

Abstract Submitted
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Liquid-impregnated surfaces: overcoming the limitations of superhydrophobic surfaces for robust non-wetting and anti-icing surface J. DAVID SMITH, RAJEEV DHIMAN, ERNESTO REZA-GARDUNO, GARETH MCKINLEY, ROBERT COHEN, KRIPA VARANASI, None — 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 impregnating liquid serves as a barrier to the penetration of impinging water droplets and forces preferential condensation and frost formation on texture tops. We predict the thermodynamically stable wetting states based on a free energy analysis, and model the behavior of rolling droplets on liquid-impregnating surfaces. We conducted droplet impact and roll-off experiments to assess the robustness of liquid-impregnating 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-impregnating surfaces compared to superhydrophobic surfaces.

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None

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