Supporting Information

Flexible hierarchically PANI/MnO_2 porous network with fast channels and extraordinary chemical process for stable fast-charging lithium-sulfur battery

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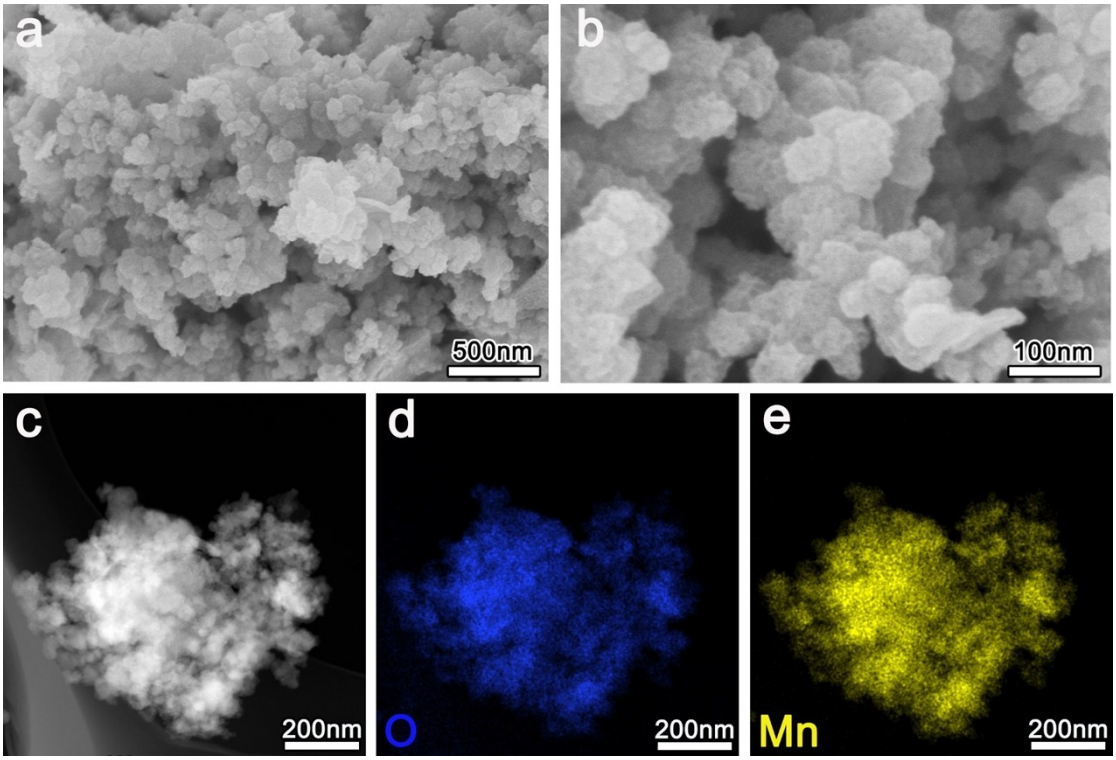

Figure S1. (a)-(b) SEM characterization of MnO_2; (c-e) corresponding EDX elemental mapping of the MnO_2, O: blue and Mn: yellow.

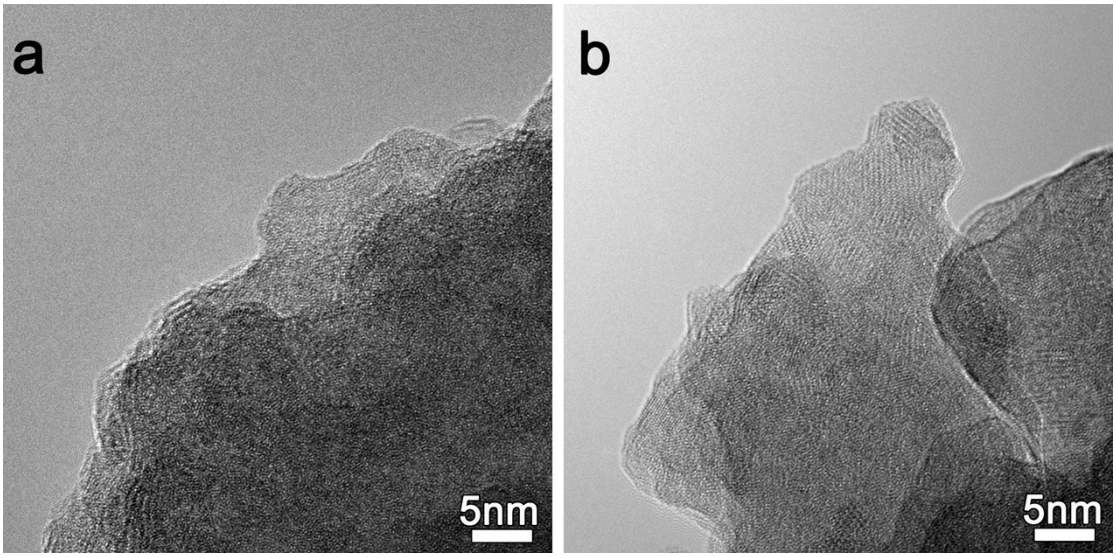

Figure S2. HR-TEM image of (a) PANI-MnO_2 and (b) MnO_2.

