

# **Supporting Information**

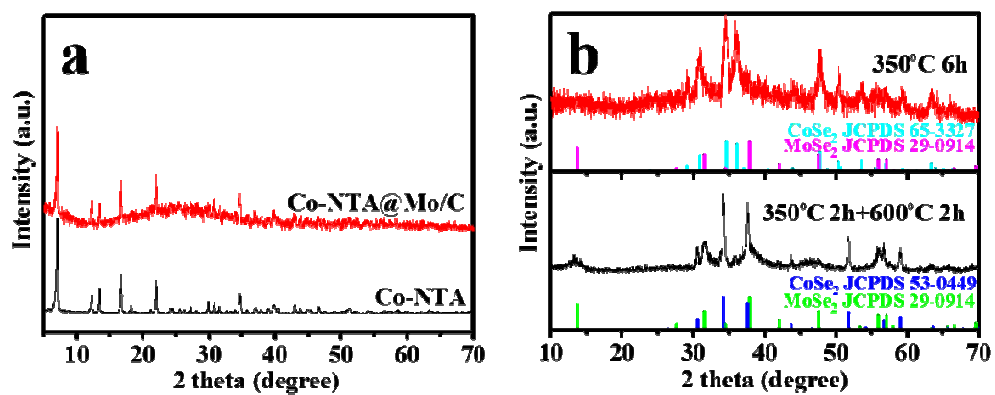
## **Rational Design of Hierarchical Nanotubes through Encapsulating CoSe<sub>2</sub> Nanoparticles into MoSe<sub>2</sub>/C Composite Shells with Enhanced Lithium and Sodium Storage Performance**

*Jingyu Gao,<sup>†</sup> Yapeng Li,<sup>†</sup> Liang Shi,<sup>§</sup> Jingjing Li<sup>§</sup> and Genqiang Zhang<sup>\*†</sup>*

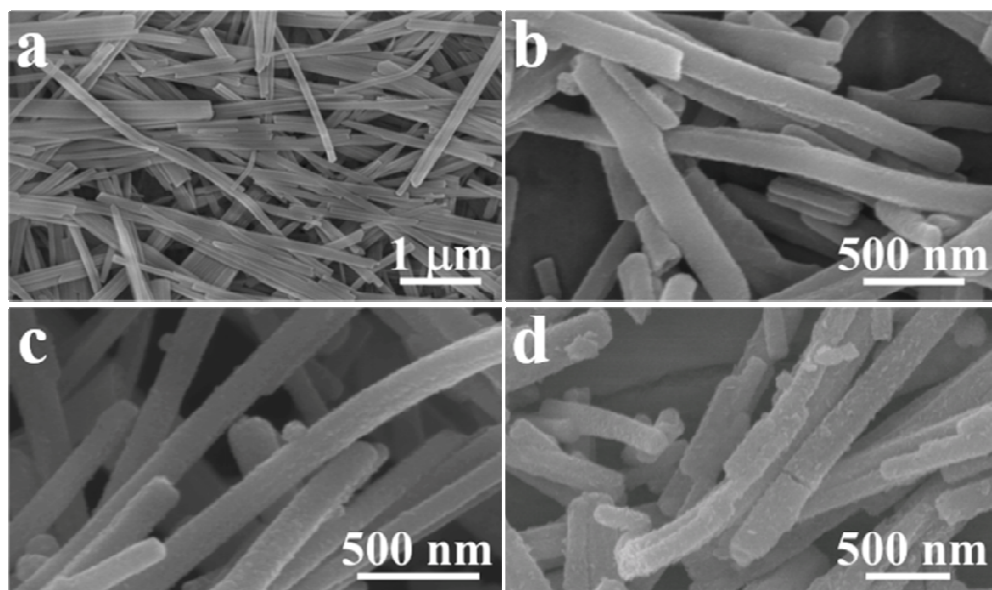
<sup>†</sup>Key Laboratory of Materials for Energy Conversion, Chinese Academy of Science; Department of Materials Science and Engineering, University of Science and Technology of China, Hefei, Anhui 230026 China;

<sup>§</sup>Department of Chemistry, University of Science and Technology of China, Hefei, Anhui 230026 China

