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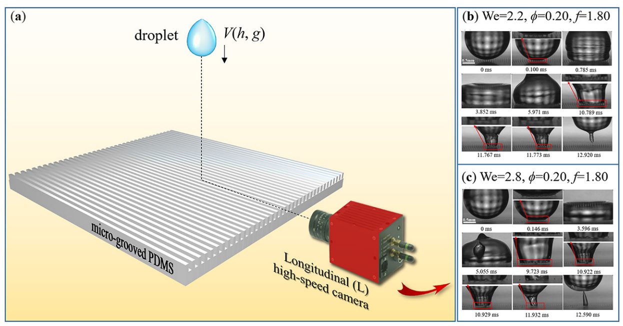
Results determined the upper limit for the impact velocity of bouncing droplets on micro-grooved surfaces.



How a water droplet bounces off a solid surface is a simple question with wide ranging applications in diverse areas from agriculture and water harvesting to weatherized clothing and heat transfer.

Wang et al. studied water droplet impacts on non-wetting, micro-grooved surfaces. They experimentally determined the upper limit of the impact velocity of bouncing droplets, and developed a theoretical model to predict this limit.

A water droplet impacting on a micro-grooved surface can either bounce, stick, or break up, depending on the droplet's velocity and the surface properties. The transition between a completely rebounding droplet and a breakup or partial rebound is due to a shift between the Cassie-Baxter wetting state, where the liquid fills the space between the grooves, and the Wenzel state, where the droplet sits on top.

Using deionized water and a high-speed camera recording at 150,000 frames per second, the researchers imaged how droplets impacted micro-grooved polydimethylsiloxane (PDMS) surfaces. The images showed that while the wettability of the surfaces was quite low, the anisotropy effect was high.

The findings were used to create a theoretical model that included the penetration of the liquid into the grooves to calculate the upper limit of impact velocity for bouncing droplets. Additional analysis showed the roughness of the surface only had a limited effect on the contact time.

"We envision that this work will highlight the application of droplets and patterned surfaces with anisotropic wetting characteristics in agricultural and industrial fields," said author Ying-Song Yu.

The authors plan to continue studying droplet imaging on similar surfaces with different topological structures with the goal of reducing water loss due to bouncing.

Source: "Bouncing droplets on micro-grooved non-wetting surfaces," by Shi-zheng Wang, Xianfu Huang, Longquan Chen, and Ying-Song Yu, *Physics of Fluids* (2023). The article can be accessed at https://doi.org/10.1063/5.0134783.