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Imparting Icephobicity with Substrate Flexibility[1] THOMAS SCHUTZIUS, THOMAS VASILEIOU, DIMOS POULIKAKOS, ETH Zurich — Ice accumulation poses serious safety and performance issues for modern infrastructure. Rationally designed superhydrophobic surfaces have demonstrated potential as a passive means to mitigate ice accretion; however, further studies on solutions that reduce impalement and contact time for impacting supercooled droplets are urgently needed. Here we demonstrate the collaborative effect of substrate flexibility and surface texture on enhancing icephobicity and repelling viscous droplets. We first investigate the influence of increased viscosity on impalement resistance and droplet–substrate contact time. Then we examine the effect of droplet partial solidification on recoil by impacting supercooled water droplets onto surfaces containing ice nucleation promoters. We demonstrate a passive method for shedding partially solidified droplets that does not rely on the classic recoil mechanism. Using an energy-based model, we identify a previously unexplored mechanism whereby the substrate oscillation governs the rebound process by efficiently absorbing the droplet kinetic energy and rectifying it back, allowing for droplet recoil. This mechanism applies for a range of droplet viscosities and ice slurries, which do not rebound from rigid superhydrophobic substrates.

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