

## Supplementary Information

### **Improved thermoelectric properties of multi-walled carbon nanotubes/Ag<sub>2</sub>Se with small size via controlling the composite ratio**

Nana Chen<sup>a</sup>, Chaojun Ren<sup>b</sup>, Like Sun<sup>a</sup>, Haoyue Xue<sup>a</sup>, Han Yang<sup>a</sup>, Xue An<sup>a</sup>, Xiaoyu Yang<sup>a</sup>, Jiajing Zhang<sup>a</sup>, Ping Che<sup>a,\*</sup>

<sup>a</sup> Beijing Key Laboratory for Science and Application of Functional Molecular and Crystalline Materials, School of Chemistry and Biological Engineering, University of Science and Technology Beijing, Beijing 100083, China

<sup>b</sup> Beijing Aerospace Propulsion Institute, No.1 South Dahongmen Road, Beijing, 100076, China

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\* Corresponding author.

E-mail address: [cheping@ustb.edu.cn](mailto:cheping@ustb.edu.cn) (P. Che).

The crystal structure of the MWCNTs was detected on X-ray diffraction (Fig. S1). Two broad diffraction peaks were observed at approximately  $26.38^\circ$  and  $44.39^\circ$ . With the increase of CNT content, the size of  $\text{Ag}_2\text{Se}$  particles decreased obviously, and then increased (Fig. S2). The phenomenon of intertwined carbon nanotubes is also more intuitive. The EDS results exhibited the elementary compositions containing Ag, Se and C (Fig. S3). The temperature dependence of PF of the  $\text{Ag}_2\text{Se}$  and MCAS were plotted in Fig. S4. The comparison of the original and tested XRD for 1%MCAS was shown in Fig. S5.

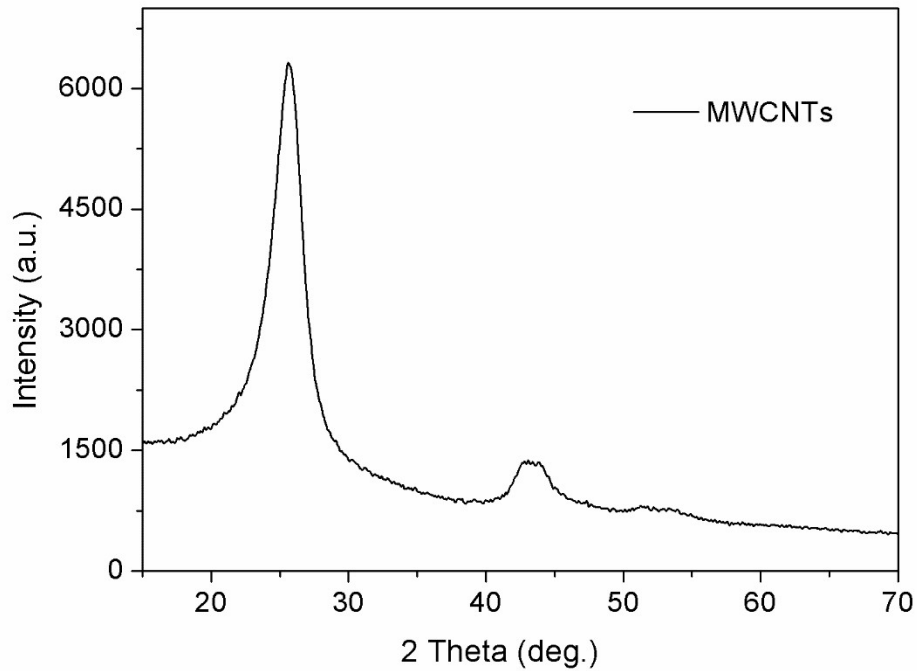


Fig. S1. The XRD pattern of MWCNTs.

