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Supplementary Information

Entrapping polysulfide by ultrathin hollow carbon sphere-functionalized separators for high-rate lithium-sulfur batteries

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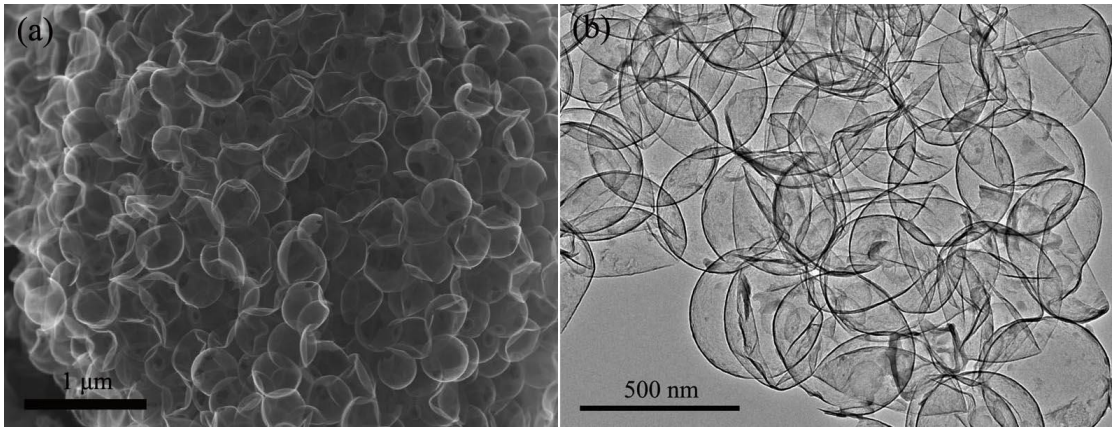

Fig. S1 Low magnification SEM image (a) and TEM image (b) of UHCS samples.

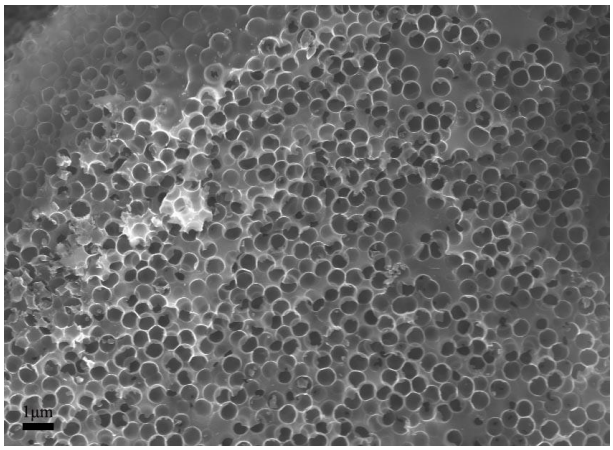

Fig. S2 SEM image of the obtained PHCS synthesized using regular glucose as carbon sources under the same preparation conditions with UHCS.

