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Liquid-encapsulating surfaces: overcoming the limitations of superhydrophobic surfaces for robust non-wetting and anti-icing surfaces J. DAVID SMITH, Massachusetts Institute of Technology, RAJEEV DHIMAN, MIT, KRIPA VARANASI¹, Massachusetts Institute of Technology — In this work we address fundamental limitations of superhydrophobic surfaces for non-wetting and anti-icing applications by impregnating them with a hydrophobic liquid. The encapsulated liquid serves as a barrier to the penetration of impinging water droplets and forces preferential condensation and frost formation on texture tops. We conducted droplet impact and roll-off experiments to assess the robustness of liquid-encapsulating micro- and nano-scale textured surfaces and found that their ability to shed droplets was improved dramatically. Furthermore, environmental scanning electron microscope experiments demonstrated that frost formation as well as condensation occurs preferentially on these surfaces thereby limiting ice contact to texture tops only. Ice adhesion strength was quantified using a custom-built adhesion testing apparatus to demonstrate greatly enhanced anti-icing performance of the liquid-encapsulating surfaces compared to superhydrophobic surfaces.

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