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The Long-Life Li–S Batteries Based on Enabling Immobilization and Catalytic Conversion of Polysulfides.

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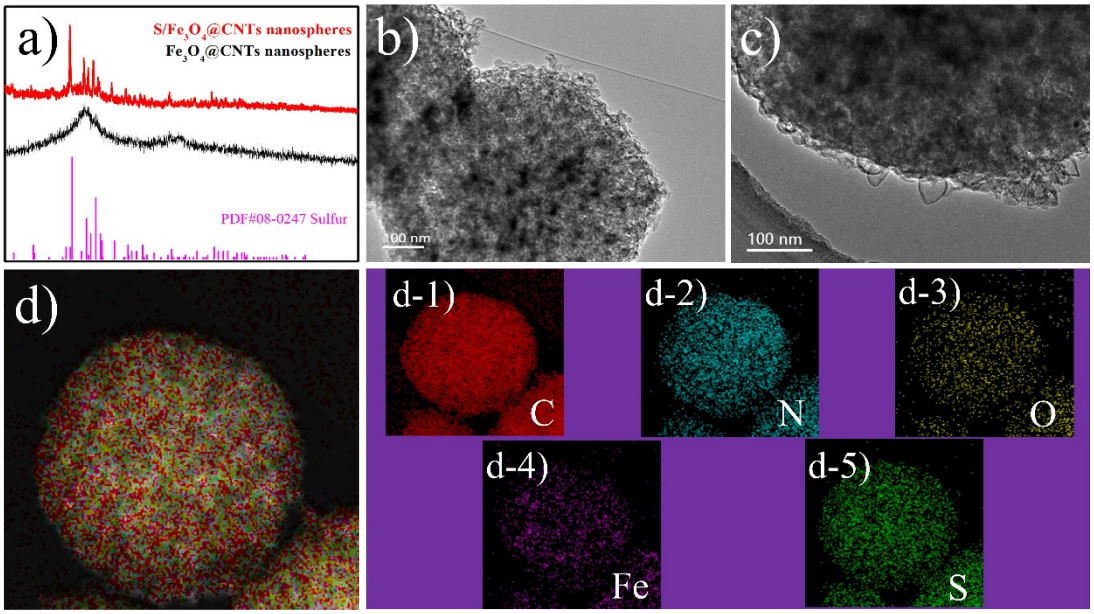


Fig. S1. Morphology and composition characterizations of S/Fe_3O_4@CNTs nanospheres composites: a) XRD pattern, (b,c) TEM images and (d) corresponding elemental mappings of the S/Fe_3O_4@CNTs nanospheres composites.

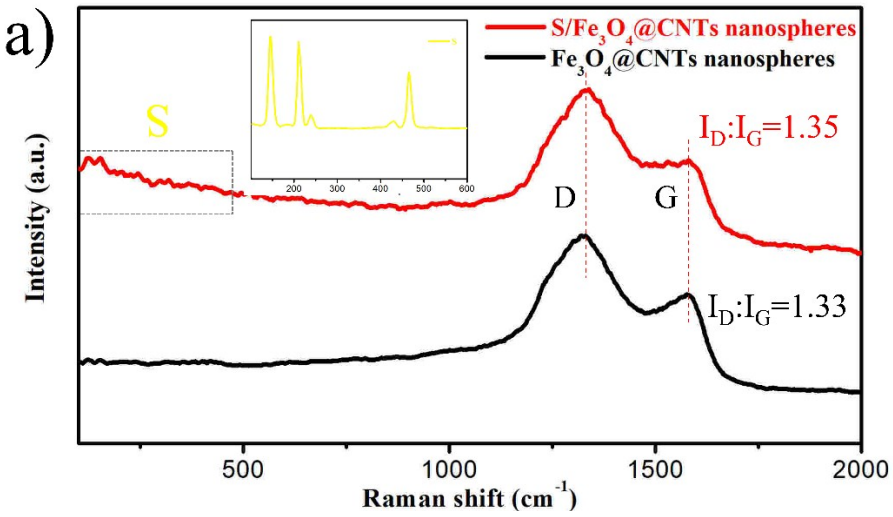
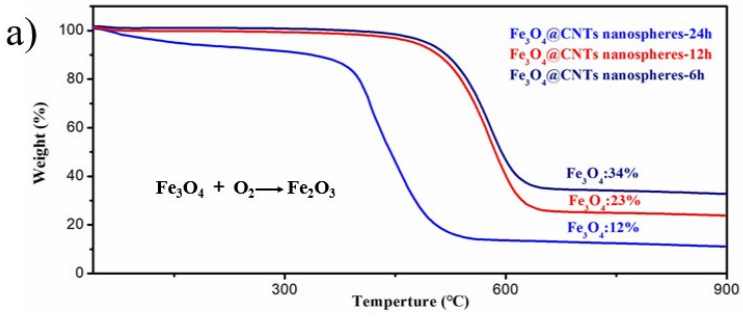


