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Multimode Multidrop Serial Coalescence Effects during Condensation on Two-Tier Superhydrophobic Surfaces[1] KONRAD RYKACZEWSKI, ADAM T. PAXTON, SUSHANT ANAND, MIT, XUEMEI CHEN, ZUANKAI WANG, City University of Hong Kong, KRIPA K. VARANASI, MIT — Mobile coalescence leading to spontaneous drop motion was initially reported to occur only during water condensation on two-tier superhydrophobic surfaces (SHS), consisting of both nanoscale and microscale topological features. However, subsequent studies have shown that mobile coalescence also occurs on solely nanostructured SHS. Thus, recent focus has been on understanding the condensation process on just nanostructured surfaces rather than on two-tier SHS. Here, we investigate the impact of microscale topography of two-tier SHS on the droplet coalescence dynamics and wetting states during the condensation process. We identify new droplet shedding modes, which consist of serial coalescence events that lead to merging of multiple droplets. The formed drops either depart or remain anchored to the surface. We explain the observed post-merging drop adhesion trends through direct correlation to formation of drops in nanoscale as well as microscale Wenzel and Cassie-Baxter wetting states. We find that optimally designed two-tier SHS, which promote the highest number of departing microdrops, consists of microscale features spaced close enough to enable transition of larger droplets into micro-Cassie state, yet at the same time provide sufficient area in-between the features for occurrence of mobile coalescence.

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