Supporting Information

Controllably Oxygen-Incorporated Interlayer-Expanded ReS_2 Nanosheets Deposited on Hollow Mesoporous Carbon Spheres for Improved Redox Kinetics of Li-Ion Storage

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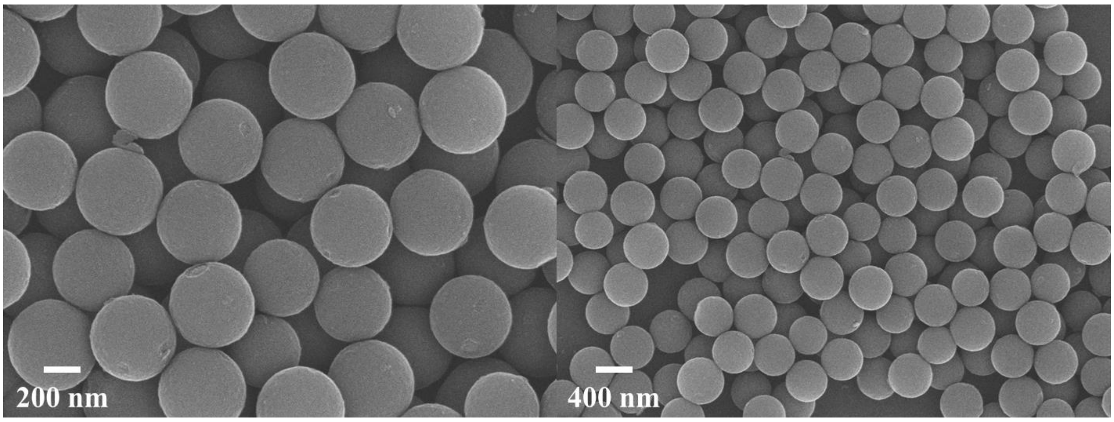


Figure S1. SEM images of the SiO_2@SiO_2/RF carbon sphere.

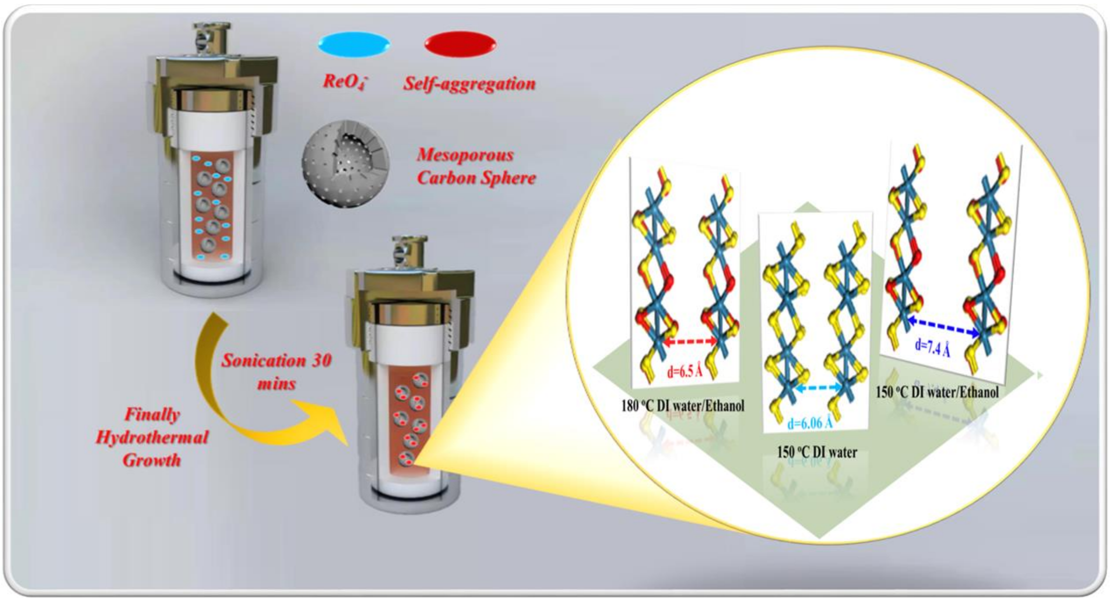


Figure S2. Schematic illustration of the synthesis process with expanded interlayer.

