Electronic Supplementary Material (ESI) for Green Chemistry.

Supporting Information

Direct application of spent graphite as functional interlayer with enhanced polysulfides trapping and catalytic performance for Li-S batteries

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Table S1 ICP-AES results of SG.

Sample	Li	Ni	Co	Mn	Al	Cu	Fe	K	Na	P
SG (ppm)	266.29	215.05	75.33	365.88	137.20	139.21	120.79	542.27	345.56	733.9

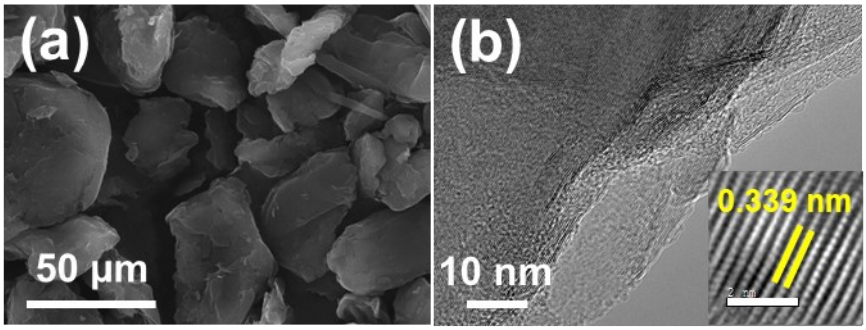

Fig. S1 (a) SEM and (b) HRTEM images of AG.

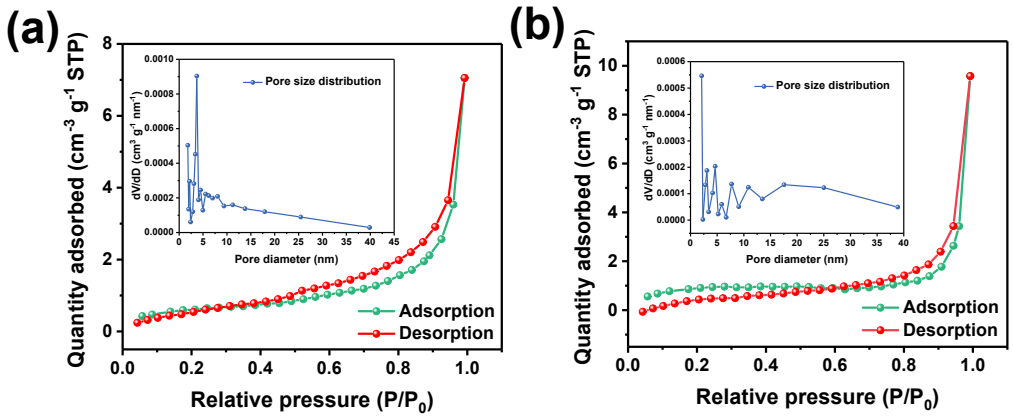

Fig. S2 N_2 adsorption-desorption isotherms and corresponding pore size distributions of (a) AG and (b) SG.

Table S2 Physical parameters of AG and SG at (002) crystal surface.

Samples	$2\theta_{002}$ (°)	$d_{(002)}$ (nm)
AG	26.210	0.339
SG	26.183	0.340

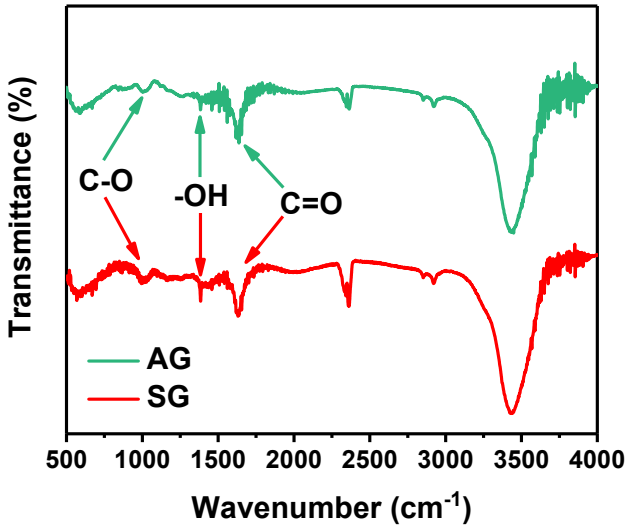

Fig. S3 FTIR spectra of AG and SG.

