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Tuning Superhydrophobic Nanostructures to Enhance Jumping-Droplet Condensation MEGAN MULROE, Virginia Tech, BERNADETA SRIJANTO, PATRICK COLLIER, Oak Ridge National Laboratory, JONATHAN BOREYKO, Virginia Tech — It was recently discovered that condensation growing on a nanostructured superhydrophobic surface can spontaneously jump off the surface when two or more droplets coalesce together. The minimum droplet size for jumping to occur is of order 10 microns, but it is unclear whether this is the true lower limit of jumping droplets or simply a limitation of current superhydrophobic surfaces. Here, we analyze the dynamics of jumping droplets on six different superhydrophobic surfaces where the topography of the nanopillars was systematically varied. The critical diameter for jumping to occur was observed to be highly dependent upon the height and diameter of the nanopillars; surfaces with very tall and slender nanopillars enabled jumping droplets at a smaller critical size of order 1 micron. An energetic model of the incipient growth of condensate shows that the nanostructure topology affects the rate of increase of a growing droplet's apparent contact angle, with jumping being enabled at very large angles. These findings indicate that the true upper limit to the performance of jumping-droplet condensers has not yet been reached and can be further improved using advanced nanofabrication techniques.

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