Experimental metrology to obtain thermal phonon transmission coefficients at solid interfaces

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Interfaces play an essential role in phonon-mediated heat conduction in solids, impacting applications ranging from thermoelectric waste heat recovery to heat dissipation in electronics. From the microscopic perspective, interfacial phonon transport is described by transmission coefficients that link vibrational modes in the materials composing the interface (Fig. 1). However, direct experimental determination of these coefficients is challenging because most experiments provide a mode-averaged interface conductance that obscures the microscopic detail. Here, we report a metrology to extract thermal phonon transmission coefficients at solid interfaces using ab-initio phonon transport modeling and a thermal characterization technique, time-domain thermoreflectance. In combination with transmission electron microscopy characterization of the interface, our approach allows us to link the atomic structure of an interface to the spectral content of the heat crossing it. Our work provides a useful perspective on the microscopic processes governing interfacial heat conduction.

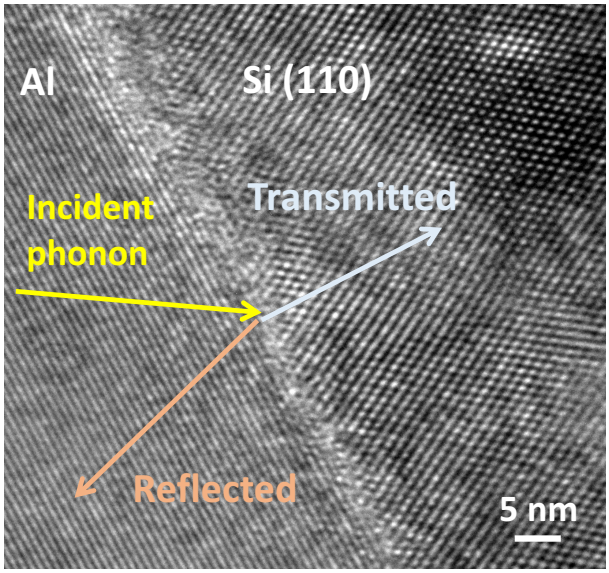

Fig. 1: At an interface, phonons will either be reflected or transmitted. This process can be characterized by transmission coefficients of phonons.

[1] Chengyun Hua, Xiangwen Chen, Navaneetha Ravichandran and Austin Minnich, *Phys. Rev. B*. **95,** 205423 (2017).