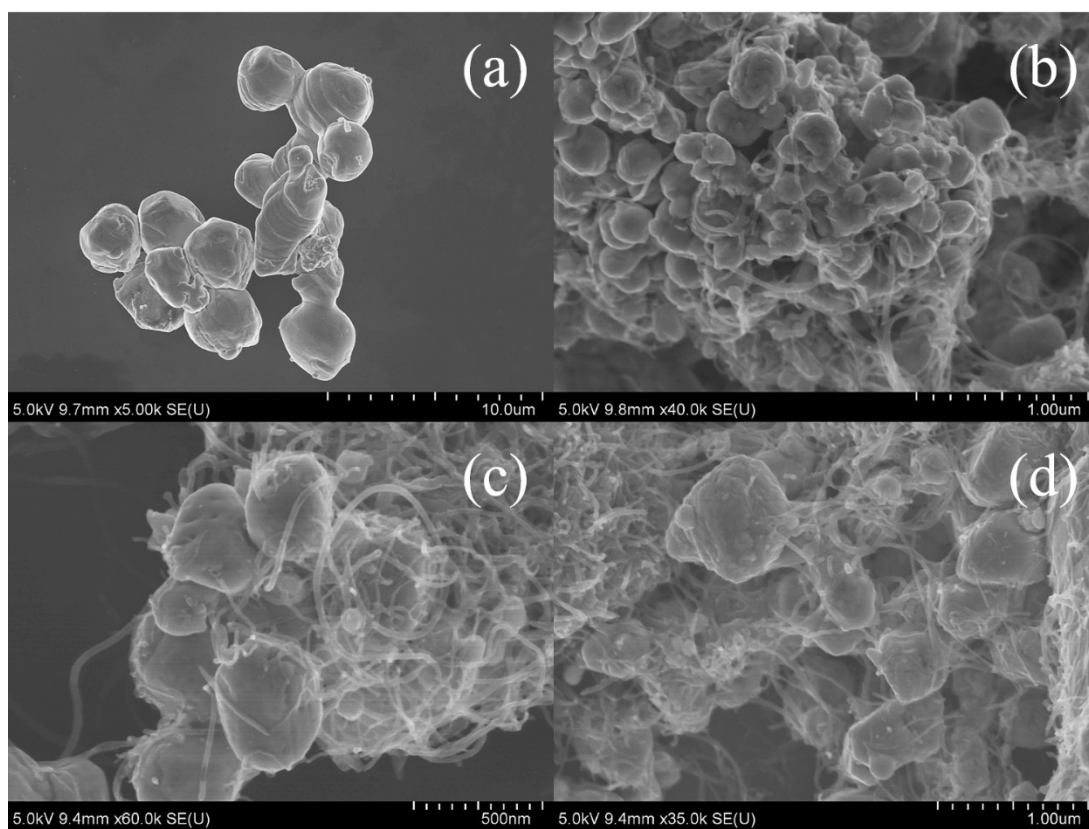


Fig. S2. The samples containing various weight percentage of MWCNTs (a) 0%; (b) 0.5%; (c) 1%; (d) 3%.

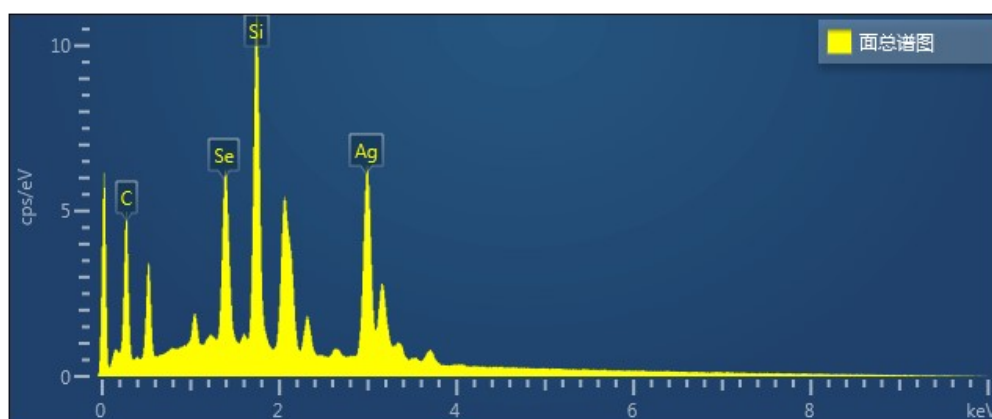


Fig. S3. EDX spectrum of MWCNTs/Ag<sub>2</sub>Se hybrid composition.

