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

Supporting information

Sulfur Film Sandwiched between Few-Layered MoS_2 Electrocatalysts and Conductive Reduced Graphene Oxide as Robust Cathode for Advanced Lithium-Sulfur Battery

Yanju Wei,[a] Zhenkai Kong,[a] Yankai Pan,[a] Yueqiang Cao,[a] Donghui Long,[a,b,*] Jitong Wang,[a,b] Wenming Qiao,[a,b] Licheng Ling [a,b,*]

[a] State Key Laboratory of Chemical Engineering, East China University of Science and Technology, Shanghai 200237, China.

[b] Key Laboratory of Specially Functional Polymeric Materials and Related Technology, East China University of Science and Technology, Shanghai 200237, China.

[*] Corresponding author: longdh@mail.ecust.edu.cn; lchling@ecust.edu.cn

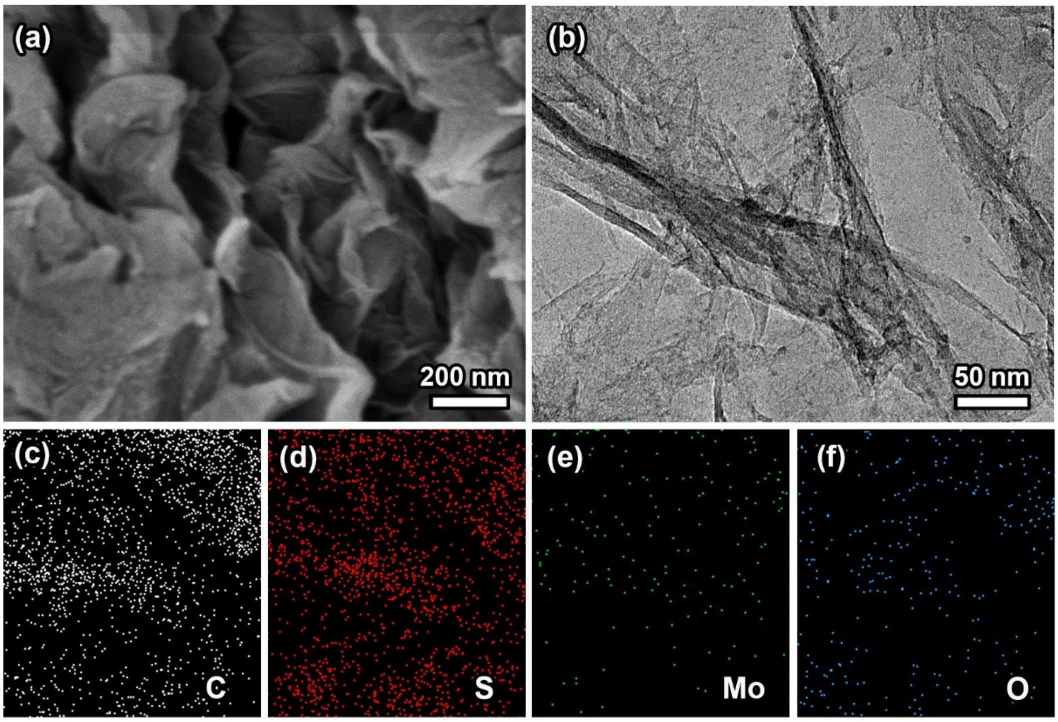

Figure S1. (a) SEM, (b) TEM and the corresponding (c-f) elemental mapping images of the S/rGO intermediate at an initial hydrothermal time of 2 h.

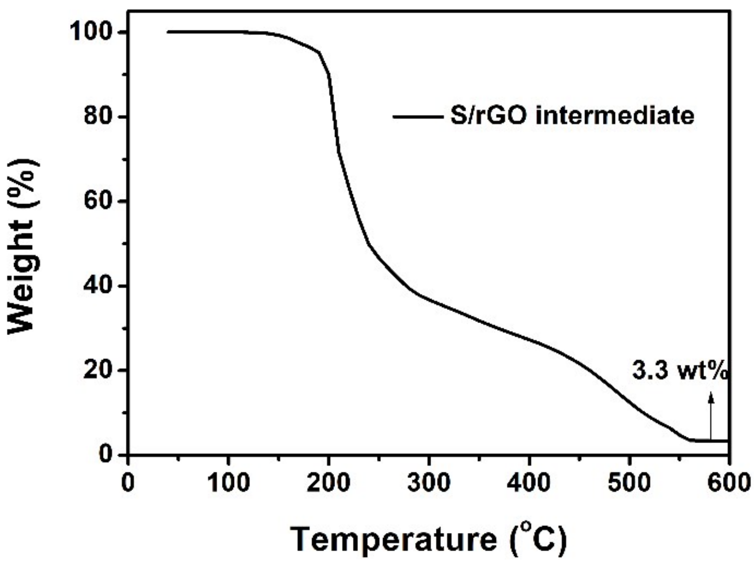

Figure S2. TGA curve under air for the S/rGO intermediate at an initial hydrothermal time of 2 h.