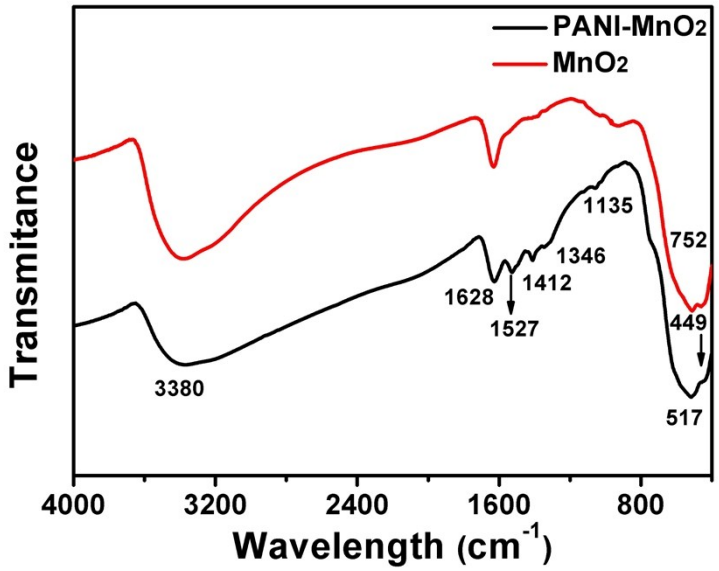

Figure S3. FTIR spectrums of PANI-MnO_2 and MnO_2.

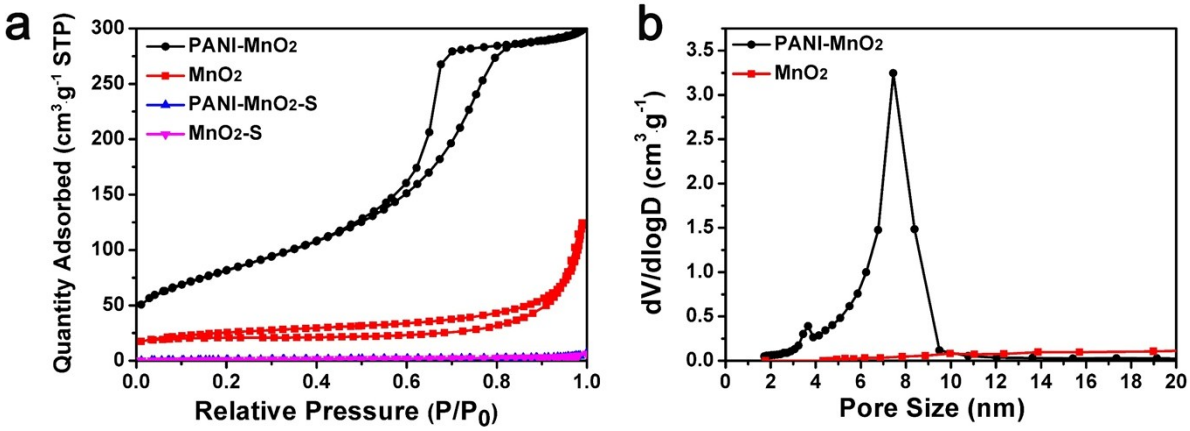

Figure S4. The nitrogen adsorption-desorption isotherms (a) and corresponding pore size (b) distributions of PANI-MnO_2 and MnO_2.

