Abstract Submitted
for the OSS09 Meeting of
The American Physical Society

Effect of PbSe nanoparticle inclusion on the lattice thermal conductivity of PbTe DIEGO HERNANDEZ, JEFFREY DYCK, John Carroll University, YIXIN ZHAO, CLEMENS BURDA, Case Western Reserve University —
Thermoelectric materials are able to convert heat energy into electrical energy and vice versa. One route toward increasing thermoelectric efficiency is by creating nanometer-sized inclusions in traditional thermoelectric materials that would scatter acoustic phonons, which transmit thermal energy, more strongly than free charge carriers. For this study, pellets of bulk, polycrystalline lead telluride with varying concentrations of PbSe nanoparticle additives were prepared by pressing mixed powders. Measurements of electrical resistivity, thermal conductivity, and Seebeck coefficient were performed from 10 K to 300 K. Experimental thermal conductivity data were compared to a model of the lattice thermal conductivity based on Debye theory. The model takes into account grain boundary, phonon-phonon, and point defect scattering. The theoretical analysis reveals that the additional phonon scattering due to PbSe nanoparticles can be reasonably modeled as an increase in point defects. Further improvements to the model that more accurately represent the spatial extent of the nanoparticles will be discussed. The impact of the addition of PbSe nanoparticles on the electrical transport properties will also be presented.

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Date submitted: 01 Apr 2009 Electronic form version 1.4