Electronic Supplementary Information

Conversion of 1T-$MoSe_2$ to 2H-$MoS_{2x}Se_{2-2x}$ mesoporous nanospheres for superior sodium storage performance

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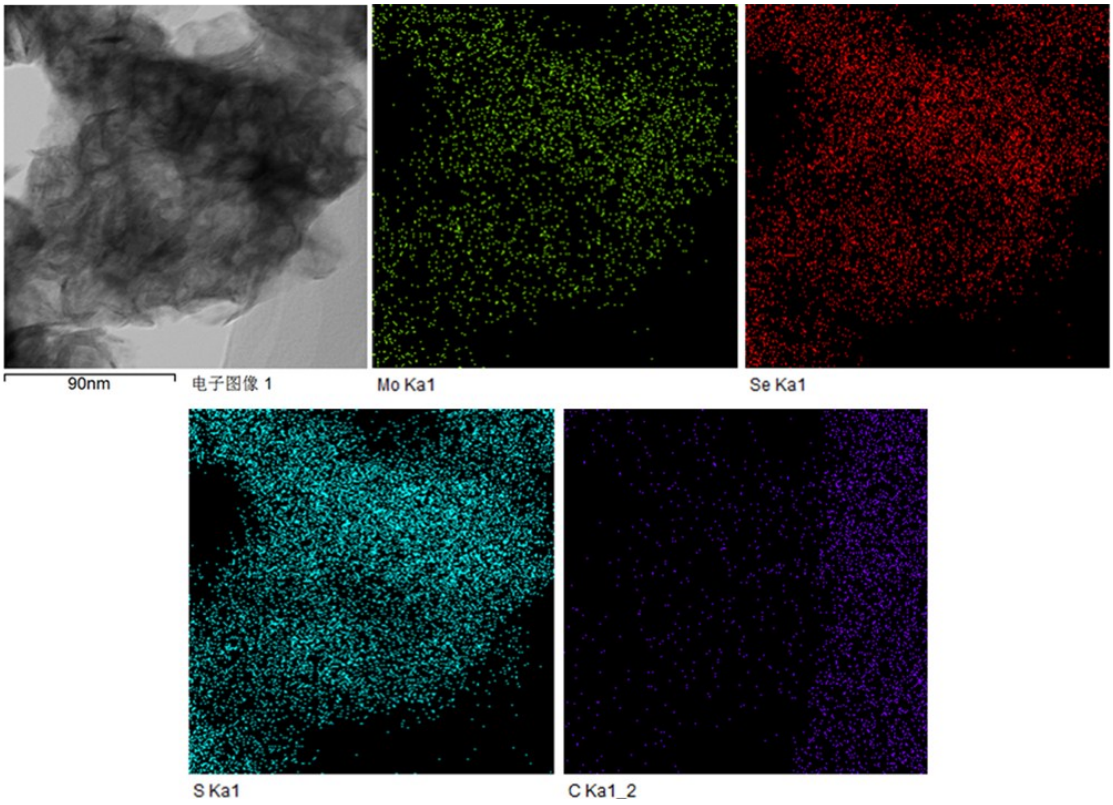

Fig. S1 TEM image and EDX mappings of the 2H-$MoS_{2x}Se_{2-2x}$ nanospheres.

