Supporting Information

Insight into the Capacity Fading Mechanism of amorphous Se_2S_5 Confined in Micro/mesoporous Carbon Matrix in Ether-based Electrolytes

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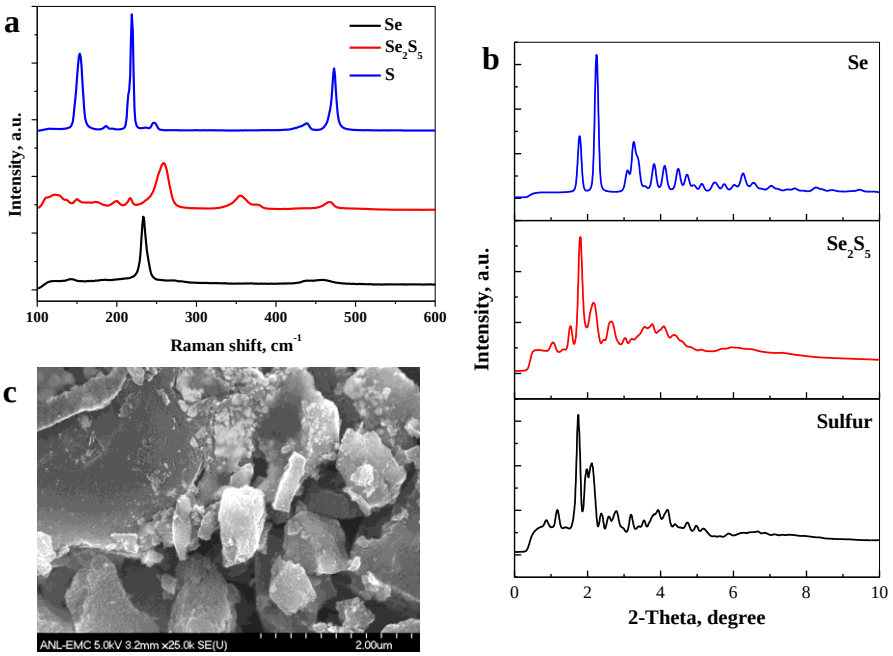

Figure S1 (a) Raman spectra and (b) HEXRD patterns of Sulfur powder, Selenium powder and bulk Se_2S_5, (c) SEM image of MPC.

