Supporting Information

Simultaneously Enhancing Redox Kinetics and Inhibiting the Polysulfides Shuttle Effect by MOF-derived CoSe Hollow Sphere Structures for Advanced Li-S Batteries

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Experimental section

1. Preparation of carbon with hollow structures (C HSs)

In a typical procedure, the obtained Co/C HSs powder was then immersed in 2 M HCl aqueous solution and heated at 150 ℃ for 24 h [1]. After cooling to room temperature, the C HSs power was collected and washed with deionized water and ethanol for 3 times, respectively.
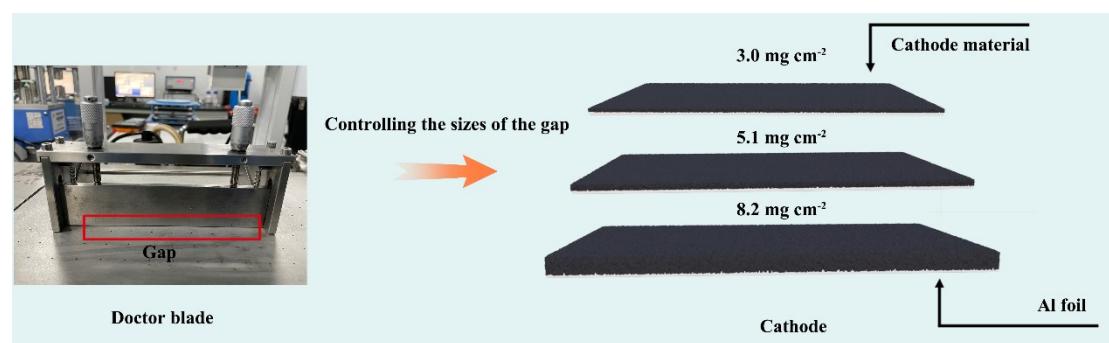
Scheme. S1 The preparation of the high sulfur loading electrodes using the adjustable doctor blade.
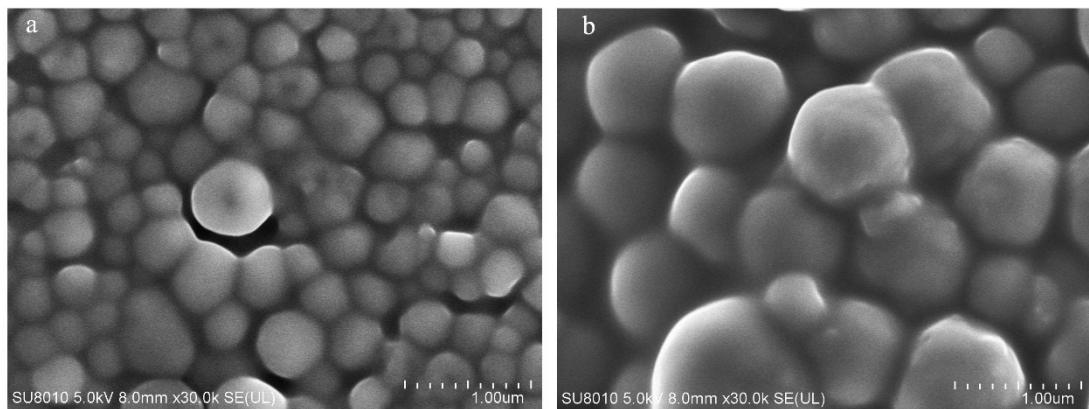
Fig. S1 SEM images of the Co-MOF.
