Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Supporting Information

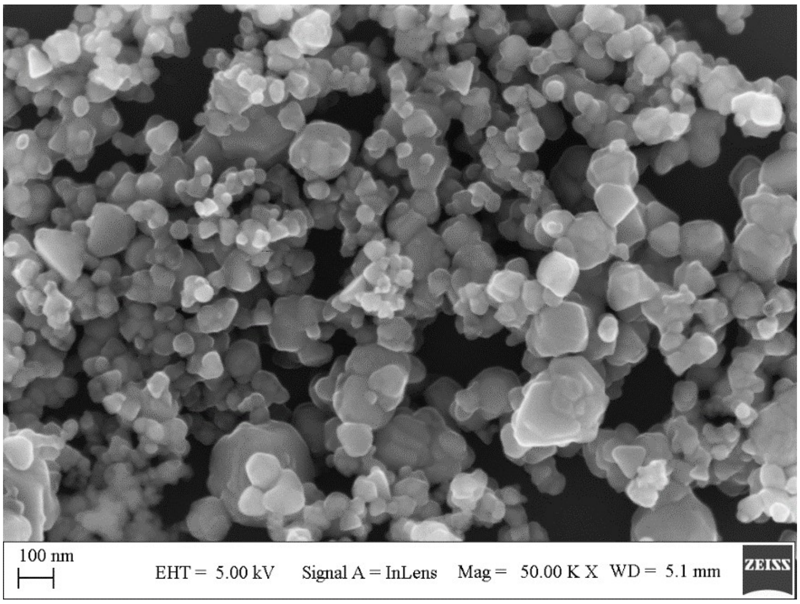

Figure S1 SEM image of SiC nano powders.

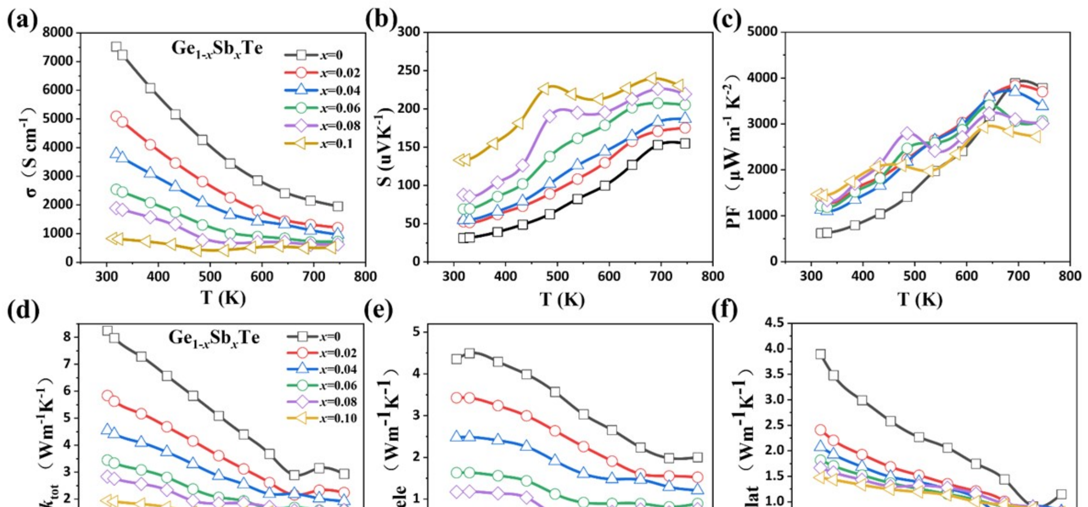

Figure S2 Temperature dependence of the electrical transport characteristics of $Ge_{1-x}Sb_xTe$ (x = 0, 0.02, 0.04, 0.06, 0.08, and 0.10): (a) electrical conductivity, (b) Seebeck coefficient, (c) PF, (d) total thermal conductivity, (e) carrier thermal conductivity, and (f) lattice thermal conductivity.

