Supporting Information

Interwoven V_2O_5 Nanowire/Graphene Nanoscroll Hybrid Assembled as Efficient Polysulfide-Trapping-Conversion Interlayer for Long-Life Lithium-Sulfur Batteries

Yi Guo, [a‡] *Yin Zhang,* [a‡] *Yun Zhang,*[a]* *Mingwu Xiang,*[a] *Hao Wu,*[a]* *Huakun Liu* [b]*and Shixue Dou*

[a] *Department of Advanced Energy Materials, College of Materials Science and Engineering, Sichuan University , Chengdu, 610064, P. R. China*

[b] *Institute for Superconducting & Electronic Materials, Australian Institute of Innovative Materials, University of Wollongong, Wollongong, NSW 2500, Australia*

Supporting Figures and Tables

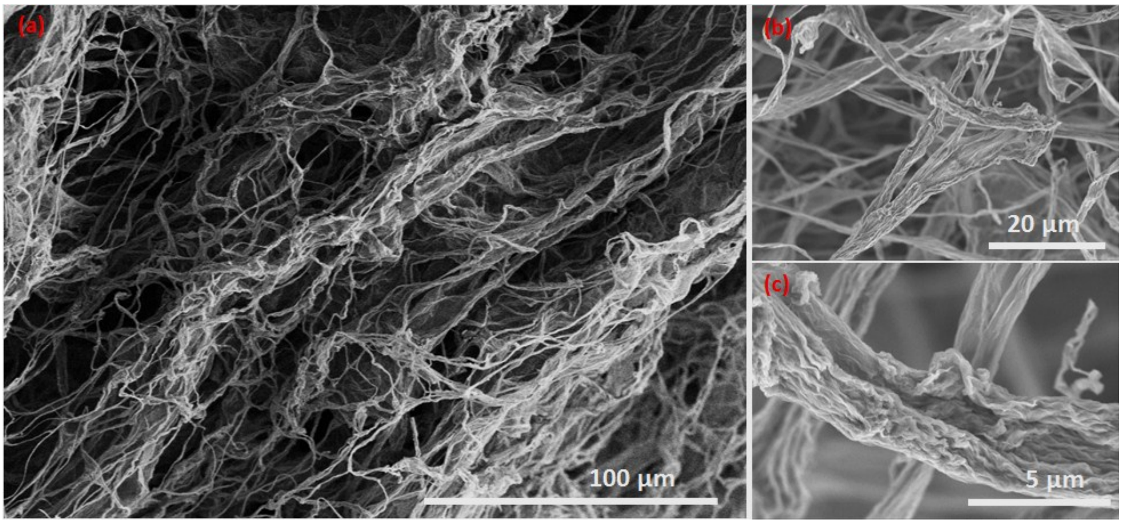

Figure S1 SEM images of as-prepared GNS

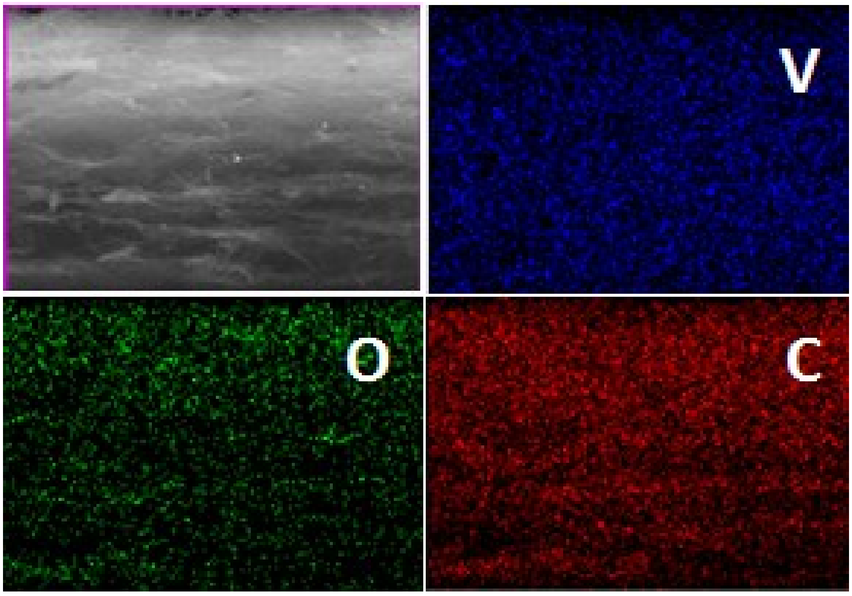

Figure S2 EDS mappings of V, O, and C elements of GSVm

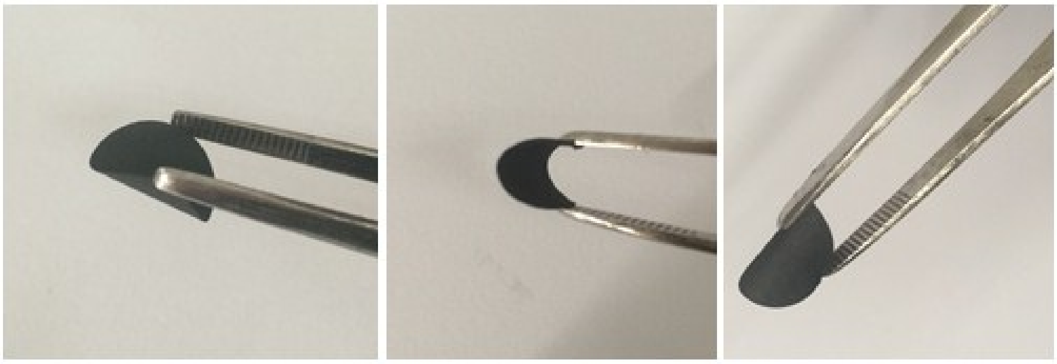

Figure S3 Digital photographs of bending test on the as-prepared GSVm interlayer

