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Boundary conditions for the Boltzmann equation derived from a kinetic model of gas-surface interaction

Abstract

Boundary conditions for the Boltzmann equation are investigated on the basis of a kinetic model for gas-surface interaction. The model takes into account gas and physisorbed molecules interacting with a surface potential and colliding with surface and bulk phonons. The interaction layer is assumed to be thinner than the mean free path of the gas molecules, and the phonons are assumed to be at equilibrium. The asymptotic kinetic equation for the inner physisorbate layer, which forms a steady half-space problem, is derived and used to investigate boundary conditions for the Boltzmann equation that is valid outside the physisorbate layer. To be more specific, new models of the boundary condition are proposed on the basis of iterative solutions of the half-space problem and are assessed by the direct numerical analysis of the problem. In addition, some rigorous mathematical results for the half-space problem are presented. This is a joint work with Vincent Giovangigli (Ecole Polytechnique), François Golse (Ecole Polytechnique) and Shingo Kosuge (Kyoto University).