

Supplementary information

A Co₉S₈ microsphere and N-doped carbon nanotube composite host material for lithium-sulfur batteries

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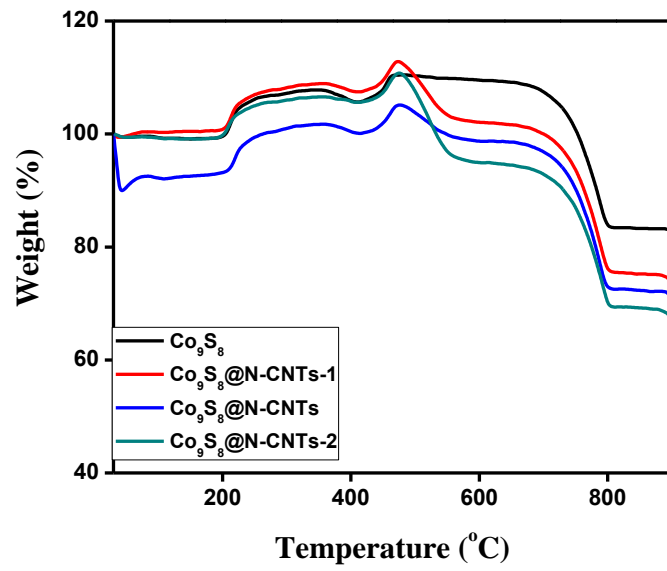


Fig. S1 TG analysis of Co_9S_8 , $\text{Co}_9\text{S}_8@\text{N-CNTs-1}$, $\text{Co}_9\text{S}_8@\text{N-CNTs}$ and $\text{Co}_9\text{S}_8@\text{N-CNTs-2}$.

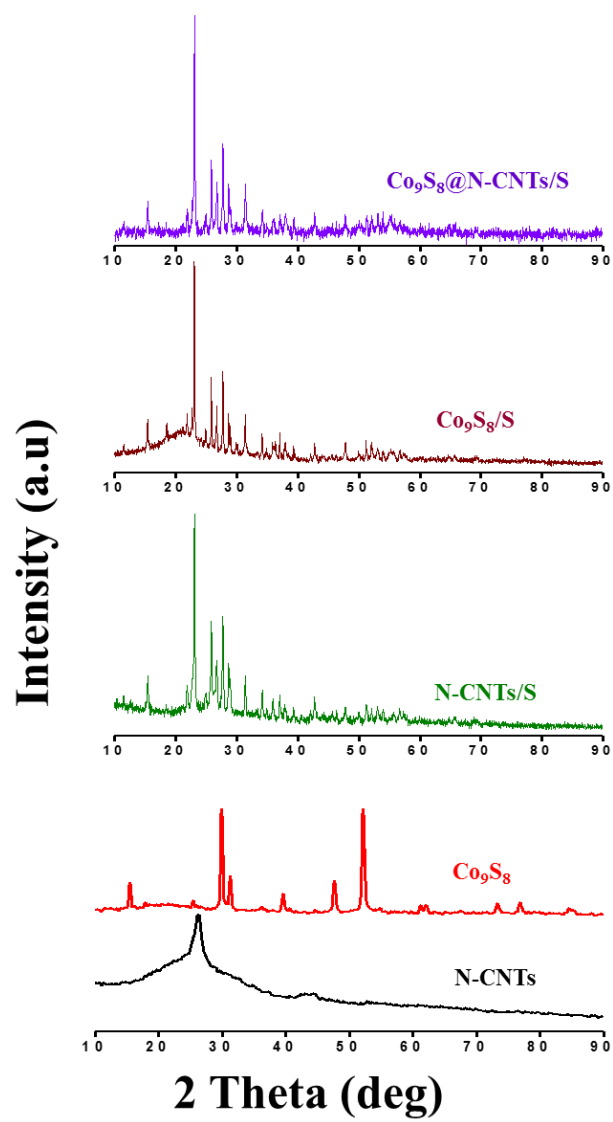


Fig. S2 XRD patterns of N-CNTs, Co₉S₈, N-CNTs/S, Co₉S₈/S and Co₉S₈@N-CNTs/S.

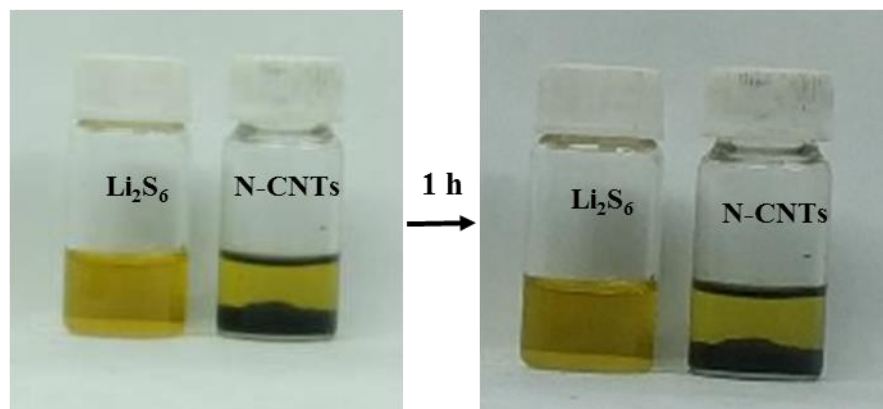


Fig. S3 Optical photographs of Li₂S₆ solution added with N-CNTs.