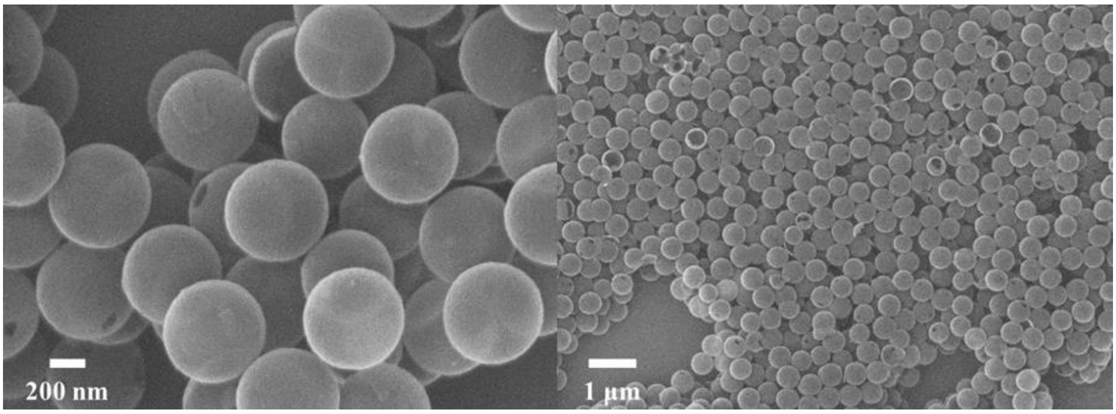


Figure S3. SEM images of the HMCS.

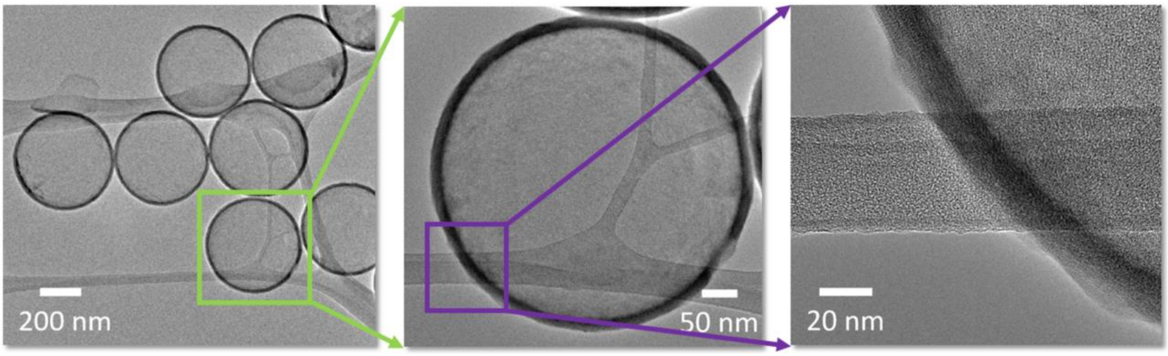


Figure S4. TEM image of the HMCS.

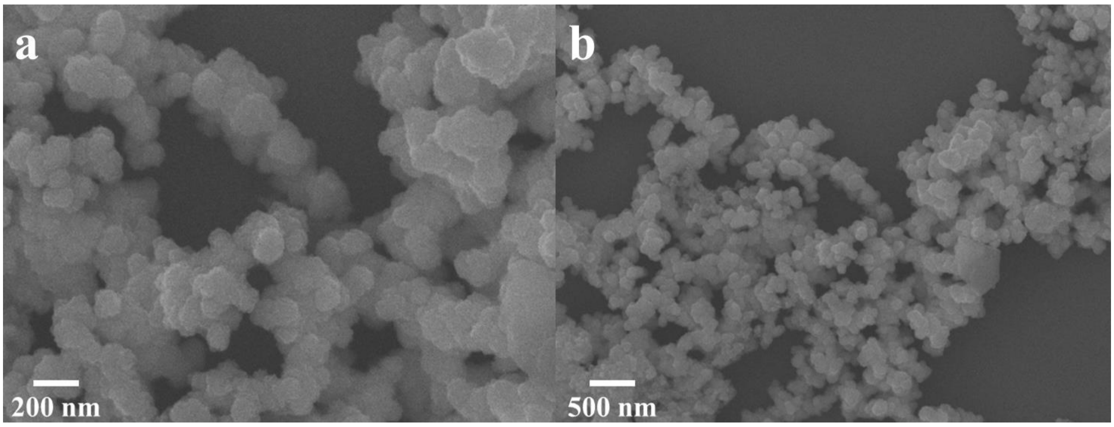


Figure S5. SEM images of the O-ReS_2 powder.

