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A thermally driven ratchet for the separation of gas molecules STEFFEN HARDT, Center of Smart Interfaces, TU Darmstadt, SUDARSHAN TIWARI, AXEL KLAR, Fachbereich Mathematik, TU Kaiserslautern — If a gas is confined between two suitably structured surfaces, the application of a temperature gradient between the surfaces gives rise to nontrivial phase-space distributions inside the gas if the Knudsen number is larger than one. In such non-equilibrium situations a nonzero momentum and mass flux can be created in a direction parallel to the surfaces. We study a situation of comparatively large molecules of low concentration moving in a background gas of small molecules. It is assumed that the Knudsen number of the small molecules is much larger than one. Therefore, the small molecules dominantly collide with the wall boundaries, whereas the large molecules undergo collisions with the walls as well as the small molecules. Such a scenario is analyzed using Monte-Carlo simulation techniques based on a hard-sphere collision model. It is shown that while the small molecules show no net motion, the large molecules are driven parallel to the surfaces with a velocity that depends on their size. Larger molecules are transported faster than smaller ones. In consequence we have demonstrated a novel scheme of gas dynamics that may find applications in the size separation of molecules.

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