Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

The cobalt-based current collectors for flexible electrodes and its application in lithium-sulfur battery

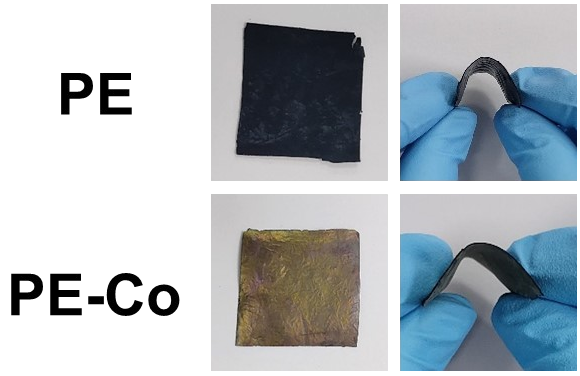

Fig. S1 Optical images of (up) PE and (bottom) PE-Co.

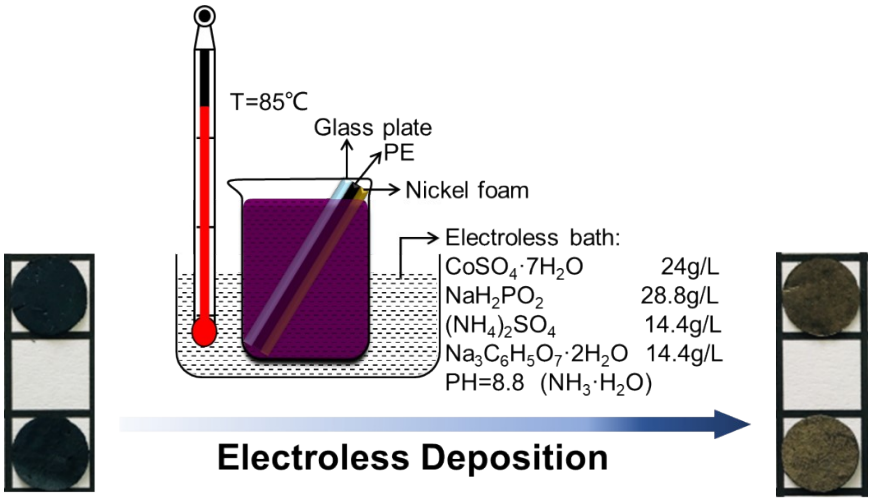

Fig. S2 The schematic diagram of electroless deposition.

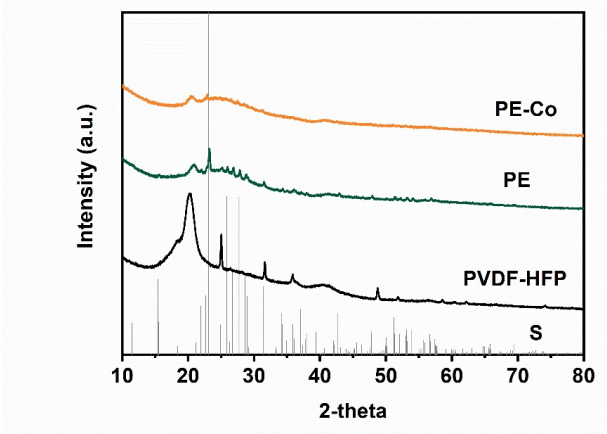

Fig. S3 The XRD spectrum of PE, PE-Co and PVDF-HFP membrane.

