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Influence of nanoscale surface roughness on mechanism of dropwise water condensation[1] KONRAD RYKACZEWSKI, Material Measurement Laboratory, National Institute of Standards and Technology — Adversely to most potential applications of superhydrophobic coatings, only a few natural and artificial surfaces retain their superhydrophobic characteristics during water condensation. This work addresses the key question of why condensation on such surfaces leads to self-propelled dropwise condensation but causes wetting of other surfaces with water contact angles above 150 degrees. The effects of gradually varying nanoscale roughness of a hydrophobic surface on the mechanism of drop growth and coalescence are observed using electron and light microscopy. It is demonstrated that increasing the nanoscale surface roughness confines the base diameter of the nucleating droplets causing them to grow by increasing their contact angle. The increase in the nanoscale surface roughness also decreases triple line pinning during coalescence, thus allowing formation of nearly spherical drops after merging of two high contact angle drops. The role of the nanoscale roughness in the diameter confinement effect is explained through thermodynamic calculations. Lastly, confined base diameter growth model is derived and compared with experimental results.

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