Electronic Supplementary Information

Solvothermal Synthesis of Wire-Like $Sn_xSb_2Te_{3+x}$ with Enhanced Thermoelectric Performance

Heng Quan Yang,[abc] Lei Miao,*[a] Cheng Yan Liu,[a] Xiao Yang Wang,[a] Ying Peng,[a] Ai Juan Zhang,[d] Xiao Yuan Zhou,[d] and Guo Yu Wang,[e] Chao Li,[f] Rong Huang[f]

[a]Guangxi Key Laboratory of Information Material, Guangxi Collaborative Innovation Center of Structure and Property for New Energy and Materials, School of Material Science and Engineering, Guilin University of Electronic Technology, Guilin 541004, P. R. China

[b]Key Laboratory of Renewable Energy, Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences, Guangzhou 510640, P. R. China

[c]University of Chinese Academy of Sciences, Beijing 100049, P. R. China

[d]College of Physics, Chongqing University, Chongqing 401331, P. R. China

[e]Chongqing Institute of Green and Intelligent Technology, Chinese Academy of Sciences, Chongqing 400714, P. R. China

[f]Key Laboratory of Polarized Materials and Devices, Ministry of Education, East China Normal University, Shanghai 200062, P. R. China

*Author to whom correspondence should be addressed.

E-mail: miaolei@guet.edu.cn

The Preparation of Elemental Sb and Te Precursors:

Hydrothermal route for the synthesis of elemental Sb precursor. 12 g of $SbCl_3$ was firstly dissolved into 20 ml of EG, and then 200ml of ~ 1.9 mol L^{-1} NaOH solution and 20 ml of ~ 5.3 mol L^{-1} of $NaBH_4$ solution were added successively under stirring. Finally, the mixture was transferred into a 500-ml-capacity Teflon-lined stainless-steel autoclave and filled up to about 80% of its total volume. It was maintained at 150 °C for 12 h and then cooled to room temperature naturally. The product was collected after washing and drying.

Reflux method for the synthesis of elemental Te precursor. 12 g of TeO_2 and 300 ml of EG were added into a 500 ml one-neck flask. Then it was put on a mantle and maintained at 180 °C for about 30 min to form a transparent solution. 15 ml of $N_2H_4 \cdot H_2O$ was added into the above solution after it cooled down below 100 °C. Finally, the mixture was refluxed at 120 °C for 12 h. The product was collected after washing and drying.

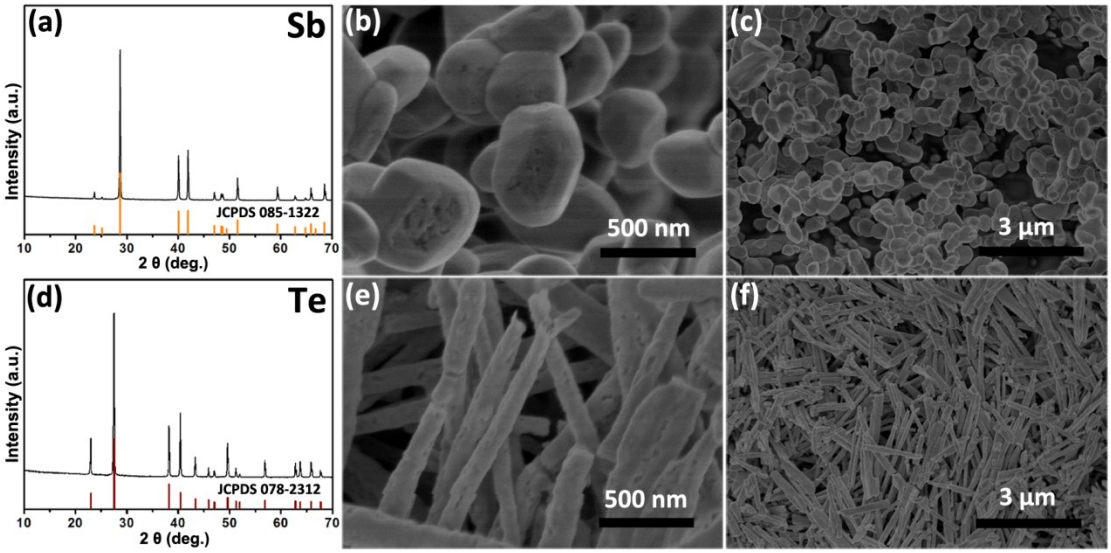

Fig. S1 XRD patterns and SEM images of as-synthesized elemental Sb and Te precursors: (a,b,c) Sb; (d,e,f) Te. The orange and wine bars stand for the standard XRD pattern of Sb (JCPDS 085-1322) and Te (JCPDS 078-2312), respectively.

