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Microscopic Investigations of Phonon Thermal Conductivity in SiGe Superlattices with Rough Interfaces SHANG-FEN REN, Illinois State University, WEI CHENG, Illinois State University and Beijing Normal University, GANG CHEN, Massachusetts Institute of Technology — Phonon thermal conductivity in semiconductor superlattices (SLs) has attracted a great research attention in recent years due to the potential applications of SLs in thermoelectric devices and other applications [1]. By using a microscopic model developed to investigate phonon properties in semiconductor nanostructures [2], we have calculated thermal conductivities of SiGe SLs with rough interfaces in both the growth and in-plane directions. The results are compared with SLs with perfect smooth interfaces as well as bulk random alloys. Our results show that thermal conductivities of SLs with rough interfaces are much lower than SLs with the same thickness but smooth interfaces in both directions. In the in-plane direction, the thermal conductivities of SLs with rough interfaces are about the same as random alloy but lower than random alloy in the growth direction. Our results indicate that the interface roughness is a true mechanism of thermal conductivity reduction in SLs.
References: [1] Partially Coherent Phonon Heat Conduction in Superlattices, B. Yang and G. Chen, Phys. Rev. B 67, 195311 (2003). [2] A Microscopic Investigation of Phonon Modes in SiGe Alloy Nanocrystals, S. F. Ren, W. Cheng, and P. Y. Yu, Phys. Rev. B 69, 235327 (2004).

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