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# Simulations of Laminar Liquid Flows through Superhydrophobic Micro-Pipes

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**Abstract :** This paper investigates the dynamic behavior of laminar water flows inside superhydrophobic micro-pipes patterned with square micro-posts features under different operating conditions. It also investigates the effects of air fraction and Reynolds number on the frictional performance of these pipes. Rather than modeling the air-water interfaces of superhydrophobic as a flat inflexible surface, a transient, incompressible, three-dimensional, volume-of-fluid (VOF) methodology has been employed to continuously track the air–water interface shape inside micro-pipes. Also, the entrance effects on the flow field have been taken into consideration. The results revealed the strong dependency of the frictional performance on the air fractions and Reynolds number. The frictional resistance reduction becomes increasingly more significant at large air fractions and low Reynolds numbers. Increasing Reynolds number has an adverse effect on the frictional resistance reduction.

**Keywords :** drag reduction, laminar flow in micropipes, numerical simulation, superhyrophobic surfaces, microposts
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