Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Thermal Conductivity Accumulation Function of Silicon-Germanium Alloy from Thermoreflectance and First-Principles KEVIN PARRISH, JUSTIN FREEDMAN, KEITH REGNER, ANKIT JAIN, JONATHAN MALEN, ALAN MCGAUGHEY, Carnegie Mellon Univ — Phonons are the dominant heat carriers in semiconductors. Alloying changes their properties by introducing mass disorder and altering the bonding environment. In this study, we determine the thermal conductivity accumulation functions of silicon-germanium alloys using broadband frequency-domain thermoreflectance experiments. The accumulation function describes the cumulative mean free path-dependent contributions to thermal conductivity and provides a measure for determining how alloying alters thermal conductivity compared to pure semiconductors. The experimental results are compared to calculations based in density functional theory, lattice dynamics, the virtual crystal approximation, and the Boltzmann transport equation. In both thermoreflectance and lattice dynamics we find alloying increases the proportional accumulation of long MFP phonons.

Kevin Parrish
Carnegie Mellon Univ

Date submitted: 05 Nov 2015 Electronic form version 1.4