Supporting Information

Tungsten Oxide Nanowire Clusters Anchored on Porous Carbon Fibers as a Sulfur Redox Mediator for Lithium-Sulfur Batteries

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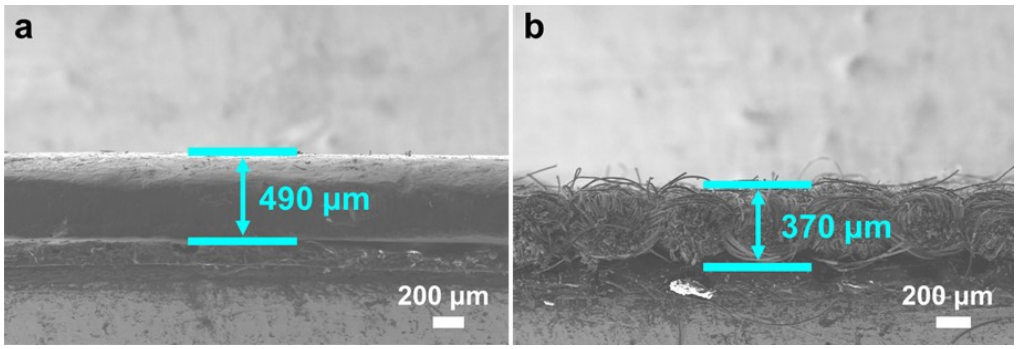

Fig. S1 SEM images of lithium anode and WO_3/PCF cathode.

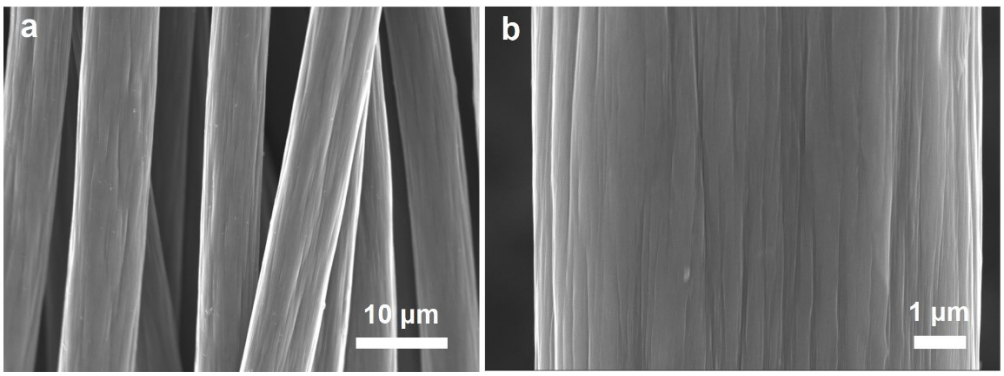

Fig. S2 SEM images of CF.

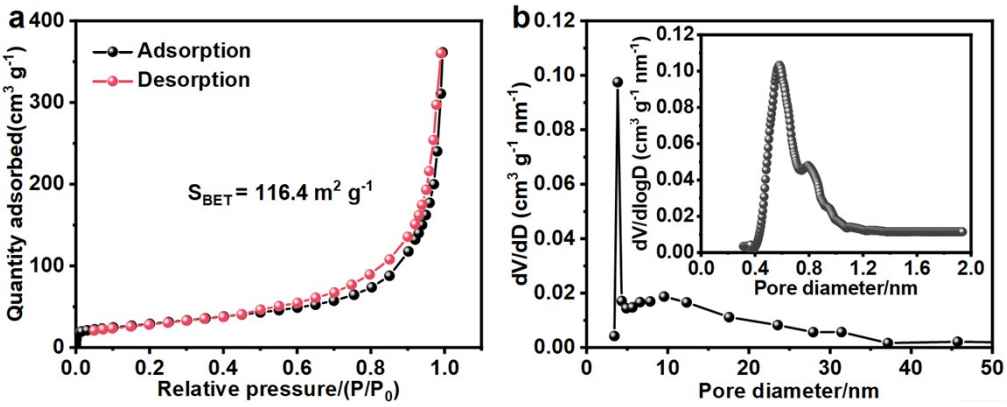

Fig. S3 N_2 adsorption/desorption isotherms of PCF.

