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Nanoscale control of thermal transport via SiGe quantum dots F. PEZZOLI, P. CHEN, M. STOFFEL, C. DENEKE, A. RASTELLI, O.G. SCHMIDT, Institute for Integrative Nanosciences, IFW Dresden, Germany, A. MALACHIAS, Laboratorio Nacional de Luz Sincrotron, Brazil, A. JACQUOT, Fraunhofer-IPM, Germany, G. PERNOT, S. DILHAIRE, CPMOH, Université Bordeaux-CNRS, France, I. SAVIC, N. MINGO, LITEN, CEA-Grenoble, France — A study of cross plane thermal transport in SiGe/Si quantum dot multilayers (QD ML) is presented. Recent advances in heteroepitaxial growth allowed the fabrication of nanostructures, initiating intriguing investigations into low dimensional physics. Previous reports on thermal transport demonstrated that nanostructuring can reduce the thermal conductivity of a material even below the amorphous limit. Yet, the fundamental reasons why nanostructuring reduces thermal conductivity in crystalline materials are not fully understood. In this work we investigate cross-plane thermal transport through SiGe QD ML grown by means of MBE on Si. Measurements of the thermal properties were carried out along with a detailed AFM, TEM and x-ray characterization. Our findings demonstrate that quantum dots provide a means to tailor the thermal conductivity to extremely low values, about 1 W/m K. The highly diffusive interfaces achieved in SiGe/Si systems may be relevant to the development of integrated miniaturized energy harvesting or thermal management devices, in view of the integrability of SiGe in novel nanoscale devices.

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