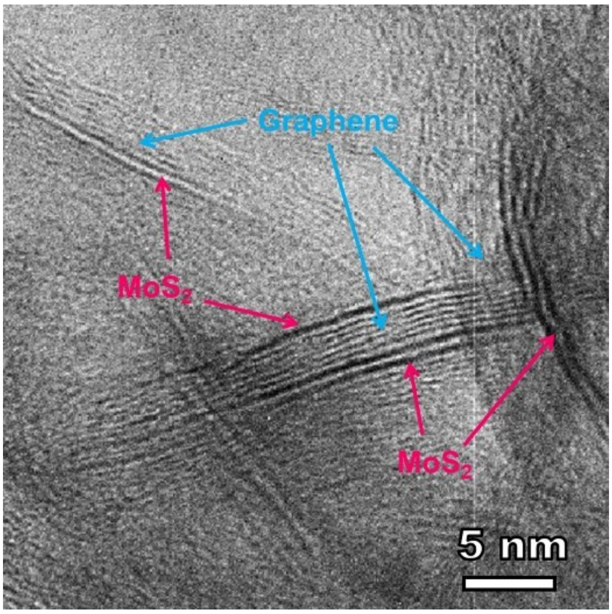

Figure S3. HR-TEM image of the MoS_2/S/rGO-HT composite, obtained by heat-treating MoS_2/S/rGO at 800 °C for 2 h in argon environment.

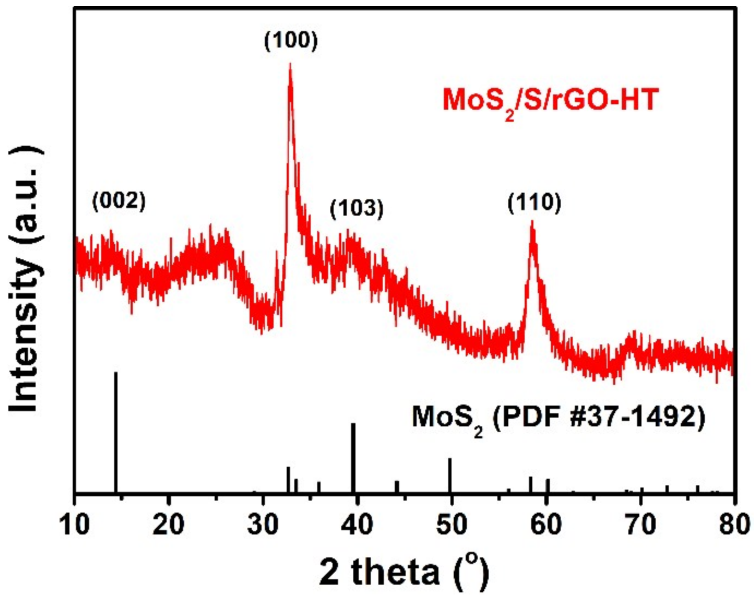

Figure S4. XRD pattern of the MoS_2/S/rGO-HT composite.