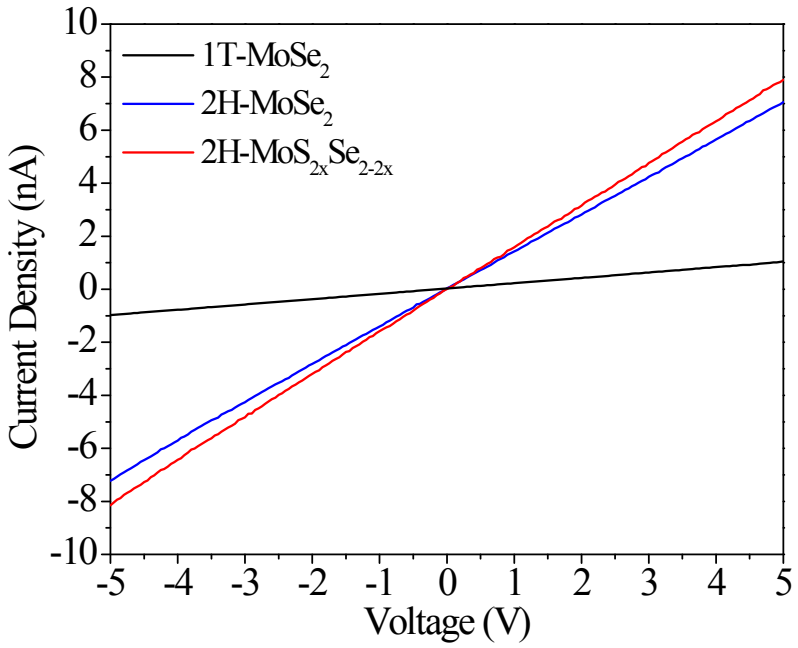

Fig. S2 I-V curves of the films of the three samples deposited on SiO_2 substrates, showing significant improvement in conductivity by post sulfuration treatment.

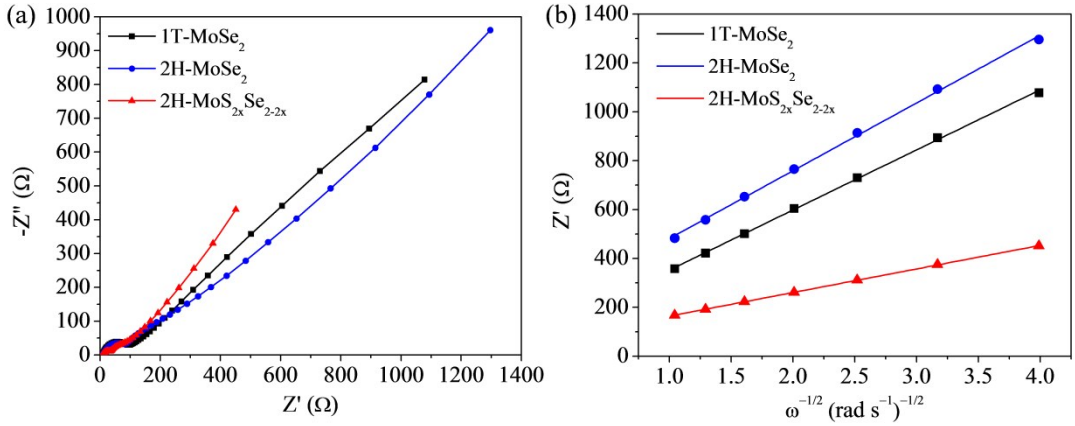

Fig. S3 (a) Nyquist plots of three electrodes after 3 cycles at the current density of 500 mA g^{-1}; (b) the relationship between Z' and $\omega^{-1/2}$ at low frequency.

The sodium ion diffusion coefficient (D) is calculated according to the following equation:

$$D = \frac{(RT)^2}{2(An^2F^2C\sigma)^2} \qquad (1)$$

where R is the gas constant, T is the absolute temperature, A is the surface area of the electrode, n is the number of electrons per molecule during reduction, F is the Faraday constant, C is the molar concentration of sodium ions, and σ is the Warburg factor which has a relationship with Z':

$$Z' = R_s + R_{ct} + \sigma\omega^{-1/2} \qquad (2)$$

The $Z'-\omega^{-1/2}$ plots of the three samples are presented in Fig. S3b. The σ value is estimated to be 245.9 Ω $s^{1/2}$ for the freshly-prepared 1T-$MoSe_2$, 277.5 Ω $s^{1/2}$ for the annealed 2H-$MoSe_2$, and 96.5 Ω $s^{1/2}$ for the S-doped 2H-$MoSe_2$. As a result, it is calculated that the D values of the 1T-$MoSe_2$, 2H-$MoSe_2$, and 2H-$MoS_{2x}Se_{2-2x}$ samples are 3.54×10^{-19}, 2.79×10^{-19}, and 2.30×10^{-18} cm^2 s^{-1}, respectively. Thus, the 2H-$MoS_{2x}Se_{2-2x}$ sample obtained after sulfuration shows the fastest sodium ion diffusion rate.