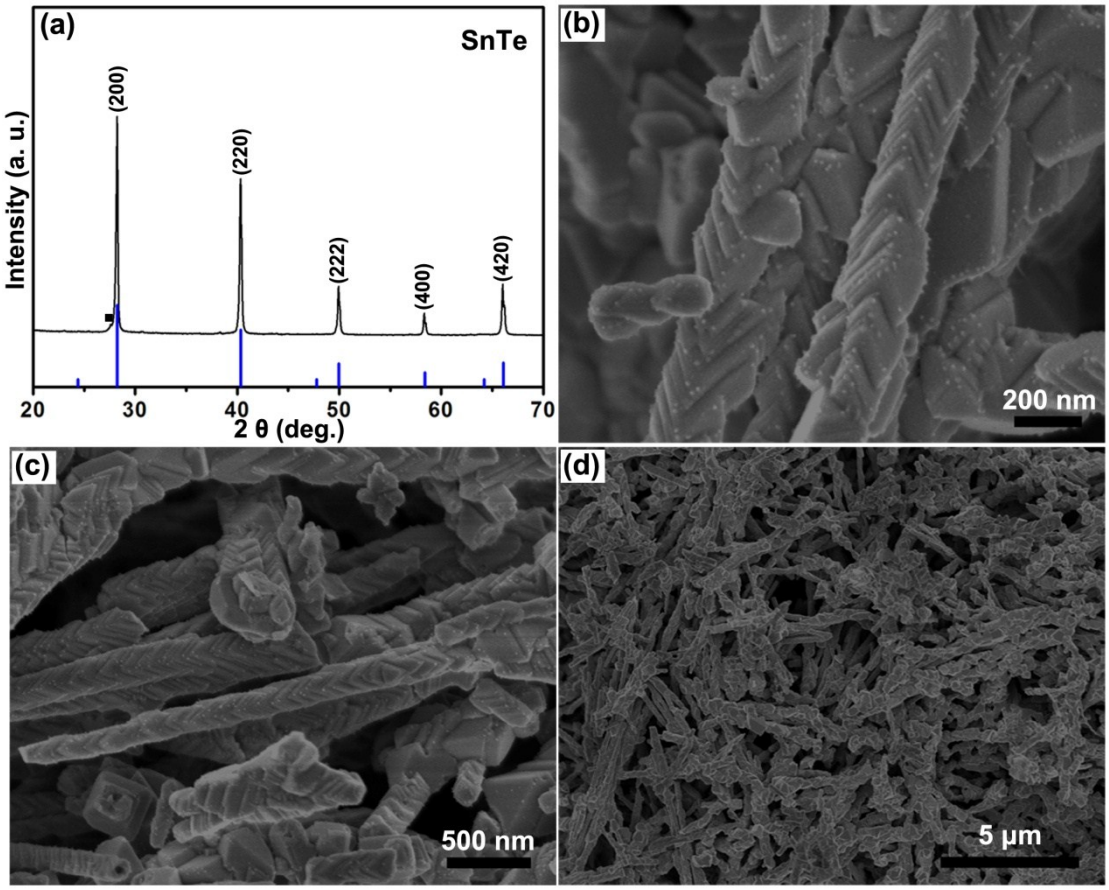

Fig. S2 (a) XRD pattern of the SnTe powder synthesized at 120 °C for 24 h. The blue bars stand for the standard XRD pattern of SnTe (JCPDS 065-7162) and the black solid square (■) stands for Te. (b–d) SEM images of as-synthesized SnTe powder.

