Supplementary Materials

High-sulfur-doped hard carbon for sodium-ion battery anode with large capacity and high initial Coulombic efficiency

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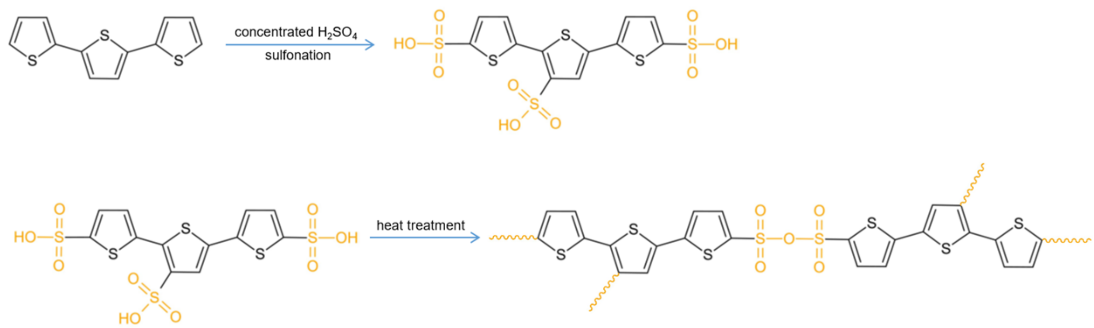

Fig. S1. A proposed reaction process for the synthesis of sulfonation reaction.

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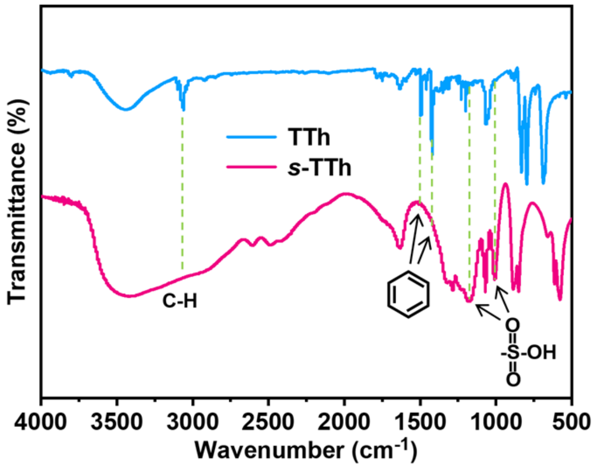

Fig. S2. FT-IR spectra of TTh and *s*-TTh.

Fig. S3. Narrow XPS spectra of *s*-TTh: (a) C1s narrow spectrum and (b) S2p narrow spectrum.

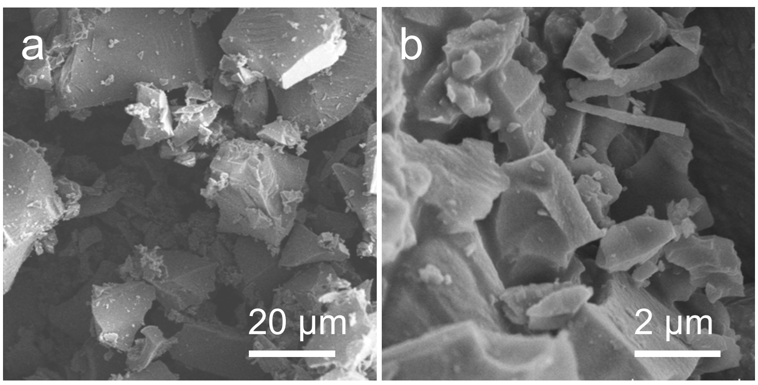

Fig. S4. (a, b) SEM images of SHC-500.

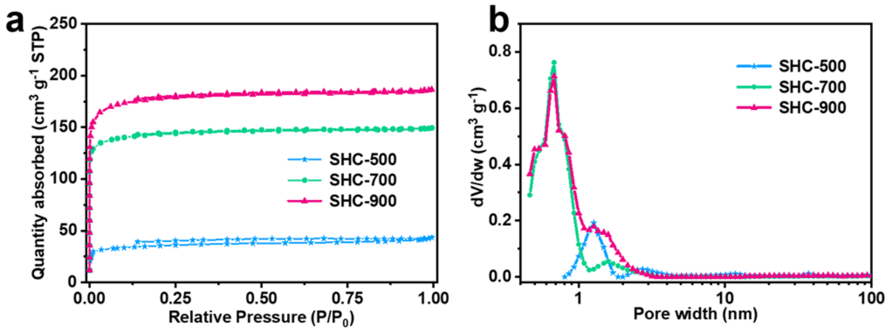

Fig. S5. (a) N_2 adsorption−desorption isotherms and (b) NLDFT pore size distributions of obtained SHC samples.