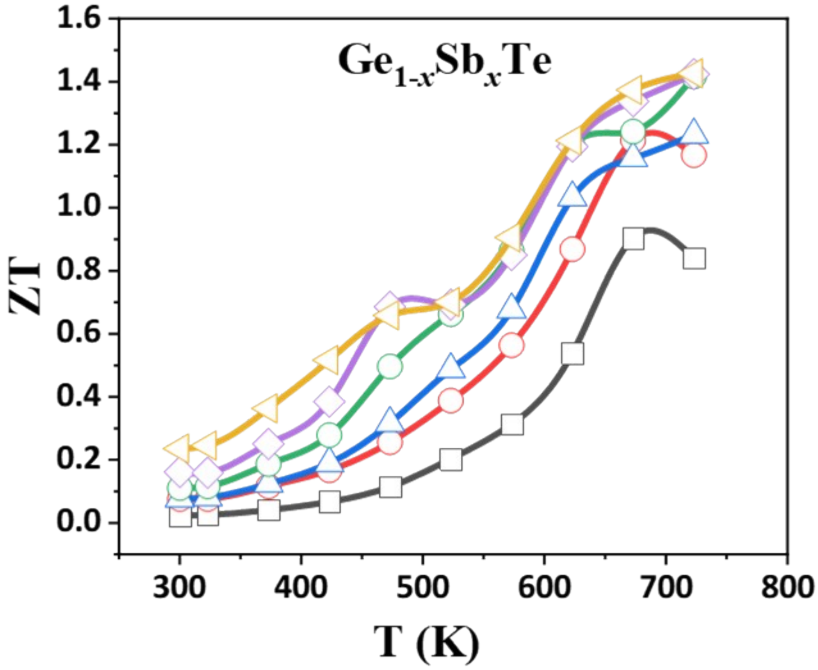

Figure S3 *ZT* values of the samples $Ge_{1-x}Sb_xTe$ (x = 0, 0.02, 0.04, 0.06, 0.08, and 0.10) as a function of temperatures.

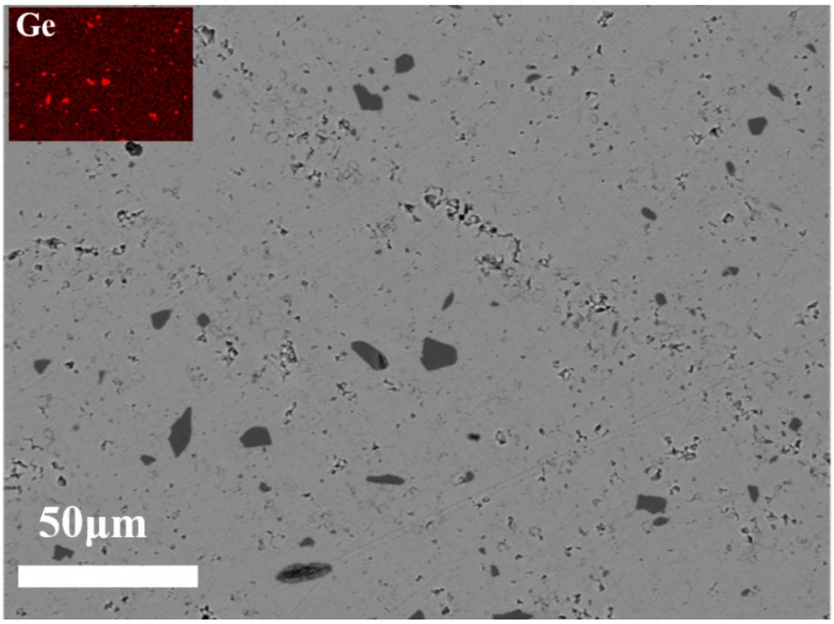

Figure S4 The second phase of Ge in SEM images.

