以直接模擬蒙地卡羅法計算三維微管流場與熱傳特性探討

The Direct Simulation Monte Carlo (DSMC) method is employed to analyze the heat and fluid flow of low-speed three-dimensional (3-D) rectangular microchannels of various sizes and open cross-section aspect ratios. The VHS model and nitrogen are used in the present study. The distributions of slip velocity and the slip temperature along the wall boundaries and the corners are calculated and discussed. The Fanning friction coefficient and Poisseuille number along the corner and the center of the wall are also investigated. Although in the previous studies showed that when cross-section aspect ratio is 5, both heat and flow fields of 3-D simulations are roughly 99% approaching to that of 2-D case. These agreement only valid in the central part of the the channel. The present results showed that along the two side wall boundaries and the corners of a 3-D channel even at this high aspect ratio, the heat and flow properties still manifest the 3-D effects due to the existence of the two side walls. It is also found that the friction coefficient (C/sub f/) increases when the Knudsen number of the flow increase and the Poissruille number decreases as the Kn number increase. For the same size of the open cross section and the same Kn number, the higher inlet pressure will results in higher C/sub f/ values. When the wall temperature increases that cause decreasing both C/sub f/ and Poissruille number.