Supporting Information

Smart assembling of multi-scaled functional interfaces in thermoelectric Ga_2Te_3/Te hetero-nanocomposites

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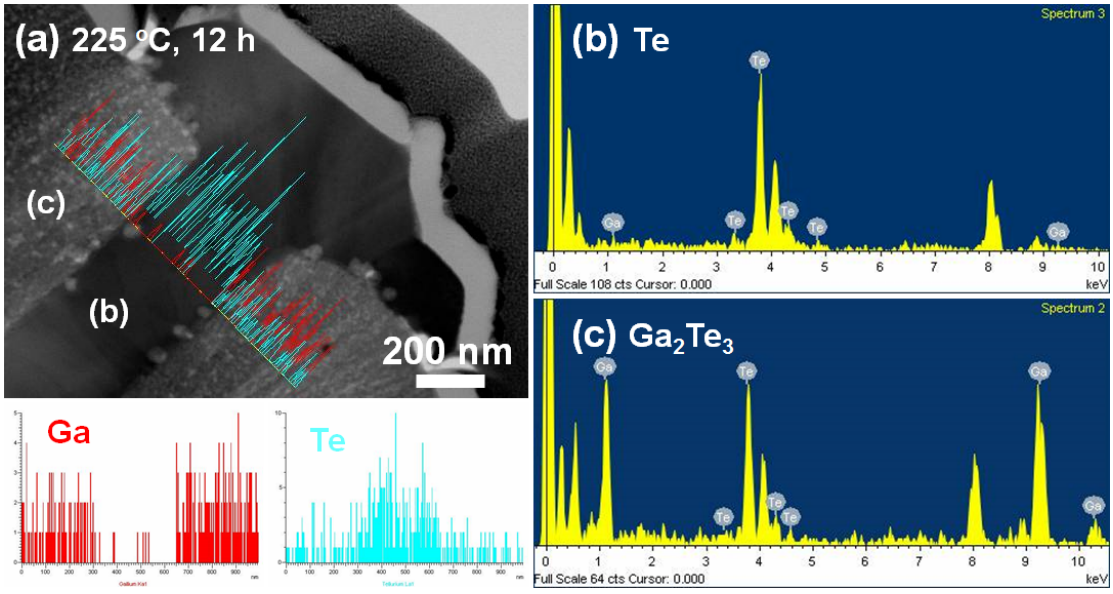

Fig. S1 (a) The cross-sectional TEM image and the compositional line scans across the laterally-assembled Ga_2Te_3/Te hetero-nanocomposite film formed at 225 °C for 12 h evidencing the precipitation of pure Te in the crack. The TEM-EDS spectra recorded from the areas (b) and (c) also confirm the presence of Te and Ga_2Te_3, respectively.