Figure S4 The mass of three GSVm interlayers and a single one (inset)

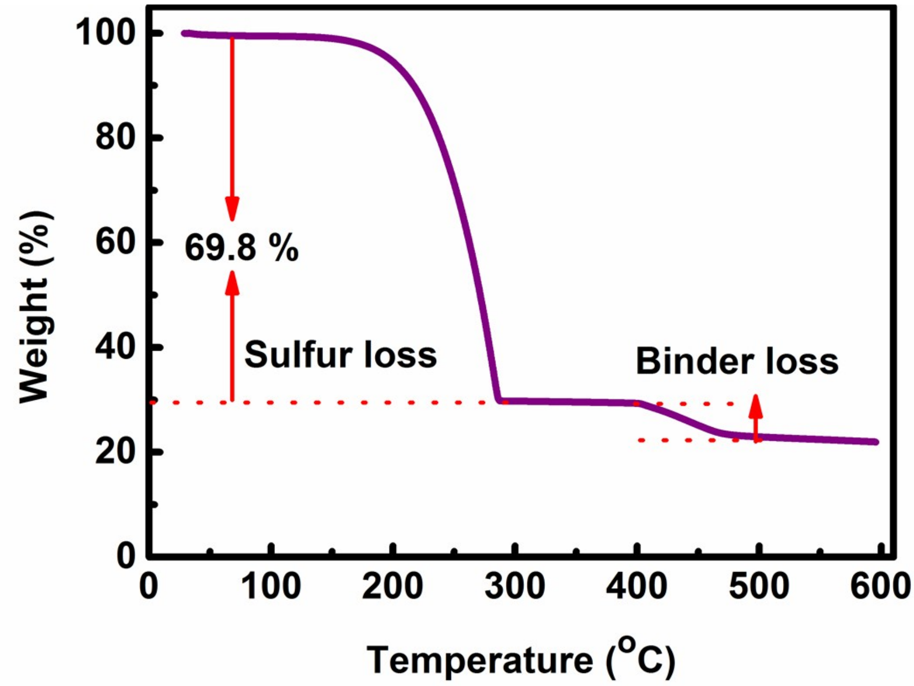

Figure S5 TGA curve of the electrode material in our Li-S cells

The sulfur content of the as-prepared electrode was determined by TGA characterization performed from 20 to 600 °C at a heating rate of 5 °C min^{-1} under nitrogen atmosphere. As shown in the above TGA plot, the conventional blade-casted electrode material has two steps of weight loss, i.e. the first one involves about 69.8 wt% weight loss between 100 and 300 °C, corresponding to the thermal evaporation of sulfur; the second one involves about 8.9 wt% weight loss between 400 and 500 °C, corresponding to the thermal decomposition of polyvinylidene fluoride. There is about 20.6 wt% residual corresponding to the remaining super P carbon. This result is approximate to the mass ratio of sulfur, binder, and conductive additive, (7:2:1), and hence the actual sulfur content of the electrode is determined to be ~70 wt%.