Fig. S2. a) Raman spectra of Fe_3O_4@CNTs nanospheres and S/Fe_3O_4@CNTs nanospheres



b)

	Fe_3O_4@CNTs nanospheres-6h	Fe_3O_4@CNTs nanospheres-12h	Fe_3O_4@CNTs nanospheres-24h
Surface area (m^2 g^{-1})	141	165	174.2
Pore volume (cm^3 g^{-1})	0.047	0.1	0.16

Fig. S3. a) TGA curve of Fe_3O_4@ CNTs nanospheres in air; b) surface area and pore volume of the Fe_3O_4@CNTs nanospheres-6 h, Fe_3O_4@CNTs nanospheres-12 h and Fe_3O_4@CNTs nanospheres-24 h

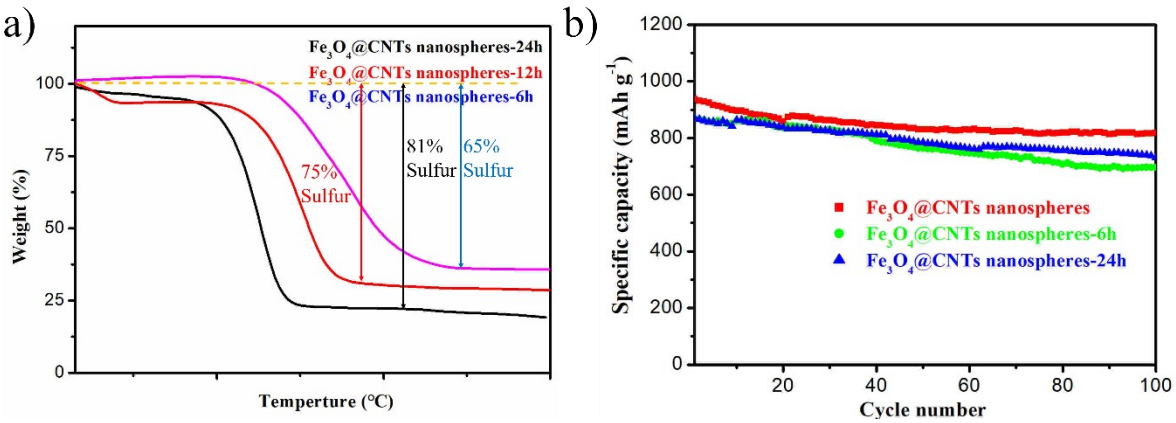


Fig. S4. a) TG curves of S/Fe_3O_4@CNTs nanospheres-6 h, S/Fe_3O_4@CNTs nanospheres-12 h, and S/Fe_3O_4@CNTs nanospheres-24 h b) Corresponding cyclic performance at 1C over 100 cycles with 2.1 mg cm^{-2} sulfur loading

