

**Supporting Information**

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

Shunyou Hu<sup>a</sup>, Yuanyuan Hu<sup>a</sup>, Xiangli Liu<sup>c,\*,</sup>, Jiaheng Zhang<sup>a,b,\*</sup>

*<sup>a</sup>Research Centre of Printed Flexible Electronics, School of Materials Science and  
Engineering, Harbin Institute of Technology,*

*Shenzhen 518055, China*

*<sup>b</sup>State Key Laboratory of Advanced Welding and Joining, Harbin Institute of  
Technology, Shenzhen 518055, China.*

*<sup>c</sup>Shenzhen Engineering Laboratory of Aerospace Detection and Imaging, Department  
of Materials Science and Engineering, Harbin Institute of Technology (Shenzhen),  
Shenzhen 518055, China*

Corresponding author:

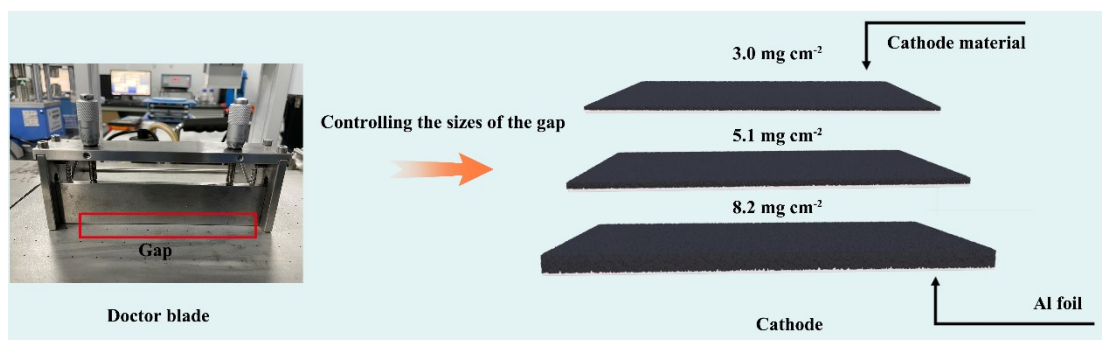
Jiaheng Zhang, Email: zhangjiaheng@hit.edu.cn

Xiangli Liu, Email: xiangliliu@hit.edu.cn

## 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 °C for 24 h<sup>-1</sup>. After cooling to room temperature, the C HSs powder 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.

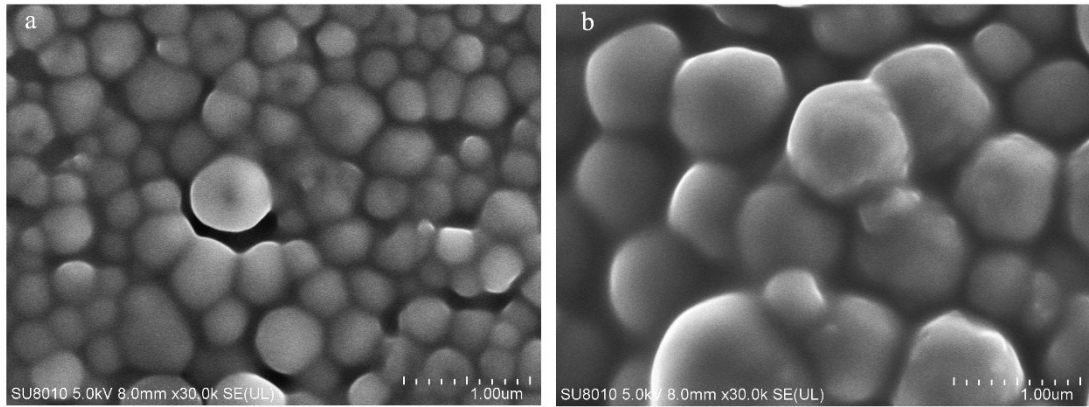


Fig. S1 SEM images of the Co-MOF.