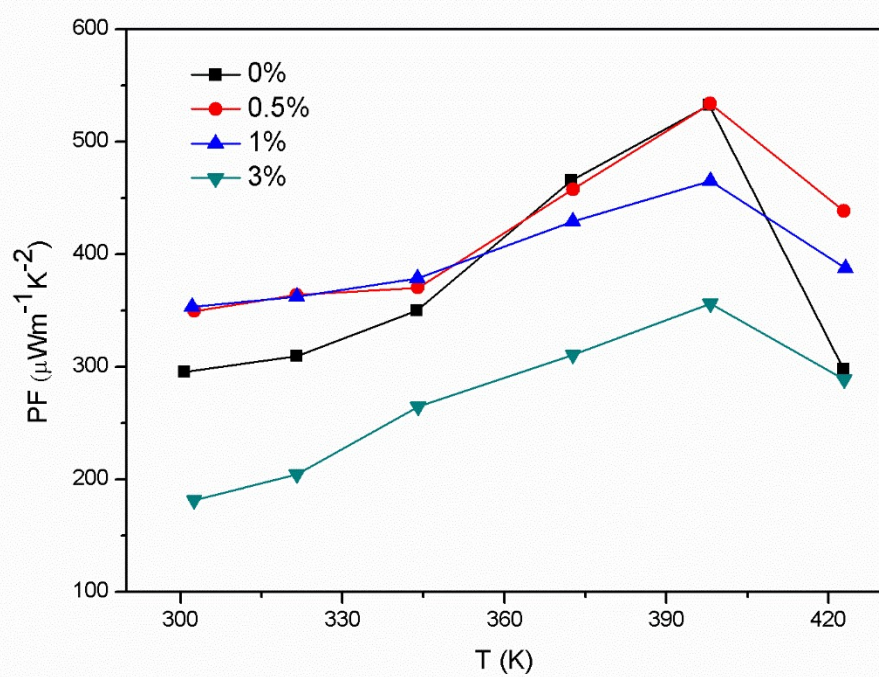


Fig. S4. Power Factor (PF) of  $\text{Ag}_2\text{Se}$  and the samples containing various weight percentage of MWCNTs.

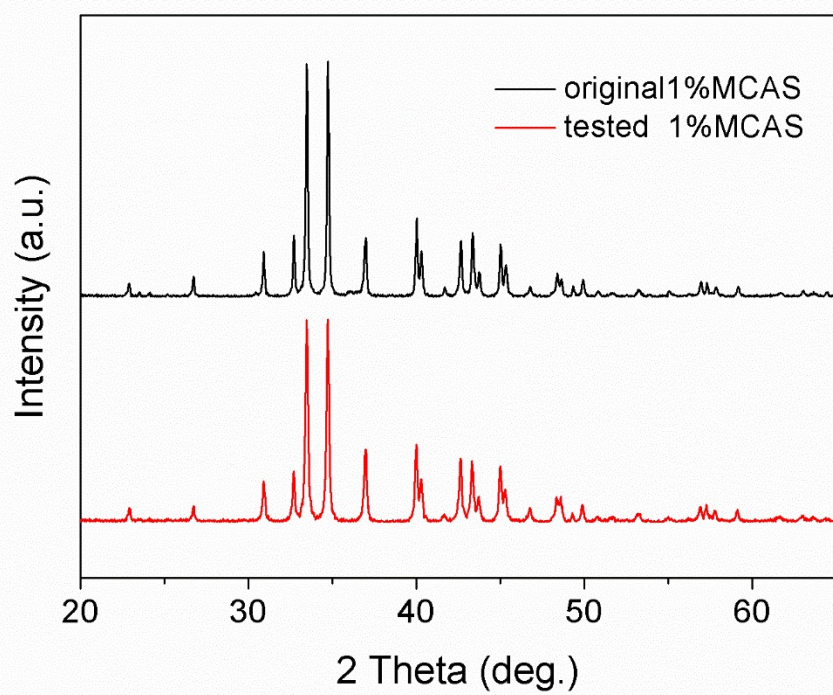


Fig. S5. Comparison of the original and tested XRD for 1%MCAS.