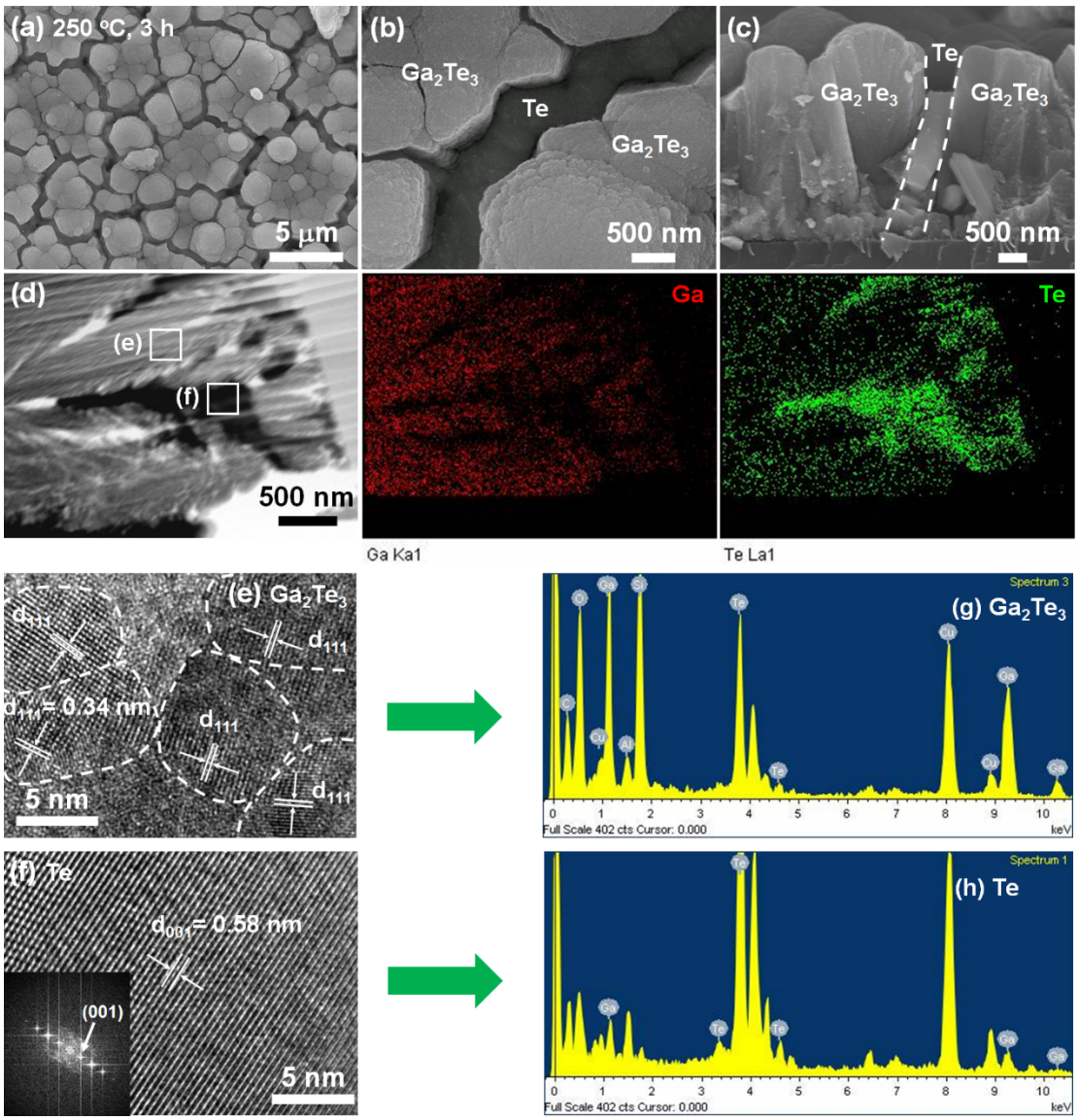

Fig. S2 (a) The top-view SEM image of the laterally-assembled Ga_2Te_3/Te hetero-nanocomposite film formed at an annealing temperature of 250 °C for 3 h. The magnified (b) top-view and (c) cross-sectional SEM images confirm that the cracks are occupied with Te. (d) The cross-sectional TEM image and the corresponding sharp EDS elemental maps evidence the presence of pure Te in the crack. (e-f) The HRTEM images of the Ga_2Te_3 and Te regions as shown in (d). Inset shows the corresponding FFT ED pattern. The TEM-EDS spectra recorded from the Ga_2Te_3 nanoassemblies and Te single crystal are shown in (g) and (h), respectively.