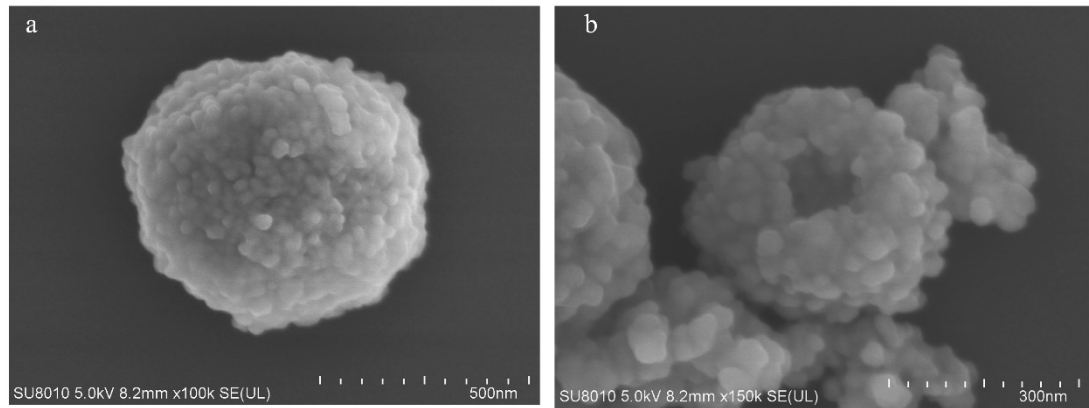


Fig. S2 SEM images of CoSe/C HSs.

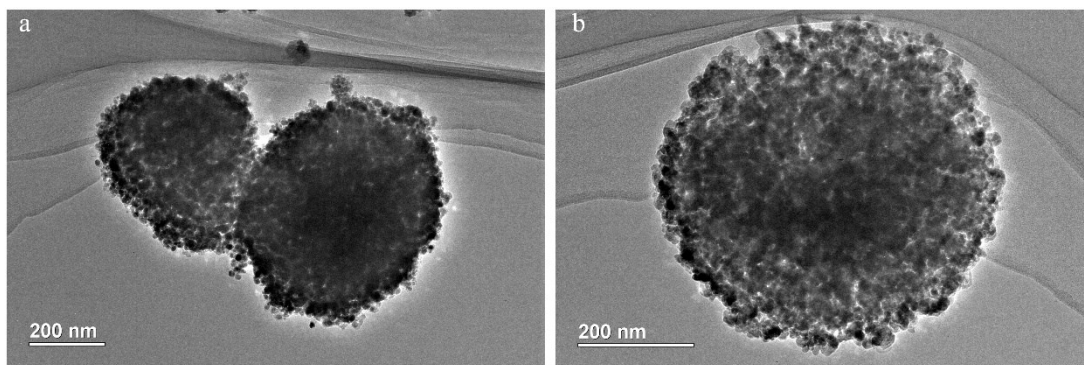


Fig. S3 TEM images of CoSe/C HSs.

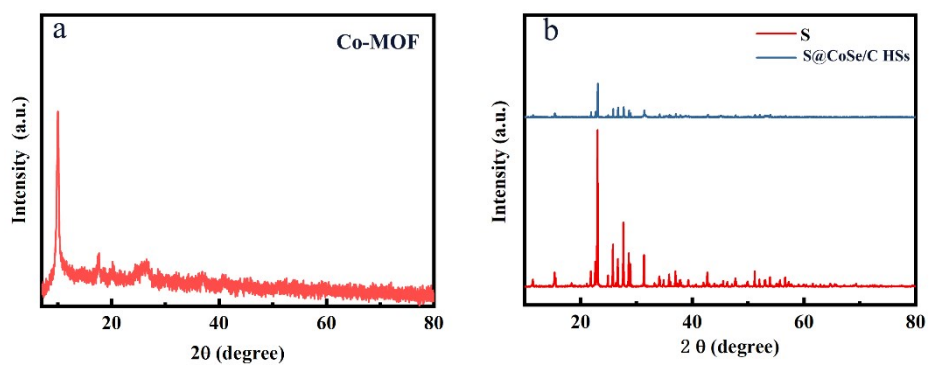


Fig. S4 XRD patterns of Co-MOF (a), S and S@CoSe/C HSs (b).

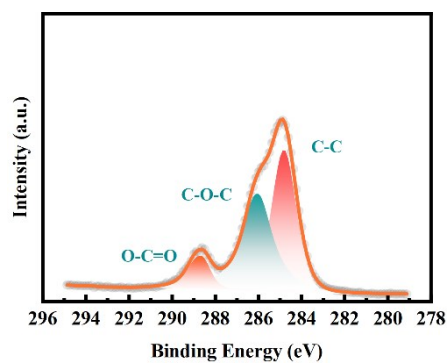


Fig. S5 XPS spectrum of C 1s of CoSe/C HSs.

