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Imaging interfacial thermal transport of WSe2/SiO2 via ultrafast infrared nano-thermometry PETER A. CHABAL, SAMUEL C. JOHNSON, University of Colorado, Boulder, SHIQIAN HU, Yunnan University, JUN NISHIDA, BAOWEN LI, MARKUS B. RASCHKE, University of Colorado, Boulder — Interfacial energy transport is of high importance in technological advances, e.g., semiconducting nanoelectronics, 2D material nanocomposites, and energy transmission and conservation devices. For materials of little spectral overlap and length scales smaller than the phonon mean path, like semiconductors on silicon with a thermal oxide, the energy transfer resistance is dominated by the interface. However, these fundamental interfacial processes are poorly understood due to limitations of conventional spectroscopy techniques by spatial resolution, interfacial sensitivity, or ultrafast temporal resolution. Here, we implement ultrafast *s*-SNOM, with its evanescent signal spatially confined to the nanoscale to resolve ultrafast dynamics at the interface that is discriminated from the conventionally bulk dominated response. We perform pump modulated pump-probe nano-spectroscopy and -imaging, for a monolayer to bulk transition metal dichalcogenide (TMD) on SiO2, resolving thermal dynamics on the 10 ps timescale through substrate phonon softening to measure interfacial transport. We supplement this with molecular dynamic simulations to quantify relationships between maximum temperature, TMD layer number, and thermal boundary conductance (TBC). The interfacial phonon scattering at high temperatures and the finite size effects of monolayer WSe2 both limit the thermal conductivity in relation to bulk WSe2. This approach can be applied to optimize interfacial thermal management.

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