Supplementary Information

High Thermoelectric Performance by Nano-inclusion and Randomly Distributed Interface Potential in N-type (PbTe_{0.93-x}Se_{0.07}Cl_x)_{0.93}(PbS)_{0.07} Composites

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Figure S1. Schematic diagram of PbS nano-inclusion in PbTe matrix and the band bending effect near a boundary.



Figure S2. Scanning transmission electron microscope (STEM) images of (PbTe_{0.93}. $_xSe_{0.07}Cl_x)_{0.93}$ (PbS)_{0.07} (x = 0.01). (a) Low magnified high angle annular dark field (HAADF) image, containing numerous nano-precipitates with bright contrast. (b) Bright field (BF) and (c) HAADF images with differences contrast of the same region.



Figure S3. TEM images of $(PbTe_{0.93-x}Se_{0.07}Cl_x)_{0.93}(PbS)_{0.07}$ (x = 0.01) along the [012] zone axis. (a) Low magnification of TEM image and the inset is the electron diffraction pattern of the matrix. (b) and (c) are HR-TEM images for lattice fringe with nano-precipitate and Inversed-fast Fourier transform (I-FFT), respectively. Upper right inset of (c) is the enlargement for the interface of the precipitate. (d) The strain field distribution along the x-axis (ε_{xx}) around the precipitate (color scale indicates the -10% to 20% strain distribution).

Parameter	Value	Parameter	Value
Eg	0.315 eV	$\hbar\omega_0$	0.0136 eV
$\binom{m_t^*}{m_0}$	0.0453	a	6.461 Å
m_l^*/m_0	0.24	ρ	8.16 g/cm
ϵ_{o}	400	E _{ac}	15 eV
ϵ_{∞}	32.6	E _{oc}	26 eV
C _l	$7.1 \times 10^{10} \text{ N/m}$	K _{v,o}	1.5
U _{vc}	$3 \times 10^{-34} {\rm erg} {\rm cm}^3$	K _v	1.5



Table S1. Parameters used to calculate the relaxation time for bulk PbTe at T = 300 K. Here, m_o is the mass of free electrons.

Figure S4. Schematic illustration of the simultaneous scattering of electron and phonon near the nano-inclusion.

Reference:

[1] S. V. Faleev, F. Léonard, Physical Review B 2008, 77.