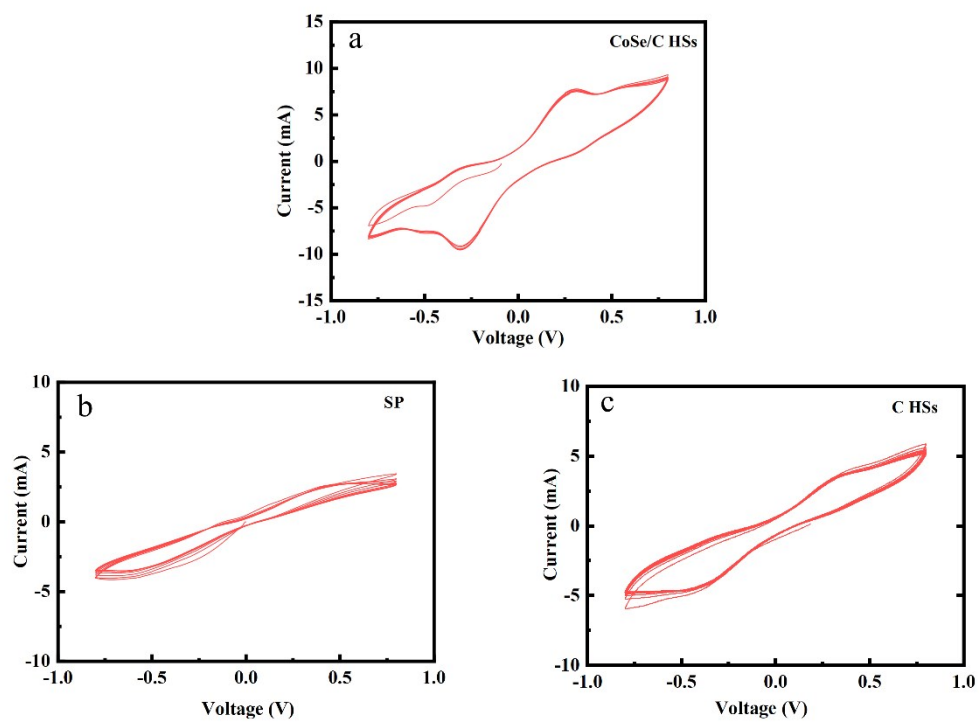


Fig. S6 CV curves of symmetric cells with S@CoSe/C HSs (a), S@SP (b), and S@CHSs (c) electrodes for 10 cycles.

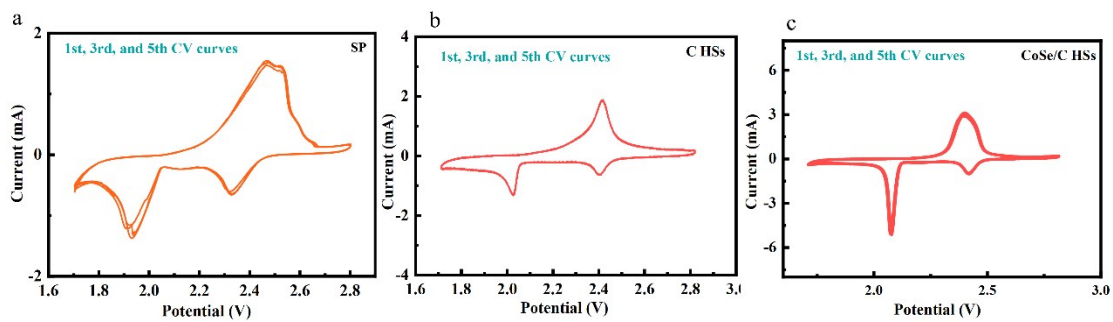


Fig. S7 The 1st, 3rd and 5th CV curves of cells with S@SP (a), S@CHSs (b) and S@CoSe/C HSs (c) electrodes.

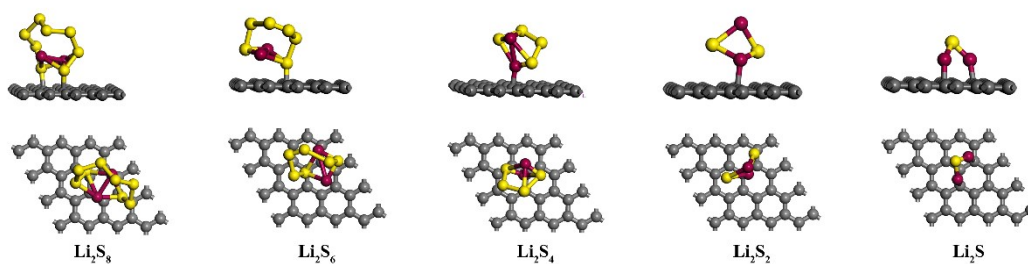


Fig. S8 Optimized configurations of polysulfides adsorption on graphene.