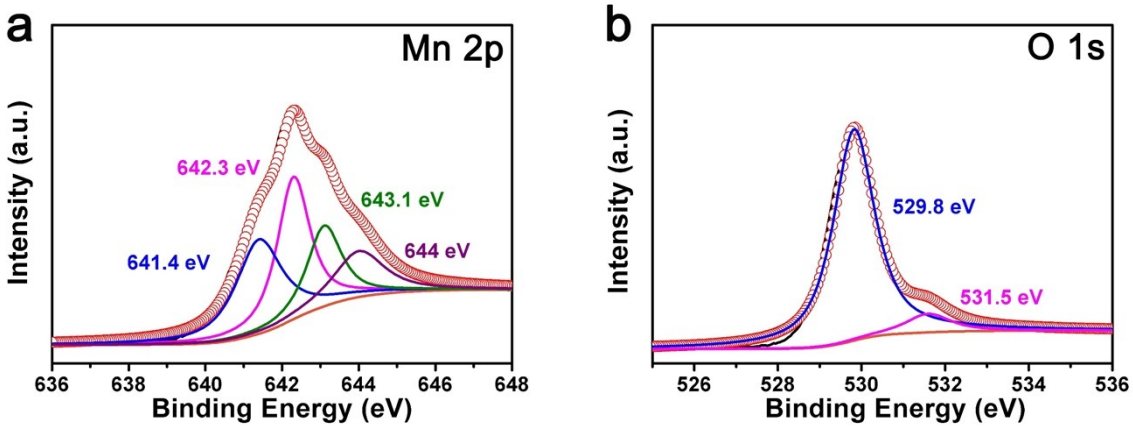

Figure S5. High-resolution Mn $2p^{3/2}$ (a) and O 1s (b) spectrums of MnO_2.

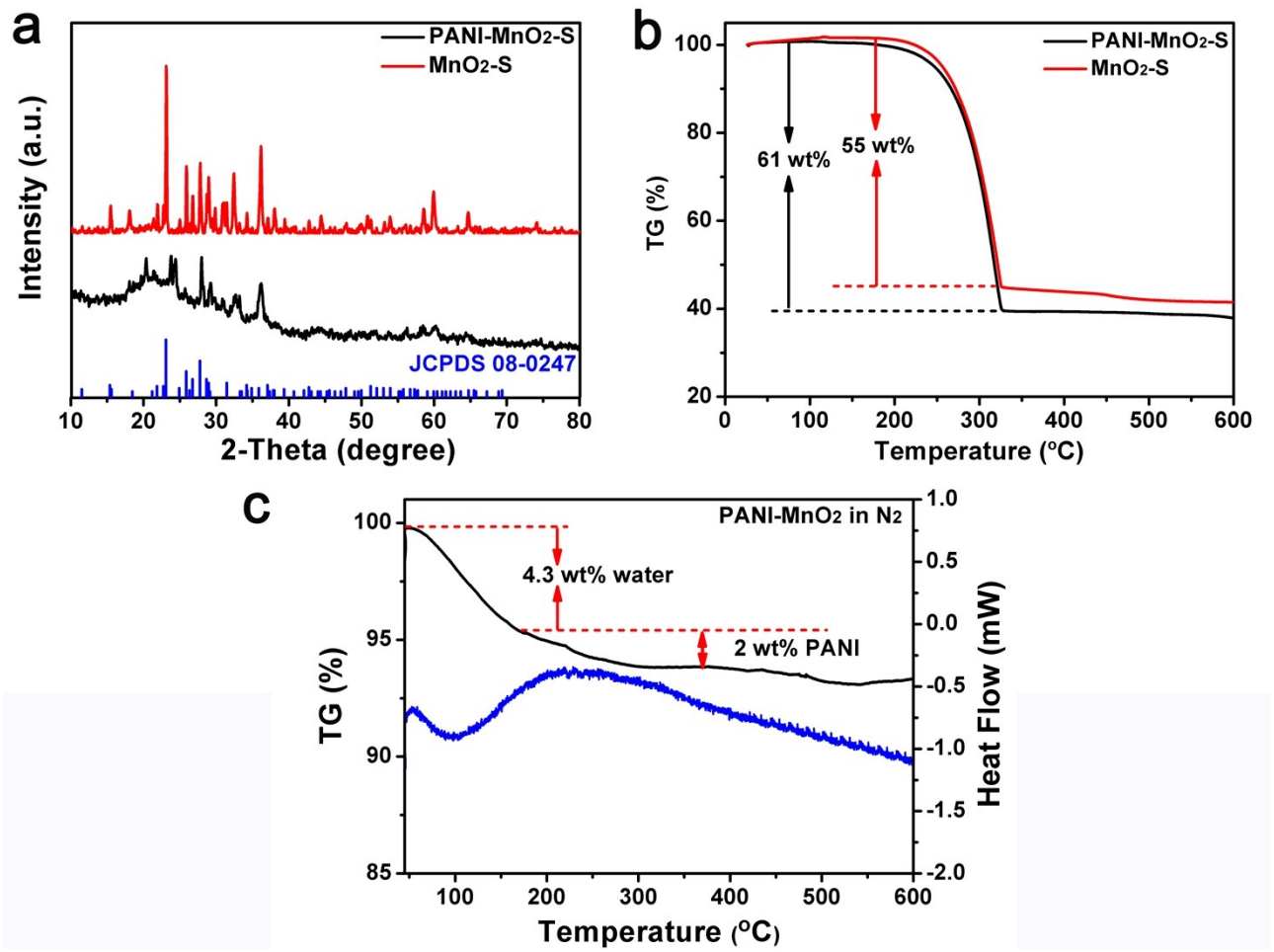

Figure S6. (a) XRD patterns of PANI-MnO_2-S and MnO_2-S; (b) TG curve of PANI-MnO_2-S and MnO_2-S in N_2; (c) TG and DSC curve of PANI-MnO_2 in N_2.

