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Cassie-Baxter to Wenzel Transition and a New Phenomenon called "the Wenzel Deviation" ARASH AZIMI, CHAE ROHRS, PING HE, Department of Mechanical Engineering, Lamar University, Beaumont, TX 77710 —
In general, on rough surfaces, two wetting regimes are possible: (1) the Cassie-Baxter state, in which the droplet sits on top of rough structures, and (2) the Wenzel state, in which the droplet completely sinks into the rough structures. In this talk, we present a numerical study of the Cassie-Baxter to Wenzel transition using a series of 3D simulations for a water droplet on micro-patterned substrates, in which the pillar height and spacing are systematically varied. The contact angles for each case are measured and compared with either the Cassie-Baxter or Wenzel equation. The total surface energy and its time evolution are discussed in detail. Energy barriers for the wetting transition are addressed. Measured contact angles show an excellent agreement for the Cassie-Baxter state, while for the Wenzel state, we find a systematic deviation from the Wenzel equation when the pillar size is large. The critical pillar size, above which the Wenzel deviation is outstanding, is identified based on simulation results and thermodynamic calculations. A modified Wenzel equation is developed to account for the Wenzel deviation.

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