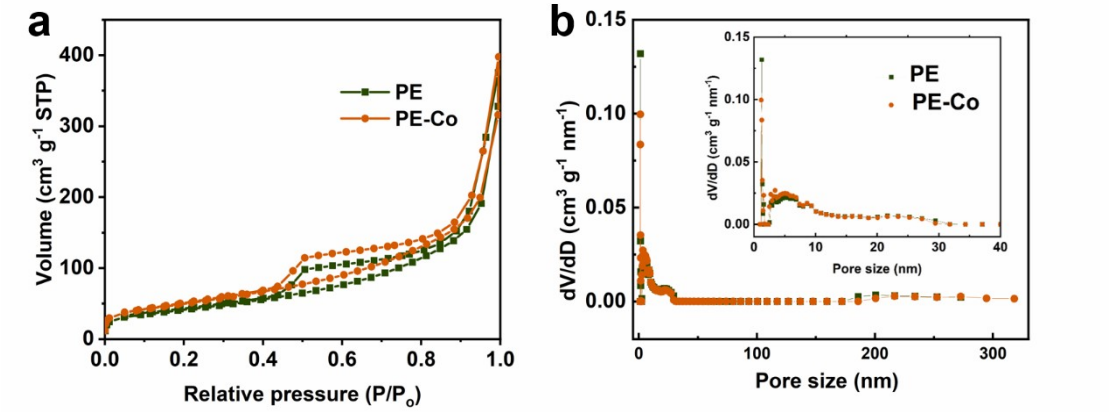

Fig. S4 (a) Nitrogen adsorption–desorption isotherms and (b) pore size distribution curves of PE and PE-Co composites.

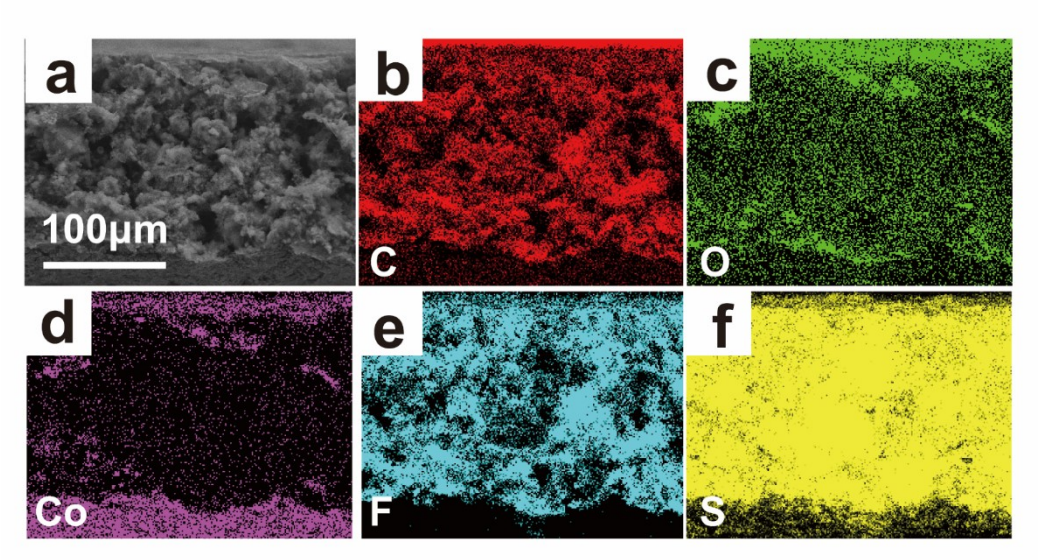

Fig. S5 (a) Cross-section morphology of PE-Co and its elemental mapping of (b) carbon, (c) oxygen, (d) cobalt, (e) fluorine and (f) sulfur.

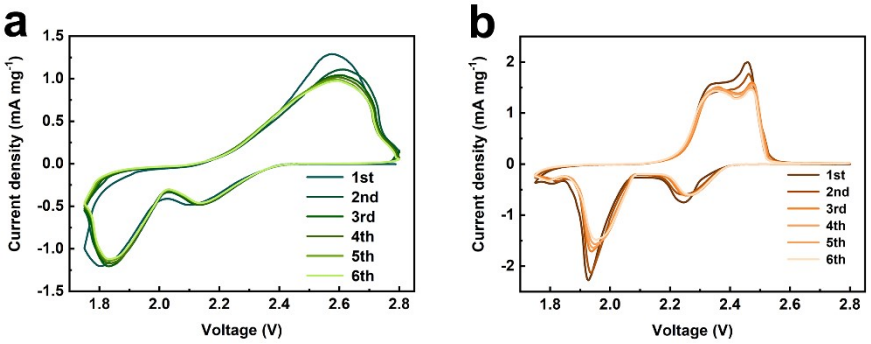

Fig. S6 CV curves of batteries assembled with (a) PE and (b) PE-Co of 6 cycles at a scanning rate of 0.1 mV s^{-1} in the range of 1.75-2.8 V.