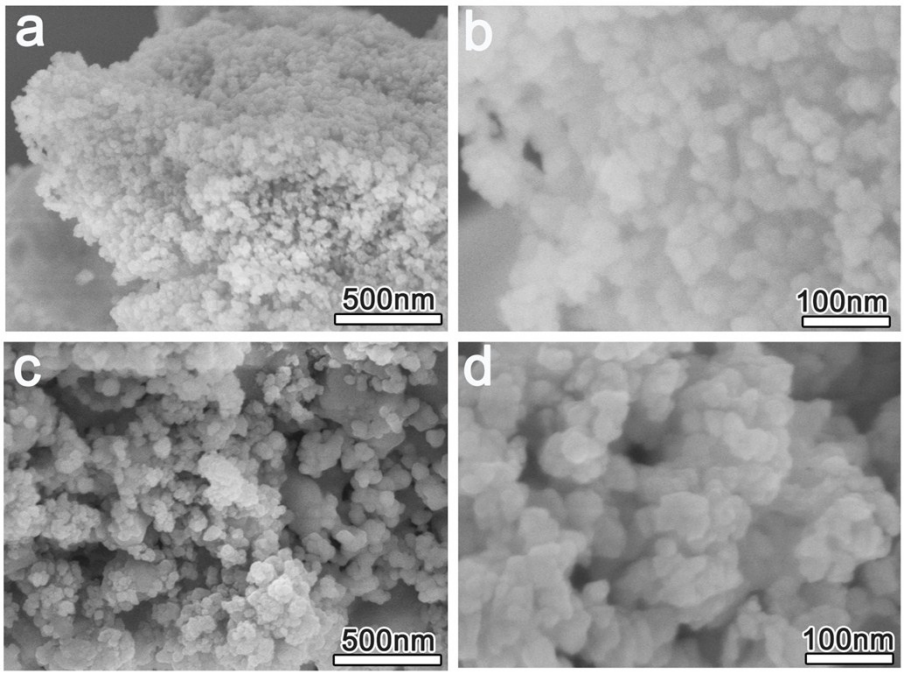

Figure S7. SEM characterization of PANI-MnO_2-S and MnO_2-S. (a)-(b) PANI-MnO_2-S; (c)-(d) MnO_2-S.

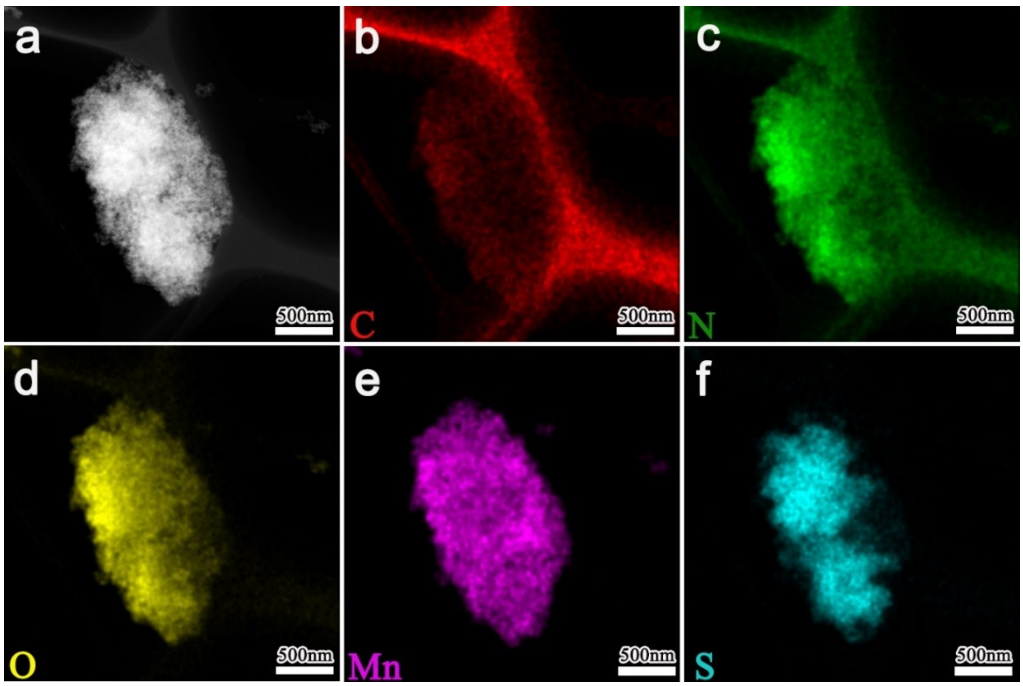

Figure S8. A TEM image (a) and the corresponding elemental mappings (b-f) for C, N, O, Mn and S of PANI-MnO_2-S. C: red; N: green; O: yellow; Mn: purple and S: cyan.

