Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Manipulating Thermal Conduction in Nanostructured Bismuth Antimony Telluride via Bandstructure Modification[1] DARYOOSH VASHAEE, ARASH MEHDIZADEH DEHKORDI, Oklahoma State University — Nanostructured $(Bi_xSb_{1-x})_2Te_3$ alloy has been recently investigated for its improved thermoelectric properties mainly caused by the reduction in its thermal conductivity. Lattice and bipolar diffusion are the main components of thermal conduction in this alloy, the latter being dominant as the temperature increases above ∼150C. Nanostructuring provides means to reduce lattice thermal conduction by scattering phonons at grain boundaries, and to reduce bipolar diffusion by scattering electrons more than the holes due to the difference in their energy. This provides means to further enhance the thermoelectric properties of this alloy by adjusting both the grain size and the bandstructure of the alloy through different x-values. Our model calculations show that the optimum x-value can be different for the nanostructured alloy than the crystalline structure that further depends on the grain size. Our experimental measurement of the grown samples further confirms this fact. Our theoretical analysis is not only important for understanding different nanostructured alloys of $(Bi_xSb_{1-x})_2Te_3$, but to identify means to reduce the bipolar thermal conduction through adjusting the grain size and the bandstructure parameters in other material systems.

[1]This work was supported by NSF under contract CBET0933763.

Daryoosh Vashaee
Oklahoma State University

Date submitted: 20 Nov 2009 Electronic form version 1.4