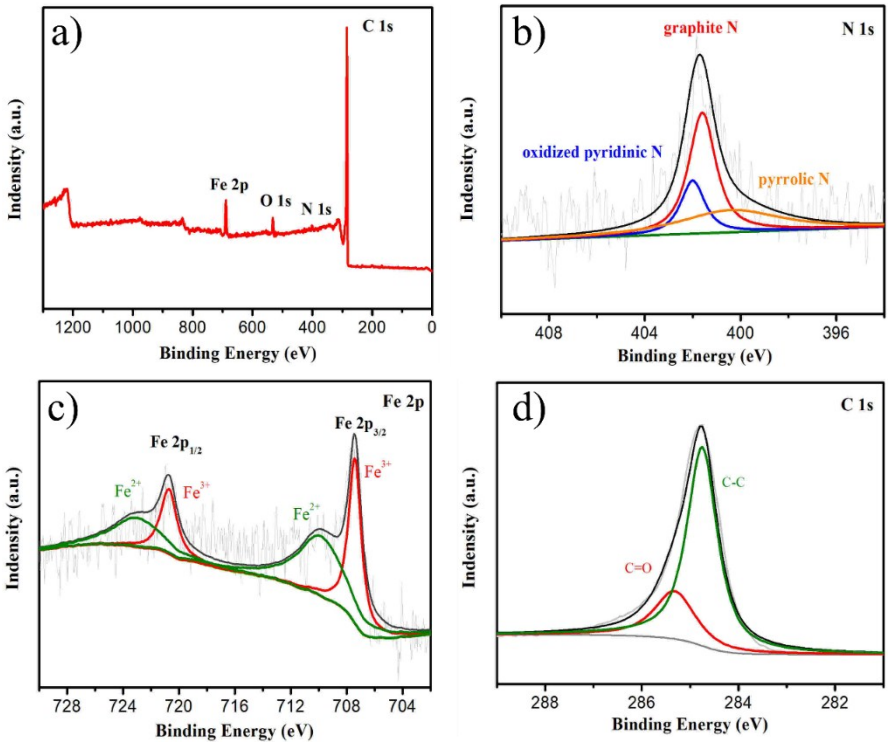


Fig. S5. (a) XPS spectra of Fe_3O_4@CNTs nanospheres; and (b-d) the high resolution XPS spectra of N 1s, C 1s, and Fe 2p

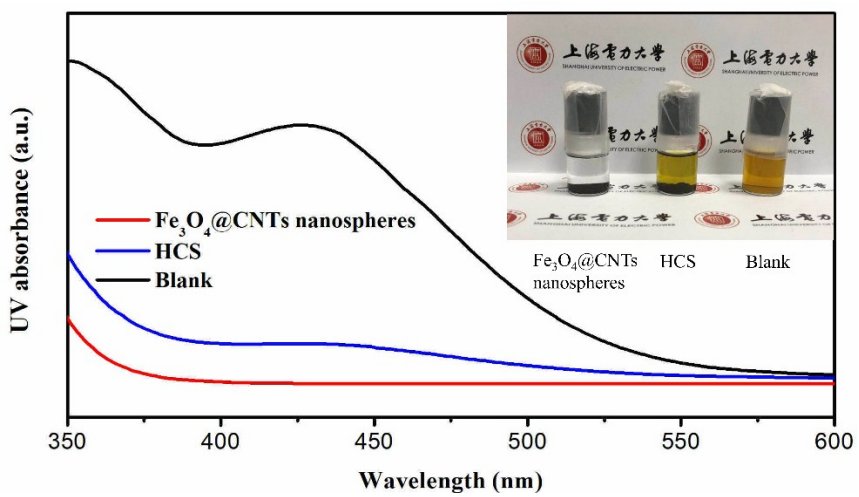


Fig. S6. UV-vis absorption spectra of Li_2S_4 solution mixed with Fe_3O_4@CNTs nanospheres and HCS after standing for half an hour