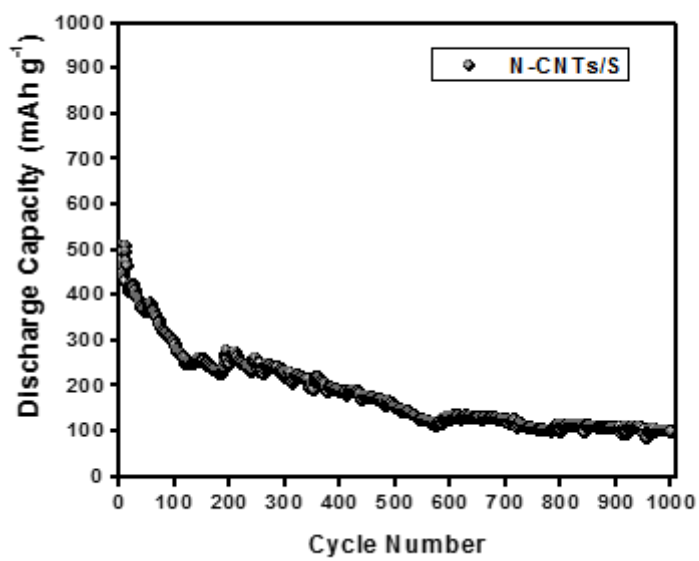


Fig. S4 Cycling performance of N-CNTs/S electrode at 0.5 C rate.

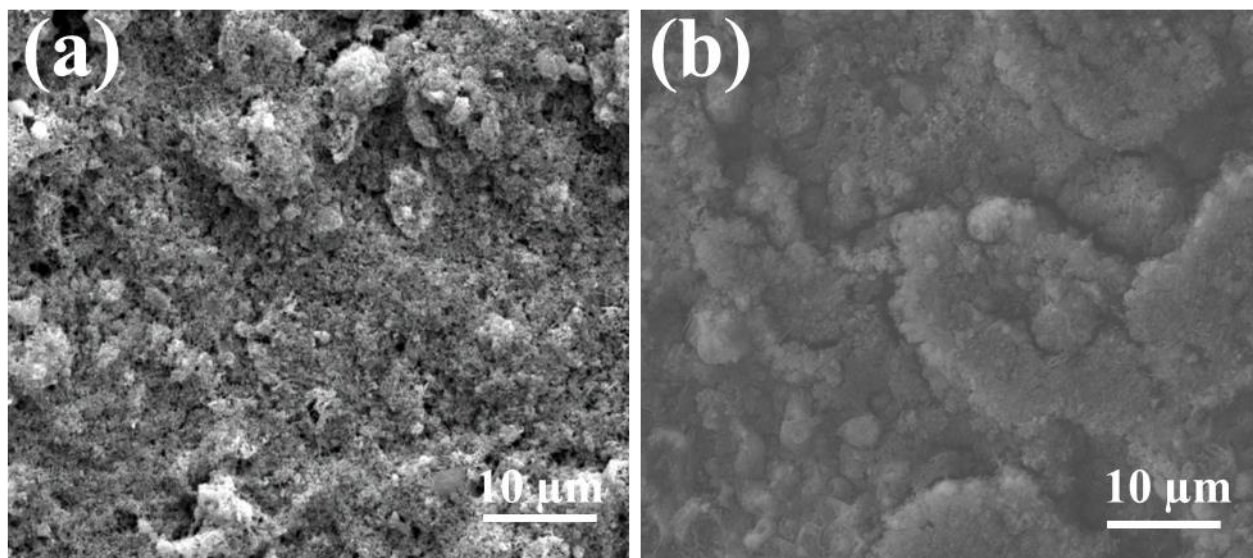


Fig. S5 SEM images of the $\text{Co}_9\text{S}_8@\text{N-CNTs/S}$ electrode before and after cycling.

