Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Thermal conductance of interfaces between highly dissimilar materials HO-KI LYEO, DAVID CAHILL, Department of Materials Science & Engineering, University of Illinois, Frederick-Seitz Materials Research Lab, Urbana, IL 61801 — Understanding the thermal conductance of interfaces G is important for improving our knowledge about interlayer heat transport in multi-layer thermoelectric devices. Previously G for interfaces between highly dissimilar materials such as Pb/diamond and Pb/Al_2O_3 was measured by Stoner and Maris and found to be much higher than the radiation limit; the radiation limit G=$\frac{\pi}{3}\frac{k_B\nu_{\max}^3}{c^2}$ is the maximum thermal conductance predicted by theory, where $\nu_{\max}$is the cutoff vibrational frequency of the metal and c is the Debye velocity of the substrate. We report data for G between Pb or Bi and several substrates; diamond, hydrogen(H)-terminated diamond, sapphire, SiO_2/Si, H-terminated Si, and BeO/Be. The thermal conductance G is obtained by analyzing in-phase and out-of-phase signals from pump-probe measurements of thermoreflectance using a mode-locked Ti:sapphire laser. Measured values at room temperature are 16-29 MW/m^2/K for Pb (a factor of 2 smaller than previously reported) and 15-20 MW/m^2/K for Bi; i.e, the measured values of G exceed the radiation limit by a factor of 3-7, and are nearly independent of the substrate.

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Date submitted: 27 Mar 2013 Electronic form version 1.4