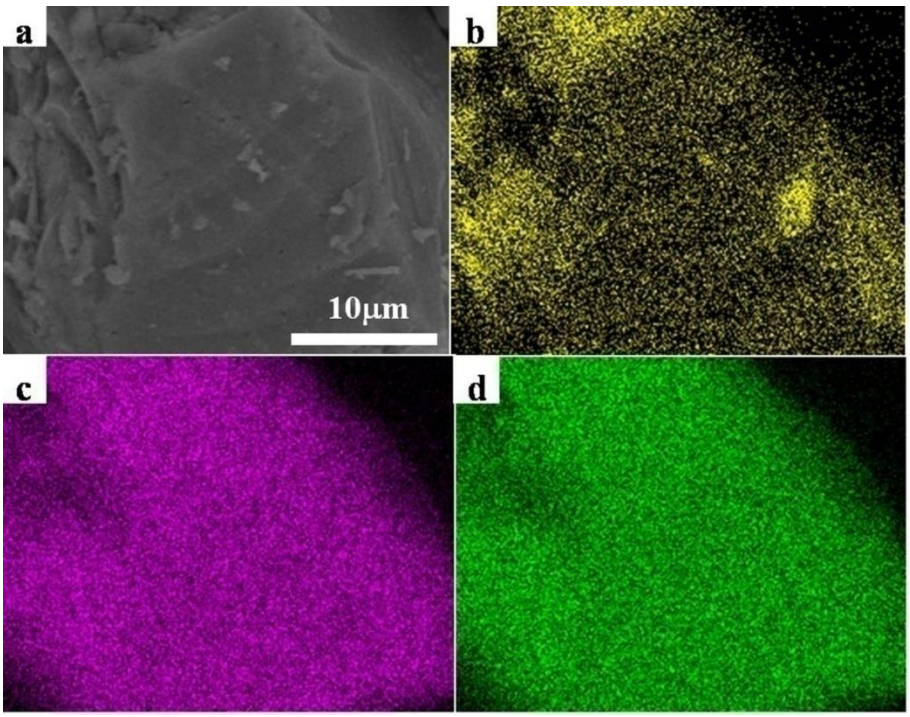

Figure S2 (a) SEM image of the Se_2S_5/MPC composite and the corresponding SEM elemental mapping images of (b) Carbon, (c) Sulfur and (d) Selenium.

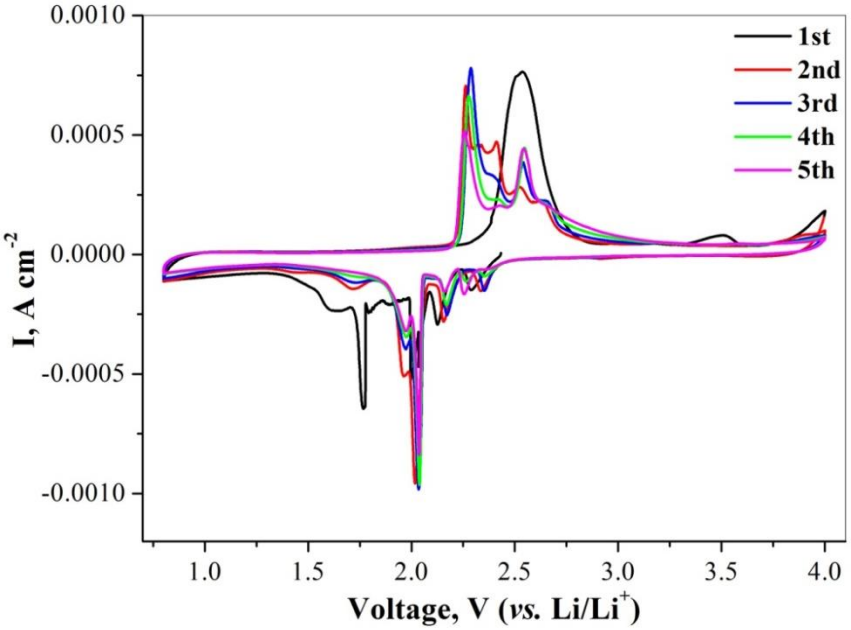

Figure S3 Cyclic voltammogram of Se_2S_5/MPC composite at a scan rate of 0.1 mV s^{-1} within a voltage range of 0.8-4.0V.

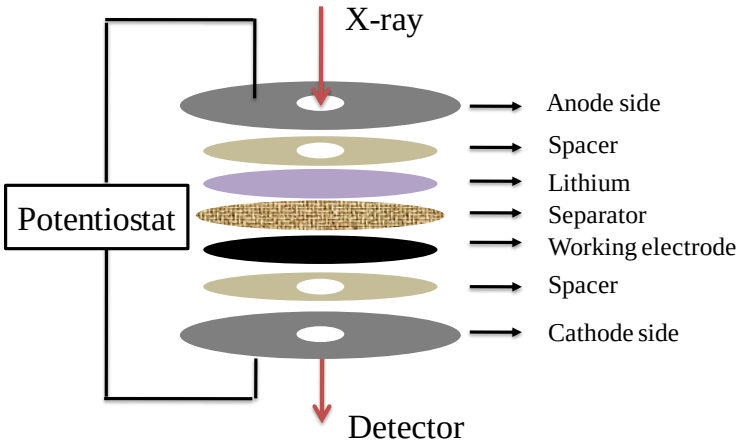

Figure S4 Scheme for the *in-situ* XANES cell.

