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Theoretical Modeling of the Thermal Conductivity of Nanostructured PbTe DIEGO HERNANDEZ, JEFFREY S. DYCK, Physics Dept., John Carroll University, YIXIN ZHAO, CLEMENS BURDA, Chemistry Dept., 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 thermal conductivity were performed from 8 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, and an additional scattering term that describes scattering by spherical nanoparticles. Interestingly, the theoretical analysis reveals that the addition of the nanoparticle scattering term does not improve the fitting significantly. However, we are able to see trends that support the hypothesis that some fraction of the nanoparticles are behaving as the model predicts.

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