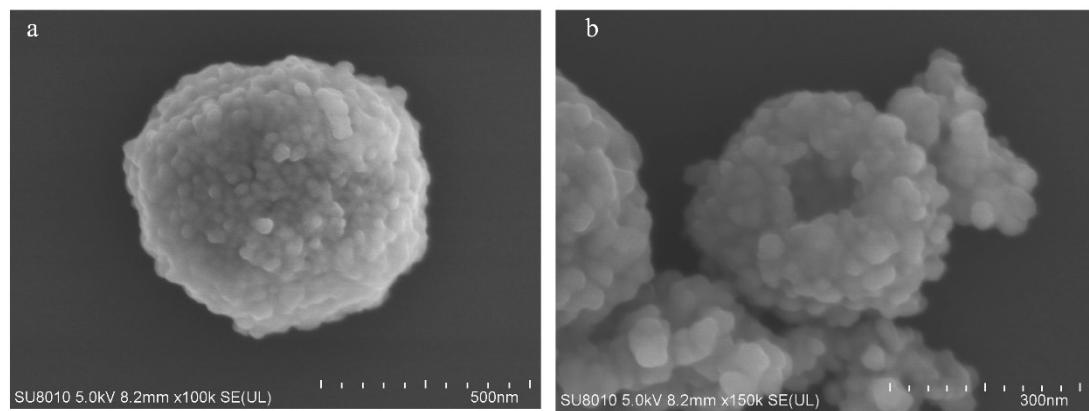

Fig. S2 SEM images of CoSe/C HSs.
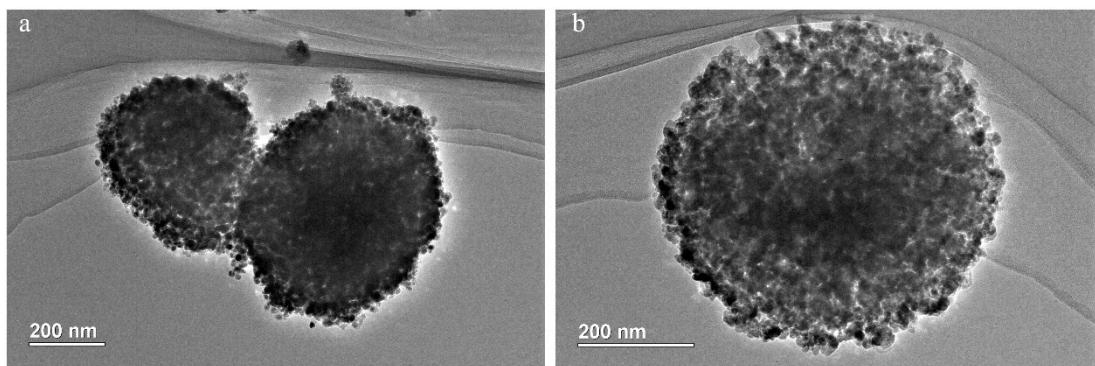
Fig. S3 TEM images of CoSe/C HSs.
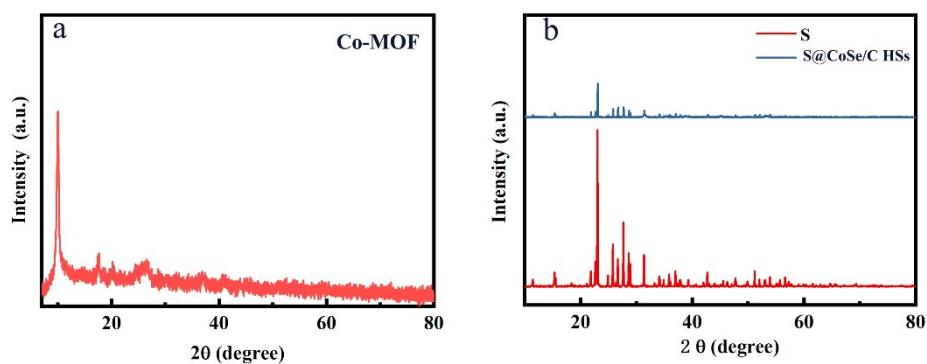
Fig. S4 XRD patterns of Co-MOF (a), S and S@CoSe/C HSs (b).