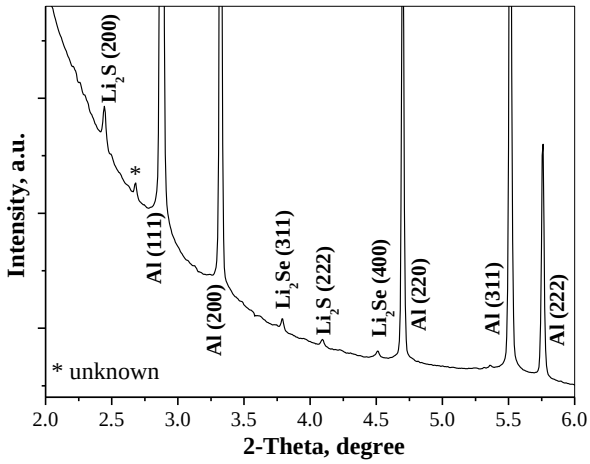

Figure S5 Ex-situ HEXRD pattern of the 1st discharge product for Se_2S_5/MPC cathode at 0.1 C.

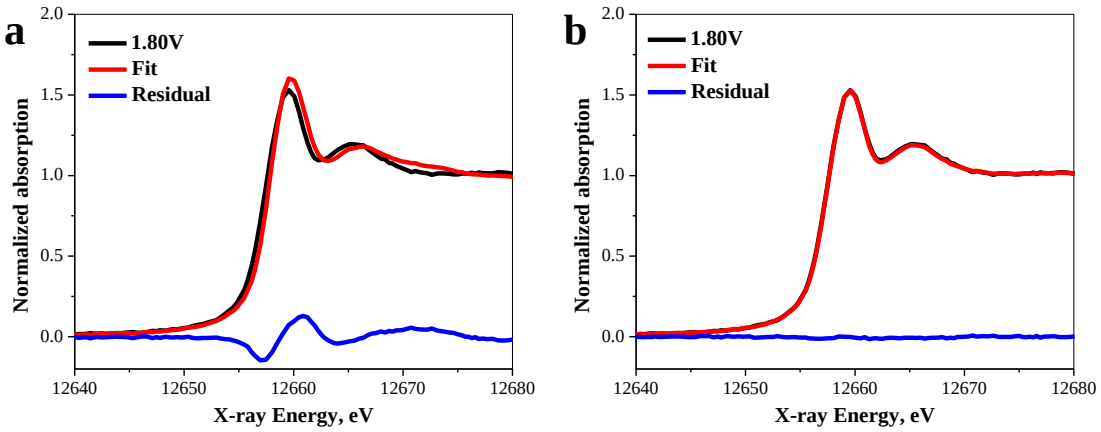

Figure S6 Linear combination fitting of the XANES spectrum collected at 1.80 V in the 1st discharge with (a) two phases and (b) multi-phases.

