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XAS study of Bi_2Te_3/Sb_2Te_3 Superlattices and $Sb_{1.5}Bi_{0.5}Te_3$ Alloy Film AZZAM MANSOUR, NSWC, Carderock Division, RAMA VENKATASUBRAMANIAN, RTI International — Bi_2Te_3/Sb_2Te_3 superlattices are being developed for high performance thermoelectric devices. We have used X-ray absorption spectroscopy (XAS) to investigate the local structure of Sb in 20/40 Å and 10/50 Å Bi_2Te_3/Sb_2Te_3 superlattices, a $Sb_{1.5}Bi_{0.5}Te_3$ alloy film, and a Sb_2Te_3 reference film. The films were grown on GaAs using a novel low temperature metal-organic chemical vapor deposition method. Initially, we evaluated the local structure parameters of Sb in the superlattices and the alloy relative to those of the reference Sb_2Te_3 film. Using temperature dependent Sb K-edge XAS measurements, we were able to separate structural disorder from thermal disorder for the Sb-Te pair. The temperature dependence of thermal disorder was analyzed using the Einstein and Debye models for lattice vibrations. A comparison of the results for the superlattices, the alloy and the reference film will be made. The goal is to identify key structural factors that may contribute to the enhanced value of the figure of merit "ZT" and, hence, the improved conversion efficiency for the superlattices relative to the alloys.

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