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How is Surface Roughness Affecting the Supplementary Relationship of Dynamic Contact Angles Measured by the Sessile-Droplet and Captive-Bubble Methods? SREYA SARKAR, TAMAL ROY, University of Illinois at Chicago, RANJAN GANGULY, Jadavpur University, CONSTANTINE MEGARIDIS, University of Illinois at Chicago — The wettability of a solid surface is dictated by its chemical composition as well as its roughness. The wettability of the surface can primarily be characterized quantitatively by measuring the contact angles (CAs) of sessile droplets (SD) in air or captive bubbles (CB) in liquid. The intrinsic wetting characteristics of a substrate demarcate the application of the two techniques. For surfaces with extreme wetting properties (superhydrophilic or superhydrophobic) where one of the two methods cannot be successfully implemented, a relationship between the dynamic CAs measured using these two methods is required. We performed extensive CA experiments on solid Aluminum substrates with different degrees of surface roughness using the SD and CB methods. The sum of the dynamic CAs (advancing CA of SD and receding CA of CB) on a smooth surface was found to be 180, in agreement with the known supplementary principle. However, this sum was found to deviate from 180with increased surface roughness. We explain our experimental observations using a theoretical formulation based on well-known thermodynamic models of wetting and contact angle hysteresis on rough substrates.

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