Supporting Information for

Achieving higher thermoelectric performance of n-type PbTe by adjusting band structure and enhanced phonons scattering

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1. The raw materials, XRD pattern and FE-SEM micrographs for the $Cu_{12}Sb_4S_{13}$ nanoparticles.

Raw materials	$SbCl_3$ (99%)	CuCl (97%)	S (99.5%)	ethyl alcohol (99.7%)	anhydrous ethylenediamine (99%)
Content	30mmol	90mmol	97.5mmol	-	-
Mass/Volume	6.8433g	8.9099g	3.1263g	50ml	250ml

Table S1 Raw materials for synthesizing $Cu_{12}Sb_4S_{13}$ nanoparticles.

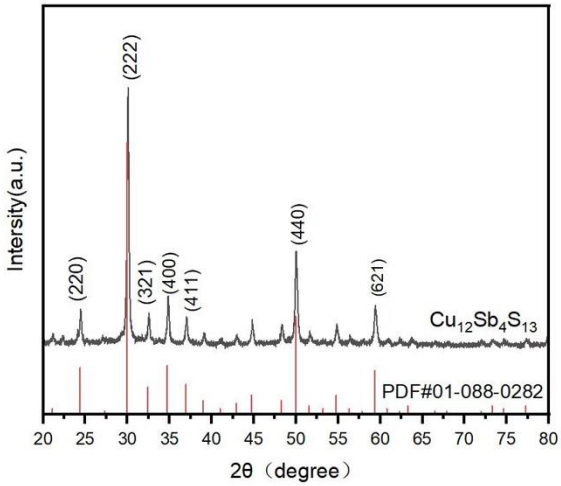

Figure S1 XRD pattern for $Cu_{12}Sb_4S_{13}$ nanoparticles.

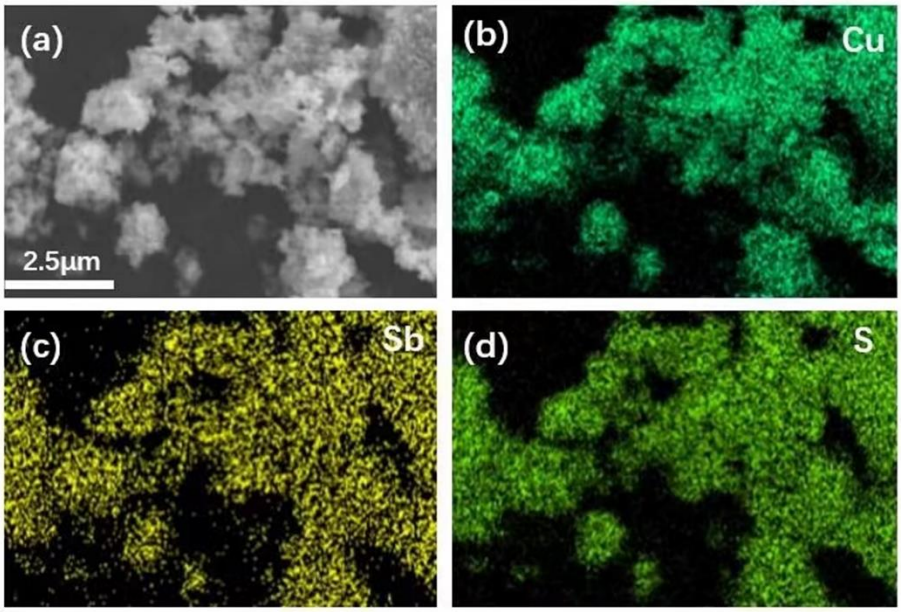

Figure S2 FE-SEM micrographs of (a) surface of the $Cu_{12}Sb_4S_{13}$ nanoparticles, and (b)–(d) an

elemental (Cu, Sb and S) mapping.

2. Theoretical densities, measured densities and relative densities for $Pb_{0.97}Sb_{0.03}Te$ + y wt.% $Cu_{12}Sb_4S_{13}$ (y = 0, 1.25, 1.5 1.75) samples.

Composition	Theoretical density ($g\ cm^{-3}$)	Measured density ($g\ cm^{-3}$)	Relative density (%)
y=0	7.799	7.576	97.1
y=1.25	7.758	7.556	97.4
y=1.5	7.748	7.531	97.2
y=1.75	7.738	7.552	97.6

Table S2 Theoretical densities, measured densities and relative densities for $Pb_{0.97}Sb_{0.03}Te$ + y wt.% $Cu_{12}Sb_4S_{13}$ (y = 0, 1.25, 1.5 1.75) samples.

3. The size distribution histogram of PbTe matrix and CuTe nanoparticles.

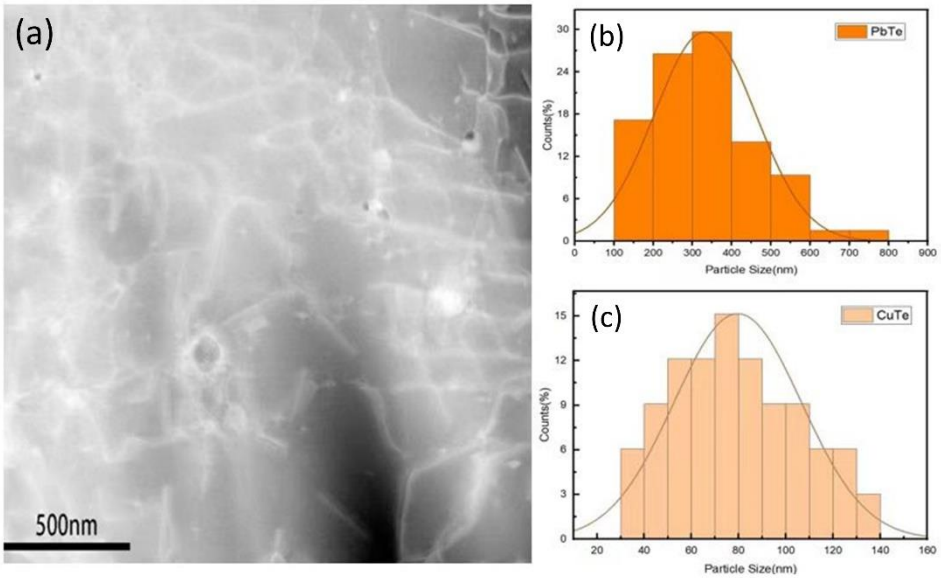

Figure S3 (a) Low magnification STEM image of $Pb_{0.97}Sb_{0.03}Te$ + 1.5 wt.% $Cu_{12}Sb_4S_{13}$ composite sample; (b) the size distribution histogram of PbTe matrix; (c) the size distribution histogram of CuTe nanoparticles.