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Transport of gas mixtures in a Knudsen pump with specular and diffuse walls TOBIAS BAIER, STEFFEN HARDT, Institute for Nano- and Microfluidics, TU Darmstadt, Germany — Gas flow in Knudsen pumps is induced by thermal gradients in channels or pores when the mean free path of the gas molecules is comparable to the geometric feature size. While thermal transpiration is often associated with flow along pores with a net axial temperature gradient, flow can also be induced by imposing a temperature difference across the channel, when suitably structured walls induce a periodic but non-mirror-symmetric temperature profile along the channel. One such arrangement, inspired by the Crookes radiometer, consists of placing an array of plates with different reflection properties on their opposing sides along a channel. By direct simulation Monte Carlo (DSMC) we investigate the transport of gas mixtures along such channels, focusing on the discrimination of individual species in the mixture by molecular size and mass during flow due to temperature, composition and pressure gradients. As Knudsen pumps do not possess any moving parts, they lend themselves for operation in low-maintenance situations such as for feeding gases to sensor surfaces. The observed discrimination of different gas species may thus adversely or favorably influence the overall detection characteristic of such a combined device.

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