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3D aspects of droplet coalescence during dropwise condensation on superhydrophobic surfaces KONRAD RYKACZEWSKI, JOHN HENRY J. SCOTT, SUKUMAR RAJAURIA, NIST, JEFF CHINN, AMY M. CHINN, WANDA JONES, Integrated Surface Technologies, Inc — Only a few selected natural and artificial surfaces with water contact angles above 150 degrees retain their superhydrophobic characteristics during water condensation. On these robust superhydrophobic surfaces, individual droplets emerge out of a few micrometer wetted area between the nanostructures and initially grow mainly by increasing their contact angle. After reaching a nearly spherical shape with a diameter between 4 um and 6 um, the droplets grow in a near constant contact angle mode while remaining in an immobile Wenzel state. Microdroplets can depart the surface by coalescing with another large drop and forming a new drop in the mobile Cassie-Baxter state. Here we report that high contact angle primary drops can project over growing nano-to-microscale satellite droplets. We show that the large primary drops can sweep up the small satellite droplets without wetting their nucleation site, promoting rapid condensation of multiple satellite droplets from the same nucleation site. We discuss the effect of this coalescence mechanism on the drop size distribution and heat transfer during the dropwise condensation process.

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