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Phase-field simulations of contact-line dynamics on rough surfaces FENGCHAO YANG, Northwestern Polytechnical University, Shaanxi, China and Virginia Tech, PENGTAO YUE, Virginia Tech, XIAOPENG CHEN, Northwestern Polytechnical University, Shaanxi, China — Wetting of solid surfaces is ubiquitous in nature, and in most cases the surfaces are not smooth. In this work, we will investigate how surface roughness influences contact-line dynamics by simulating the forced wetting in a capillary tube with microposts or microgrooves on its wall. A phase-field method is used to capture fluid interfaces as well as moving contact lines. The governing equations are solved by an implicit finite-element method on an adaptive triangular mesh, which conforms to the topological patterns on the tube wall and also refines at the fluid interface. With our computational setup, we can capture the advancing and receding contact angles. As the contact line moves, it jumps from one pillar to the next; consequently, the apparent contact angle exhibits a periodic behavior. By comparing with the result on a smooth surface, we will explain how surface roughness affects contact-line dynamics by modifying the effective contact angle and slip length. Numerical results on different arrangements and shapes of microposts will be presented.

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