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Shaping/Launching Droplets Impacting on Wettability-Patterned Surfaces M. ELSHARKAWY, University of Illinois at Chicago, T. SCHUTZIUS, Eidgenössische Technische Hochschule Zürich, G. GRAEBER, RWTH Aachen, J. ORELUK, University of California Berkeley, R. GANGULY, Jadavpur University, C. MEGARIDIS, University of Illinois at Chicago
— We present experimental results of droplet impact on wettability-patterned surfaces specifically designed to perform various liquid handling tasks. Such surfaces are implemented for converting droplets from spheres to complex shapes (*e.g.*, annuli or squares) and laterally launching the droplets even under orthogonal impact. The procedure harnesses the naturally occurring contact line pinning mechanisms at sharp wettability changes to influence droplet impact outcome, or even mobilize the fluid asymmetrically post impact. In the launching scenario, droplets impact orthogonally on a superhydrophobic surface and come in contact with a patterned hydrophilic region upon maximum spread. The end result is the launch of the droplet in the lateral direction due to contact line pinning on the hydrophilic region, and the resultant asymmetric disruption of the receding droplet dynamics. We analyze this phenomenon and explain the underlying physical conditions driving the lateral launch post impact. For such patterned surfaces, we show that there exist three possible regimes of dewetting, which depend on total contact time and location of droplet launch from the point of first contact. A model is put forth that predicts the horizontal launch velocity and relates the forces at play to discern between the three dewetting regimes. The study presents a new approach to control impacting droplet outcome and offers new insight on droplet impact behavior on wettability patterned surfaces.

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