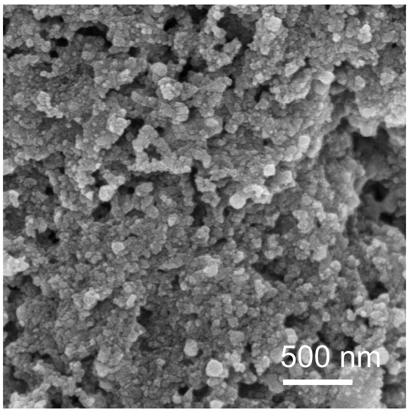

Fig. S6. SEM image of SHC-500 electrode after 100 cycles.

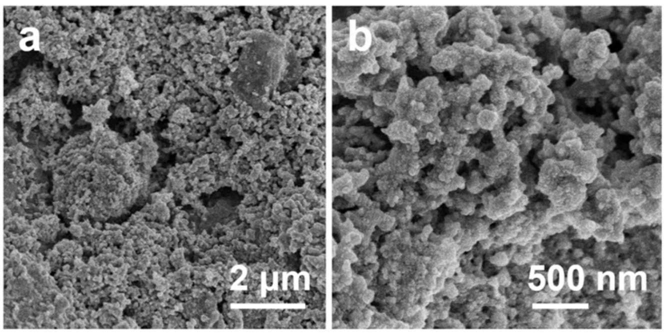

Fig. S7. (a, b) SEM images of SHC-500 electrode after 1000 cycles.

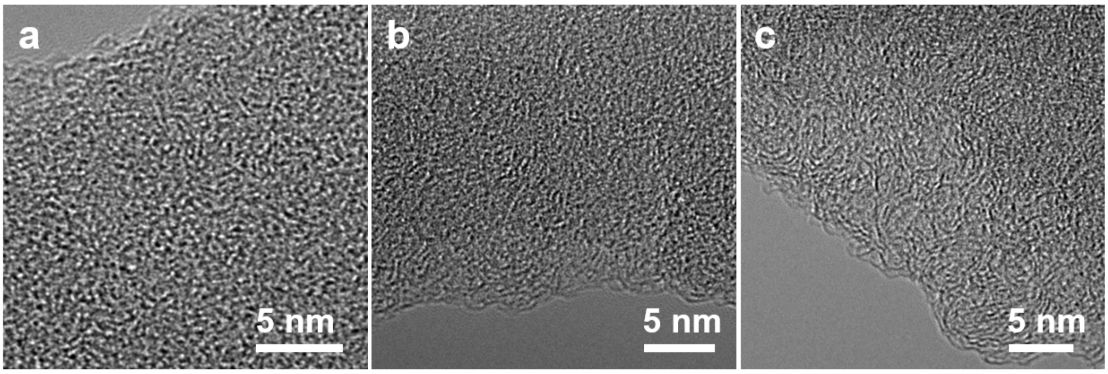

Fig. S8. TEM images of S-doped hard carbons prepared using Th-DS as starting materials: (a) Th-DS-500, (b) Th-DS-700 and (c) Th-DS-900.

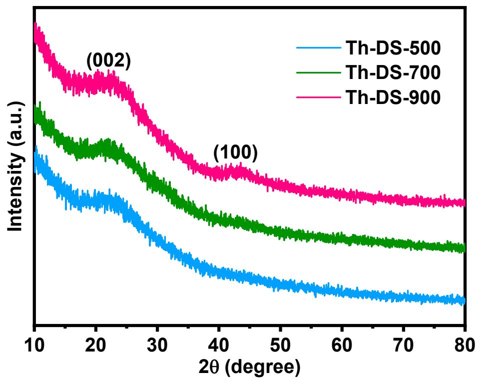

Fig. S9. XRD patterns of Th-DS-500, Th-DS-700 and Th-DS-900.

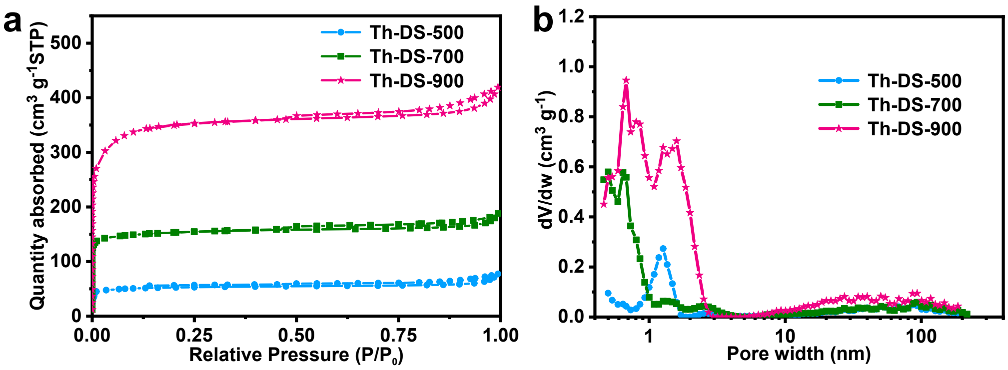

Fig. S10. N_2 adsorption−desorption isotherms and NLDFT pore size distribution of S-doped hard carbons prepared using Th-DS as starting materials.