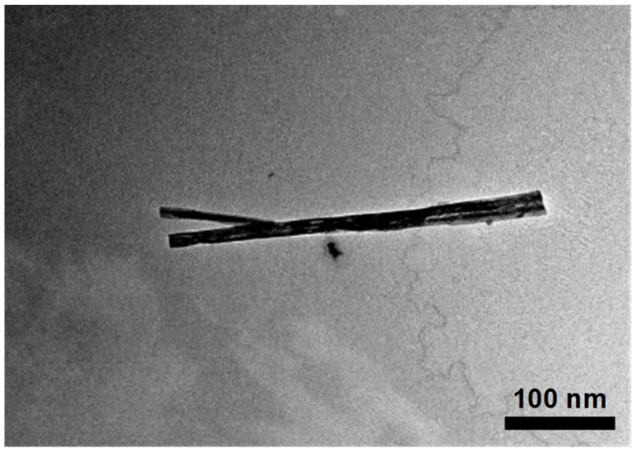

Fig. S4 TEM image of a single WO_3 nanowire.

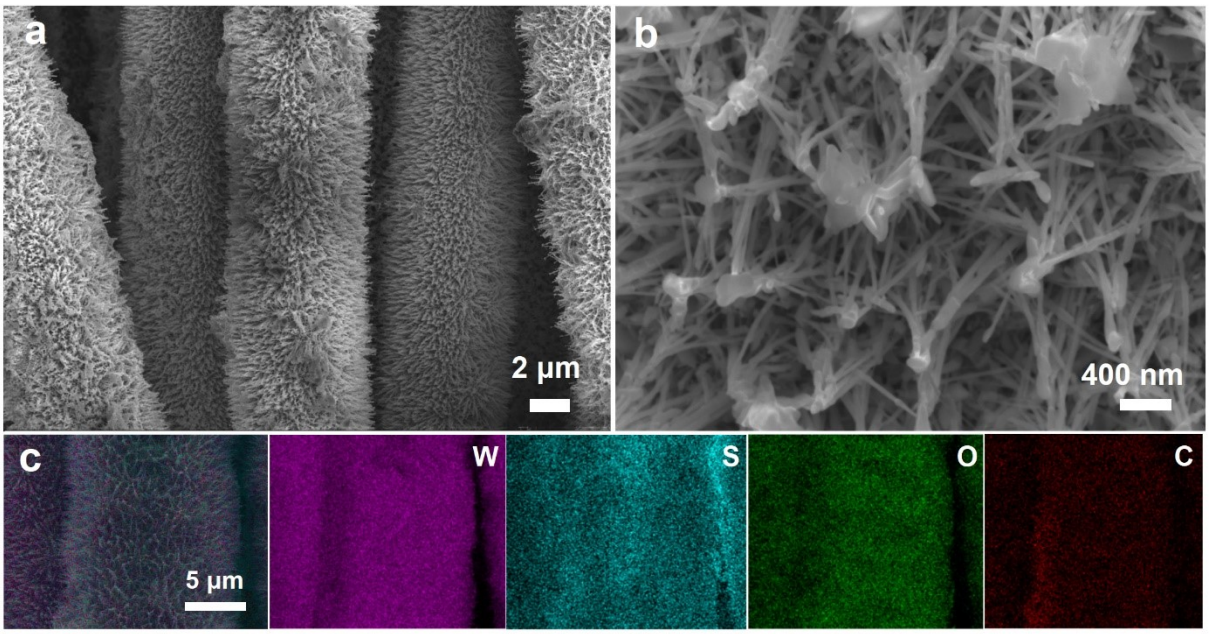

Fig. S5 SEM images and energy dispersive X-ray spectroscopy elemental mapping of W, S, O and C elements for WO_3/PCF/S.