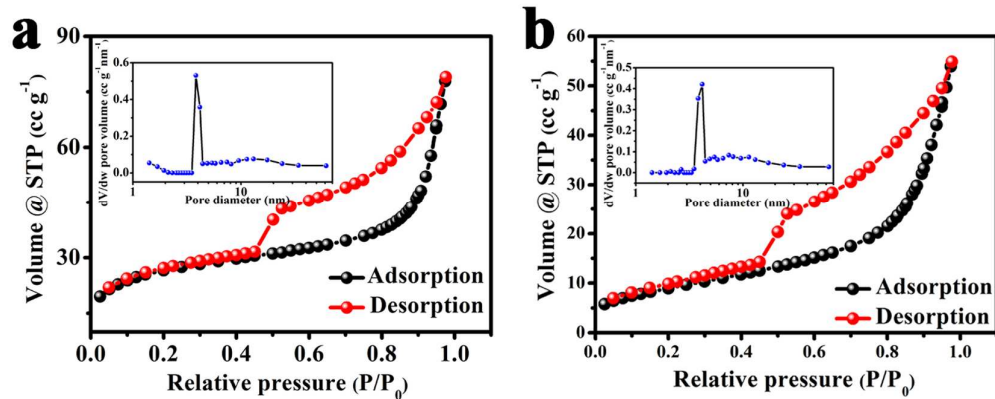
<sup>\*</sup>To whom the correspondence should be referred. Email: gqzhangmse@ustc.edu.cn



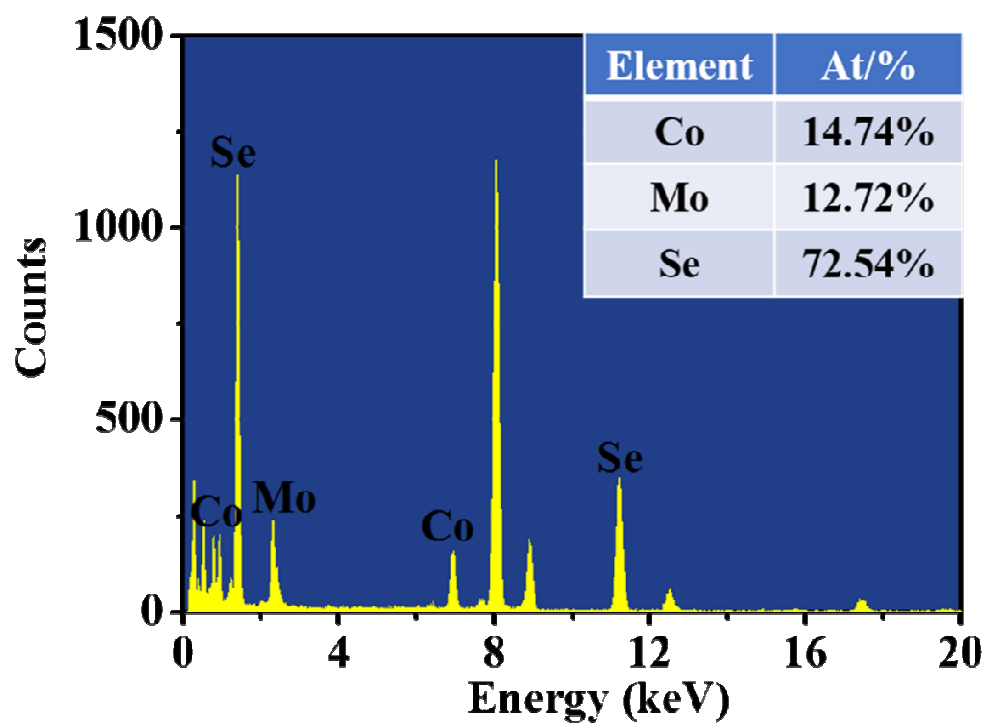
**Figure S1.** XRD patterns of a) Co-NTA, Co-NTA@Mo/C; b) CoSe<sub>2</sub>@MoSe<sub>2</sub>/C-350 porous nanowires, CoSe<sub>2</sub>@MoSe<sub>2</sub>/C HNT.