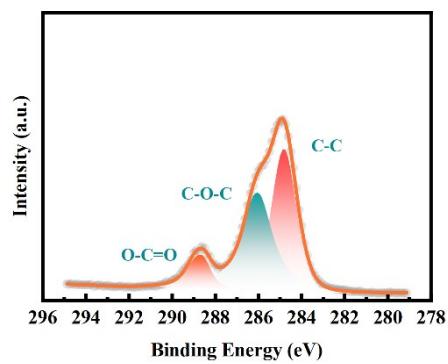
Fig. S5 XPS spectrum of C 1s of CoSe/C HSs.
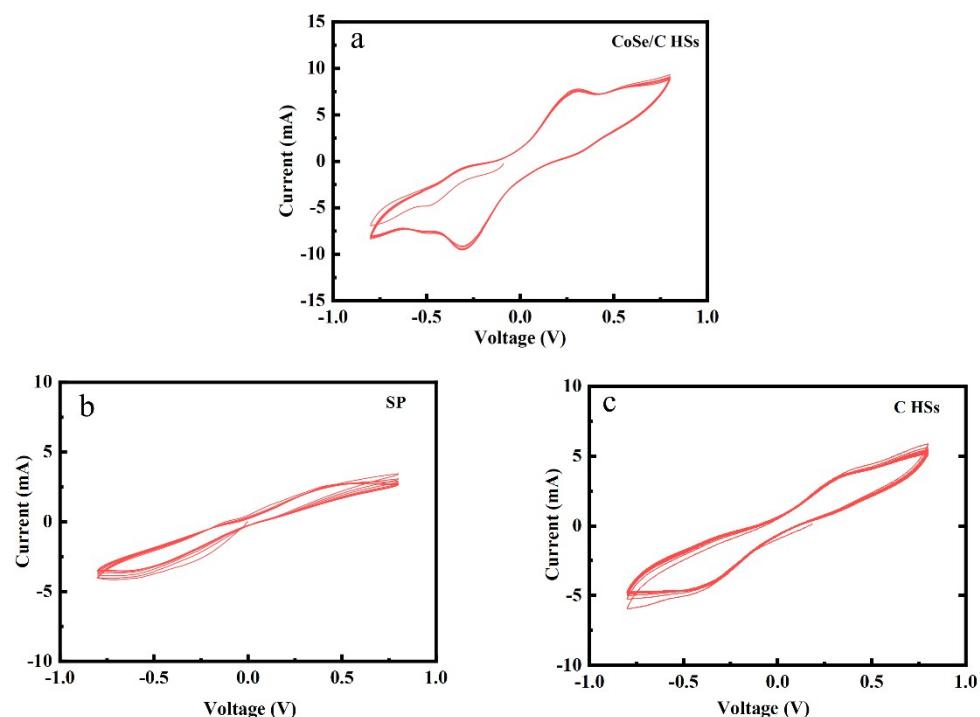
Fig. S6 CV curves of symmetric cells with S@CoSe/C HSs (a), S@SP (b), and
S@CHSs (c) electrodes for10 cycles.
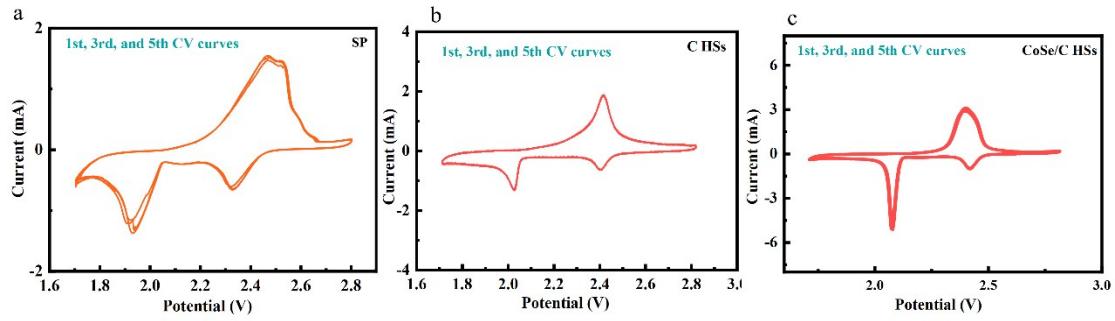
Fig. S7 The 1st, 3rd and 5th CV curves of cells with S@SP (a), S@CHSs (b) and S@CoSe/C HSs (c) electrodes.
