Thermal Transport across Nanostructured Interfaces

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Interfacial thermal transport plays an important role in the reduced thermal conductivity of nanostructured materials, which can benefit the thermoelectric efficiency. However, the reduced thermal conductance can be the bottleneck for the thermal management of high power electronics such as GaN-based devices. There have been significant efforts in reducing the interfacial thermal resistances, including improving the interface quality and reducing interfacial phonon mismatch. Recently, some of the experiments showed that a fin-like nanostructured interface can be a potential way to enhance the thermal transport across the interfaces. In this work, the frequency-dependent phonon Boltzmann Transport Equation (BTE) is solved using Monte Carlo simulation with the aim to understand the fundamental heat transport across the nanostructured interface. The effects of nanopillar size and spacing on the interfacial thermal conductance will be evaluated quantitatively. The results from the simulations could be used to guide the design of the nanostructured interfaces for efficient thermal transport.