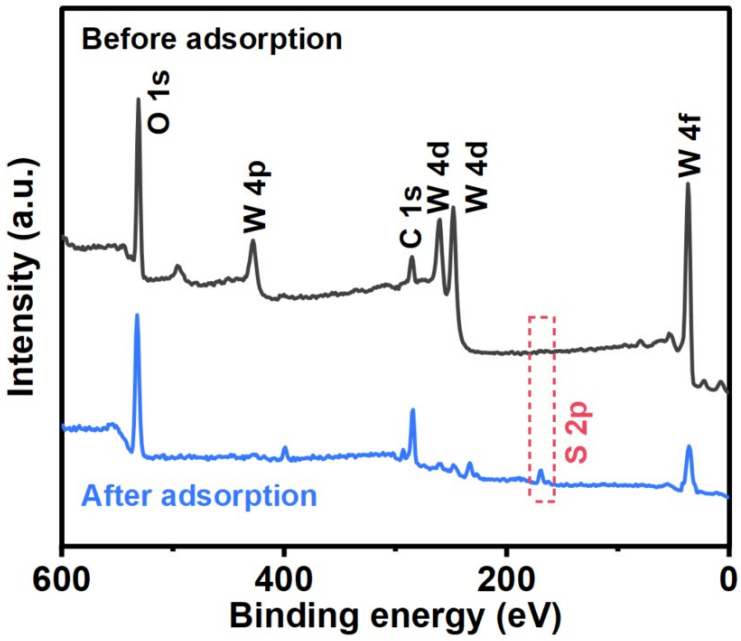

Fig. S6 XPS survey spectra of WO_3/PCF before and after Li_2S_6 adsorption.

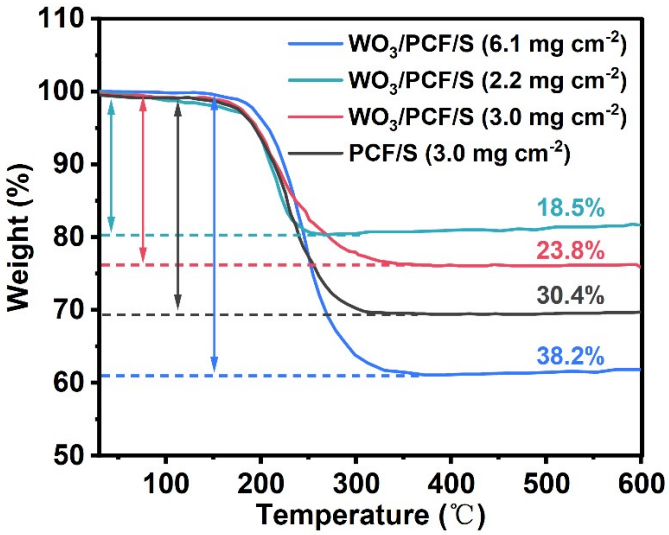

Fig. S7 Thermogravimetry analysis for WO_3/PCF/S and PCF/S.

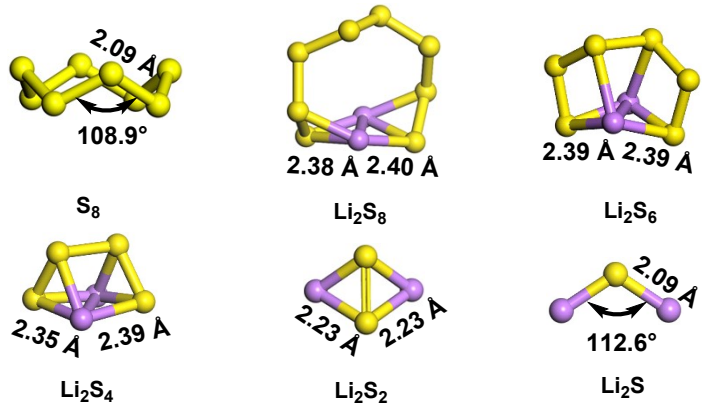

Fig. S8 Fully optimized geometries and structural parameters of S_8 and Li_2S_n (n = 8, 6, 4, 2, 1).

