Perfectly Flawed: Leveraging on Defects in AgSbTe2 via Ge Doping for Thermoelectric Waste Heat Harvesting

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Hitherto, the two main causes of global warming are the burning of fossil fuels which release greenhouse gases, and the emission of waste heat as a byproduct of processes. Thermoelectrics have the ability to convert waste heat into electricity, which makes them perfect as a clean energy alternative while making use of waste heat. Recently, AgSbTe2 has emerged as a promising thermoelectric due to its relatively high thermoelectric figure of merit (zT), a way to measure the performance of thermoelectrics. However, the performance of AgSbTe2 needs to be improved for practical applications. My study aims to investigate the effect of a novel dopant, Germanium (Ge), on the zT of AgSbTe2 by varying the amount of Ge in each sample to produce AgSb1-xGexTe2 (x = 0 - 0.15). The electrical and thermal properties of each sample were measured, and the results demonstrated that 6% Ge produced the optimal trade-off between the properties and enhanced the zT of the sample by 92% as compared to undoped AgSbTe2. After characterization using electron microscopy and x-ray diffraction techniques, it was discovered that the zT enhancement was due to the Ge doping inducing the formation of an ideal amount of Ag2Te secondary phase. These findings would create opportunities to discover more sustainable synthesis and processing methods to enhance the performance and cost-effectiveness of AgSbTe2, thus realizing the potential of AgSbTe2 as a promising thermoelectric for combating global warming by cooling the environment and serving as a clean energy alternative.

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