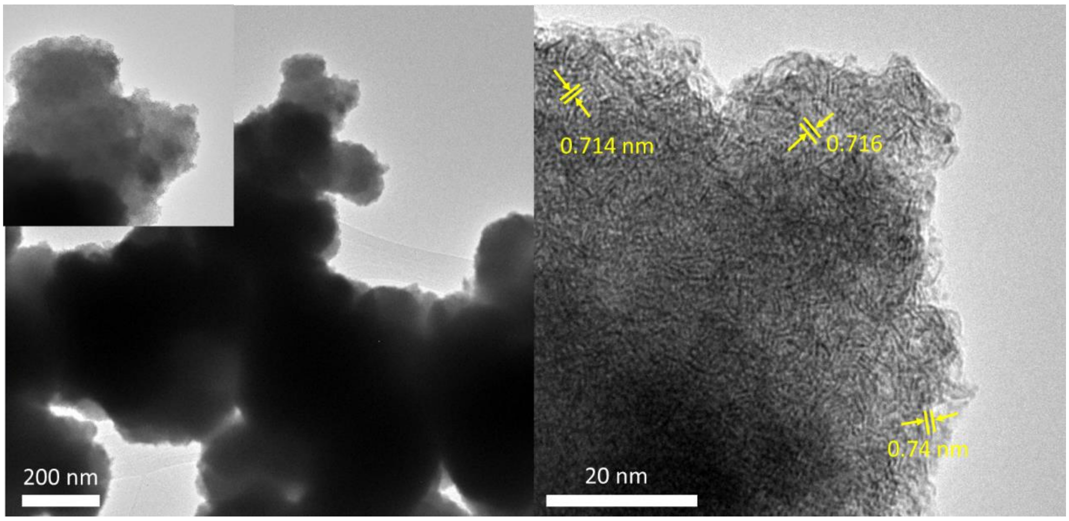


Figure S6. TEM images of the O-ReS_2 powder.

