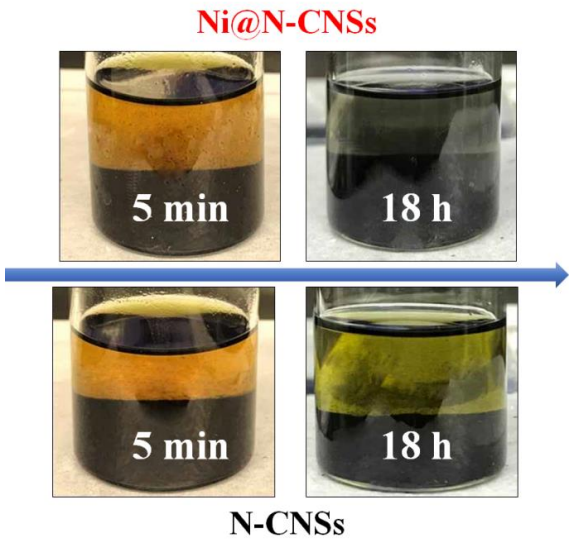

Fig. S9 Adsorption test for Li_2S_6 solution with Ni@/N-CNSs and N-CNSs

Table S1 Electrochemical performance of other carbon/S composite cathodes

Samples	Initial capacity	Cyclability (mAh g^{-1})
CNSs/S powder [S1]	1031 mAh g^{-1} at 0.5 C	477 mAh g^{-1} after 100 cycles at 0.5 C
Porous CNSs/S powder [S2]	1150 mAh g^{-1} at 1 C	680 mAh g^{-1} after 100 cycles at 1 C
CNTs/graphene/S powder [S3]	829 mAh g^{-1} at 0.5 C	89% retention after 200 cycles at 0.5 C
S/C nanosphere (PSCs) powder [S4]	809 mAh g^{-1} at 0.5 C	775 mAh g^{-1} after 200 cycles at 0.5 C
Hollow CNSs/S powder [S5]	~1318 mA h g^{-1} at 0.5 C	~700 mAh g^{-1} after 200 cycles at 0.5 C
TiO@CNSs/S powder [S6]	1285 mAh g^{-1} at 0.1 C	76% retention after 200 cycles at 0.1 C
Yolk–shell CNSs/S powder [S7]	1106 mAh g^{-1} at 0.05 C	832 mAh g^{-1} after 200 cycles at 0.05 C
CNSs-trithiocyanuric acid /S powder [S8]	1227 mAh g^{-1} at 0.2 C	443 mAh g^{-1} after 200 cycles at 0.2 C
S@C@MnO_2/S powder [S9]	1345 mAh g^{-1} at 0.1 C	1043 mAh g^{-1} after 200 cycles at 0.1 C
N-CNSs@MnO_2/S powder [S10]	1249 mAh g^{-1} at 0.5 C	1110 mAh g^{-1} after 200 cycles at 0.1 C
This work	**1350 mAh g^{-1} at 0.1C**	**1175 mAh g^{-1} after 200 cycles at 0.1 C**

Supplementary References

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