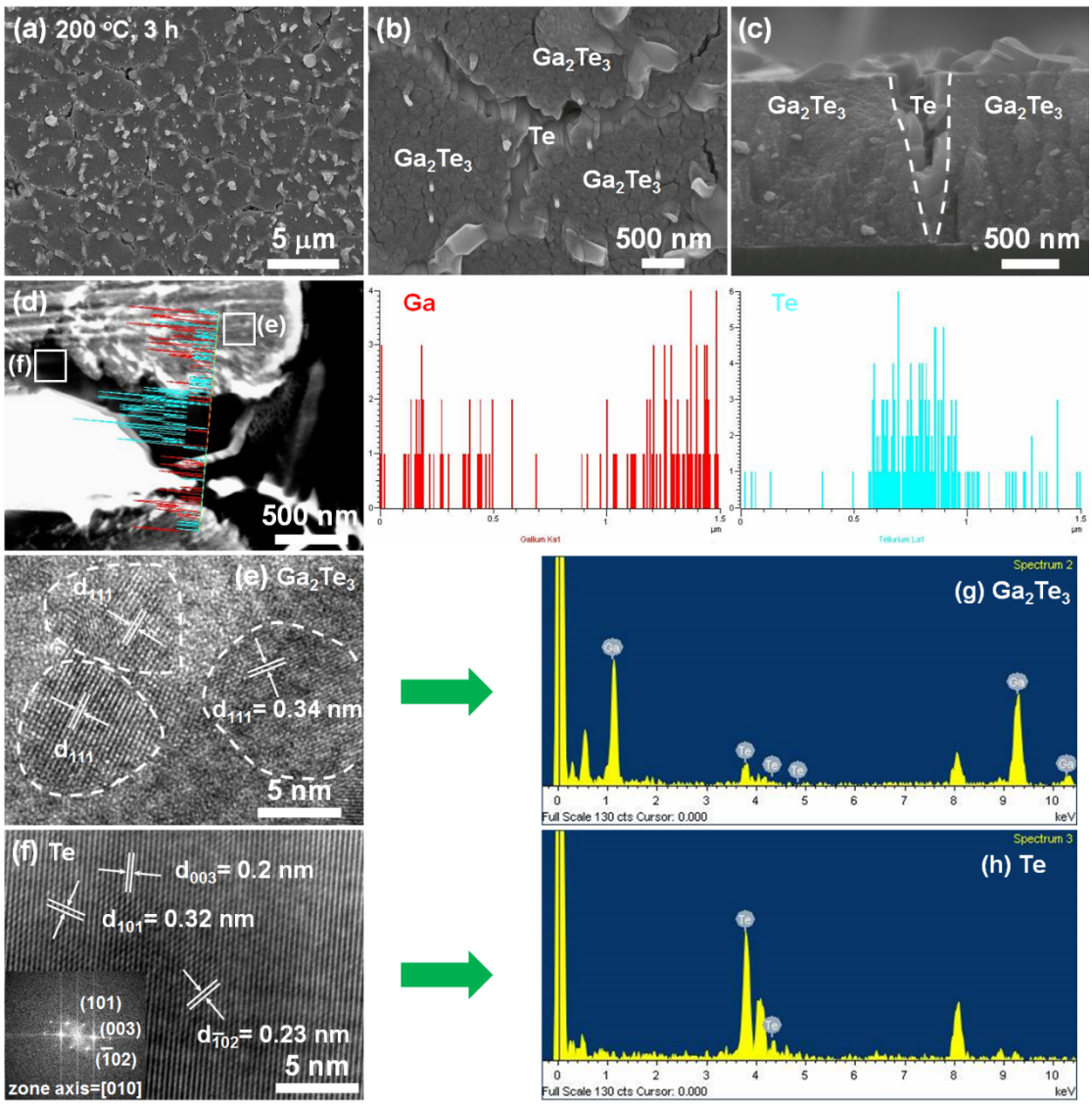

Fig. S3 (a) The top-view SEM image of the laterally-assembled Ga_2Te_3/Te hetero-nanocomposite film fabricated at an annealing temperature of 200 °C for 3 h. The magnified (b) top-view and (c) cross-sectional SEM images confirm the cracks are occupied with Te. (d) The cross-sectional TEM image and the corresponding sharp EDS elemental maps evidence the presence of pure Te in the crack. (e-f) The HRTEM images of the Ga_2Te_3 and Te regions as shown in (d). Inset shows the corresponding FFT ED pattern. The TEM-EDS spectra recorded from the Ga_2Te_3 nanoassemblies and Te single crystal are shown in (g) and (h), respectively.