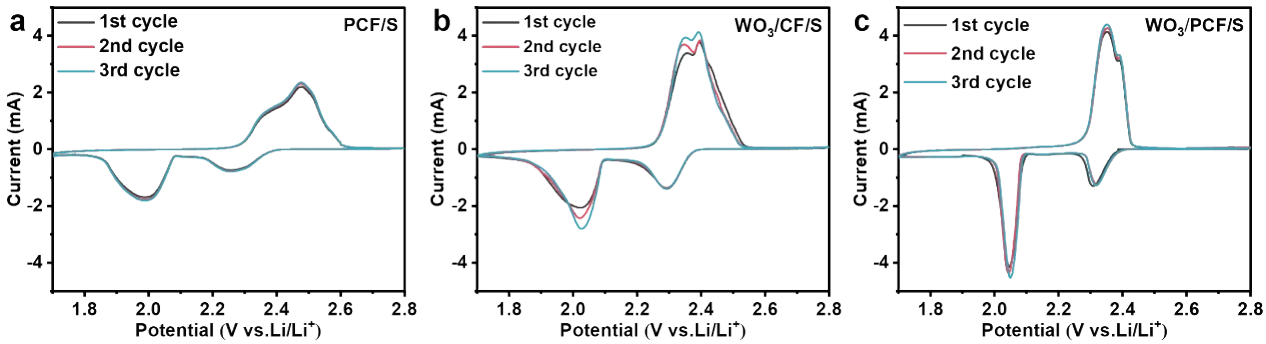

Fig. S9 CV curves within Li-S cells based on PCF/S, WO_3/CF/S, and WO_3/PCF/S cathodes.

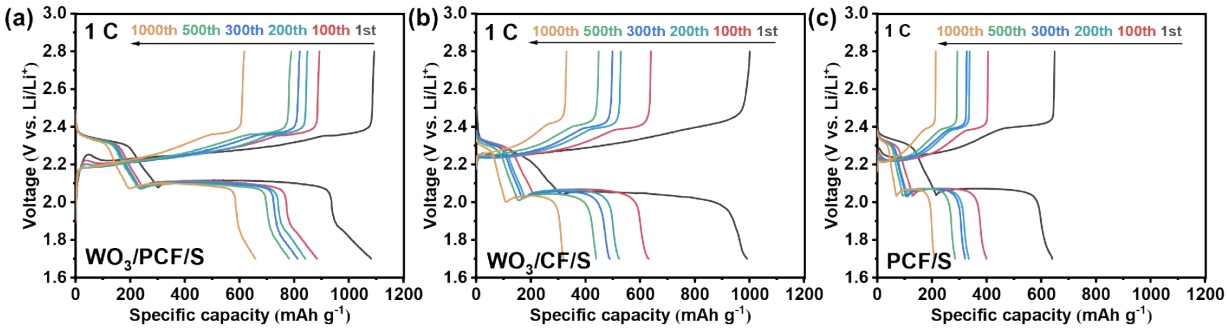

Fig. S10 Charge-Discharge voltage profiles of Li-S cells based on PCF/S, WO_3/CF/S, and WO_3/PCF/S cathodes at 1 C.

Tab. S1 Impedance fitting results of the WO_3/PCF/S, WO_3/CF/S, and PCF/S cathodes before and after 200 cycles at 1 C.