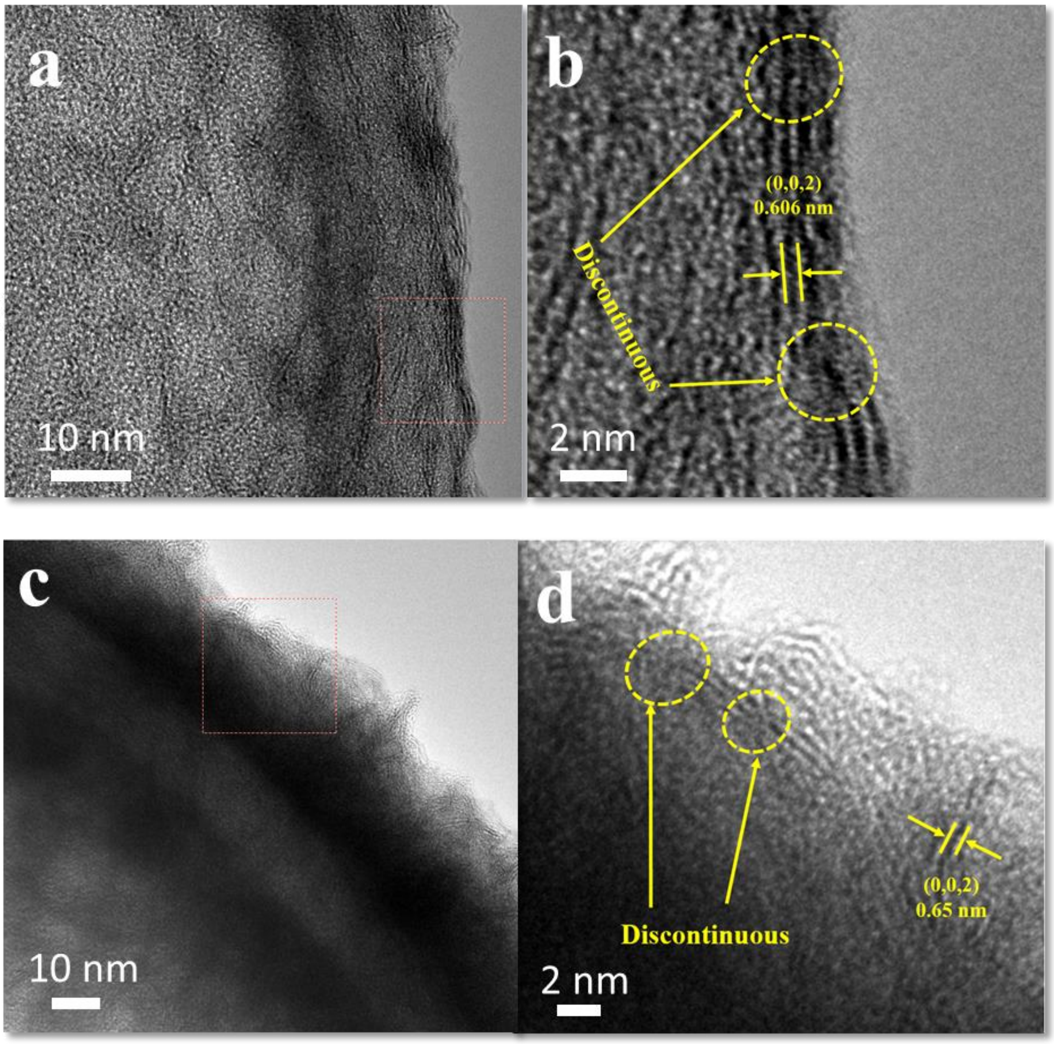
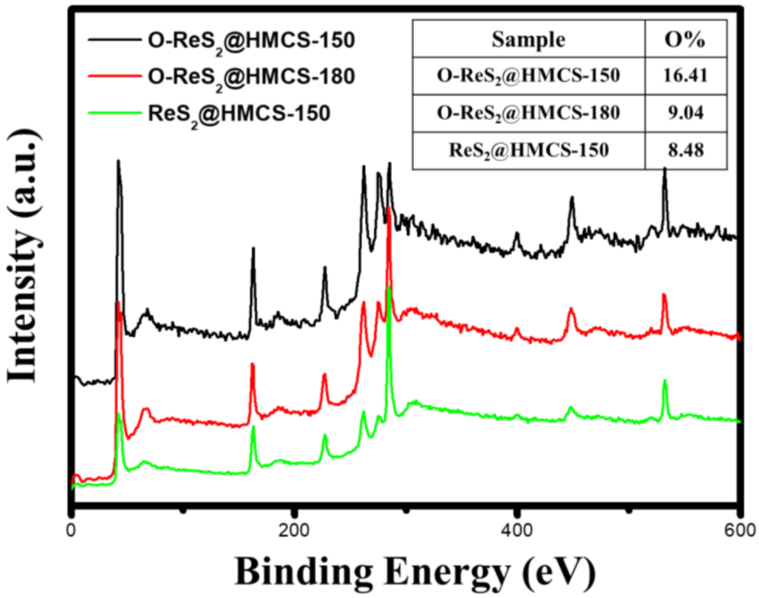
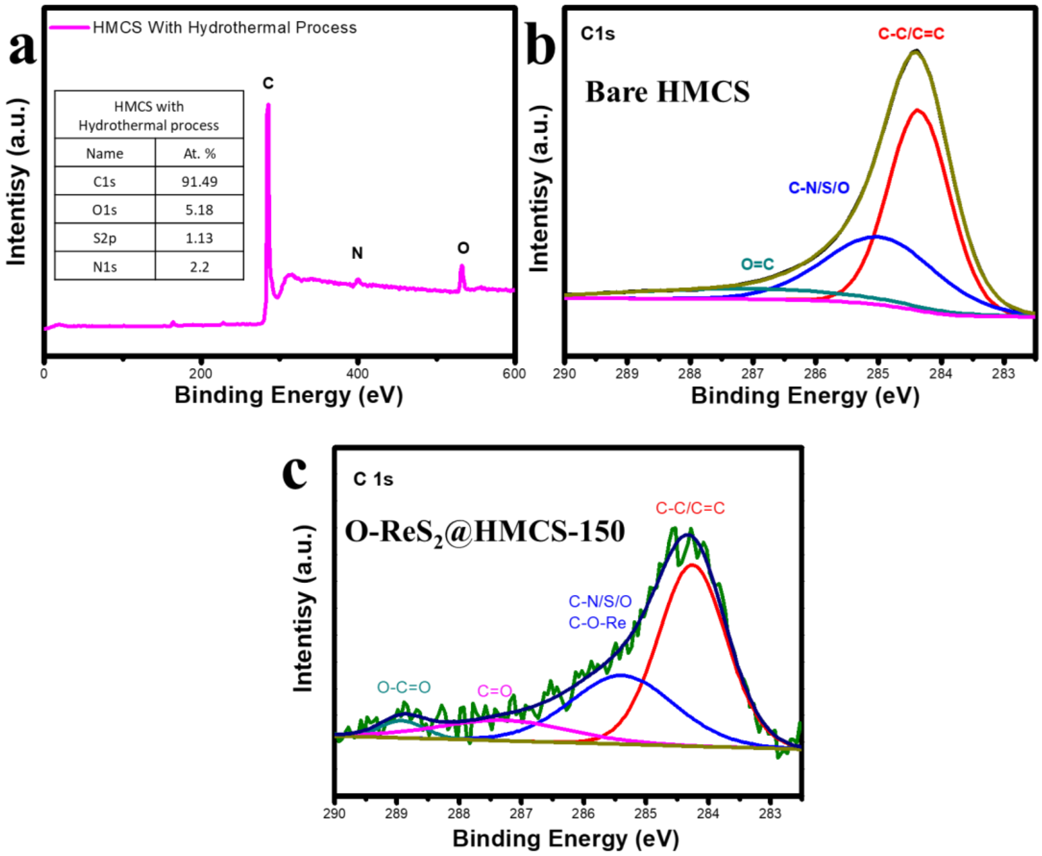


