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High thermal conductivity of a hydrogenated amorphous silicon film J.L. FELDMAN, George Mason University, XIAO LIU, Naval Research Laboratory, D.G. CAHILL, University of Illinois, R.S. CRANDALL, National Renewable Energy Laboratory, NOAM BERNSTEIN, D.M. PHOTIADIS, M.J. MEHL, Naval Research Laboratory, D.A. PAPACONSTANTOPOULOS, George Mason University, HO-SOON YANG, Pusan National University, Korea — We measured the thermal conductivity κ of an 80 μm thick hydrogenated amorphous silicon (a-Si:H) film from 80 K to room temperature with the 3ω method and at room temperature with the time-domain thermoreflectance (TDTR) method. The a-Si:H sample with 1 at.% hydrogen was prepared by hot-wire chemical-vapor deposition (HWCVD), a procedure which was found previously to produce superior material properties with a near absent atomic tunneling states that are ubiquitous in glasses. We find that κ is higher than any of the previous temperature dependent measurements, and shows a strong phonon mean free path dependence. We also performed numerical calculations on three 1000 atom models using Kubo theory and a tight binding electronic structure method. Due to the restraints of the TDTR results on low frequency extrapolations of calculated phonon diffusivities, the Kubo thermal conductivityis seen to be too small to explain our experiments. We conclude that the HWCVD a-Si:H sample has superior structural ordering relative to any amorphous silicon previously studied.

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