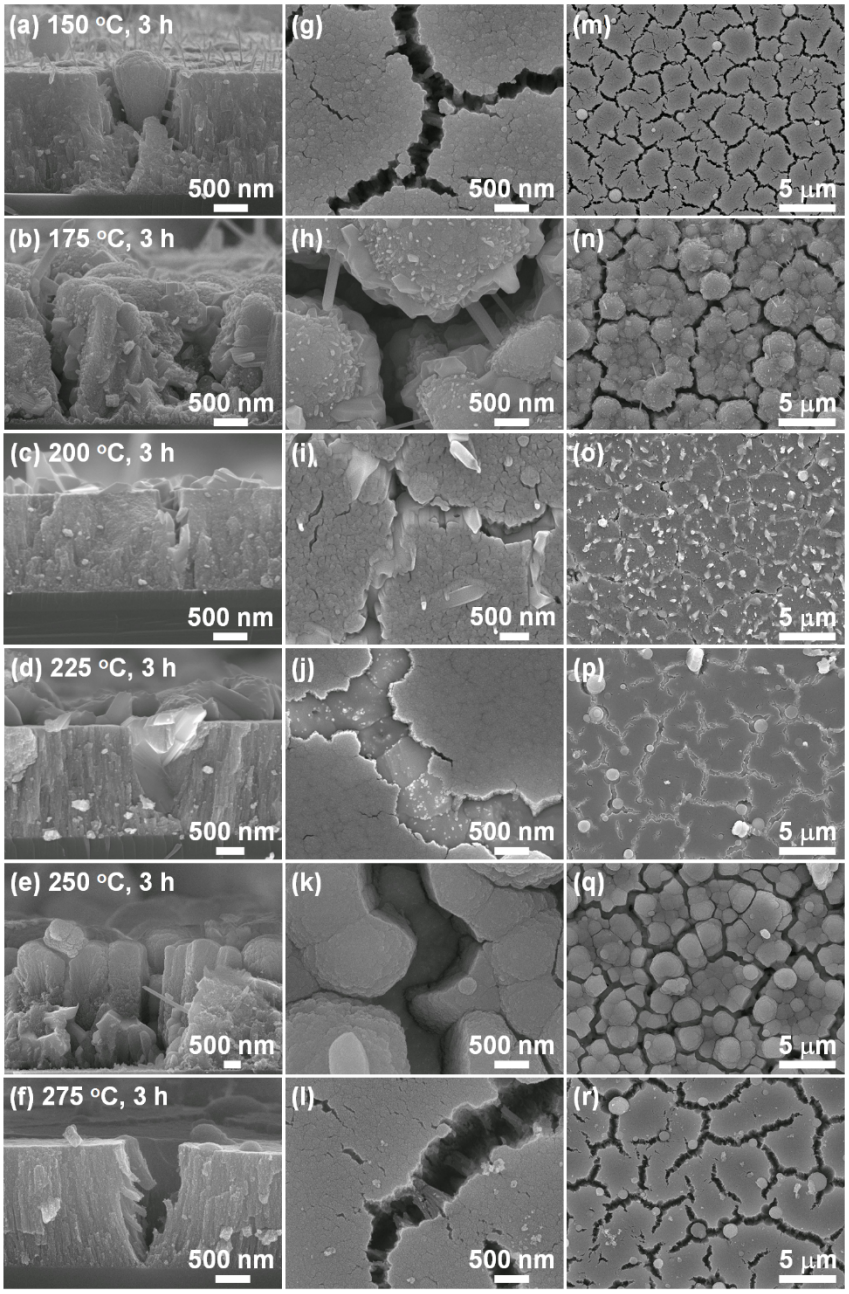

Fig. S4 The cross-sectional SEM images of the Ga_2Te_3/Te hetero-nanocomposite films prepared at an annealing temperature of (a) 150 °C, (b) 175 °C, (c) 200 °C, (d) 225 °C, (e) 250 °C, and (f) 275 °C for 3 h. The corresponding top-view SEM images are shown in (g)-(l). The Te precipitates increase with the annealing temperature from 150 °C to 225 °C. In contrast, further increasing the annealing temperature to 250 °C and 275 °C (both are higher than half of the melting point of Te) leads to obvious reduction of the Te precipitate. The low-magnification top-view SEM images shown in (m)-(r) indicate the large-scale uniformity of the films.