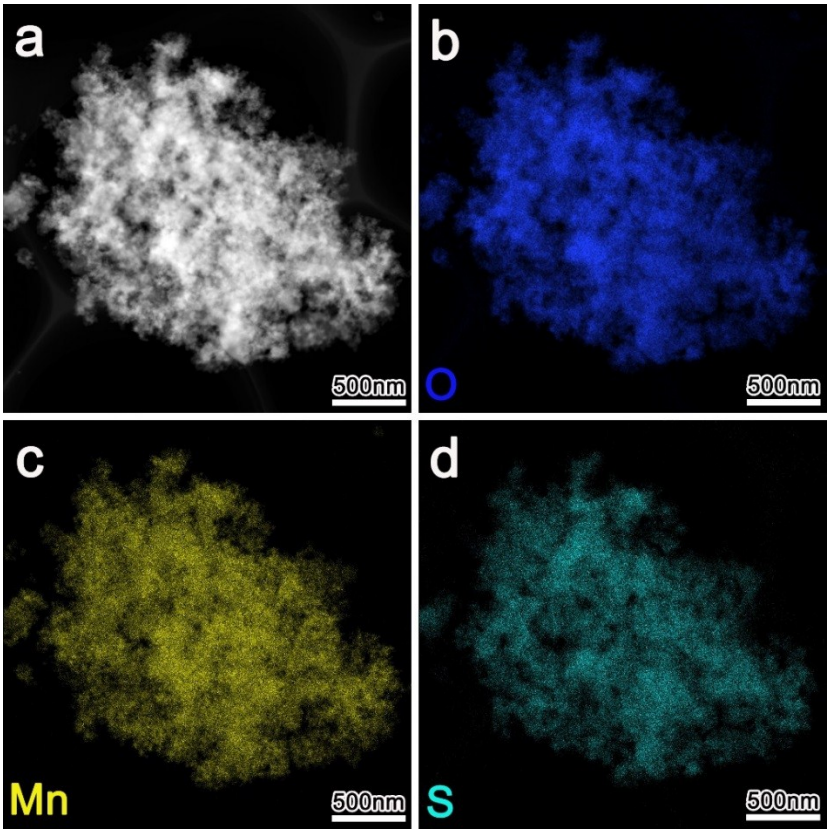

Figure S9. A TEM image (a) and the corresponding elemental mappings (b-d) for O, Mn and S of MnO_2-S. O: blue; Mn: yellow and S: cyan.

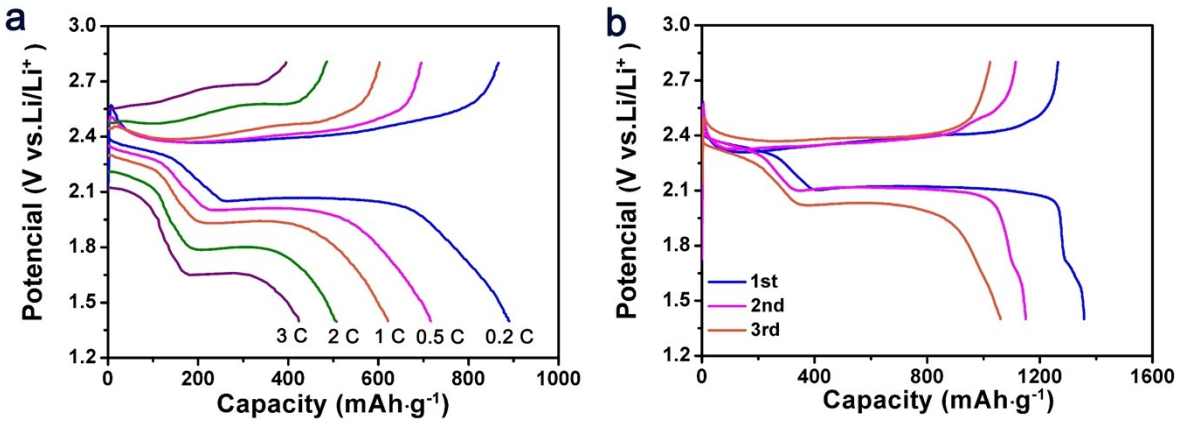

Figure S10. (a) Charge-discharge profiles of MnO_2-S electrode at various rate; (b) the first three cycles of charge-discharge profiles of MnO_2-S electrode at 0.5 C.