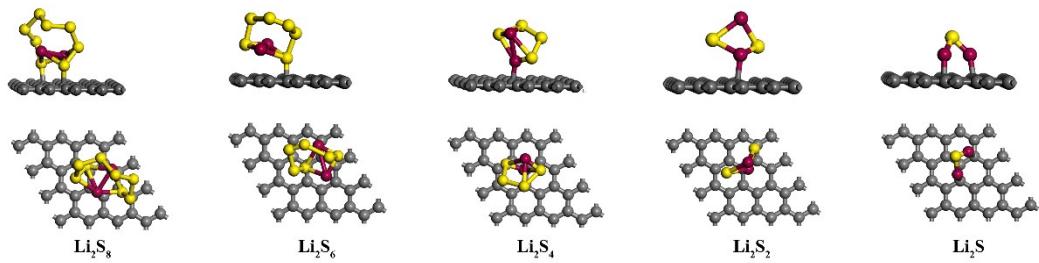
Fig. S8 Optimized configurations of polysulfides adsorption on graphene.
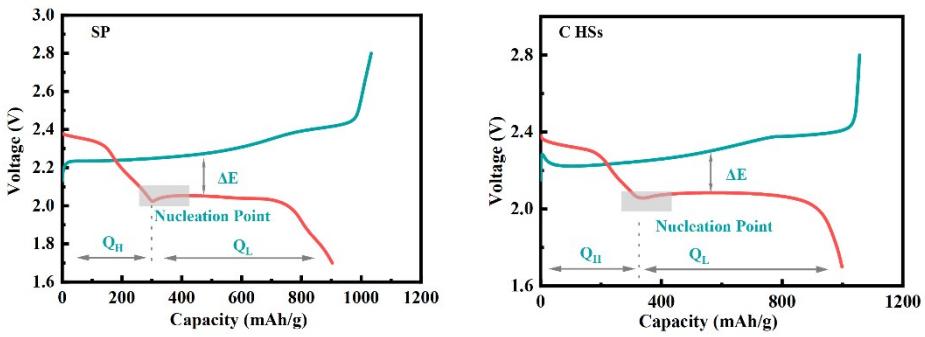
Fig. S9 The charge/discharge profiles for the first cycle of the cells with S@SP and S@C HSs electrodes.
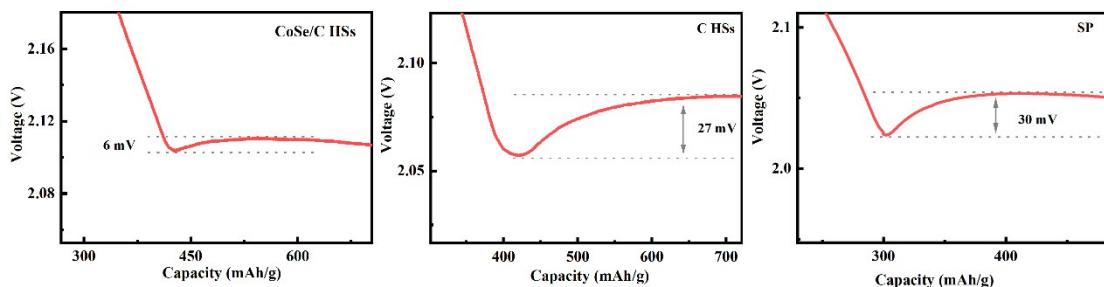
Fig. S10 The overpotential of Li_2S_2/Li_2S nucleation of the cells with S@CoSe/C HSs (a), S@CHSs (b) and S@SP (c) electrodes.
