

عنوان مقاله:

DSMC simulation of micro gas sensor for detection of Ammonia

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خلاصه مقاله:

Recently, the importance of the micro sensors has increased due to their applications in the various industries and applications. In this article, Direct Simulation Monte Carlo (DSMC) method is applied to evaluate the performance of a new micro gas sensor (MIKRA) for mass analysis of ammonia in the rarefied gas. This sensor applied the Knudsen force induced by temperature difference at low pressure condition to diagnosis the main components of the mixture. In order to simulate a rarefied gas inside the micro gas detector, Boltzmann equation are applied to obtain high precision results. To solve these equations, Direct Simulation Monte Carlo (DSMC) approach is used as a robust method for the non-equilibrium flow field. This study performed comprehensive studies to reveal the main mechanism of force generation and applied this for the analysis of the gas mixture. Hence, effects of main parameter such as temperature gradient and gap of arms are expansively examined in different ambient pressures. Our findings show that value of generated Knudsen force significantly varies when the percentage of the NH₃ varies in the mixture. According to obtained results, the maximum Knudsen force increases when the fraction of the ammonia decreases in the domain. Our findings reveal that the effect of gap size varies with the pressure of the domain. In addition, the increasing of temperature gradient from 40 K to 100K rises the maximum Knudsen force more than 400% on the shuttle arm.

کلمات کلیدی:

Ammonia; Knudsen force; DSMC; low-pressure gas actuators; MEMS

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