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Probing phonon surface scattering in nanostructures RICHARD ROBINSON, JARED HERTZBERG, OBAFEMI OTELAJA, Cornell University, Department of Materials Science and Engineering — In insulating materials, heat is transmitted by atomic vibrations ("phonons"). In nanostructured materials such as nanowires and nanosheets, the characteristic length scale of a material can be less than the mean free path of a phonon. The phonon transport is then drastically altered and becomes dominated by scattering from surfaces. We demonstrate a method to assess the scattering rate and transmission factor of phonons traversing a silicon nanosheet. Generation and detection of phonons is accomplished by a superconducting tunnel junction attached to the silicon nanostructure and operated at a temperature of 0.3K. Decay of excited states in the superconductor is employed as a tunable narrow-band source of phonons [1,2]. This tunable source enables investigation of the phonon mean free path as a function of phonon frequency and surface roughness, for frequencies from ∼100 GHz to ∼500 GHz in nanosheets 100 to 200 nm thick. This work is supported by DOE (DE-SC0001086).

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