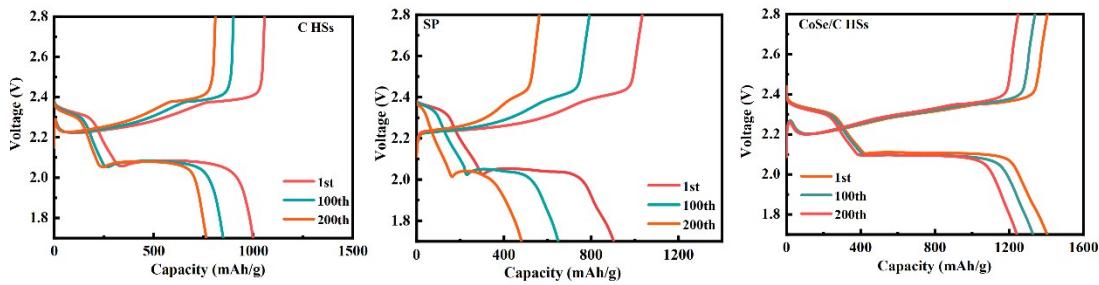
Fig. S11 The 1st, 100th and 200th charge/discharge profiles of the cells with S@CHSs, S@SP and S@CoSe/C HSs electrodes.
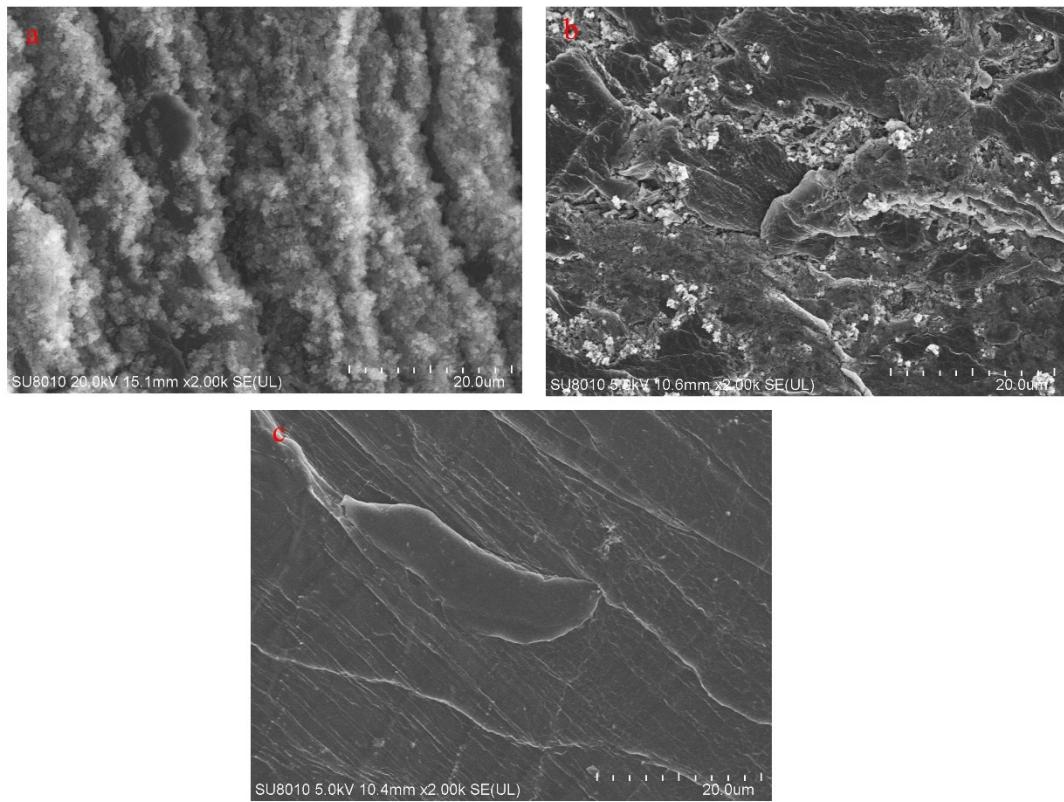
Fig. S12 SEM images of the Li anodes of the cells with S@SP (a), S@C/HSs (b) and S@CoSe/C HSs (c) cathode.