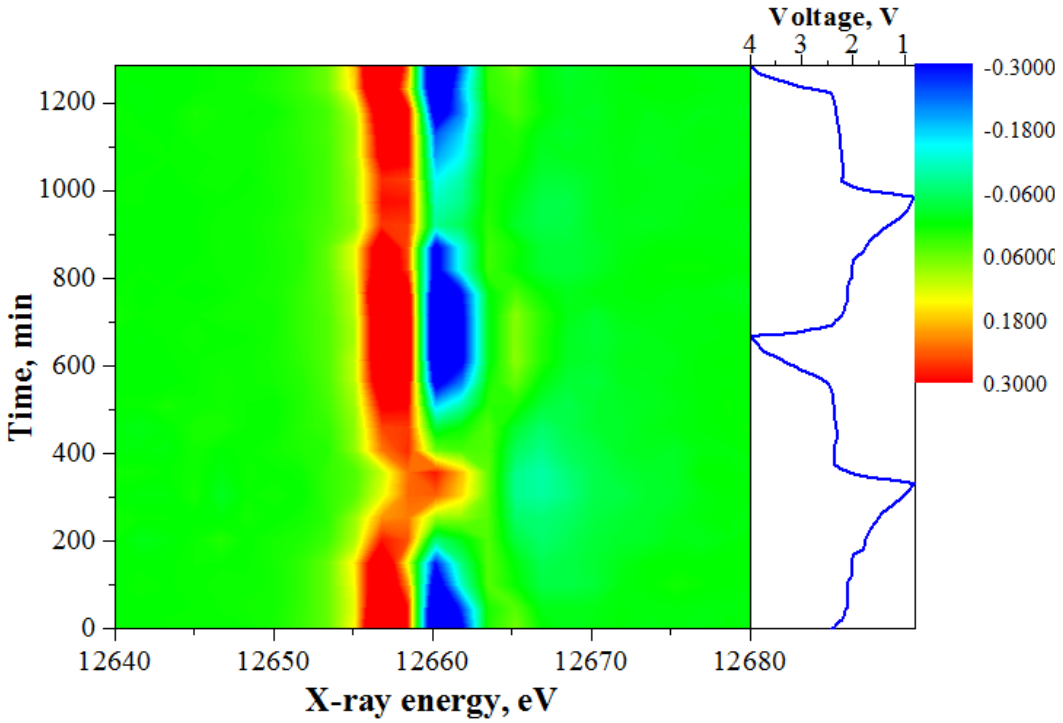

Figure S7 Derivative of normalized XANES data of Se_2S_5/MPC cathode along with charge/discharged at 0.2 C.

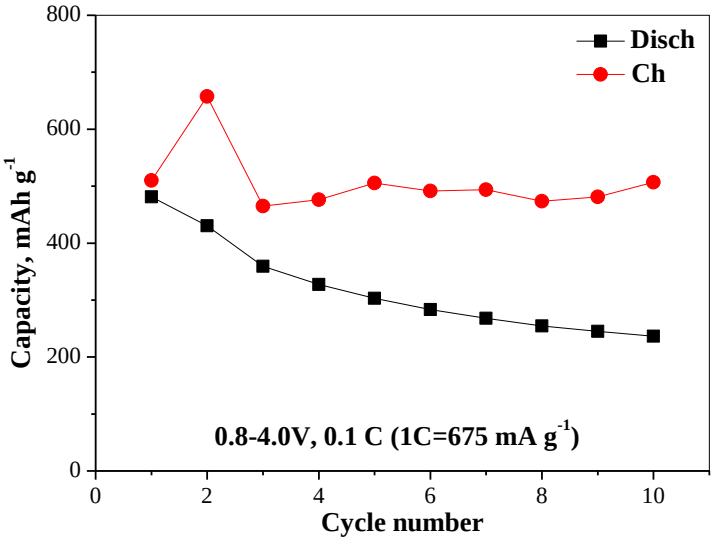

Figure S8 Cycle performance of Se/MPC composite at 0.1 C within 0.8-4.0 V in ether-based electrolytes.

Table S1 Summary of Se-based cathodes in ether-based electrolytes

Reference	Current density/ mA g^{-1}	Voltage range /V	1^{st} cycle /mAh g^{-1}	Last cycle /mAh g^{-1}	Cycles
[24]	500	0.8-4.0	816	300	50
[27]	337.5	1.0-3.0	558	181	80
[23]	337.5	1.0-3.0	645.7	355.5	100
[22]	135	1.65-2.60	533	308	200
[25]	337.5	1.2-3.0	560	246	80
[21]	337.5	0.8-3.0	513	300	100
[20]	337.5	0.8-3.0	571.5	298.7	100
[18]	67.5	1.0-3.0	620	300	20
[26]	67.5	1.0-3.0	481	158	50
[17]	675	1.2-3.0	535	267	50
[16]	337.5	1-3.0	587	367	50