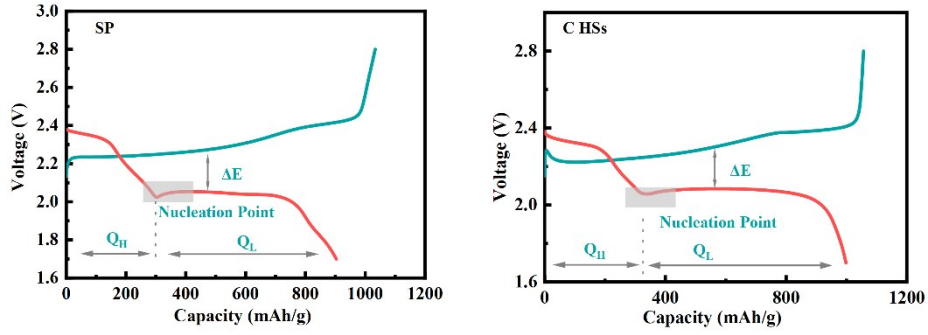


Fig. S9 The charge/discharge profiles for the first cycle of the cells with S@SP and S@C HSs electrodes.

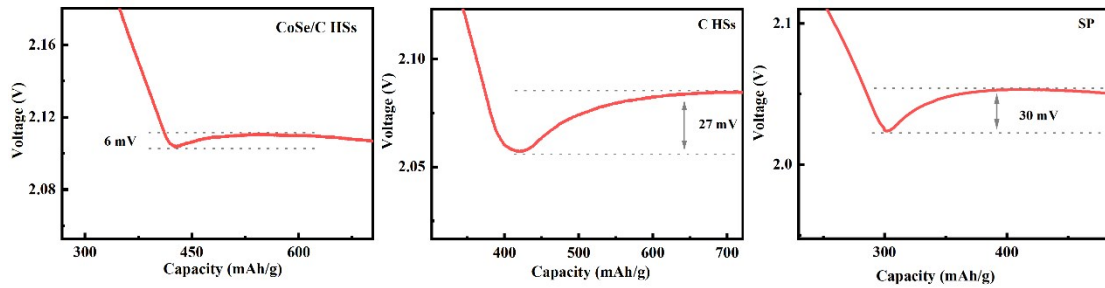


Fig. S10 The overpotential of  $\text{Li}_2\text{S}_2/\text{Li}_2\text{S}$  nucleation of the cells with S@CoSe/C HSs (a), S@CHSs (b) and S@SP (c) electrodes.

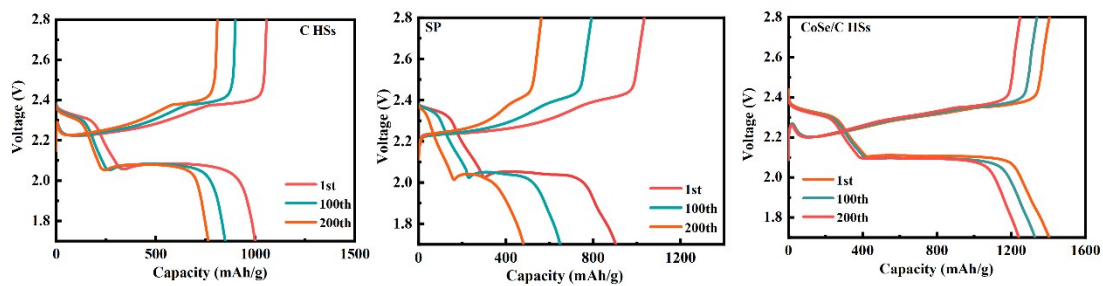


Fig. S11 The 1st, 100th and 200th charge/discharge profiles of the cells with S@CHSs, S@SP and S@CoSe/C HSs electrodes.