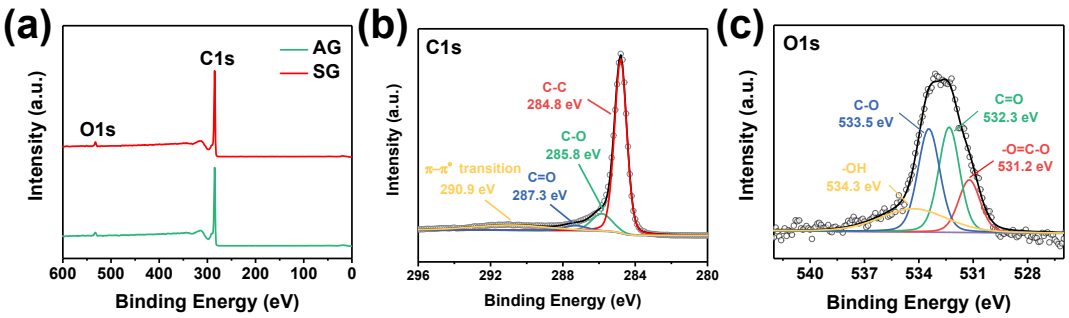

Fig. S4 (a) XPS survey spectra of AG and SG, (b) C1s and (c) O1s spectra of AG.

Table S3 Atomic ratio measured by XPS survey results.

Samples	C (%)	O (%)
AG	93.96	6.04
SG	87.59	12.41

Table S4 Comparison of physical parameters of AG and SG.

Materials	BET surface area (m^2 g^{-1})	Pore volume (cm^3 g^{-1})	Interlayer distance (nm)	I_D/I_G	Surface element content (at%)	Transition metals content (ppm)
SG	3.49	0.015	0.341	0.70	C: 87.59 O: 12.41	Ni: 215.05 Co: 75.33 Mn: 365.88
AG	2.23	0.010	0.339	0.16	C: 93.96 O: 6.04	/

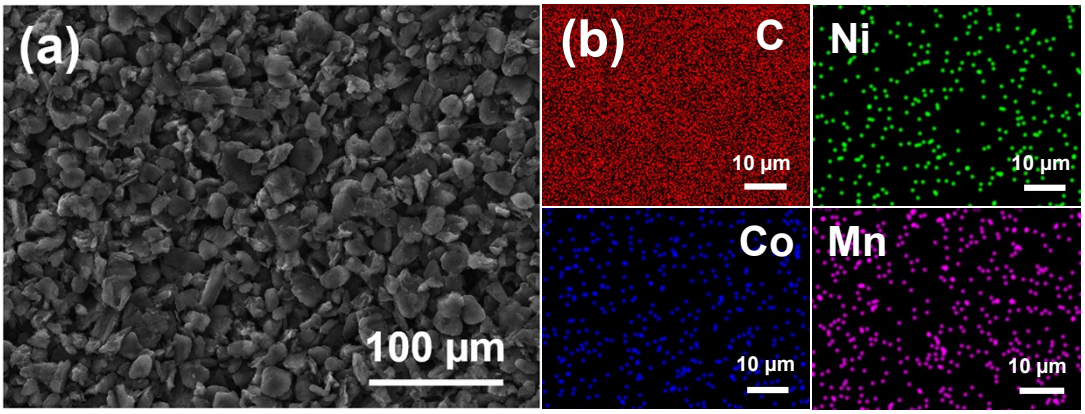

Fig. S5 (a) SEM image and (b) corresponding EDS mapping images of AG-modified separator.

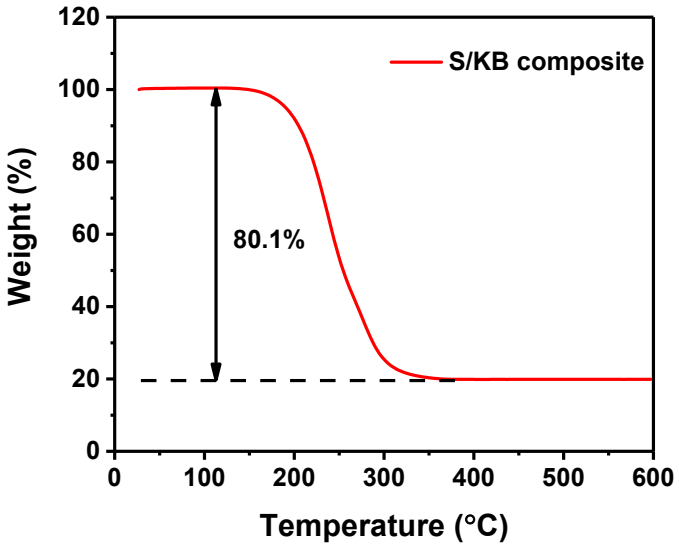

Fig. S6 TGA curve of S/KB composite in Ar_2.

