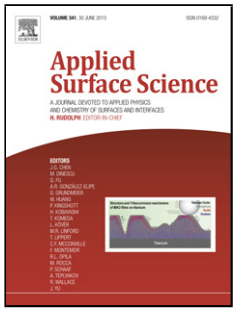

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Highlights

Wemodel the superhydrophobic surface with anisotropicand hierarchical structure.
Anisotropic wetting only shows in noncomposite state (not in composite state).
Transition from noncomposite tocomposite state on dual-scale structure is hard.
Droplets tend to roll in the particular direction.
Droplets tend to stably remain in one preferred thermodynamic state.

Thermodynamic analysis on an anisotropically superhydrophobic surface with a hierarchical structure

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Abstract

Superhydrophobic surfaces, which refer to the surfaces with contact angle higher than 150◦ and hysteresis less than 10°, have been reported in various studies. However, studies on the superhydrophobicity of anisotropic, hierarchical surfaces are limited and the corresponding thermodynamic mechanisms could not be explained thoroughly. Here we propose a simplified surface model of anisotropic patterned surface with dual scale roughness. Based on the thermodynamic method, we calculate the equilibrium contact angle (ECA) and the contact angle hysteresis (CAH) on the given surface. We show here that the hierarchical structure has much better anisotropic wetting properties than the single-scale one, and the results shed light on the potential application in controllable micro-/nano-fluidic systems. Our studies can be potentially applied for the fabrication of anisotropically superhydrophobic surfaces.

Key words

Superhydrophobic; Anisotropic; Hierarchical; Contact angle; Contact angle hysteresis.