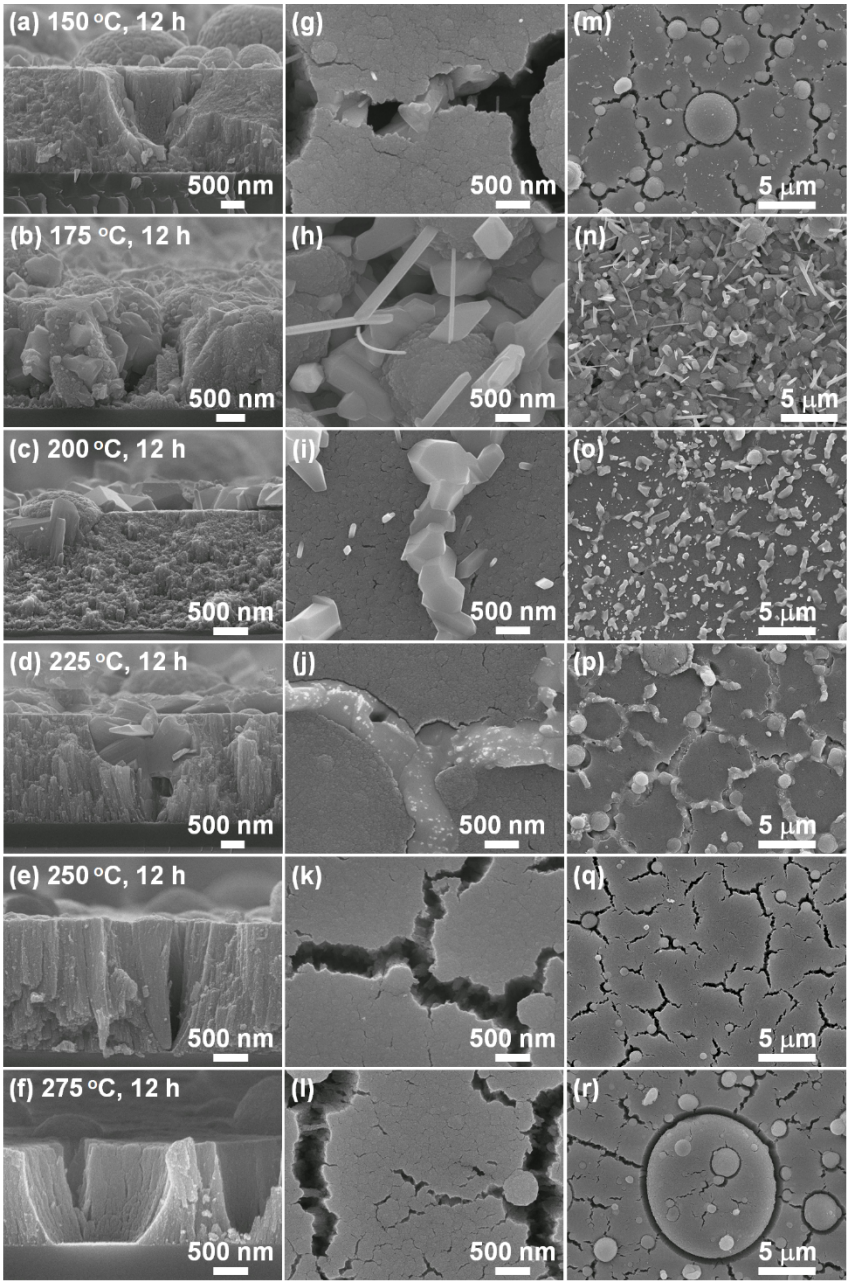

Fig. S5 The cross-sectional SEM images of the Ga_2Te_3/Te hetero-nanocomposite films prepared at an annealing temperature of (a) 150 °C, (b) 175 °C, (c) 200 °C, (d) 225 °C, (e) 250 °C, and (f) 275 °C for 12 h. The corresponding top-view SEM images are shown in (g)-(l). Similar to the films annealed for 3 h, the amount of the Te precipitates increase with the annealing temperature up to 200 °C. The Te precipitates begin to reduce when the annealing temperature is higher than 225 °C. The low-magnification top-view SEM images shown in (m)-(r) indicate the large-scale uniformity of the films.

