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Simulations of Droplets on Micro-patterned Surfaces BANGLIN LIU, MICHAEL GRIGOLA, HUAN LI, SASCHA HILGENFELDT, K. JIMMY HSIA, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — The behavior of liquid droplets on micro-patterned surfaces made from arrays of micropillars is important for applications in self-cleaning surfaces, refrigeration, or pore filtration. Properties like droplet contact angles and their hysteresis have been described in macroscopic terms from coarse-grained variables like pillar density. However, for accurate modeling of the droplet shape and dynamical behavior, microscopic parameters like pillar positioning and the topography of the contact line are crucial. We have developed an energy-based model of a water droplet on a PDMS substrate in the Cassie-Baxter state using Surface Evolver. We assess the changes in droplet energy upon deformation and displacement, with particular attention to the pinning and depinning from individual pillars. The majority of shape distortion and energy change is found to occur in close proximity to the substrate, encouraging a simplified theoretical description using concepts of 2D contact-line pinning. The versatile simulation tool can be used to study the effects of pillar position pattern, pillar orientation, substrate symmetry, and many more general problems of contact-line statics and dynamics.

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