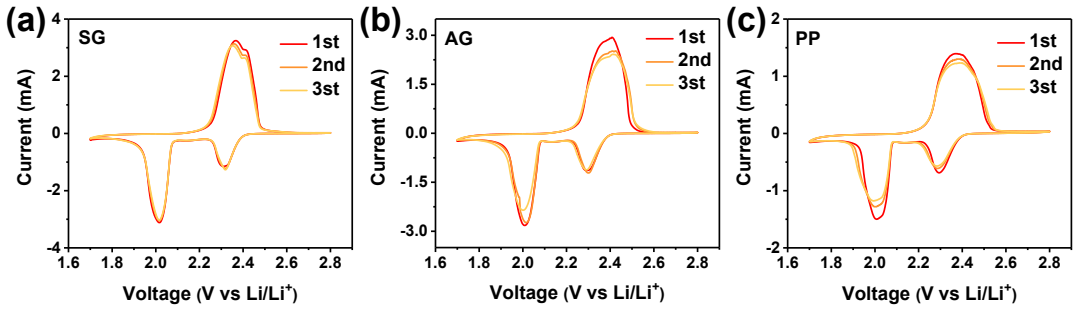

Fig. S7 CV curves of the cells with (a) SG-modified, (b) AG-modified and (c) PP separators for the first three cycles at a scan rate of 0.1 mV s^{-1}.

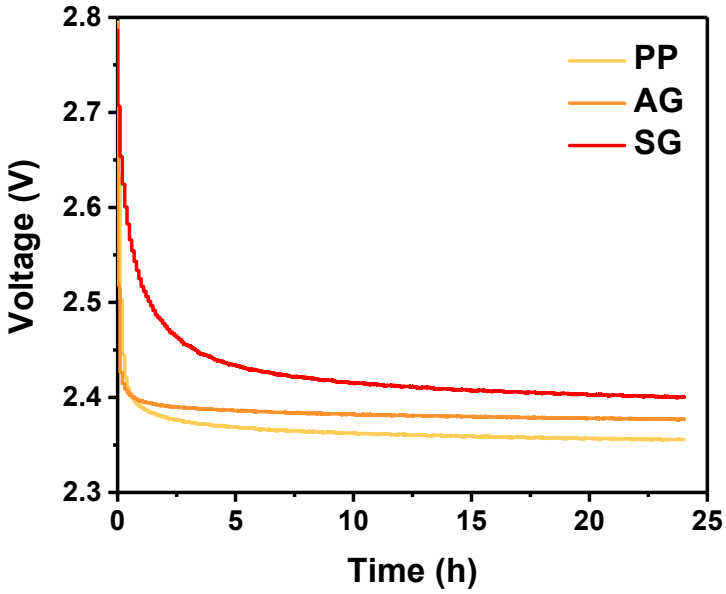

Fig. S8 Time-dependent open-circuit voltages with different separators.

Table S5 Comparison of electrochemical performance with the other carbon-based interlayer materials in recent reported literatures.

Materials	Initial capacity ($mAh\ g^{-1}$)	Cycles	Reversible capacity ($mAh\ g^{-1}$)	Rate performance ($mAh\ g^{-1}$)	Ref
$Ni/SiO_2/G$	1037, 1 C	300	772	782, 2 C	1
GF/GF@ZnO	1051, 0.5 C	100	672	518, 2 C	2
CuS/graphene	1029, 0.5 C	200	639	568, 3 C	3
MG	~700, 1 C	250	~600	~750, 1 C	4
CTC	900, 0.5 C	200	614	650, 2 C	5
CNF/CoS/KB	~1000, 1 C	760	~422	650, 2 C	6
NMT	~750, 0.5 C	500	463.7	518.7, 1 C	7
GO/CNT	~800, 2 C	200	441.97	560, 2 C	8
CCC	827, 1 C	1000	498	718, 2 C	9
NPPC	757.3, 1 C	500	525.8	758.1, 2 C	10
NSHPC	960, 1 C	100	723	515, 1 C	11
NB-PPCA	987.6, 1 C	500	586.6	748.7, 2 C	12
AG	939, 0.5 C 845, 1 C	200 500	626 496	744, 2 C	**This work**
SG	1042, 0.5 C 968, 1 C	200 500	762 562	813, 2 C	

