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Numerical Study of Wettability on the Triangular Micro-pillared Surfaces Using Lattice Boltzmann Method

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Abstract : In this study, we present the numerical investigation of surface wettability on triangular micropillar surfaces by using a two-dimensional (2D) pseudo-potential multiphase lattice Boltzmann method with a D2Q9 model for various interaction parameters of the range varies from -1.40 to -2.50. Initially, simulation of the equilibrium state of a water droplet on a flat surface is considered for various interaction parameters to examine the accuracy of the present numerical model. We then imposed the microscale pillars on the bottom wall of the surface with different heights of the pillars to form the hydrophobic and superhydrophobic surfaces which enable the higher contact angle. The wettability of surfaces is simulated with water droplets of radius 100 lattice units in the domain of 800x800 lattice units. The present study shows that increasing the interaction parameter of the pillared hydrophobic surfaces dramatically reduces the contact area between water droplets and solid walls due to the momentum redirection phenomenon. Contact angles for different values of interaction strength have been validated qualitatively with the analytical results.

Keywords : contact angle, lattice boltzmann method, d2q9 model, pseudo-potential multiphase method, hydrophobic surfaces, wenzel state, cassie-baxter state, wettability
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