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Simulation Approach for Microscale Noncontinuum Gas-Phase Heat Transfer J.R. TORCZYNSKI, M.A. GALLIS, Sandia National Laboratories — In microscale thermal actuators, gas-phase heat transfer from the heated beams to the adjacent unheated substrate is often the main energy-loss mechanism. Since the beam-substrate gap is comparable to the molecular mean free path, noncontinuum gas effects are important. A simulation approach is presented in which gas-phase heat transfer is described by Fourier's law in the bulk gas and by a wall boundary condition that equates the normal heat flux to the product of the gas-solid temperature difference and a heat transfer coefficient. The dimensionless parameters in this heat transfer coefficient are determined by comparison to Direct Simulation Monte Carlo (DSMC) results for heat transfer from beams of rectangular cross section to the substrate at free-molecular to near-continuum gas pressures. This simulation approach produces reasonably accurate gas-phase heat-transfer results for wide ranges of beam geometries and gas pressures. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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