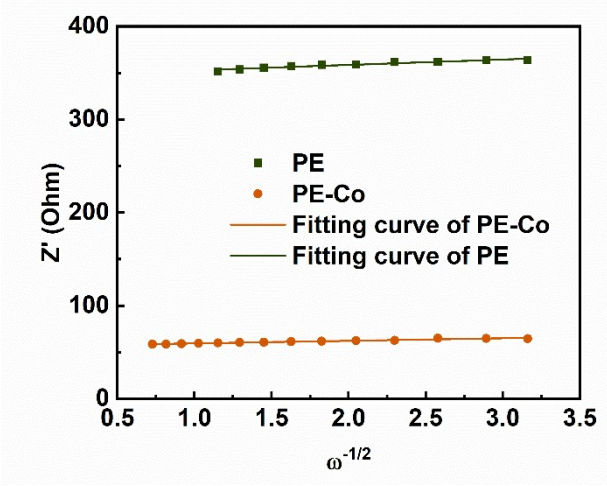

Fig. S7 Relationship between Z' and square root of frequency ($\omega^{-1/2}$) in the low-frequency region.

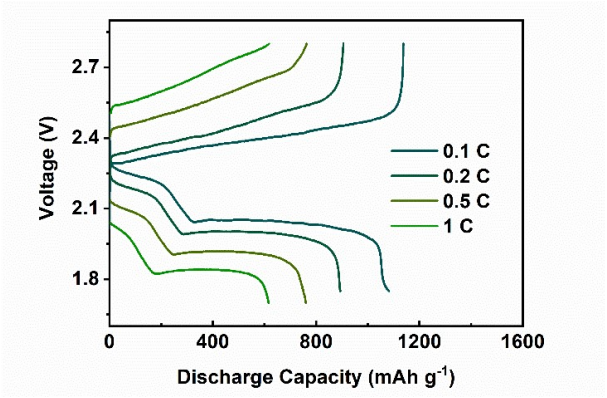

Fig. S8 Charge/discharge curves of batteries assembled with PE at various C-rate from 0.1 to 1 C.

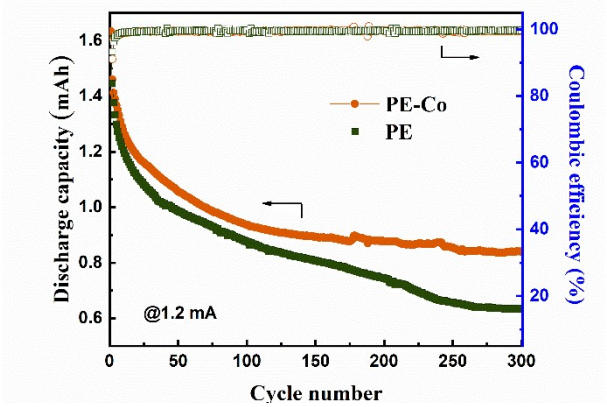

Fig. S9 Cycling performance of batteries assembled with PE and PE-Co at 1.2 mA.

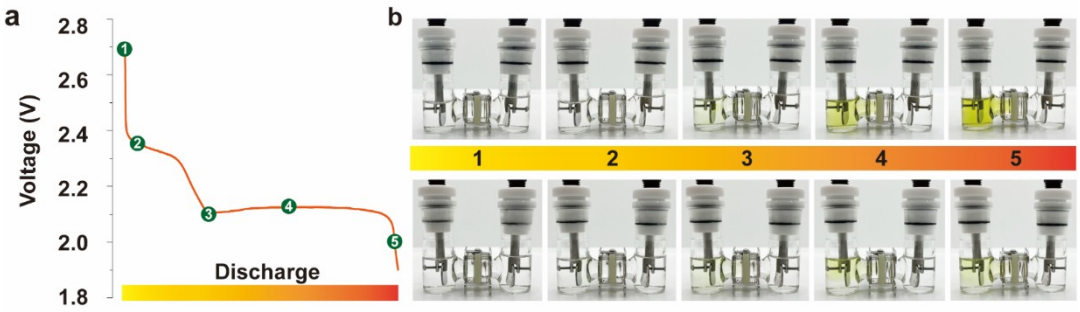

Fig. S10 (a) Schematic of discharge curve diagram. (b) Photos of polysulfide entrapment of PE (up) and PE-Co (down) cathodes at different discharge states of 1 to 5 from (a).