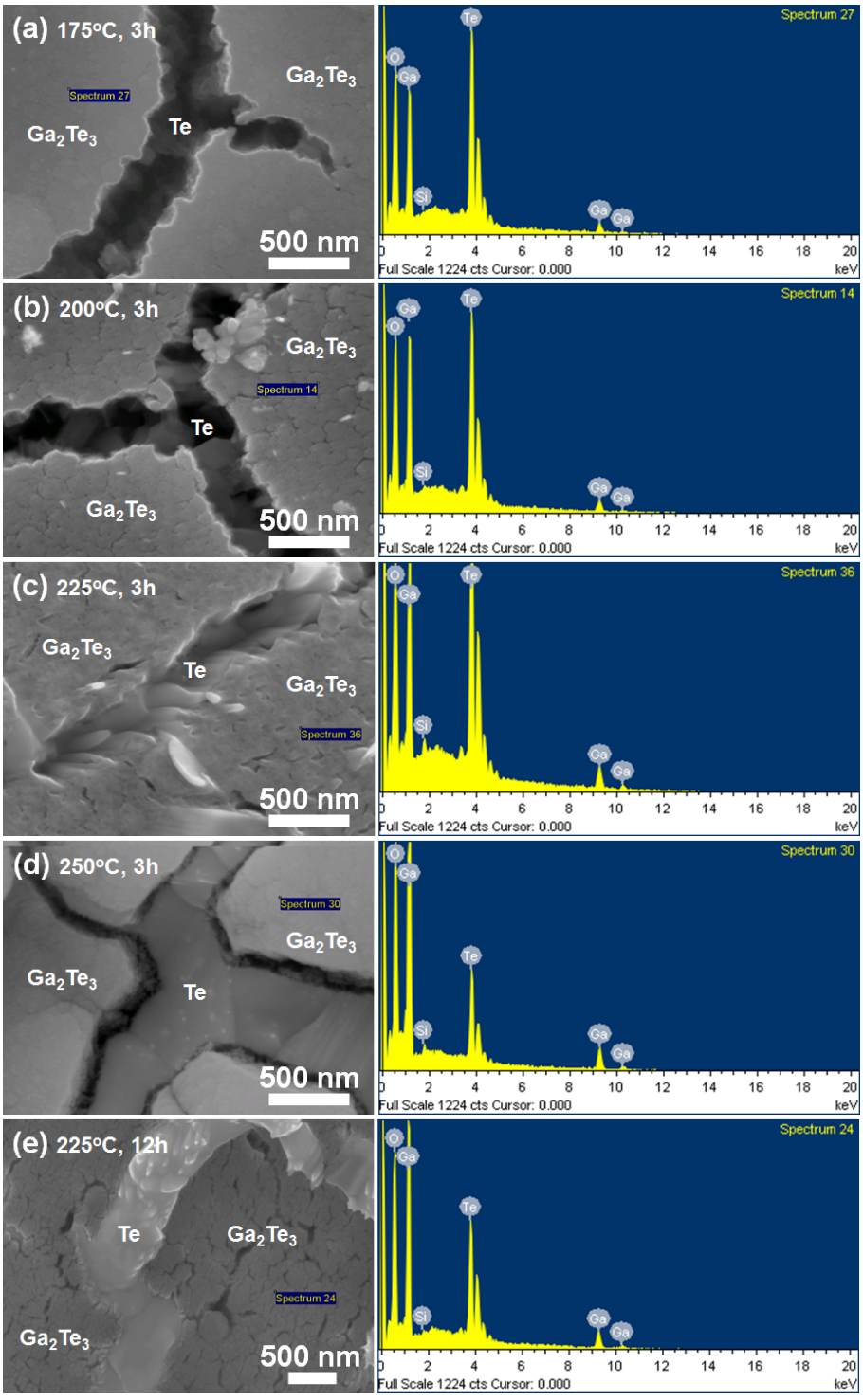

Fig. S6 The top-view SEM images of the Ga_2Te_3/Te hetero-nanocomposite films prepared at an annealing temperature of (a) 175 °C (3 h), (b) 200 °C (3 h), (c) 225 °C (3 h), (d) 250 °C (3 h), and (e) 225 °C (12 h). The corresponding EDS spectra recorded from the annealed Ga_2Te_3 nanoassemblies clearly show Ga, Te, Si, and O signals where the Si and O signals originate from the SiO_2/Si substrate.