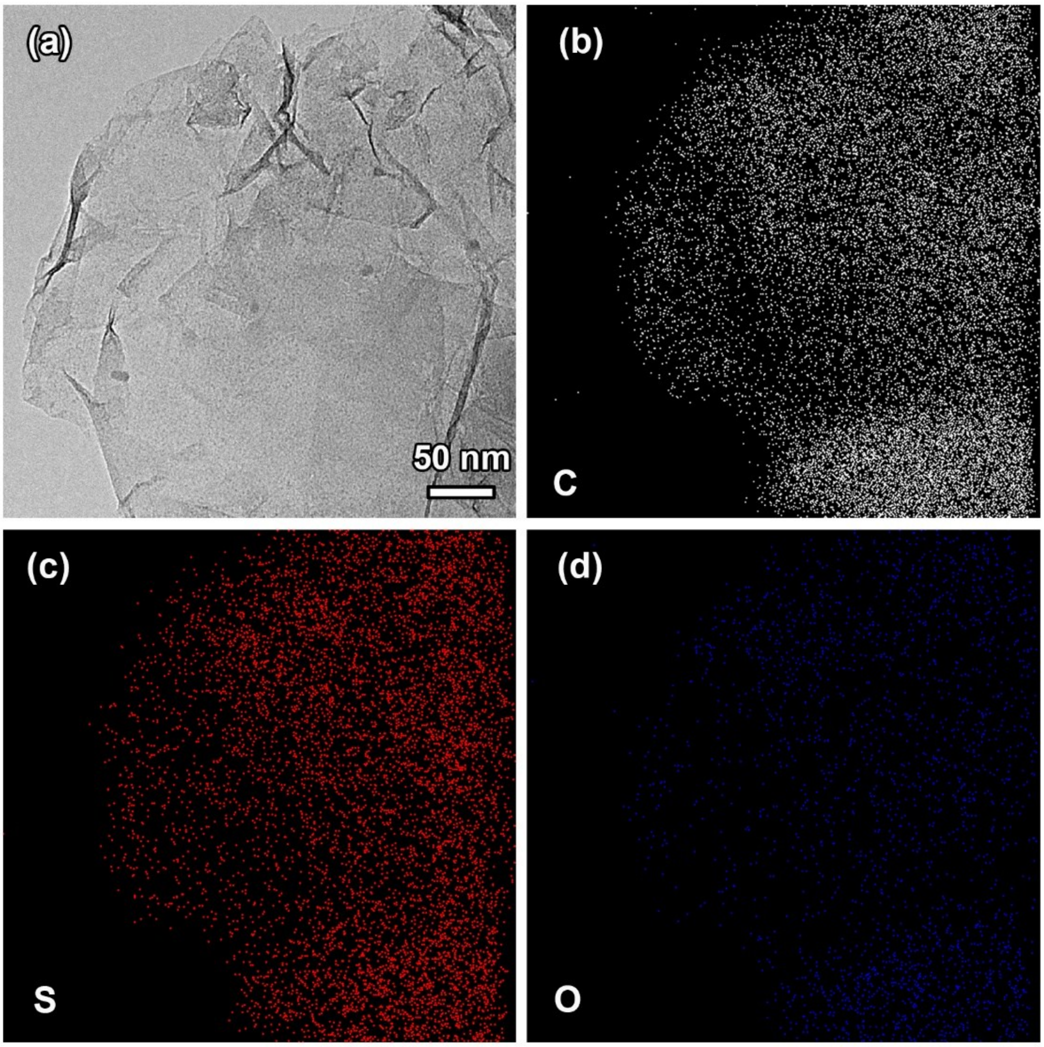

Figure S5. (a) TEM and the corresponding (b-d) elemental mapping images of the S/rGO composite.

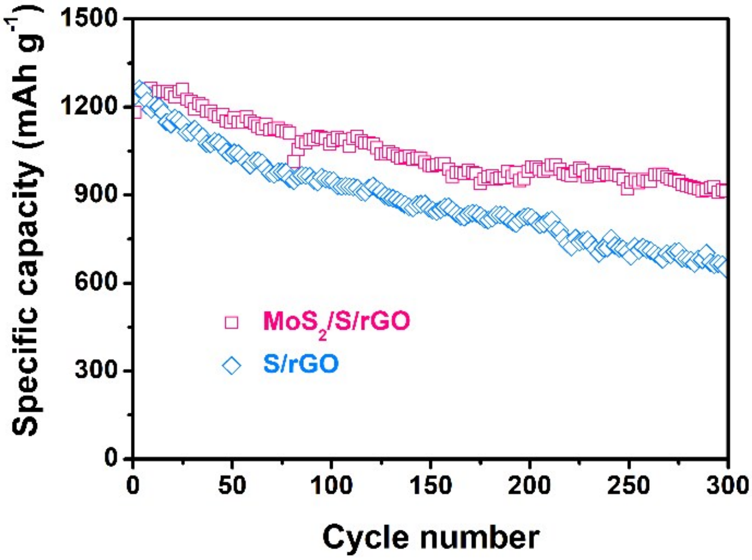

Figure S6. Cycling performance of the MoS_2/S/rGO and S/rGO cathodes at 0.5 C.

