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Thermal Conductivity of Silicon/Germanium Nanostructures H.-Y. CHANG, L. TSYBESKOV, A. SIRENKO, New Jersey Institute of Technology, D.J. LOCKWOOD, J.-M. BARIBEAU, X. WU, M.W.C. DHARMA-WARDANA, National Research Council of Canada, T.I. KAMINS, A.M. BRATKOVSKY, Hewlett-Packard Laboratories — The efficiency of thermoelectric devices can be enhanced by increasing electrical conductivity and lowering thermal conductivity. Semiconductor nanostructures, whose electrical and thermal conductivities could be optimized by changing their electronic and structural properties, are ideal candidates for such device applications. However, complete understanding of their device properties and limitations requires a technique allowing temperature measurements with a nanoscale spatial resolution. In this work, we studied the thermal conductivities of two groups of Si/Ge nanostructures: Si/SiGe multilayer samples prepared by molecular beam epitaxy, and Si/Ge nanowire heterojunctions prepared by chemical vapor deposition based vapor-solid-liquid process. Sample temperatures during irradiation by a laser beam were measured using Stokes and Anti-Stokes modes of Raman scattering of different vibration modes, and thermal conductivity was calculated by using the temperature gradient between different parts of SiGe nanostructures. We find clear correlations between samples' structural properties and their thermal conductivity. This work suggests a novel approach toward high-efficiency Si/SiGe nanostructure-based thermoelectric generators.

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