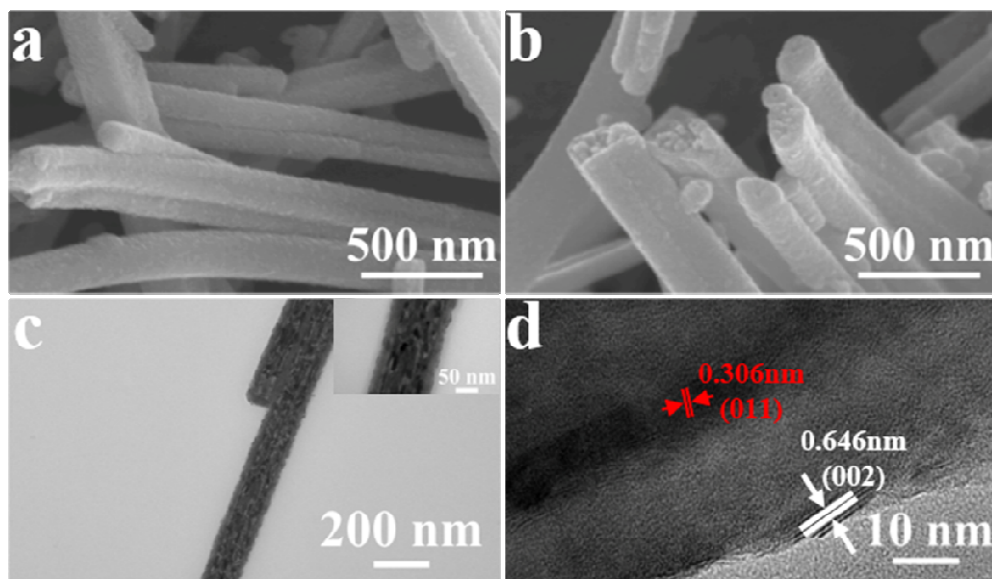
**Figure S2.** SEM images of a) Co-NTA, b) Co-NTA@Mo/C, c) CoSe<sub>2</sub>@MoSe<sub>2</sub>/C-350 porous nanowires and d) CoSe<sub>2</sub>@MoSe<sub>2</sub>/C-600 HNT.



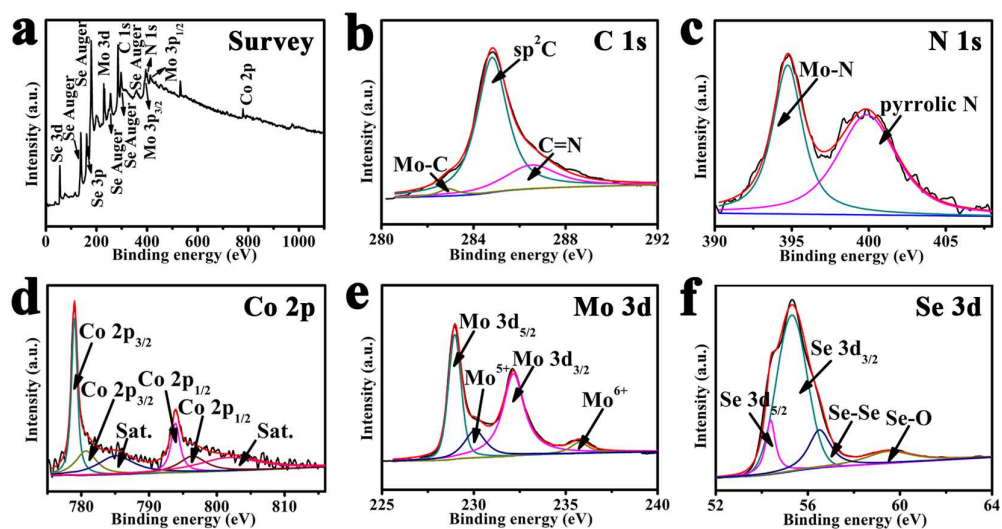
**Figure S3.** Nitrogen absorption/desorption isotherms and pore size distributions of (a) CoSe<sub>2</sub>@MoSe<sub>2</sub>/C HNT obtained at 600 °C; b) CoSe<sub>2</sub>@MoSe<sub>2</sub>/C porous nanowires annealed at 350 °C in argon.



