

Public Abstract

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Title:Study of drag reduction in microstructured channel with patterned cavities and wettability control

Microstructured channel can trap air in small cavities, thereby reducing flow resistance and pressure drop. The shape of the air-water interface plays an important role in the drag reduction and the formation of the meniscus depends on the initial conditions, geometries and wettability of the surface. In the present work, we use a two-dimensional VOF model to investigate the flow resistance in microchannel. Numerical simulations are carried out in laminar regime ($1 < Re < 50$) to study the effect of initial and boundary conditions on the flow resistance. It is found that the effective slip length is in good agreement with the experimental results at low gas fraction. However, it has a dramatic deviation at high gas fraction when changing the initial interface assumption. Studied also found that drag reduction increased when increasing the contact angle of the cavity surfaces. At low gas fraction, parametric studies have been carried out to investigate the effect of geometry by changing the cavity width, fraction and numbers. It is found that increasing the gas fraction and decreasing the cavity numbers can provide better performance on drag reduction, as the interfaces provide longer and continuous slip-boundary condition.