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Engineering Surfaces for Enhanced Nucleation and Droplet Removal During Dropwise Condensation. SANMITRA DUTTA, SAMEERA KHAN, SUSHANT ANAND, University of Illinois at Chicago — Condensation plays critical role in numerous industrial applications, such as condensers, HVAC,etc In the most applications,fast formation (i.e. high nucleation) and subsequent removal of water droplets is critical for enhancing the efficiencies of their associated systems. Significant focus has been placed on the aspect of droplet removal from surfaces.This has led to, development of superhydrophobic surfaces with special textures on which droplets are self-removed after coalescence. However,because of their inherent low surface energy, nucleation energy barriers are also high on such surfaces. In contrast to conventional superhydrophobic surfaces, here we show that surfaces can be engineered such that the simultaneous benefits of high nucleation rates and fast droplet removal can be obtained during the condensation process.These benefits are obtained by impregnating a superhydrophobic surface with an oil that despite its defect-free interface provides low nucleation energy barrier during condensation.At the same time,the oil facilitates high droplet shedding rates by providing a lubricating layer below the droplets due to which droplets have negligible contact angle hysteresis. We provide a guide to choose oils that lead to enhanced nucleation, and provide experimental evidence supporting the proposed guide. We discuss the importance of different oil properties in affecting the droplet growth and subsequent removal of water droplets.

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