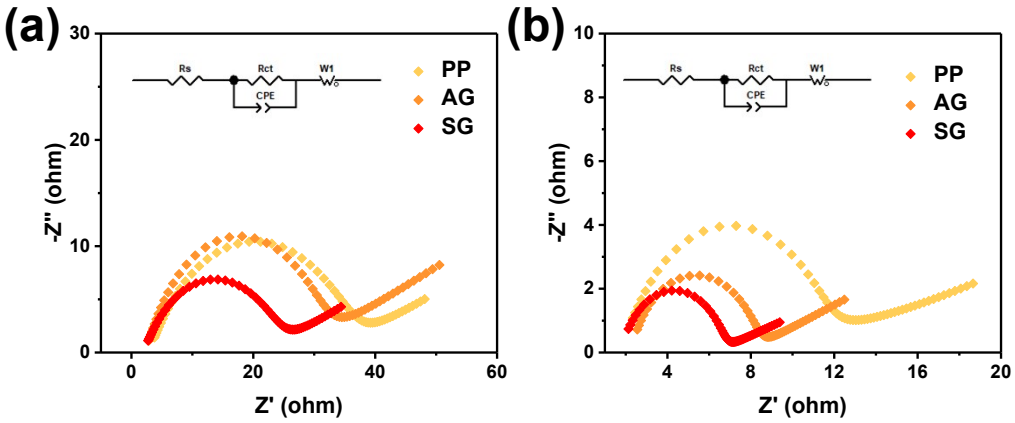

Fig. S9 EIS spectra of the cells with PP, AG and SG-modified separators (a) before and (b) after 100 cycles at 0.5 C, respectively.

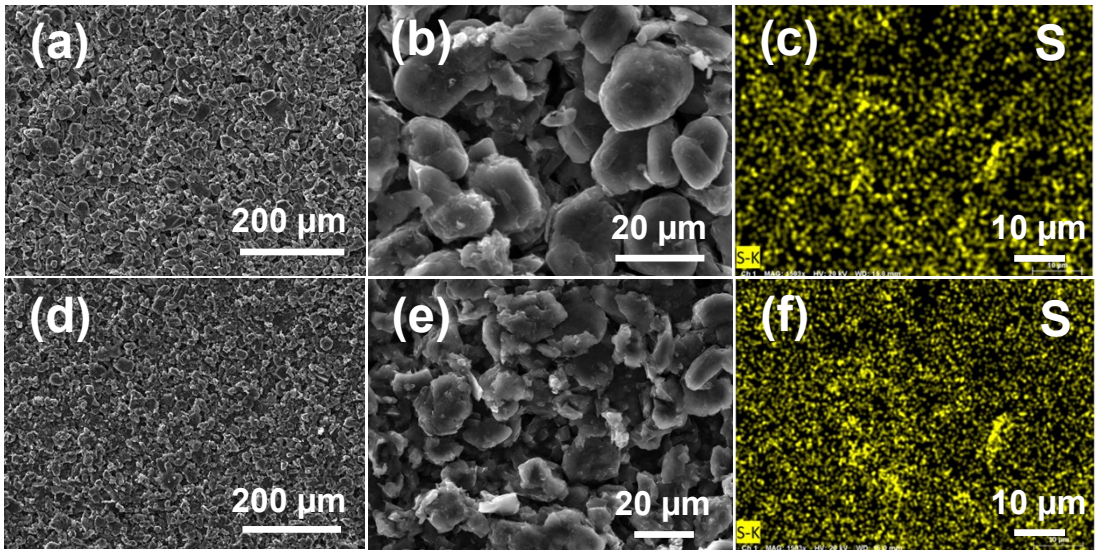

Fig. S10 SEM images of (a, b) AG and (d, e) SG-modified separator and (c, f) corresponding EDS mapping images of S after 100 cycles at 0.5 C.

References

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