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Dynamics of the Liquid Meniscus in Micropillar Arrays RONG XIAO, RYAN ENRIGHT, EVELYN WANG, MIT — Liquid dynamics in superhydrophilic micropillar arrays is of broad interest in microfluidics for lab-on-a-chip, biomedical, and thermal management applications. Accurate prediction and optimization of propagation rates in such microstructures require detailed understanding of the evolution of the liquid meniscus. In this work, we experimentally investigated microfabricated circular pillar arrays with diameters of 2.5 μm and 5 μm, periods ranging from 5 μm to 30 μm, and heights ranging from 10 μm to 30 μm. By coupling interference microscopy and high-speed imaging, the dynamics of the advancing liquid front were precisely captured. Two distinct time scales in the wetting process were observed associated with the liquid sweeping across the bottom surface and rising along the sides of the pillars, which is dependent on the height-to-period ratio of the pillar array,. This behavior was modeled by using an energy-based approach. This work provides important insights towards accurately predicting propagation rates for a range of micropillar arrays and can be extended to other microstructure geometries.

Rong Xiao
MIT

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