Figure S7. (a,b) HR-TEM images of the nanocomposite with only DI water solvent. (c,d) HR-TEM images of the nanocomposite with 180 ℃ reaction temperature.



Sample	O%
O-ReS$_2$@HMCS-150	16.41
O-ReS$_2$@HMCS-180	9.04
ReS$_2$@HMCS-150	8.48

Figure S8. XPS data of the composite. Insert table shows the O ratio.



HMCS with Hydrothermal process	
Name	At. %
C1s	91.49
O1s	5.18
S2p	1.13
N1s	2.2

Figure S9. (a,b) XPS of the HMCS with same hydrothermal process without the Re-precursors and (c) C1s of the O-ReS$_2$@HMCS-150.

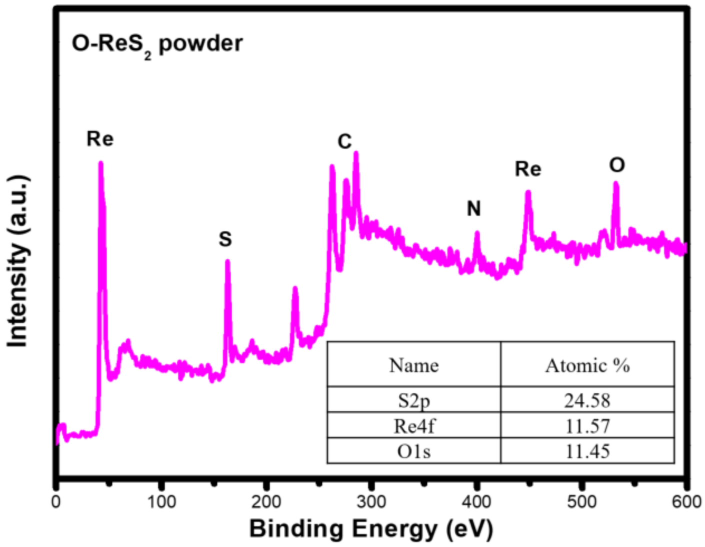
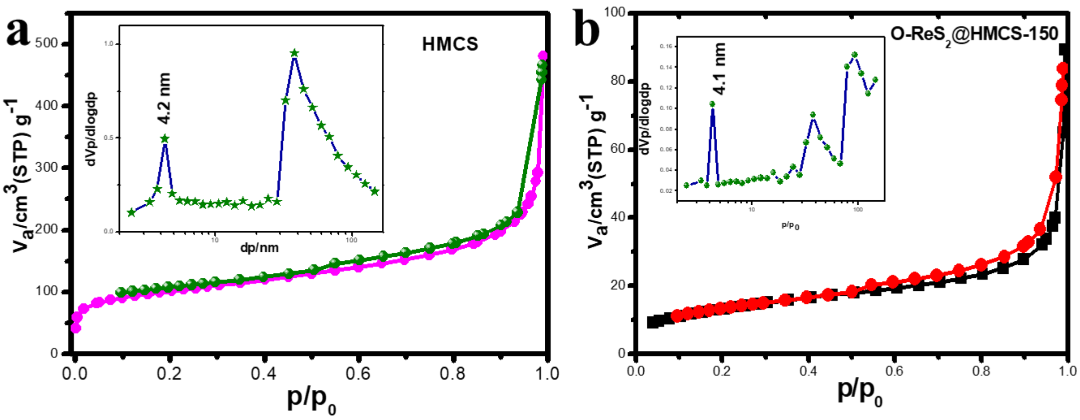


