Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Hydrodynamics-Dominated Wetting Phenomena on Hybrid Superhydrophobic Surfaces ARASH AZIMI, CHAE ROHRS, PING HE, Department of Mechanical Engineering, Lamar University, Beaumont, TX 77710 — On chemically heterogeneous rough surfaces, determining the true apparent contact angle is a challenging task, because the global minimum surface energy is hardly attainable. The equilibrium contact angle is associated with the global minimum surface energy of the droplet-air-substrate system. However, in practice, the most stable contact angle is the measurable contact angle of the system. We present a series of 3D simulations using various initial conditions to reach possible meta-stable states for a water droplet on four micro-patterned hybrid substrates. The surface energy and energy barriers are computed. The apparent contact angles compared with experiments, global contour of the droplets, and liquid-solid area fractions are presented. Our results reveal a hydrodynamics-dominated wetting behavior on these hybrid surfaces, and capture several meta-stable Cassie-Baxter states, which cause a large contact angle hysteresis. For a given micro-patterned hybrid substrate, a critical impact speed can be found, above which the impact method cannot overcome more energy barriers to reach a lower energy state. Furthermore, a smaller variation of the measured contact angles is observed on the substrate with a lower heterogeneity of topology and chemistry.

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Date submitted: 02 Aug 2019 Electronic form version 1.4