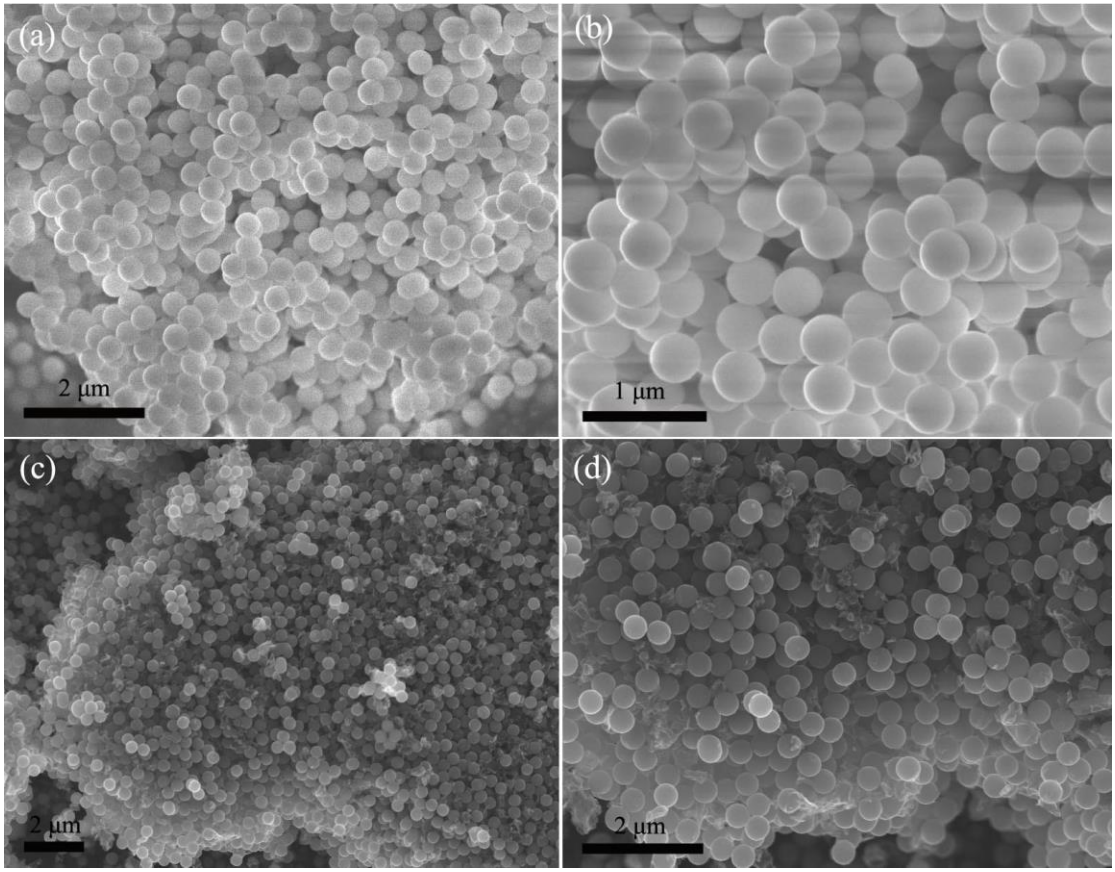

Fig. S3 SEM images of SiO_2 sphere templates (a,b), and SiO_2/C spheres (c,d).

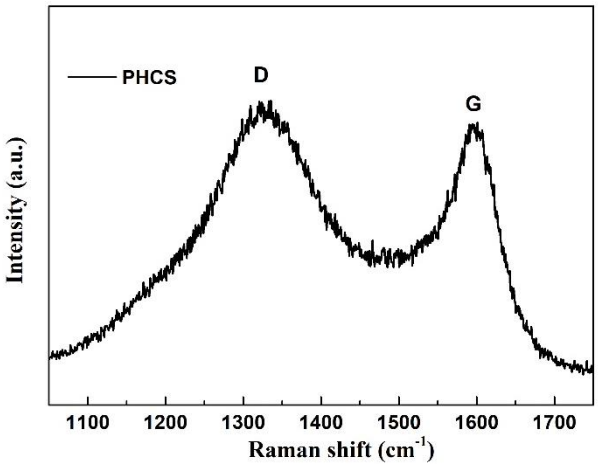

Fig. S4 Raman spectrum of the obtained PHCS synthesized using regular glucose as carbon sources.