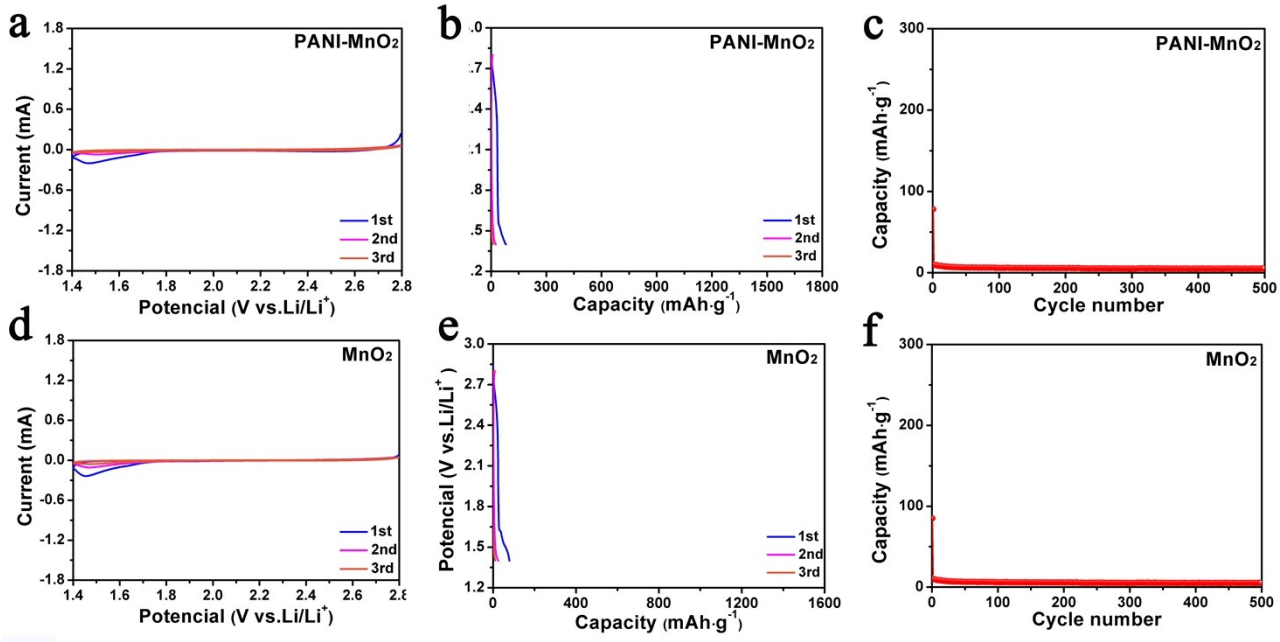

Figure S11 CV curves of PANI-MnO_2 (a) and MnO_2 (d) electrode at 0.2 $mV \cdot s^{-1}$; the first three cycles of charge/discharge profiles of PANI-MnO_2 (b) and MnO_2 (e) eletroode at 0.5 C; the cycle capacity of PANI-MnO_2 (c) and MnO_2 (f) eletroode at 0.5 C.