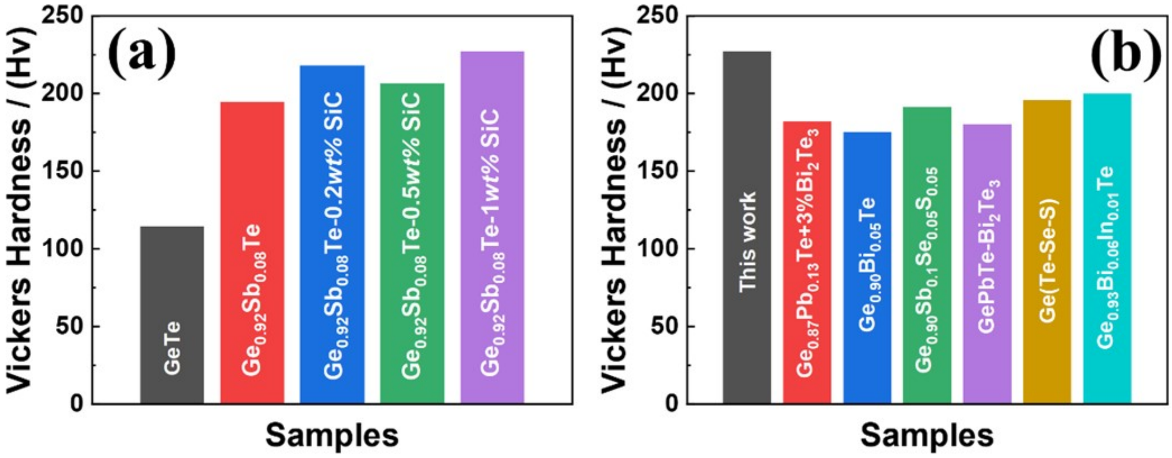

Figure S5 (a) Vickers microhardness of samples $Ge_{0.92}Sb_{0.08}Te$+*y* wt%SiC, (b) Microhardness of some typical thermoelectric compounds.

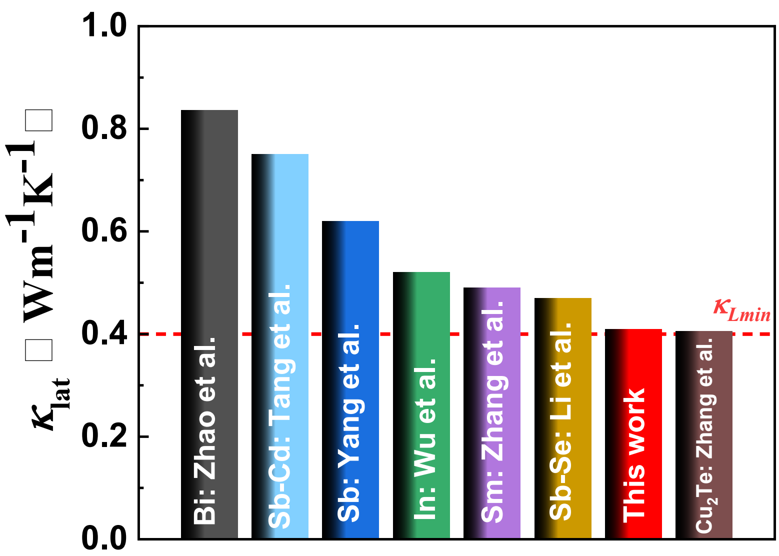

Figure S6 comparison of κ_L in GeTe systems.[1-7]

1. Geometric model design

A single-leg thermoelectric generator (TEG) is a device designed to convert heat energy directly into electrical power using the Seebeck effect, a phenomenon where a temperature difference across a thermoelectric material result in the generation of an electric voltage. In the case of a single-leg TEG, there is only one thermoelectric leg (either p-type or n-type) through which the heat flows. **Figure S7** illustrates the configuration of the single-leg thermoelectric generator (TEG) with a size of 2.5 × 2.5 × 3.8 mm. The single-leg TEG comprises ceramic plates, electrical insulators, copper conductors, and p-type thermoelectric materials. One side of the thermoelectric leg is exposed to a heat source, and the other side is in contact with a heat sink or a region at a lower temperature. The temperature gradient between these two sides induces a voltage potential across the thermoelectric material, leading to the generation of electric power. Geometric structures for the TEG were constructed, and COMSOL MULTIPHYSICS software was employed for the analysis of material properties. In order to achieve optimal results, it is imperative to conduct an overall resistance measurement through COMSOL, as the external resistance and internal resistance are identical. Subsequently, the measured resistance values are utilized as the external resistance values for further simulation.