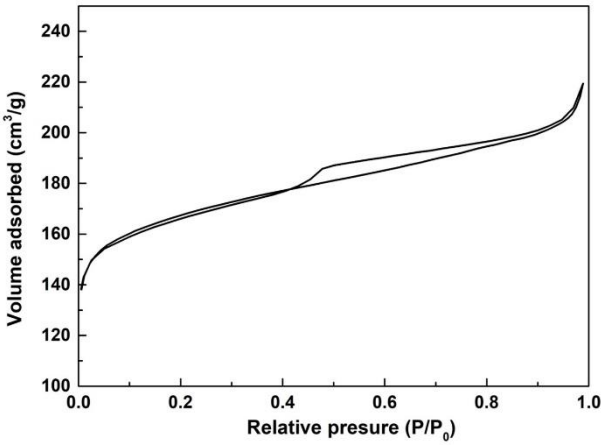

Fig. S5 Nitrogen adsorption/desorption isotherm of PHCS

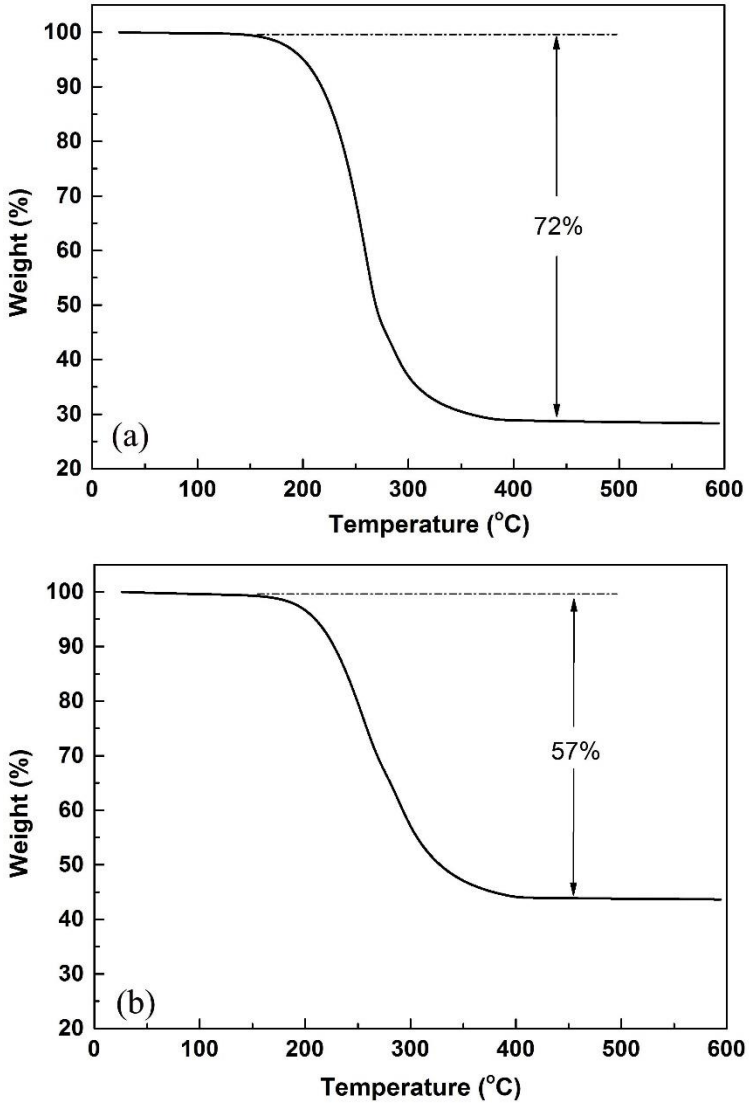

Fig. S6 TGA analysis of the S/CB composites. The simple CB/S composites with 72 wt% S content (a) were prepared and used as sulfur cathode materials for LSBs with UHCSPP separators. To make the sulfur ratio comparable, the CB/S composites with 57 wt% S content (b) were used for testing in the LSBs with PP separators.