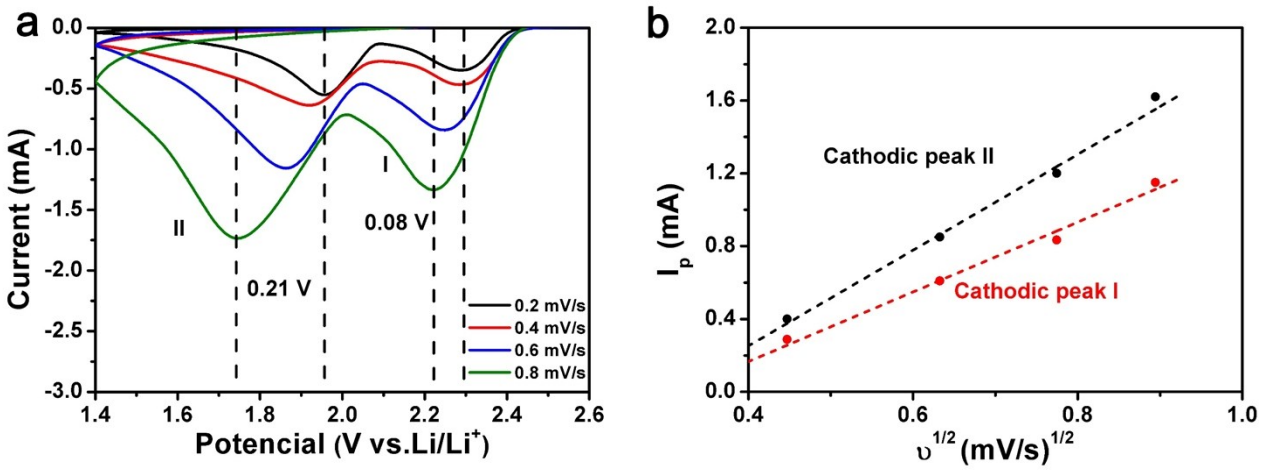

Figure S12. (a) CV curves of MnO_2-S electrode with increase of scan rate from 0.2 to 0.8 $mV \cdot s^{-1}$; (b) the relationship between the peak current I_{peak} and the sweep rate $\nu^{0.5}$ at the two reduction peaks.

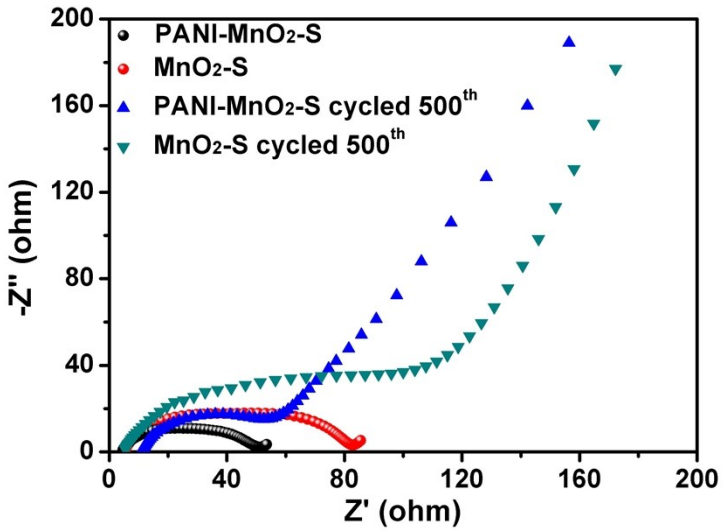

Figure S13. Electrochemical impedance spectra (EIS) of PANI-MnO_2-S and MnO_2-S cathodes before and after 500 cycles at 2 C.