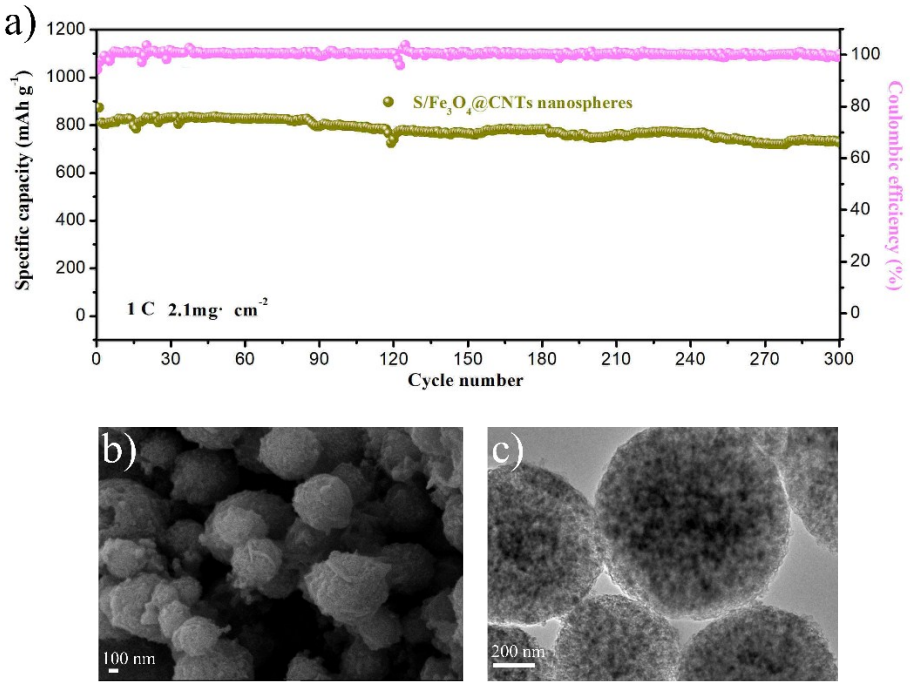


Fig. S7. a) Cycling test of the S/ Fe_3O_4@ CNTs nanospheres at 2 C over 300 cycles b) SEM image c) TEM image of S/ Fe_3O_4@ CNTs nanospheres after the cycle.

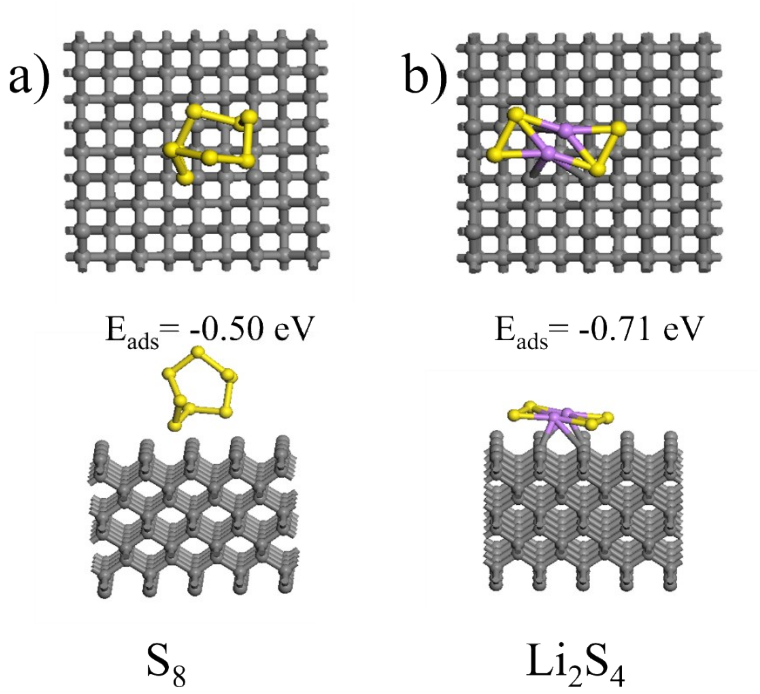


Fig. S8. binding geometric configurations and binding energies of S_8 and Li_2S_4 species with graphene

Table S1. Li-S batteries properties of various carbon-based cathode materials

Materials	Sulfur content (wt%)	Sulfur loading/mg cm^{-2}	Cycling performance		Rate of capacity decay per cycle	Ref.
			Cycle No.	Capacity/mAh g^{-1}		
Fe_3O_4@CNTs nanospheres	75wt%	2.1	1800	538.5 (1C)	0.023%	This Work
p-CNT@Void@MnO2	65wt%		100	526.1 (1C)	0.12%	1
Crumpled N-$Ti_3C_2T_x$	73wt%	1.5	200	950 (0.2C)	0.08%	2
$Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskite nanoparticles	63wt%	1.1	400	632 (0.5C)	0.05%	3
W_2C NPs-CNFs			400	605 (1C)	0.06%	4

P@E-CNTs	72wt%	2	200	735 (0.5C)	0.13%	5
GN–CNT	75wt%	1.6	500	363.5(1C)	0.09%	6
PPy-MnO_2	70wt%	2	500	550 (1C)	0.07%	7

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