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31 - Thermal Conductances of Silicon Phononic Crystals by Molecular Dynamics

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Silicon nanostructures are candidates for thermoelectric materials and can be used to effectively harvest energy if they can be designed in such a way as to improve their thermodynamic figure of merit. In silicon this is achieved primarily by reducing thermal conductivity through clever design minimizing heat transport. Phononic crystals are a form of acoustic metamaterial that aim to do this through periodic inclusions in a larger nanostructure. First, the design and application of phononic crystals is discussed. We then present the thermal conductances, a quantity related to the thermal conductivity, of honeycomb silicon phononic crystals calculated using molecular dynamics simulations. Calculations show that the presented phononic crystals exhibit greatly reduced thermal conductances, and their length scaling is different from bulk and nanowire systems, indicating differences in the primary mechanisms of heat transport.

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