

# Perfectly Flawed: Leveraging on Defects in AgSbTe<sub>2</sub> 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, AgSbTe<sub>2</sub> 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 AgSbTe<sub>2</sub> needs to be improved for practical applications. My study aims to investigate the effect of a novel dopant, Germanium (Ge), on the zT of AgSbTe<sub>2</sub> by varying the amount of Ge in each sample to produce AgSb<sub>1-x</sub>Ge<sub>x</sub>Te<sub>2</sub> (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 AgSbTe<sub>2</sub>. 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 Ag<sub>2</sub>Te secondary phase. These findings would create opportunities to discover more sustainable synthesis and processing methods to enhance the performance and cost-effectiveness of AgSbTe<sub>2</sub>, thus realizing the potential of AgSbTe<sub>2</sub> as a promising thermoelectric for combating global warming by cooling the environment and serving as a clean energy alternative.

## Awards Won:

Fourth Award of \$500