Figure S10. XPS of the O-ReS_2 powder with same hydrothermal process without HMCS.



Material	$a_{s,BET}/m^2\ g^{-1}$	Mean pore diameter/nm
HMCS	362.95	8.19
O-ReS_2@HMCS-150	48.45	11.39

Figure S11. N_2 adsorption/desorption isotherms of (a) MHCS and (b) O-ReS_2@HMCS-150. Insert is the corresponding pore size distribution profile.

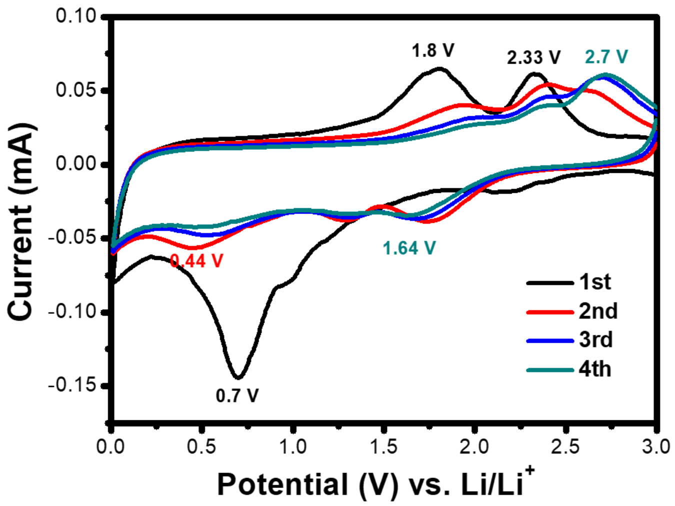


Figure S12. CV curves of the O-ReS_2 powder.

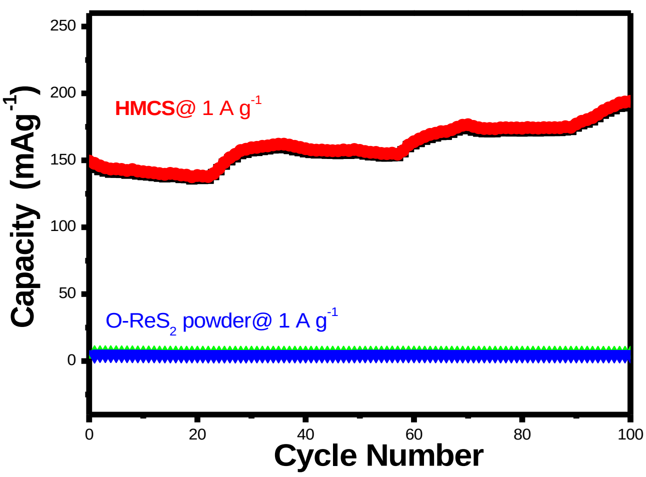


Figure S13. Cycling stability of the HMCS and O-ReS_2 powder.