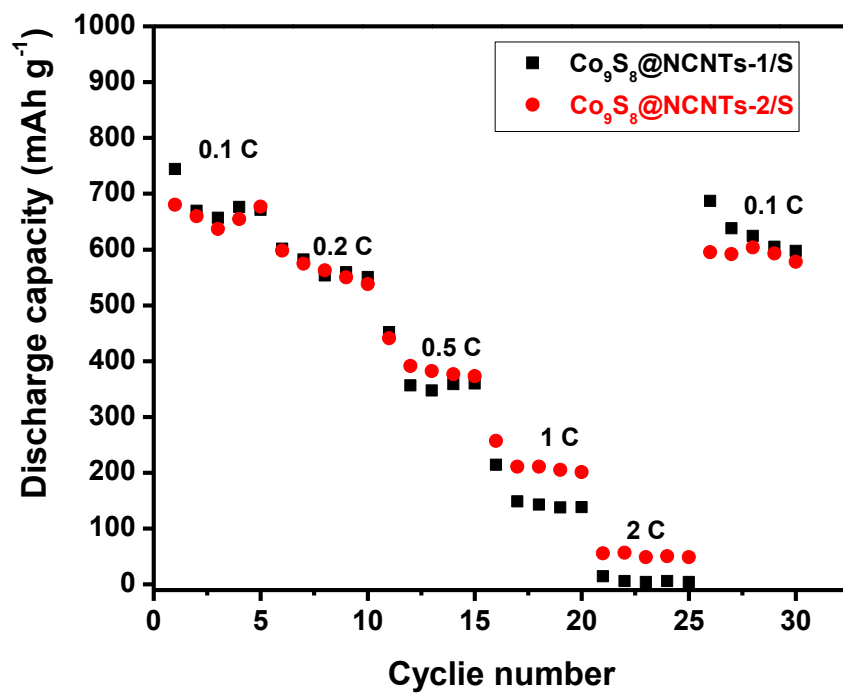


Fig. S6 Discharge capacities vs cycle numbers of Co₉S₈@N-CNTs-1/S and Co₉S₈@N-CNTs-2/S at different rates.

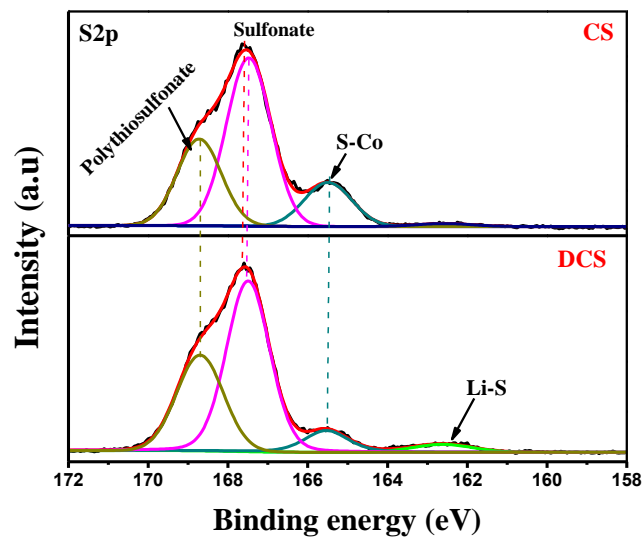


Fig. S7 The core level XPS spectra of S 2p of $\text{Co}_9\text{S}_8@\text{N-CNTs/S}$ at the fully charged state (CS) and discharged state (DCS).

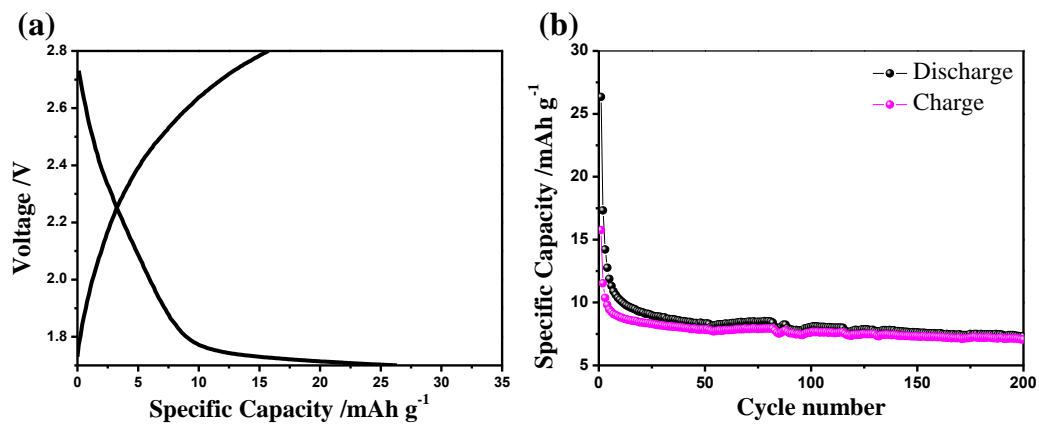


Fig. S8 Discharge-charge profile of N-CNTs electrode (without the impregnation of sulfur) at 0.2

C (a), Cycling performance of N-CNTs electrode (without the impregnation of sulfur) at 0.2 C (b).

Table S1: Performance comparison of the Co₉S₈@N-CNTs composite with previously reported sulfur host materials in the literature as cathode materials for Li-S batteries.

Electrode materials	Sulfur Loading	Rate	Discharge capacity (mAh g⁻¹)	Cycle Number	References
Fe ₃ O ₄ /C/S	67.5%	1 C	642	300	[64]
AZO@S/CNT	75%	0.2 C	700	200	[65]
S@TiO ₂ /PPy	72.4%	0.5 C	<700	200	[66]
SnO ₂ /CAs@S	75.2%	0.1 C	785	80	[67]
FeS ₂	62%	0.15 C	500	150	[68]
CoS ₂ /Graphene	50%	2 C	700	200	[68]
Graphene like Co ₉ S ₈	70%	0.2 C	554	2000	[69]
Co ₉ S ₈ @N-CNTs/S	75%	2 C	652	1000	this work