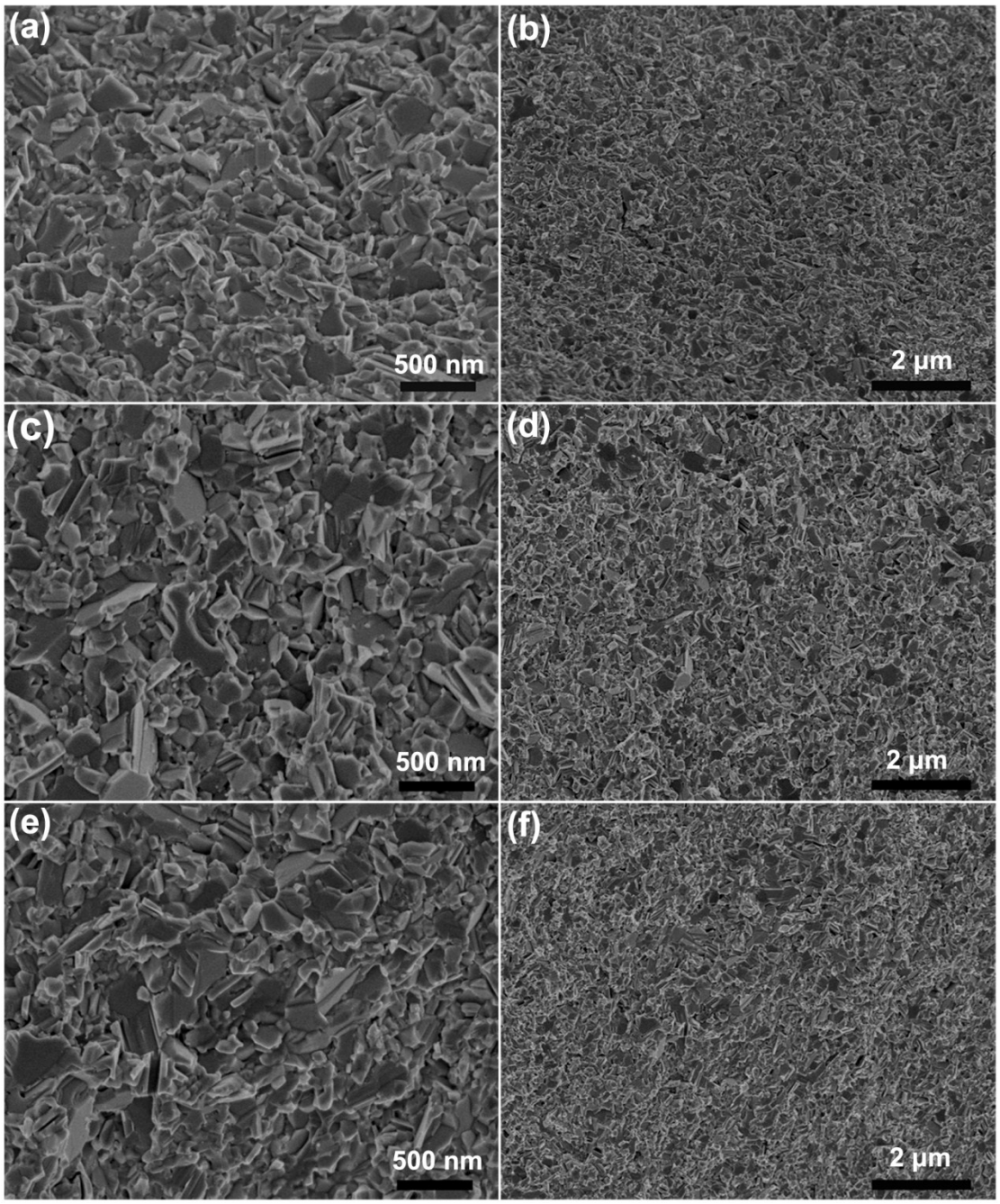

Fig. S3 SEM images of the as-sintered Sb_2Te_3 (a,b), $Sn_{0.02}Sb_2Te_{3.02}$ (c,d) and $Sn_{0.05}Sb_2Te_{3.05}$ (e,f) bulk samples.

