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Vibrational energy on surfaces: Ultrafast flash-thermal conductance of molecular monolayers

DANA DLOTT, University of Illinois at Urbana-Champaign

Vibrational energy flow through molecules remains a perennial problem in chemical physics. Usually vibrational energy dynamics are viewed through the lens of time-dependent level populations. This is natural because lasers naturally pump and probe vibrational transitions, but it is also useful to think of vibrational energy as being conducted from one location in a molecule to another. We have developed a new technique where energy is driven into a specific part of molecules adsorbed on a metal surface, and ultrafast nonlinear coherent vibrational spectroscopy is used to watch the energy arrive at another part. This technique is the analog of a flash thermal conductance apparatus, except it probes energy flow with angstrom spatial and femtosecond temporal resolution. Specific examples to be presented include energy flow along alkane chains, and energy flow into substituted benzenes. Ref: Z. Wang, J. A. Carter, A. Lagutchev, Y. K. Koh, N.-H. Seong, D. G. Cahill, and D. D. Dlott, Ultrafast flash thermal conductance of molecular chains, Science 317, 787-790 (2007).

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