Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Strong suppression of near-surface thermal transport by metal-assisted chemical etching of Si JOSEPH FESER, DAVID CAHILL, Department of Materials Science and Engineering, U. Illinois, Urbana — Recently, we reported that the thermal conductivity of Si nanowire arrays roughened by metal-assisted chemical etching (MAC-etch) is strongly correlated to both the magnitude of the roughness and a broadening of the one-phonon Raman linewidth. We hypothesized that microstructural disorder induced by the etching chemistry leads to changes in the Raman linewidth and reduced thermal conductivity. Here, we simplify the study of such effects by chemically roughening Si wafers instead of nanowires. We have studied the effects of various roughening procedures on the near-surface thermal transport properties using time-domain thermoreflectance. We find that the thermal conductance of the near-surface region is systematically reduced by the MAC-etch process, despite the expectation that pristine roughened surfaces should have increased conductance due to enhanced surface area. In addition, highly roughened surfaces show strong picosecond acoustic echoes with reflection coefficient indicative of a soft interface. These features are consistent with the presence of strong disorder or nanoporosity in the near-surface region created by the MAC-etch process.

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Date submitted: 08 Nov 2012 Electronic form version 1.4