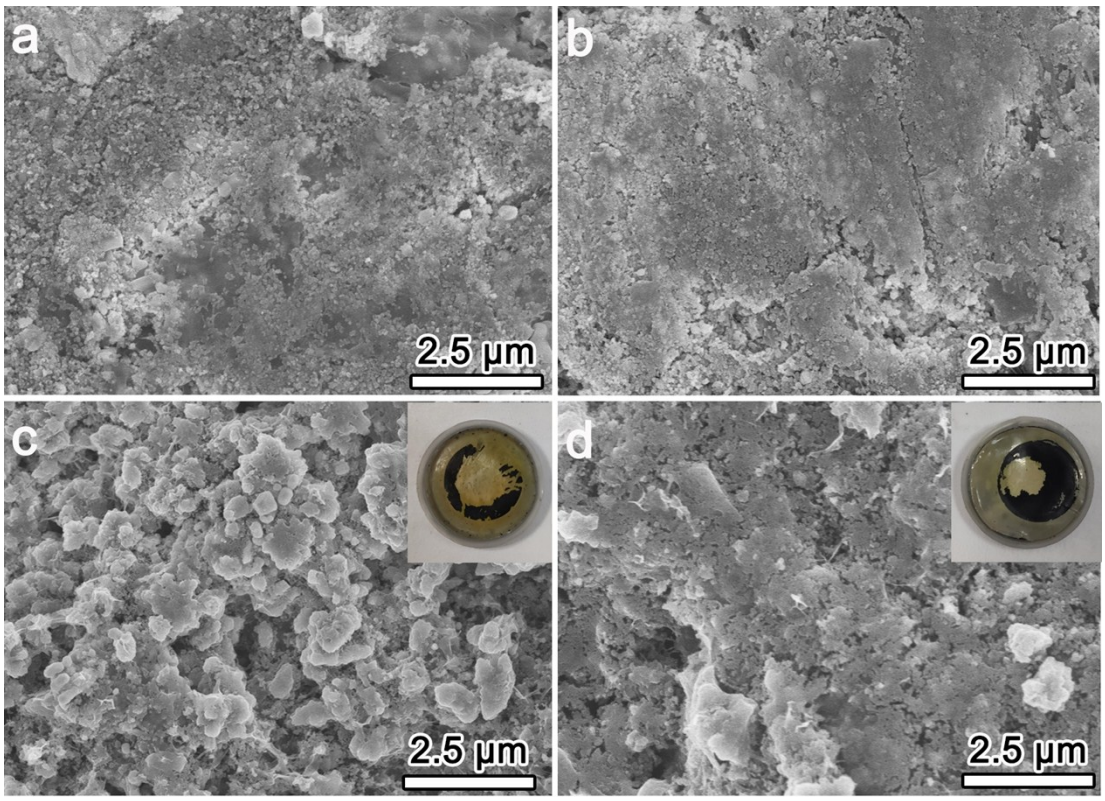

Figure S14. The SEM characterization of fresh/cycled electrodes: MnO_2-S (a) and PANI-MnO_2-S (b) fresh electrodes; MnO_2-S (c) and PANI-MnO_2-S (d) electrodes after 500 cycles at 2 C, Inset: photograph of the corresponding separator.

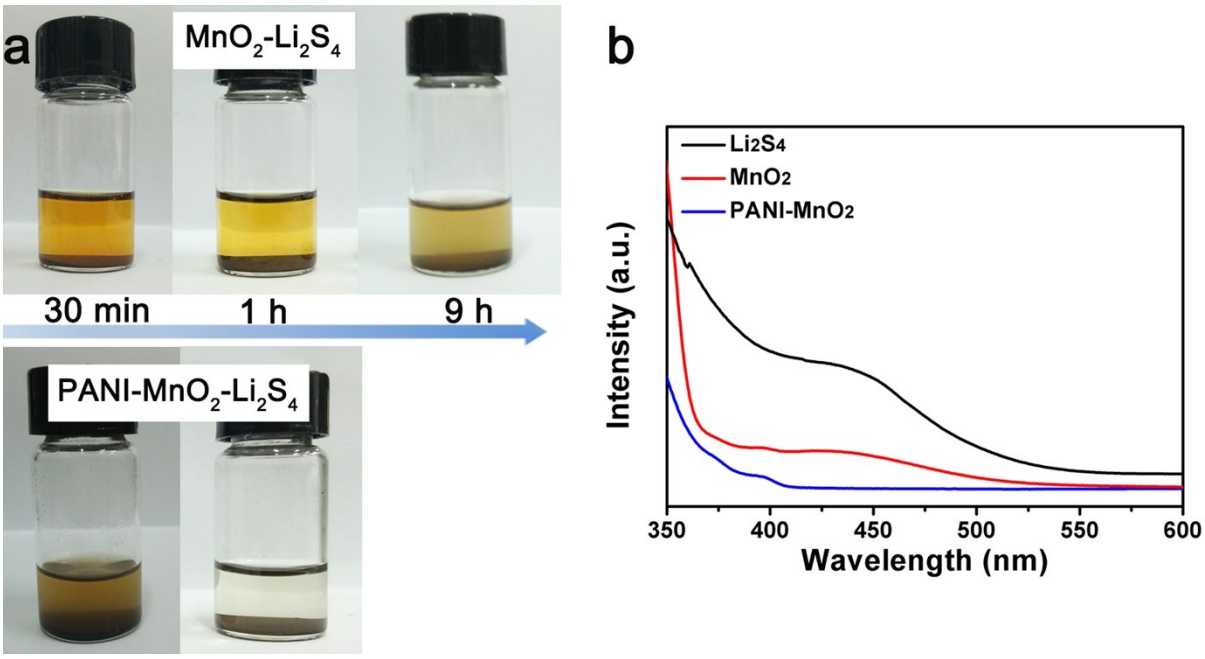

Figure S15. (a) Optical pictures of adsorption tests with MnO_2 and PANI-MnO_2 in lithium polysulfides solution (Li_2S_4 dissolved in DOL/DME solvents, 10 mM), (b) UV-vis spectra (350-600 nm) of the 10 mM Li_2S_4 solution after exposure with blank, MnO_2 and PANI-MnO_2 composites.

Table S1 Comparison with previously reported manganese dioxide based carbonaceous host material.

Host materials*	Rate	Cycles	Reversible Capacity (mA h/g)	Ref.
MnO_2@HCF/S	0.5 C	100	850	21
PPy@MnO_2	0.5 C	100	720	33
MnO_2 nanosheets-S	0.2 C	200	1030	20
MnO_2@NHCSs-S	0.5 C	100	860	14
In-situ S@MnO_2	0.5 C	100	912	22
MnO_2@HCB/S	1 A/g	60	500	30
S@MnO_2@GO	0.35 C	50	350	10
S@MnO_2-C	0.1 C	50	500	61
S@PEDOT/MnO_2	0.5 C	200	545	31
Mesopore PANI-MnO_2 particles	**0.5 C**	**100**	**1161**	**This work**

*HCF: hollow carbon nanofibers; NHCSs: N-doped hollow porous carbon nanospheres; HCB: hollow carbon nanoboxes.