Fig. S11. Narrow XPS spectra of Th-DS-500: (a) C1s narrow spectrum and (b) S2p narrow spectrum.

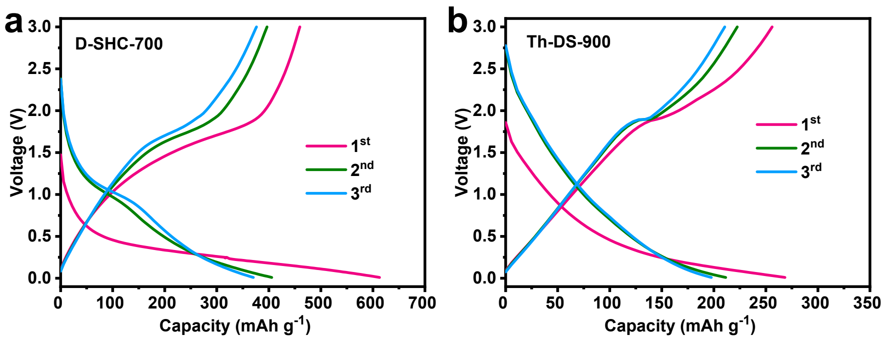

Fig. S12. (a, b) Galvanostatic charge/discharge profiles for the initial three cycles of Th-DS-700 and Th-DS-900.

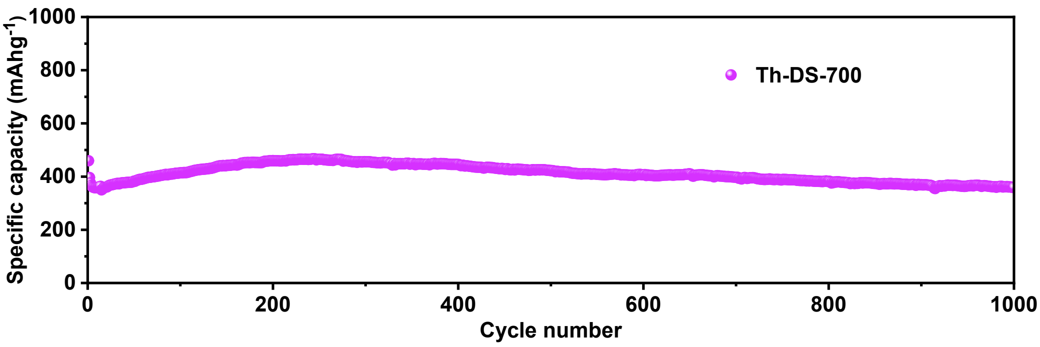

Fig. S13. Cycling performance of Th-DS-700 at a current density of 1 A g^{-1}.

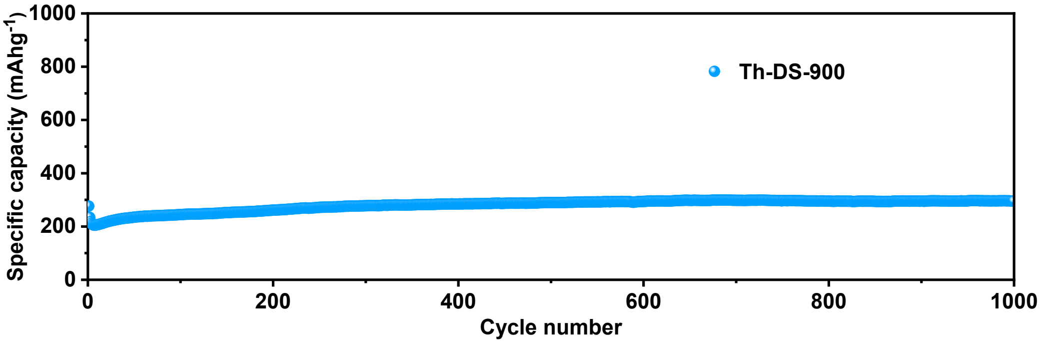

Fig. S14. Cycling performance of Th-DS-900 at a current density of 1 A g^{-1}.

Table S1. Sodium storage performance of recently reported S-doped carbons.

Sample	S content (%)	C (mAh g^{-1})		ICE (%)	Ref.
		1st discharge	1st charge		
SHC-500	**15.91**	**921**	**777**	**84.2**	**This work**
SHC-700	**5.67**	**788**	**667**	**84.5**	
NSGHS	5.21	1000	386	38.6	[1]
KEC-600	8.22	900	530	58.9	[2]
OMCP-800-S10	-	-	405	-	[3]
S-CNS	23	1211	708	58.4	[4]
SNCNF	2.3	790	315	39.9	[5]
3DSC-700	20.1	1088	526	48.4	[6]
S-SG	21.8	878	488	55.6	[7]
S-HC-p	6.3	870	488	56.1	[8]
DC-S	26.9	887	561	63.2	[9]

SC	15.2	655	482	73.6	[10]
SFG	16.7	676	330	48.8	[11]
SN-HCS	0.55	890	260	29.2	[12]

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