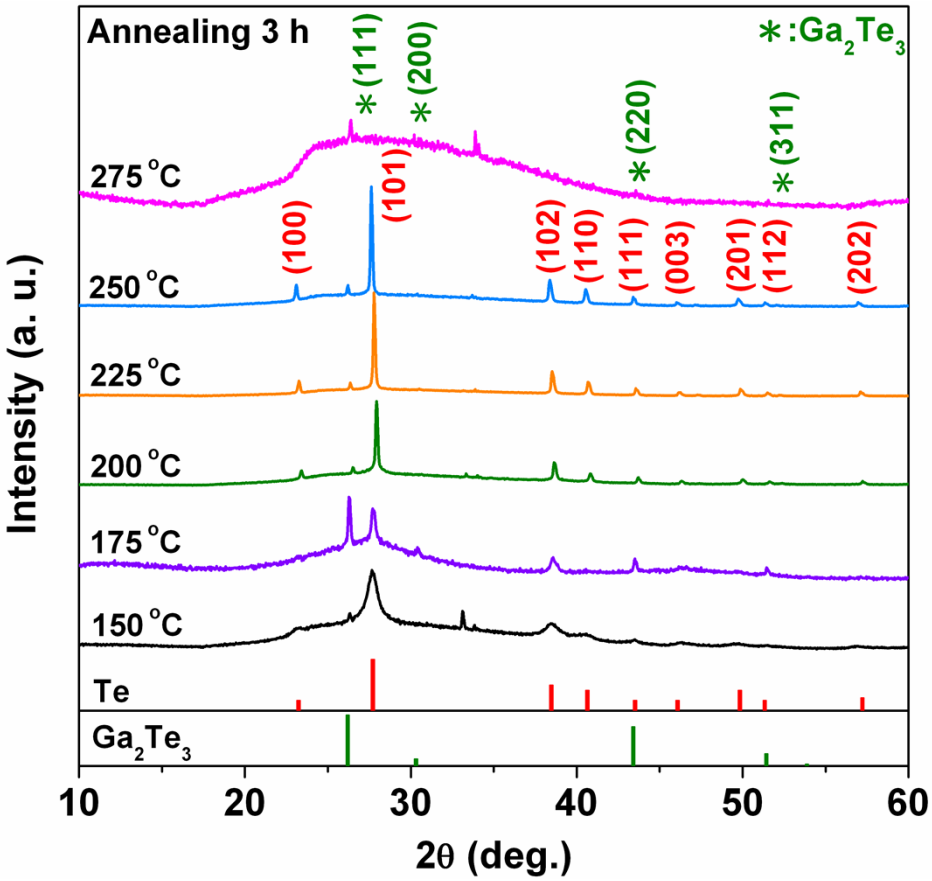

Fig. S7 XRD patterns recorded from the Ga_2Te_3/Te hetero-nanocomposites formed at an annealing temperature of 150, 175, 200, 225, 250, and 275 °C for 3 h.

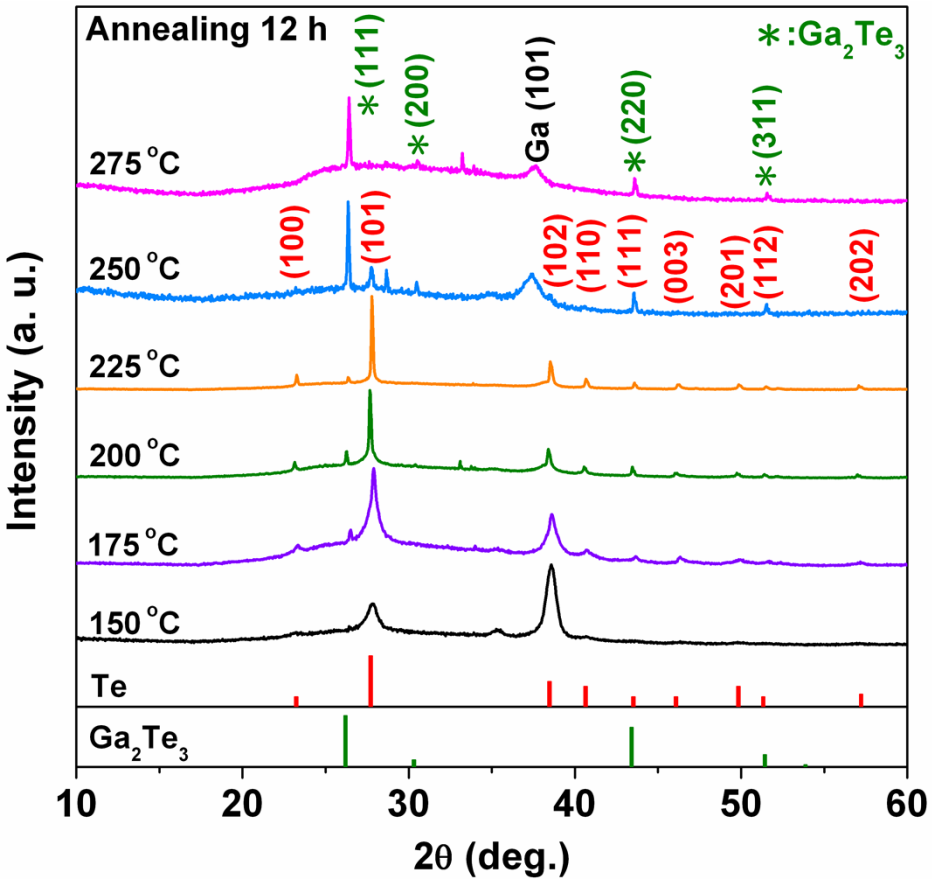

Fig. S8 X-ray diffraction patterns recorded from the Ga_2Te_3/Te hetero-nanocomposites prepared at an annealing temperature of 150, 175, 200, 225, 250, and 275 ^oC for 12 h. The diffraction peak of Ga is clearly observed in the pattern of 250 ^oC and 275 ^oC.