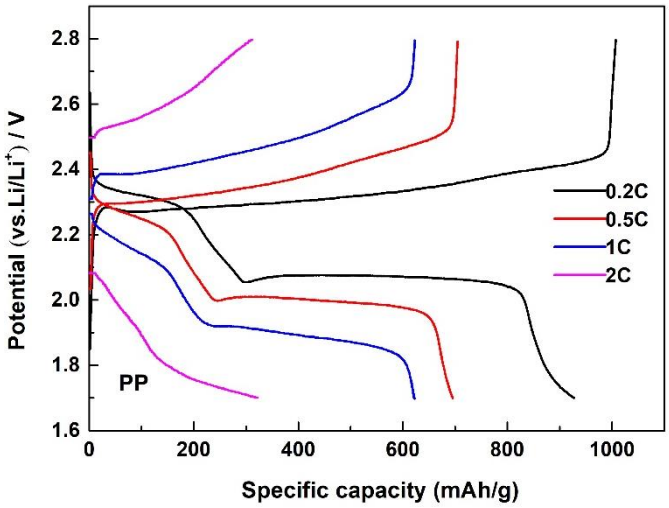

Fig. S7 Charge/discharge curves of LSBs using PP separators at various rates.

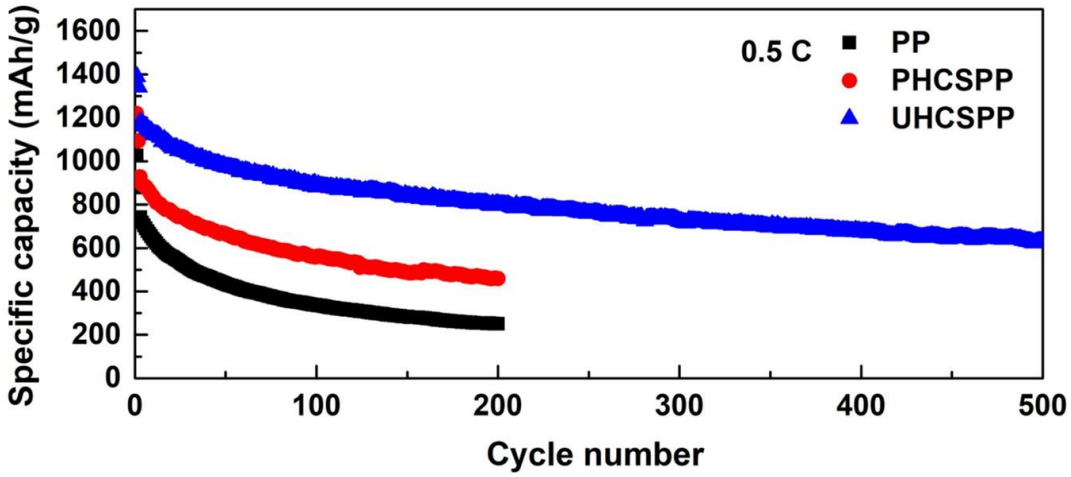

Fig. S8 Cycling performance of LSBs using PP, PHCSPP and UHCSPP separators at 0.5 C.

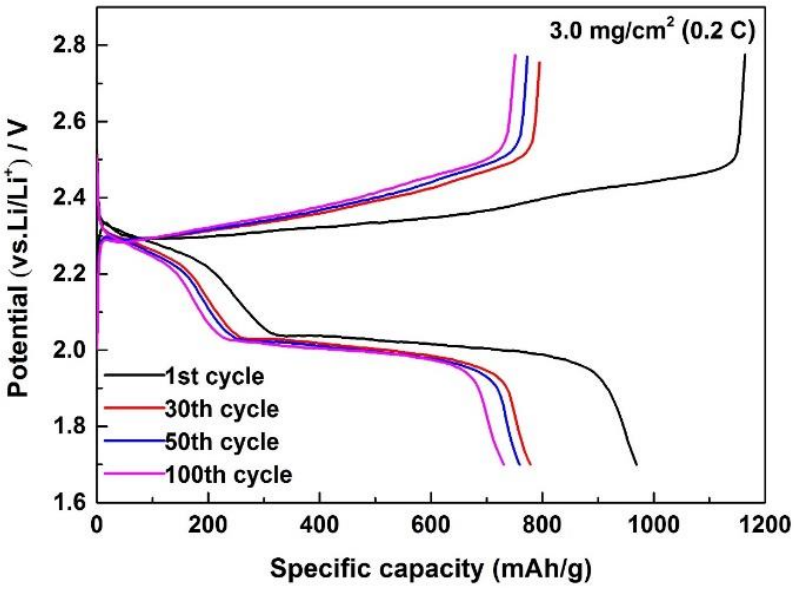

Fig. S9 Charge/discharge curves of the 1st, 30th, 50th, and 100th cycles for the LSBs with UHCSPP separators at a high sulfur loading of 3 mg cm^{-2}.