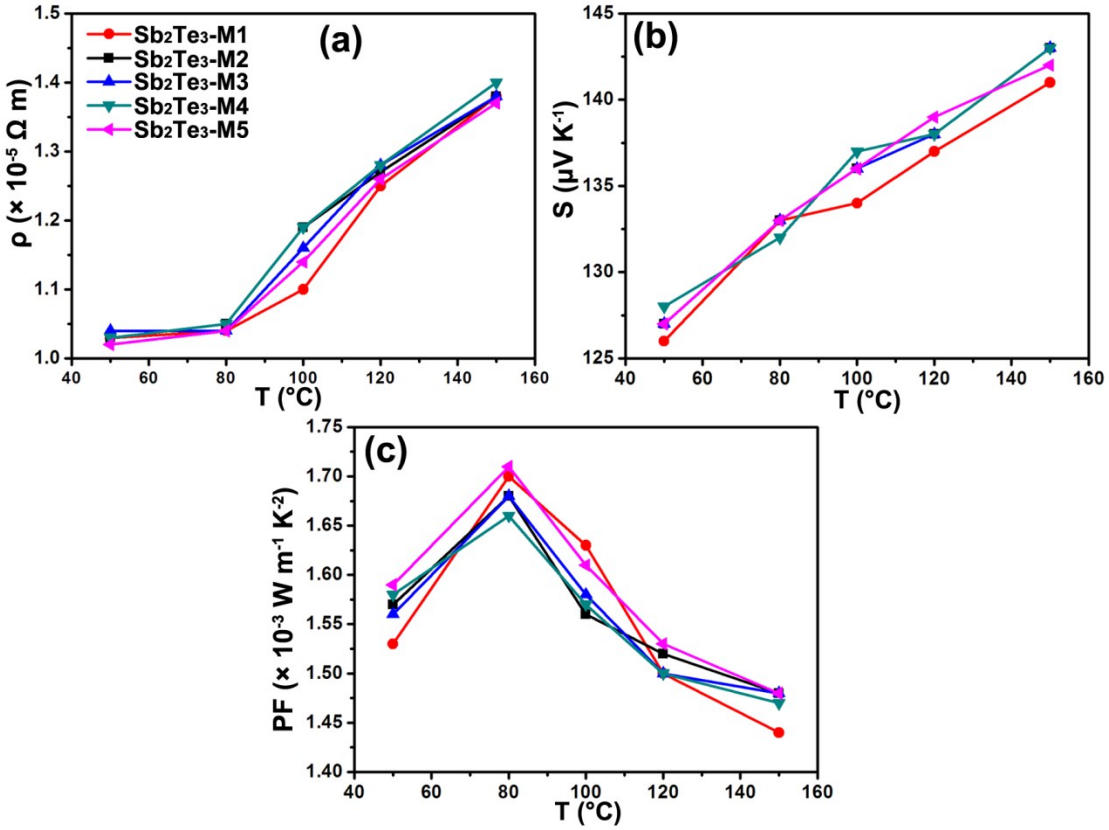

Fig. S4 The repeated measurement of temperature dependent resistivity (a) and Seebeck coefficient (b) and calculated power factor (c) on the Sb_2Te_3 nanobulk sample.

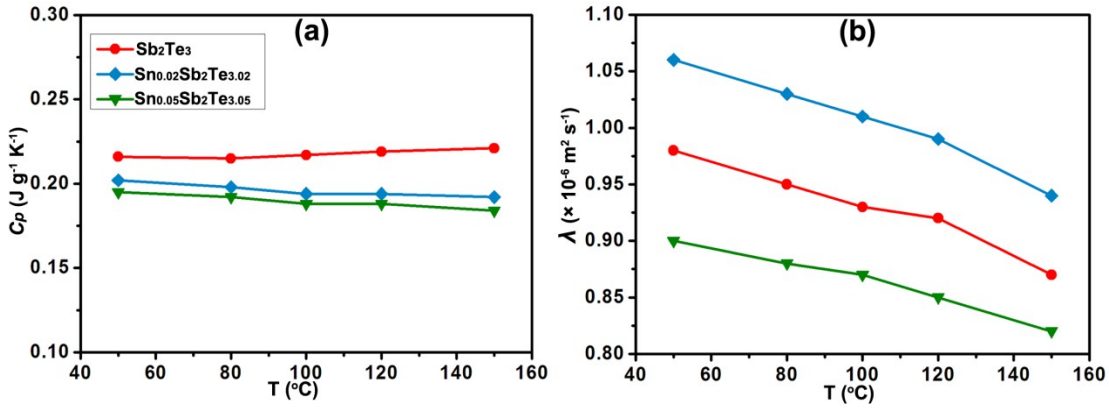

Fig. S5 The measured specific heat (C_p) and thermal diffusivity (λ) of Sb_2Te_3 and $Sn_xSb_2Te_{3+x}$ (x = 0.02 and 0.05) samples: (a) C_p; (b) λ.

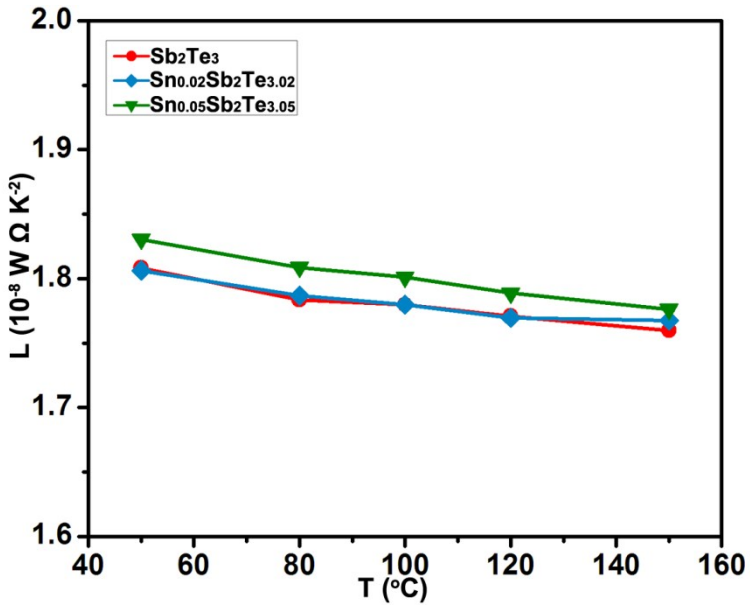

Fig. S6 The calculated Lorenz number (*L*) of Sb_2Te_3 and $Sn_xSb_2Te_{3+x}$ (x = 0.02 and 0.05) samples.