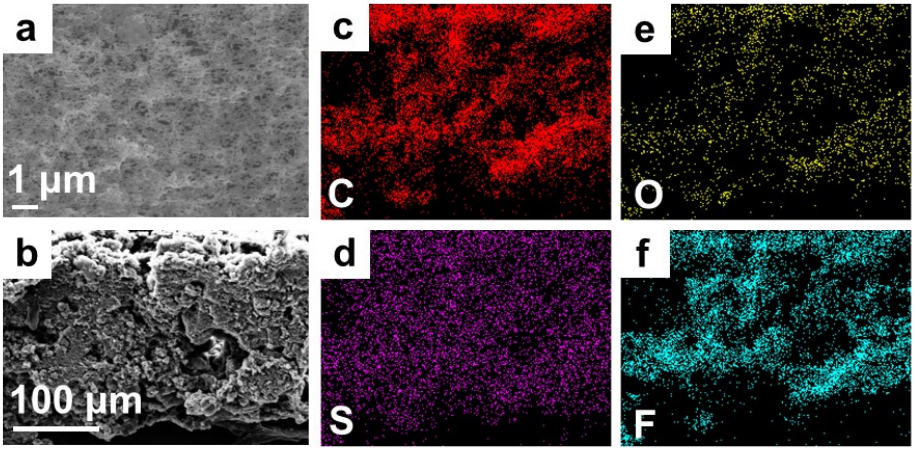

Fig. S11 (a) Surface and (b) cross-section morphology of PE after cycling and its elemental mapping of (c) carbon, (d) sulfur, (e) oxygen, and (f) fluorine.

Table S1 The definite quantitative porous structures of PE and PE-Co.

sample	BET Surface Area ($m^2\ g^{-1}$)	Total Volume in Pores ($cm^3\ g^{-1}$)
PE	147.90	0.56
PE-Co	181.05	0.58

Table S2 Kinetic parameters of PE and PE-Co.

Kinetic parameters	R_s [$\Omega\ cm^{-2}$]	R_{ct} [$\Omega\ cm^{-2}$]	σ	D [$cm^2\ s^{-1}$]
PE	2.6	421.1	5.76	1.09×10^{-10}
PE-Co	2.5	65.2	2.75	4.74×10^{-10}

Table S3 Statistical information of publications about flexible electrodes with high sulfur loading in Li-S battery systems.

Sulfur hosts	Sulfur loading （mg cm^{-2}）	Capacity at last cycle （mAh g^{-1}）	Current density	Cycling number	Capacity retention（%）	Ref
PE-Co	2.5	624	0.2C	300	55.6%	This work
	8	639	0.1C	200	56.1%	
PPy@rGO/CNTs	2.8	757.9	0.2C	100	87.06	1
	4.5	489.5	0.2C	100	83.24	
	5.4	390.2	0.2C	50	80	
PEDOT：PSS	6.1	559	2C	500	71.5	2
VIPIE(S/C＋PVDF)	10	917.88	0.1C	60	90.7	3
PES/CNT	4.8	653	0.25C	50		4
	5.9	539				
	7	507				
PAN/TiO_{2-x}	2.3	921.9	0.5C	100		5
	4.3	699.4				
	5.31	670				
Ti_3C_2Tx-CNT@PAN	4.5	747.8	0.2C	100	83.68	6
Fe_3C/C	1.6	742.5	0.5C	100		7
	3.4	656.8		100		
S@Co_xP/NC	3.15	615.6	0.5C	300		8
	3.92	519.4	0.5C	300		
	4.68	368.8	0.5C	300		
	6.2	570	0.1C	100	59.50%	
Fe-N-GOMC/S	3	920.6	0.5C	500		9
	6	715	1C	120		
$MoSe_{2-x}$@GA/S	4.8	503.2	1C	1000	70%	10

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