Supporting Information for

Nanoscale fabrication of heterostructures in thermoelectric

SnTe

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Figure S1. The structure, morphology, and chemical analyze of the synthesized SnTe samples. (a) Typical X-ray diffraction patterns of $Sn_{0.6}Te_{0.4}$, $Sn_{0.5}Te_{0.5}$, and $Sn_{0.4}Te_{0.6}$ bulk samples. Compared with the $Sn_{0.6}Te_{0.4}$ and $Sn_{0.4}Te_{0.6}$ samples, the single-phase polycrystalline β -SnTe was obtained in the $Sn_{0.5}Te_{0.5}$ sample. (b,c) Low-magnification scanning electron microscopy image and the corresponding energy dispersive X-ray spectroscopy elemental maps of $Sn_{0.6}Te_{0.4}$ and $Sn_{0.4}Te_{0.6}$, showing the coexistence of β -SnTe and Sn in the $Sn_{0.6}Te_{0.4}$ sample, and β -SnTe and Te in the $Sn_{0.6}Te_{0.4}$ sample.



Figure S2. The effect of electron beam irradiation dose on the formation of h-SnTe in the β -SnTe matrix. (a) HAADF-STEM image showing that h-SnTe does not form while the ROI indicated by a white arrow is irradiated at the probe current density of 1.5×10^{27} e·m⁻²·s⁻¹. (b) HAADF-STEM image showing the formation of h-SnTe while the ROI is irradiated at the probe current density of 6.0×10^{27} e·m⁻²·s⁻¹. The viewing direction is aligned with the $[1^{1}0]_{\beta$ -SnTe zone axis.



Figure S3. The formation of nanoscale h-SnTe precipitates in the β -SnTe matrix. HAADF-and BF-STEM images were simultaneously acquired at 200 kV (a,b) and 300 kV (c,d). The h-SnTe precipitate is indicated by vertical red arrows. The ROI was irradiated at the probe current density of 7.5×10^{27} e·m⁻²·s⁻¹. The viewing direction is aligned with the $[1^{1}0]_{\beta$ -SnTe zone axis.



Figure S4. Fabrication of nanopillars of h-SnTe in β -SnTe matrix. Bright-field STEM image displays that nanopillars of h-SnTe have been realized in β -SnTe matrix by electron beam irradiation. The viewing direction is aligned with the $[1\bar{1}0]_{\beta$ -SnTe zone axis.

Video S1. Nanoscale h-SnTe precipitate formed in the β -SnTe matrix under electron beam irradiation. The ROI was irradiated at the probe current density of 7.5×10^{27} e·m⁻²·s⁻¹. Note that 5 frames per second (fps) were used in the video recorded in HAADF-STEM mode. The viewing direction is aligned with the $[1^{1}0]_{\beta$ -SnTe zone axis.