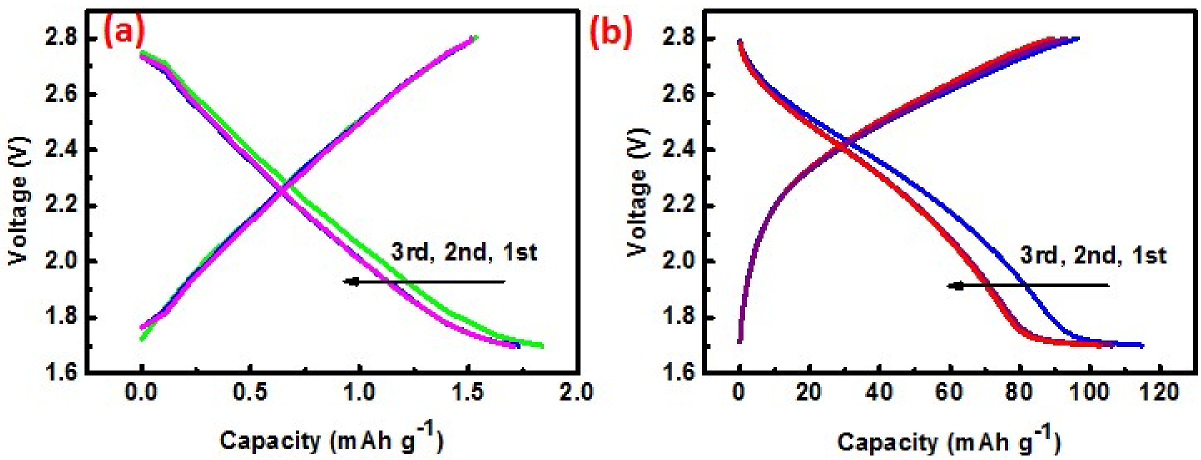

Figure S6 Initial three charge-discharge curves of Li-ion cells in the voltage range of 1.7-2.8 V, using lithium foil as the anode, and (a) GNS film and (b) V_2O_5 NW film as the cathode

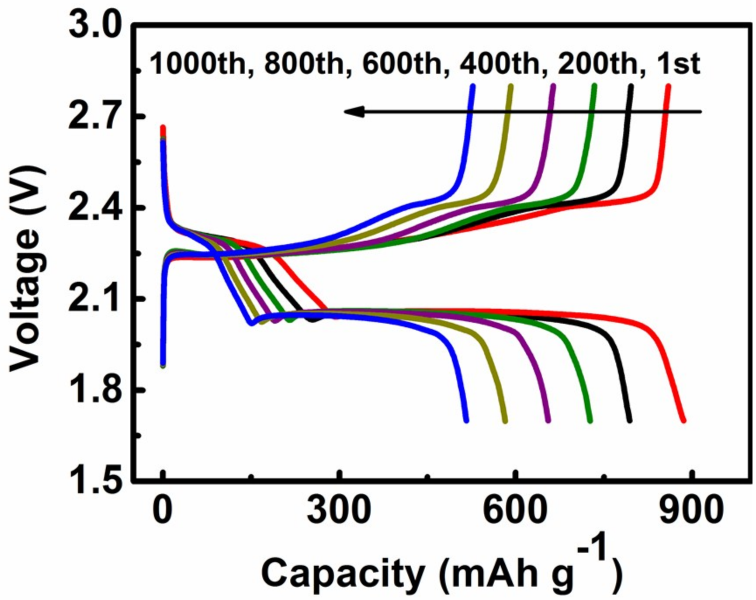

Figure S7 Typical discharge-charge curves for selected cycles of cell with GSVm interlayer at 0.5 C

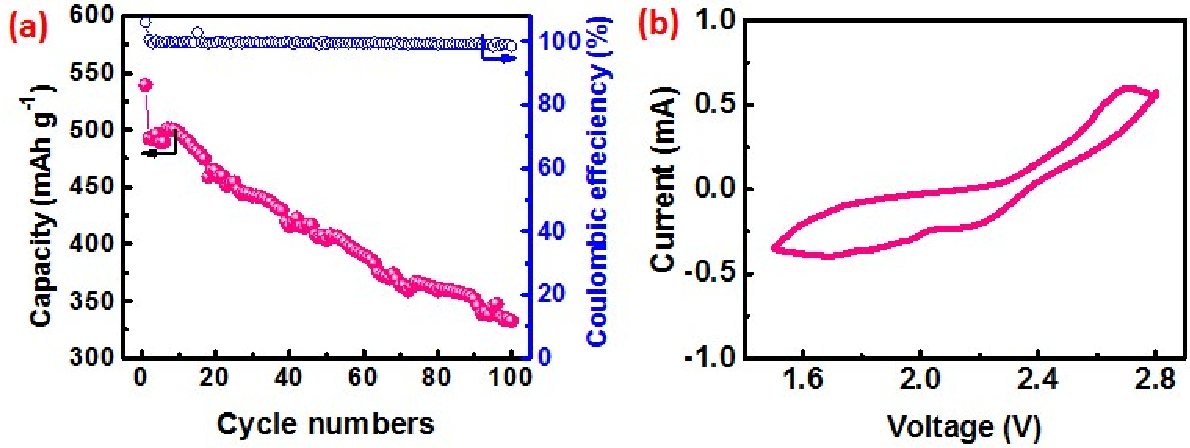

Figure S8 (a) Cycling performance of Li-S cell without an interlayer at 0.5 C; (b) CV curve of fresh Li-S cell without an interlayer