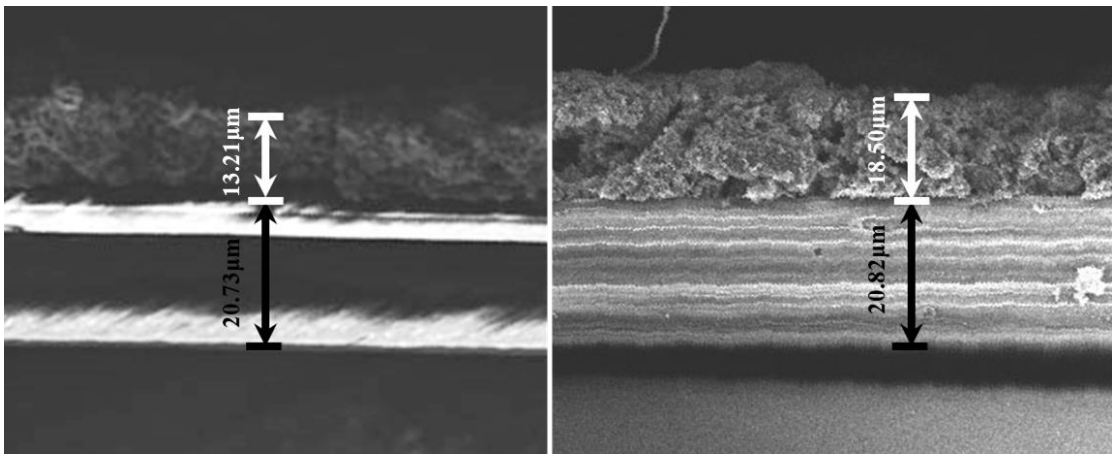

Fig. S10 Cross-sectional SEM images of the UHCSPP separators with different coating thicknesses.

Table S1 Comparison between Li-S batteries employing different carbon-based coating layers on separators.

Coating materials	Sulfur loading (mg cm^{-2})	Coating Mass (mg cm^{-2})	Initial discharge capacity (mAh g^{-1})	Reversible discharge capacity (mAh g^{-1})	Number of cycles	Rate (C)	Degradation rate per cycle	Ref.
N-doped porous carbon	1.5-2	0.2	1301	971.3	100	0.1	0.25 %	S1
			---	578	500	1	0.029 %	
Porous graphene	1.8-2.0	0.54	1165	877	150	0.5	0.16 %	S2
Super P	1.1-1.3	0.2	1389	828	200	0.2	0.2 %	S3
Super P	0.7–1.0	0.61	1200	721	200	1	0.19 %	S4
			---	421	---	4	---	
LDH/Graphene	1.2	0.3	812	337	1000	2	0.06 %	S5
CNTOH	3	---	1056	591	400	0.5	0.11 %	S6
Porous N,P-doped graphene	2.1	1	1158.3	638	500	1	0.09 %	S7
Mesoporous carbon	1.55	0.5	1058	683	500	1	0.071 %	S8
N-doped porous hollow carbon sphere	1.6	0.28	1216	542	500	1	0.11 %	S9
Graphene	1.5-2.1	1.3	932	663	500	0.9	0.058 %	S10
N-rich carbon	1.4	---	1362	1016	100	0.2	0.25 %	S11
UHCS	1.2-1.5	0.2	1033	575	500	0.5	0.088 %	This work
			643	458	1000	5	0.014 %	

References

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