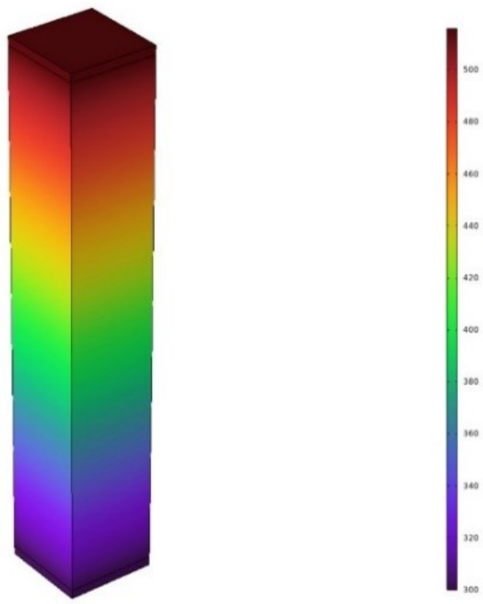

Figure S7 The geometric structure and simulated results of single-leg TEG.

2. Stimulation performance of TEG

Figure S8 illustrates the relationship between output voltage (V) and current (I) across various temperature gradients (ΔT), when the cold side temperature is fixed at 300 K. The observed linear characteristics of the V-I curves facilitate the determination of the open-circuit voltage (V_{OC}), identified as the y-intercept, and the internal resistance (R_{in}), represented by the slope. The rise in V_{OC} and R_{in} with an increasing ΔT can be attributed to the heightened Seebeck coefficient and resistivity of GeTe alloys.

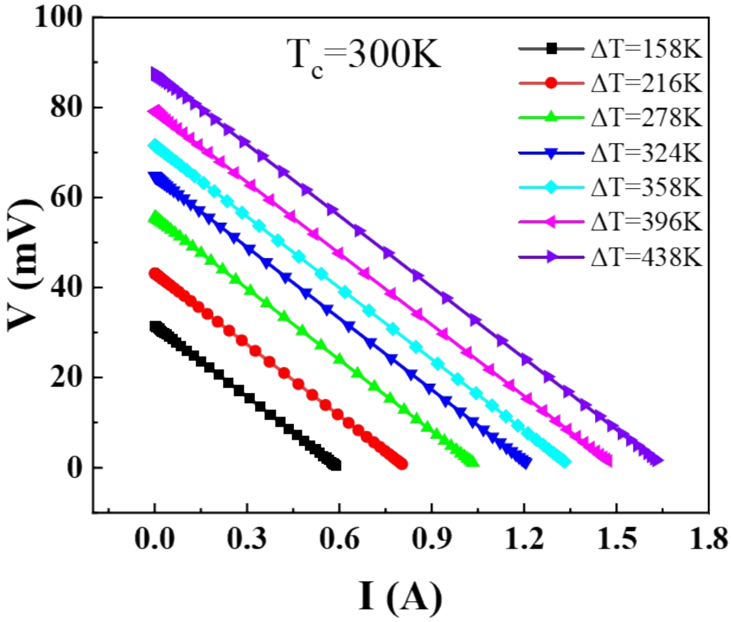

Figure S8 Current-dependent output voltage.

1. Jin, Y.; Xiao, Y.; Wang, D.; Huang, Z.; Qiu, Y.; Zhao, L.-D., Realizing High Thermoelectric Performance in GeTe through Optimizing Ge Vacancies and Manipulating Ge Precipitates. *ACS Applied Energy Materials* **2019,** *2* (10), 7594-7601.
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3. Jin, Y.; Wang, D.; Qiu, Y.; Zhao, L.-D., Boosting the thermoelectric performance of GeTe by manipulating the phase transition temperature via Sb doping. *Journal of Materials Chemistry C* **2021,** *9* (20), 6484-6490.
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