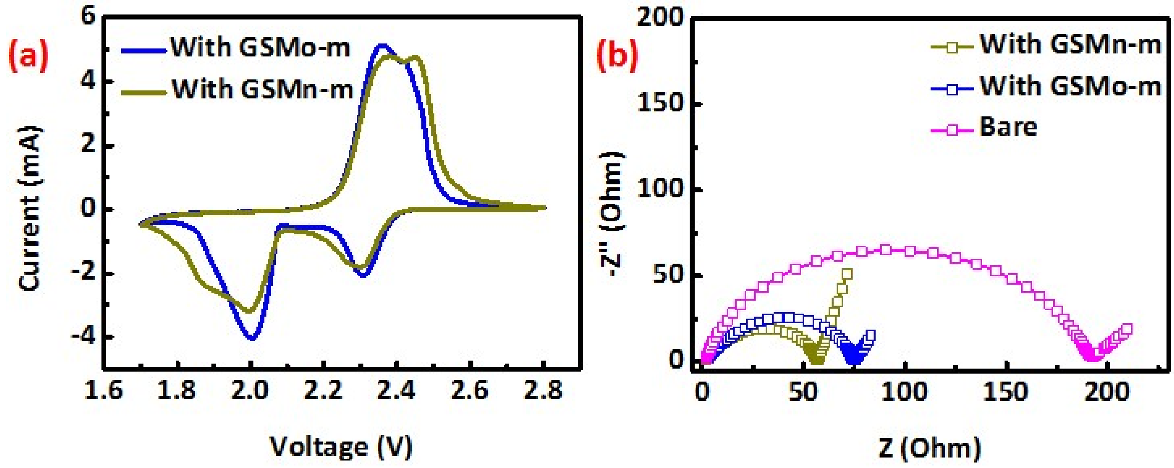

Figure S9 (a) CV curves and (b) Nyquist plots for Li-S cells with inserted GSMn-m and GSMo-m interlayers

Table S1. Comparison of the electrochemical performances of previously reported interlayer-containing Li-S batteries with our work

Interlayer materials	Areal density of interlayer ($mg\ cm^{-2}$)	Sulfur areal loading ($mg\ cm^{-2}$)	Sulfur content in electrode [a] (%)	Rate-cycle-remaining capacity ($mAh\ g^{-1}$)-capacity decay per cycle (%)	Ref.
MnO_2/graphene sheets	0.8	N.A.	~70	0.5C-100th-600-0.3	[S1]
Sulfonated graphene sheets	N.A.	1.2-1.5	~53	0.5C-250th-802-0.085	[S2]
S-doped microporous carbon	3.7-4.3	1.5	~60	2C-500th-719-0.057	[S3]
TiO_2/carbon fibres (CF)	0.6	0.8	~60	1C-500th-694-N.A.	[S4]
N-doped graphene sheets	0.71	2.7	~60	0.5C-300th-591-0.037	[S5]
GO/CNT hybrid film	1.1	1.0	~70	0.2C-300th-671-0.043	[S6]
Polyacrylonitrile modified CF	1.2	1.2	~60	0.3C-200th-710-N.A.	[S7]
TiO_2/Co_3O_4/CF	N.A.	1.5	~60	0.5C-100th-801-N.A.	[S8]
TiO_2/CNT film	0.7	3.0	~60	0.2C-100th-541-0.192	[S9]
ZnO NWs/CF mat	1.3	3.0	~49	1C-200th-776-0.05	[S10]
Al/carbon film	N.A.	0.86	~56	1C-100th-1000-0.274	[S11]
Praline-like TiO_2/CF	1.6	3.0	~49	0.2C-300th-770-0.207	[S12]
GNS/V_2O_5 NWs	**0.642**	**1.5** **5.5**	**~70**	**0.5C-1000th-516-0.041** **0.1C-100th-700-0.055**	**This work**

[a] The sulfur content in electrode is calculated based on the total mass including sulfur, host material (if used), binder, and conductive additive.

"N.A." represents the value not mentioned in the corresponding reference.

Table S2. Square resistance of V_2O_5 NWs, GNS and GSVm

Samples	V_2O_5 NWs	GNS	GSVm
Resistance (Ω/□)	1.39×10^4	1.10	18.26

Table S3. Square resistance of MnO_2 NWs, MoO_3 NBs, GSMn-m, and GSMo-m

Samples	MnO_2 NWs	MoO_3 NBs	GSMn-m	GSMo-m
Resistance (Ω/□)	0.25×10^3	N.A.	15.07	21.07

"N.A." represents no current detected, owing to the huge impedance of pure MoO_3.

References

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