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SiGe Nanocomposites Thermoelectrics: The Knowns and the Unknowns[1]

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Silicon-germanium has been used in spacecraft for a long time to convert heat from radio isotope heat sources into electricity for deep space missions. Recently, we have reported significant improvement in the thermoelectric figure of merit of nanostructured Si_xGe_{1-x}. The improvement in ZT comes mainly from reduced phonon thermal conductivity, while at the same time, maintaining the electron transport properties. These experimental successes, although providing strong support to the direction of using random nanostructures to improve thermoelectric performance, also call for a detailed understanding of thermoelectric transport in random bulk nanostructures. Careful examination of the spectral details of the electron and phonon transport reveals a significant deficiency in our current understanding, even for bulk materials. Different interfacial transport processes further complicate the picture. In this talk, we will discuss the current status of our understanding of thermoelectric transport in nanocomposites. In collaboration with A. Minnich, H. Lee, B. Muralidharan, and M.S. Dresselhaus, Massachusetts Institute of Technology, Cambridge, MA 02139; and X. W. Wang, G. Joshi, G. H. Zhu, Y. C. Lan, D. Z. Wang, and Z.F. Ren, Boston College, Chestnut Hills, MA 02467.

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