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Design principles of interfacial thermal conductance CARLOS POLANCO, ROUZBEH RASTGARKAFSHGARKOLAEI, JINGJIE ZHANG, NAM LE, PAMELA NORRIS, AVIK GHOSH, Univ of Virginia — We explore fundamental principles to design the thermal conductance across solid interfaces by changing the composition and disorder of an intermediate matching layer. In absence of phonon-phonon interactions, the layer addition involves two competing effects that influence the conductance. The layer can act as an impedance matching bridge to increase the mode-averaged phonon transmission. However, it also reduces the relevant modes that conserve their momenta transverse to the interface, so that the net result depends on features such as the overlap of conserving modes and the dispersivity of the transverse subbands. Moving into the interacting anharmonic regime, we find that the added layer aids conductance when the decreased resistances at the contact-layer boundaries compensate for the layer resistance. In fact, we show that the maximum conductance corresponds to an exact matching of the two separate contact-layer resistances. For instance, if we vary just the atomic mass across layers, then maximum conductance happens when the intervening layer mass is the geometric mean of the contact masses. We conjecture that the best interfacial layer is one that is compositionally graded into many geometric means in other words, an exponential variation in thermal impedance.

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