Abstract Submitted
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Slide, Sweep and Vanish: Droplet manipulation by wettability engineering ARITRA GHOSH, RANJAN GANGULY[1], THOMAS M. SCHUTZIUS, CONSTANTINE M. MEGARIDIS, Mechanical and Industrial Engineering, University of Illinois at Chicago — Achieving controlled droplet transport on substrates is important for multiphase heat transfer, water harvesting and lab-on-chip applications. We use a facile, scalable surface wettability engineering approach to generate wettability patterned surfaces that comprise of superhydrophilic tracks of various geometrical patterns and length scales (μm-mm) on superhydrophobic backgrounds. Liquid transport on such surfaces harnesses the force arising from the spatial contrast of surface energy on the substrate, providing rapid actuation for micro and nanoliter drops. Considering a variety of dimensions, shapes and strategic locations of the superhydrophilic patterns on the substrate, effective modes of droplet transport through hemiwicking and Laplace pressure-driven flow are analyzed. The work provides proof-of-concept for salient digital microfluidic tasks, e.g. droplet capture, transport, merging and dispensing on such patterned substrates. This droplet manipulation is pumpless and fast. With suitable patterns and wettability contrast, we demonstrate on-chip droplet transport speeds of O(10 cm/s). The study examines the geometric and surface wettability parameters for optimal substrate design for droplet manipulation.

[1]On leave from Jadavpur University, India

Aritra Ghosh
University of Illinois at Chicago

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