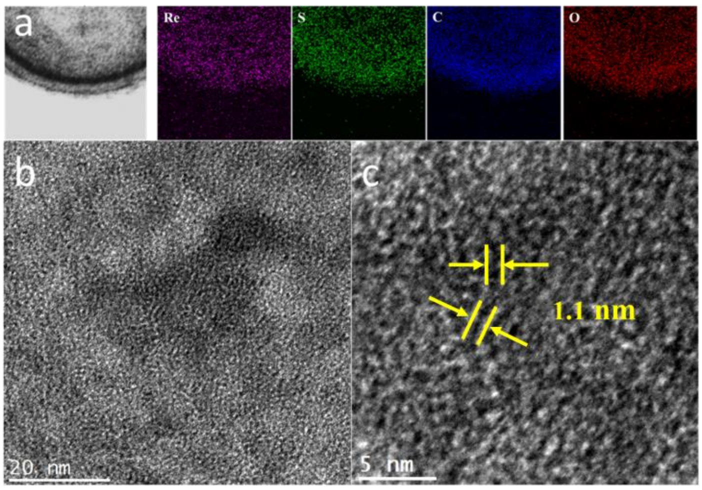


Figure S14. (a) EDX mapping and (b, c) HR-TEM images of the cycled O-ReS_2@HMCS-150 electrode.

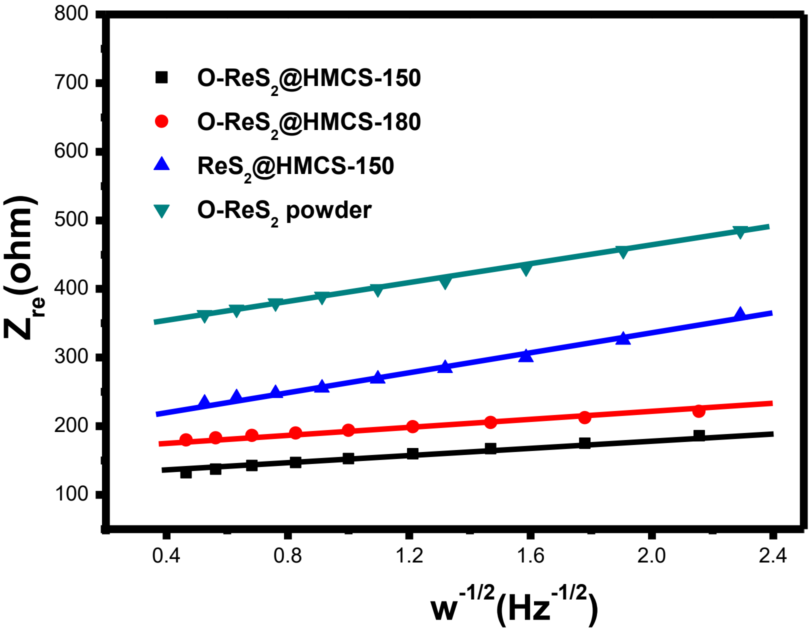


Figure S15. The linear fits of the Z_{real} vs. $\omega^{-1/2}$ curves in the low-frequency region.

The Li-ions diffusion coefficient (D_{Li}) can be calculated based on the following equation [1]

$$D_{Li} = \frac{R^2T^2}{2A^2n^4F^4C^2\sigma^2} \quad (1)$$

Here, R is the gas constant, T is the absolute temperature, A is the surface area of the cathode, n is the number of electrons per molecule attending the electronic transfer reaction, F is Faraday constant, C is the concentration of lithium ion, and σ is the Warburg coefficient associated with the slope of the linear fittings in the low frequency region. σ has the relationship with Z_{re} according to equation: [1]

$$Z_{re} = R_s + R_f + \sigma\omega^{-1/2} \quad (2)$$

So the value of σ is the slope of the graph of Z_{re} against $\omega^{-1/2}$ in the low frequency region.

Table S1. Elemental ratios of the samples.

Sample	Re	S	C	O
O-ReS_2@HMCS-150	13.06	28.74	41.78	16.41
HMCS with hydrothermal process	-	1.13	91.49	5.18

References:

[1] S. Gong, G. Zhao, P. Lyu, K. Sun, A Pseudolayered MoS_2 as Li-Ion Intercalation Host with Enhanced Rate Capability and Durability, Small. 14 (2018) 1803344.