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In situ observations of wetting transition on submerged microstructured hydrophobic surfaces PENGYU LV, YAHUI XUE, Peking University, HAO LIN, Rutgers, The State University of New Jersey, HUILING DUAN, Peking University — Superhydrophobicity of microstructured surfaces has a promising application in drag reduction. The air pockets trapped in the microstructures play the key role. However, the wetting transition from Cassie to Wenzel state will spontaneously take place due to air diffusion into the water around under pressurization, leading to the loss of air pockets and the failure of superhydrophobicity. The current work examines in situ liquid-air interfaces on a submerged surface patterned with cylindrical micropores using confocal microscopy. The dynamic process of wetting transition are directly observed and measured quantitatively, and the data are in good agreement with a diffusion-based model prediction. A similarity law along with a characteristic time scale is derived, which governs the lifetime of the air pockets. Moreover, two kinds of collapses of the menisci in the final stage of transition which refer to the symmetric and asymmetric collapses are also captured. A strategy of hierarchical structures is proposed to avoid the loss of stability of the liquid-air interfaces in advance due to asymmetric collapse. The present work enables a better prediction of underwater superhydrophobicity, and benefits design explorations to enhance its longevity.

Pengyu Lv
Peking University

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