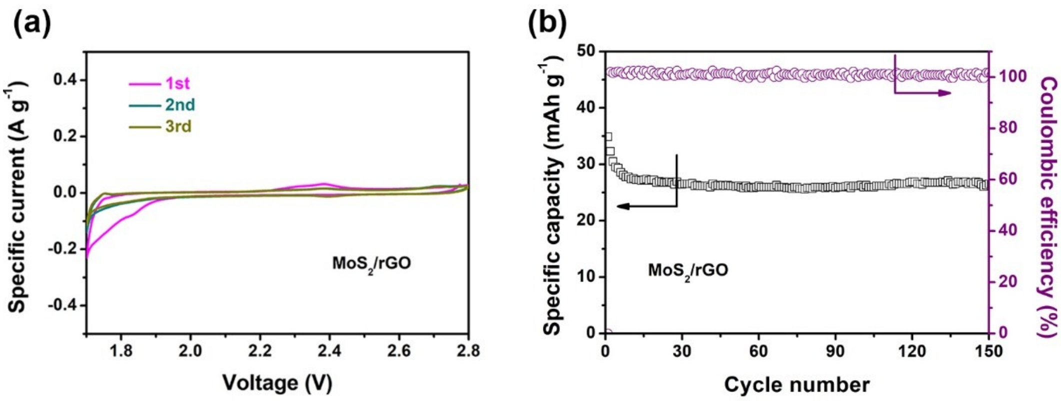

Figure S7. (a) CV curves and (b) cycling performance of the MoS_2/rGO composite at 0.2 C.

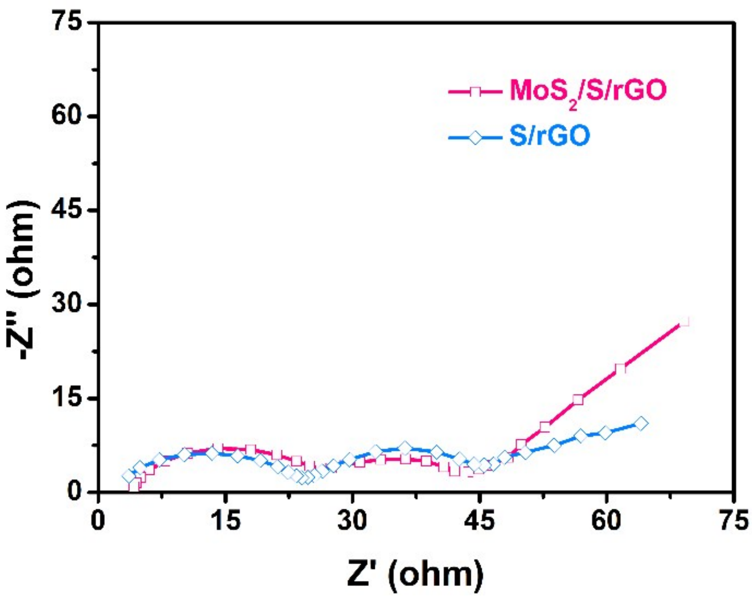

Figure S8. Nyquist plots of the MoS_2/S/rGO and S/rGO cathodes before cycling.

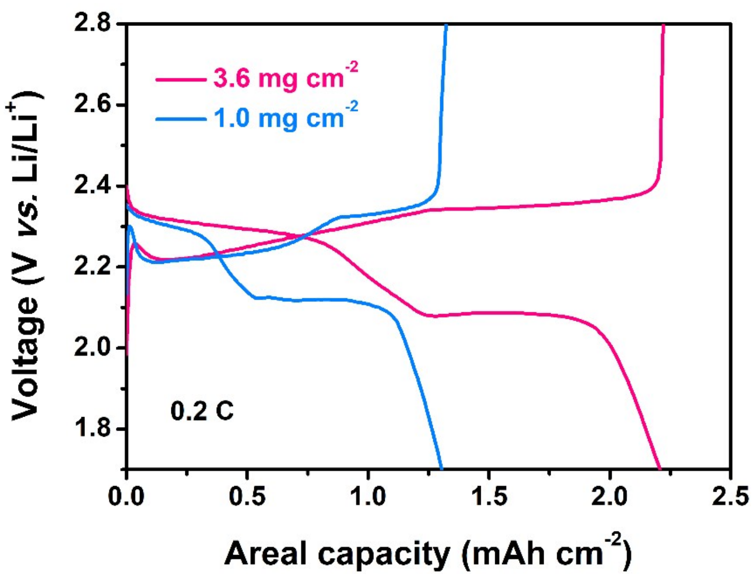

Figure S9. Initial-cycle voltage profiles of the MoS_2/S/rGO electrodes with sulfur loadings of 1.0 and 3.6 mg cm^{-2} at 0.2 C.