Fitted Date	**WO_3/PCF/S**			**WO_3/CF/S**			**PCF/S**		
	R_e	R_{ct}	R_f	R_e	R_{ct}	R_f	R_e	R_{ct}	R_f
Before cycling	1.27	19.25	/	2.05	41.55	/	2.96	98.35	/
After cycling	1.25	12.90	10.71	1.87	24.30	30.38	6.76	43.17	17.56

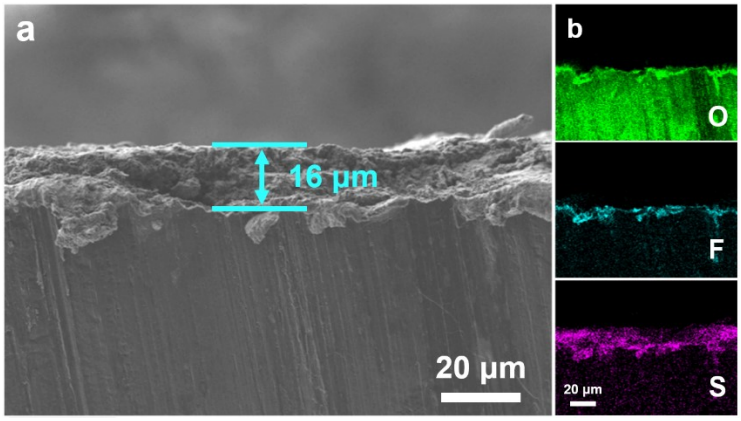

Fig. S11 SEM images and corresponding EDS spectra of cycled Li anode

Tab. S2 Summary of electrochemical performances of Li-S batteries with different cathodes.

Sulfur host material	Sulfur loading (mg cm^{-2})	Rate (C)	Initial capacity (mAh g^{-1})	Cycled capacity (mAh g^{-1})	Cycle number (n)	Decay rate per cycle (%)	Rate capacity (mAh g^{-1})	References
WO_{3-x}-W_3N_4@CC	1.3	1	1058.1	/	400	0.128	0.1-2 C 2 C:913.9	[S1]
NiO-Ni_3N-AC	1-6	4	681	/	500	0.070	0.2-4 C 4 C:652	[S2]
$NiMoO_4$@NSCC	2	1	681.9	654.2	500	/	0.1-1 C 3 C:691.1	[S3]
rGO@WO_3	2-4.6	1	1017	847	200	0.090	0.1-3 C 3 C:600	[28]
NiCoSe/CNS/CC	1.2	1	1049	454	600	0.056	0.1-3 C 3 C:391	[S4]
CC/$NiCo_2O_4$	1.1-1.3	0.5	1090	826	400	0.060	0.1-2 C 2 C:624	[S5]
NC@H-CeO_2	3.5	0.5	858	633	200	0.037	0.2-2 C 2 C:523	[S6]
CFONC	4.74	0.2	1096	681	500	0.076	0.1-2 C 2 C:703	[S7]
HMC@MoO_2	1	0.5	1043	771	500	0.052	0.1-2 C 2 C:700	[S8]
CC/HEO	1.8	2	/	/	1000	0.057	0.2-2 C 2 C:632.4	[S9]
CC/$CuCo_2O_4$	3.5	0.5	997	776	600	0.037	0.1-3 C 3 C:767	[S10]

CC/$NiCo_2O_4$	3.5	0.2	/	660	200	/	0.1-1 C 1 C:552	[S11]
NiO@HCSs	1-1.2	1	692.7	568.0	300	0.060	0.2-2 C 2 C:698.2	[S12]
CC/$NiCoSe_2$-NiO	1.55	1	979.1	606	1000	0.038	0.1-2 C 2 C:776	[S13]
WO_3/PCF	**3.0**	**1** **2** **5**	**1082** **968** **862**	**663** **489** **364**	**1000** **1000** **1000**	**0.039** **0.049** **0.058**	**0.2-5 C** **5 C: 672**	**This work**

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