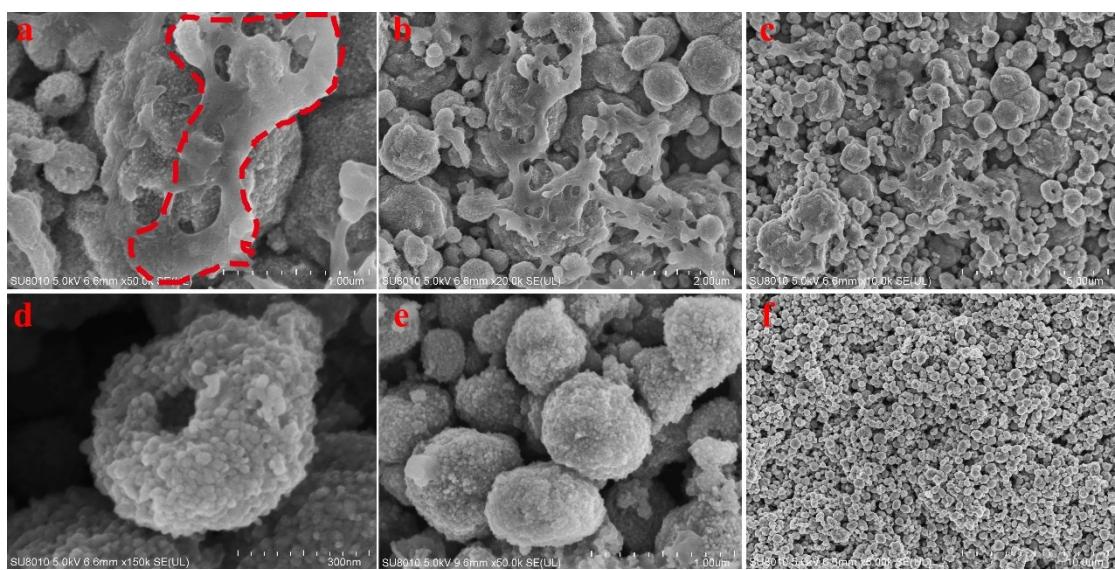
Fig. S13 SEM images of S@C HSs (a-c) and S@CoSe/C HSs (d-f) electrodes after cycles.

Table S1. The electrochemical performance of various cathodes of Li-S batteries.

| Cathode	Current Rate (C)	Area loading (mg cm^{-2})	Discharge capacity (mAh g^{-1})	Ref.
S@CP	0.2	1.5	1000	[2]
S@N-C	0.05	1.2	1107	[3]
S@CNF/LPS/CNT	0.2	7.64	452	[4]
S@3d-omsh/pure-carbon	0.2	1.2	950	[5]
S@TiN	0.5	1.0	899	[6]
CNT-NC@GC/S	0.1	1.3	1100	[7]
S/CP@NCNT	1.3 mA cm^{-2}	6	1175	[8]
S@H-LDH	0.5	1.5-2.0	825	[9]
S@CoP/NC	0.2	1.0	1263	[10]
S@rGO	0.2	2.1	1283	[11]
S@3DP-SP	0.2	3.3	837	[12]
S@g-C$_3$N$_4$	0.2	1.0	1200	[13]
S/Fe$_3$O$_4$@C	0.5	1.1	1195	[14]
S@Co@N-C	0.1	3.6	1250	[15]
Ni-MOFs	0.1	—	700	[16]
RGO/C-Co-S	0.3 A g^{-1}	1	1233	[17]
S@Co/G	0.2	2	875	[18]
Co@NHCRs/S	0.5	0.37	975	[19]
S/NiS$_2$-C	0.2	0.8-1.3	1085	[20]

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