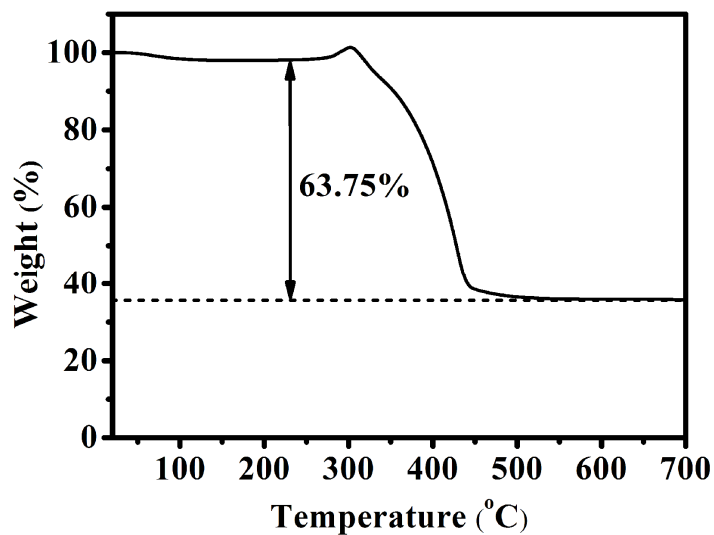
**Figure S4.** EDS spectrum of  $\text{CoSe}_2/\text{MoSe}_2/\text{C}$  HNT annealed at 350 °C for 2h and 600 °C for 2h in argon.



**Figure S5.** a, b) SEM images, c, d) HRTEM images of CoSe<sub>2</sub>@MoSe<sub>2</sub>/C-350 annealed at 350 °C in argon for 6h.



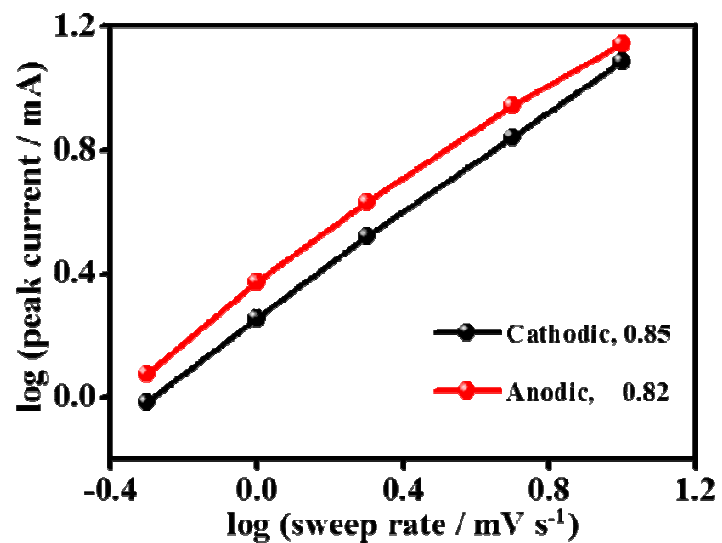
**Figure S6.** XPS spectra of CoSe<sub>2</sub>@MoSe<sub>2</sub>/C-350 porous nanowires: a) Survey spectrum, b) C 1s, c) N 1s, d) Co 2p, e) Mo 3d, and f) Se 3d, heated at 350°C for 6h in argon.



**Figure S7.** Thermogravimetric analysis of CoSe<sub>2</sub>/MoSe<sub>2</sub>/C HNT in air at the heating rate of 10 °C min<sup>-1</sup>.

As shown in Figure S7, the total weight loss of the CoSe<sub>2</sub>/MoSe<sub>2</sub>/C HNT is about 63.75% according to the thermogravimetric analysis (TGA) result, which can be attributed to the combustion of carbon and sublimation of SeO<sub>2</sub> deriving from the conversion process from CoSe<sub>2</sub> and MoSe<sub>2</sub> to Co<sub>3</sub>O<sub>4</sub> and MoO<sub>3</sub>, respectively. The content of the carbon species can then be calculated to be about 21.54 % in the hybrid nanostructure.





**Figure S8.** Plots of log (scan rate) versus log (peak current), calculated from CV curves of CoSe<sub>2</sub>@MoSe<sub>2</sub>/C HNT.