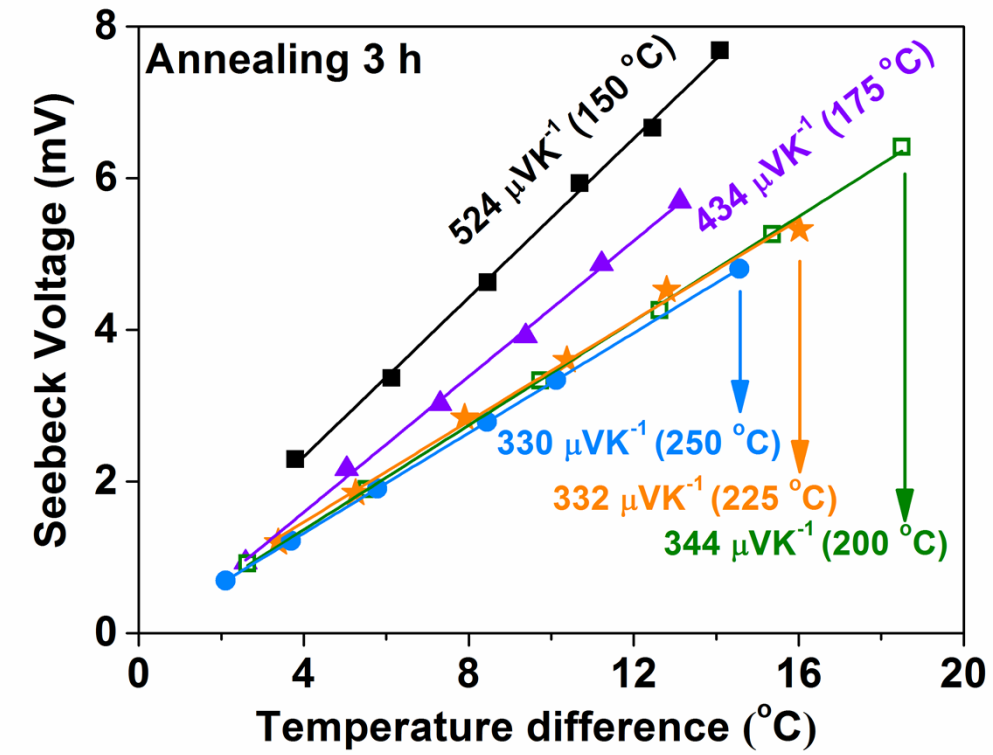

Fig. S9 The Seebeck voltage plotted as a function of the temperature difference across the Ga_2Te_3/Te hetero-nanocomposite films formed at an annealing temperature range from 150 °C to 250 °C for 3 h.

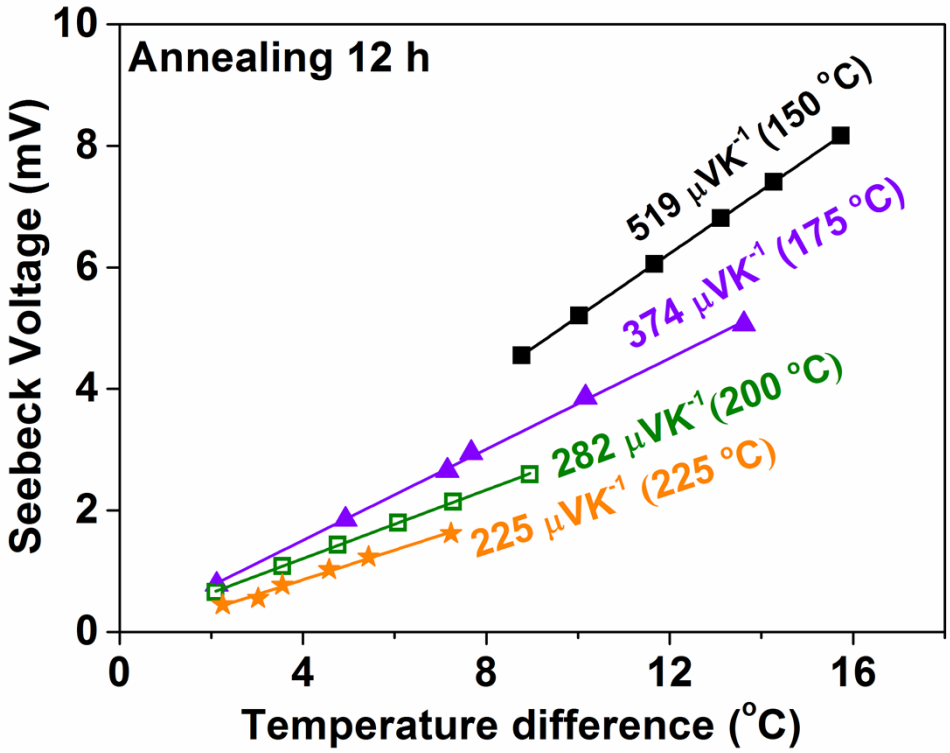

Fig. S10 The Seebeck voltage plotted as a function of the temperature difference across the Ga_2Te_3/Te hetero-nanocomposite films formed at an annealing temperature range from 150 °C to 225 °C for 12 h.