Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Contact line friction driven droplet transport over asymmetric sawtooth surface microstructures YAERIM LEE, The University of Tokyo, GUSTAV AMBERG, KTH Royal Institute of Technology, JUNICHIRO SHIOMI, The University of Tokyo — Directional control of droplet motion over a dry solid surface has broad application areas ranging from printing to heat exchangers and microfluidic devices. In this study, the macroscopic motion of liquid droplets was manipulated directionally by oscillating the structured substrates with asymmetric sawtooth shapes in microscale. The horizontally oscillating substrates propelled water droplets of few microliters preferentially in the down-hill direction relative to the sawtooth geometries. Above a threshold in oscillation acceleration, the water droplet started to travel to the down direction gradually increasing the travel speed. The opposite directionality is observed at beyond resonance frequencies with stretched liquid-solid contact line. The droplet travel speed depending on the surface geometries were formulated from the theory of contact line movement describing the local departure of the contact angle from its static value in terms of actual surface shapes. The imbalance of the hindrance from line friction can transport water droplet at a maximum speed of 22 mm/s with a small oscillation amplitude of 0.5 mm. The contact line friction driven droplet transport was valid even when the substrate was tilted from the horizontal by 15 degrees.

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Date submitted: 01 Aug 2019 Electronic form version 1.4