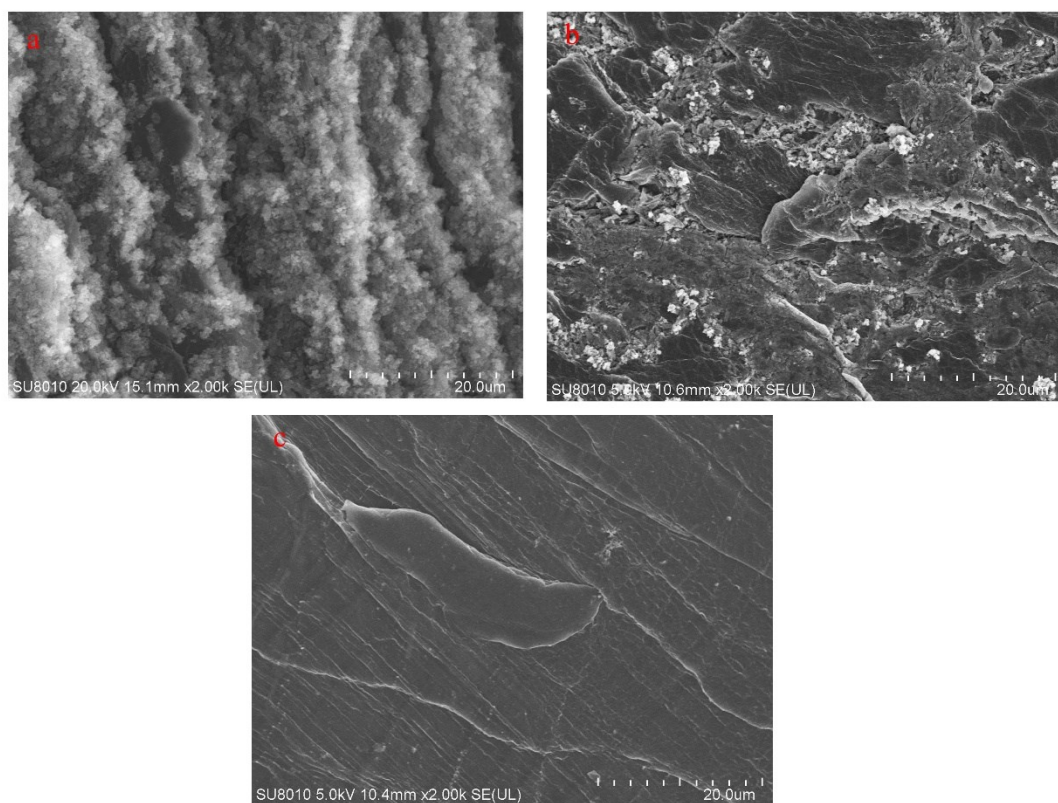


Fig. S12 SEM images of the Li anodes of the cells with S@SP (a), S@C/HSs (b) and S@CoSe/C HSs (c) cathode.



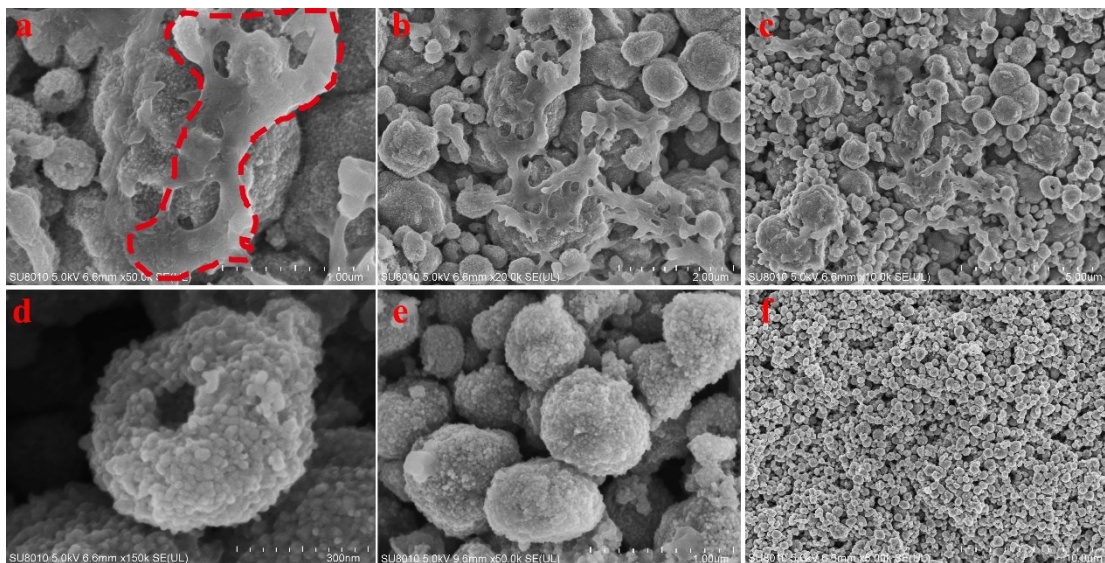


Fig. S13 SEM images of S@C HSs (a-c) and S@CoSe/C HSs (d-f) electrodes after cycles.

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

Cathode	Current Rate (C)	Area loading (mg cm <sup>-2</sup> )	Discharge capacity (mAh g <sup>-1</sup> )	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 <sup>-2</sup>	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 <sub>3</sub> N <sub>4</sub>	0.2	1.0	1200	13
S/Fe <sub>3</sub> O <sub>4</sub> @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 <sup>-1</sup>	1	1233	17
S@Co/G	0.2	2	875	18
Co@NHCRs/S	0.5	0.37	975	19
S/NiS <sub>2</sub> -C	0.2	0.8-1.3	1085	20

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