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Innovative Nano Materials for Unconventional Thermal Transport Control

Soft materials, especially polymers, are usually regarded as thermal insulators although they are widely used in heat transfer-critical applications, such as heat exchangers and thermal interface materials for electronics cooling. In this presentation, we will discuss several aspects of enhancing and manipulating thermal transport in polymers and their composites. We will discuss how to enhance thermal transport between polymer and graphene fillers by engineering the interfacial bonding properly. We will also show that unconventional enhancement of thermal transport across a hard-soft material interface can be achieved by properly functionalizing the hard material surface. We will then discuss the simulation results on a series of polymers, which shed the light on engineering fibers with ultra-high thermal conductivities. Finally, we will discuss how we can utilize the strong correlation between the molecular morphology and thermal transport properties of polymer fibers to realize nanoscale heat flow manipulation which are essential for phononic computing. Both atomistic simulations and experimental results will be included.