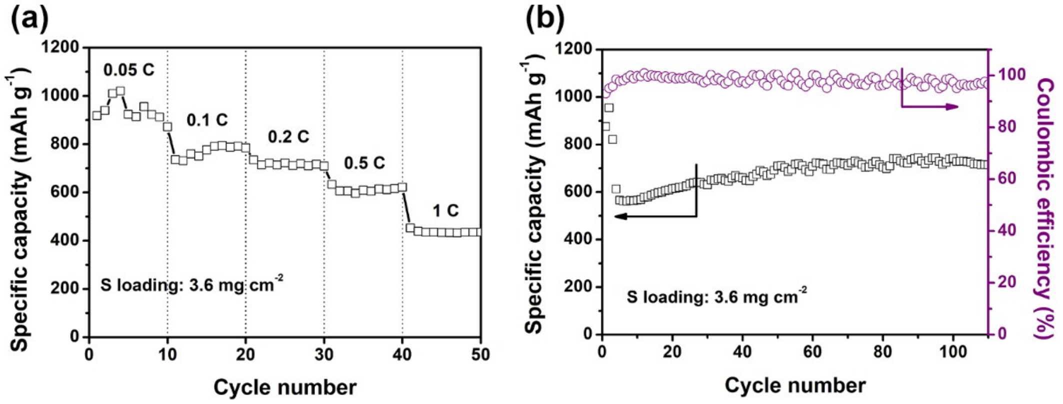

Figure S10. (a) Rate capability and (b) cycling performance at 0.2 C of the thick MoS_2/rGO electrodes with sulfur loading of 3.6 mg cm^{-2}.

Table S1. Comparison on the cycling performance of present work with the previously reported sulfur cathodes using metals, metal oxides or sulfides as electrocatalysts for Li-S batteries.

Cathode	Sulfur content (wt%)	Sulfur loading (mg cm^{-2})	C-rate	Cycle number	Initial capacity (mAh g^{-1})	Reversible capacity (mAh g^{-1})	Capacity decay rate per cycle
This work	70	0.9-1.0	0.2 C	150	1305	954	0.18%
			0.5 C	300	1183	908	0.077%
			2 C	1000	985	619	0.037%
MoS_{2-x}/rGO/S[1]	75	3.6	0.2	110	613	714	-
		0.9	0.5 C	600	1251	628	0.083%
NbS_2@S@IG[2]	72	1.05	0.5 C	350	1185	856	0.08%
			40 C	2000	218	74	0.033%
		3.25	1 C	600	506	405	0.033%
WS_2-Li_2S_8[3]	-	1.2	0.2 C	100	ca. 950	652	0.31%
			0.5 C	360	655	596	0.025%
S/CoS_2+G[4]	75	0.4	0.5 C	150	1368	1005	0.18%
			2 C	2000	1003	321	0.034%
Pt/G-Li_2S_8[5]	-	1.2	0.2 C	100	ca. 980	780	0.20%
			1 C	300	ca. 464	ca. 340	0.09%
S@Co-N-GC[6]	70	1.0-1.2	0.2 C	200	1440	850	0.20%
			1 C	500	1150	625	0.09 %
Fe_2O_3-PGM-S[7]	60	1	2 C	500	705	388	0.09%
MoO_2/G-S[8]	79	-	0.2 C	100	1124	905	0.19%
			1 C	500	806	664	0.035%

Table S2. Comparison on the rate capability of present work with the previously reported sulfur cathodes using metals, metal oxides or sulfides as electrocatalysts for Li-S batteries.

Cathode	Sulfur content (wt%)	Sulfur loading (mg cm^{-2})	C-rate	Reversible capacity (mAh g^{-1})
This work	70	0.9-1.0	5 C	733
			7 C	657
			10 C	553
		3.6	0.05	923
			0.1	787
			0.2	710
MoS_{2-x}/rGO/S[1]	75	0.9	5 C	ca. 900
			8 C	827
NbS_2@S@IG[2]	72	1.05	5 C	ca. 600
			10 C	ca. 460
		3.25	0.05	1182
			0.1	895
			0.2	811
WS_2-Li_2S_8[3]	-	1.2	-	-
S/CoS_2+G[4]	75	0.4	-	-
Pt/G-Li_2S_8[5]	-	1.2	-	-
S@Co-N-GC[6]	70	1.0-1.2	5 C	565
Fe_2O_3-PGM-S[7]	60	1	5 C	565
MoO_2/G-S[8]	79	-	2 C	615

Supporting References

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