Droplet spreading and transport : the role of substructures

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Efficient droplet transportation represents a significant challenge in the development of water collection devices [1]. It has been observed in nature that grooves favor droplet motion [2]. In this presentation, we investigate the dynamics of droplet spreading within 3D-printed grooves with varying curvatures [3]. We show that the type of curvature (convex or concave) significantly influences the droplet shape and the dynamics of spreading (see Fig. 1 (a)). Specifically, we show that the spreading of a droplet is faster inside a convex groove. Additionally, we examine the role of sub-structures in guiding droplet motion along vertical twisted threads [4]. Two fibers are twisted to create a helical groove along the bundle. We show that depending on the helical path the droplet exhibits a helical motion or a vertical descent (see Fig. 1 (b)). These findings underscore the crucial importance of substructures in manipulating droplets.

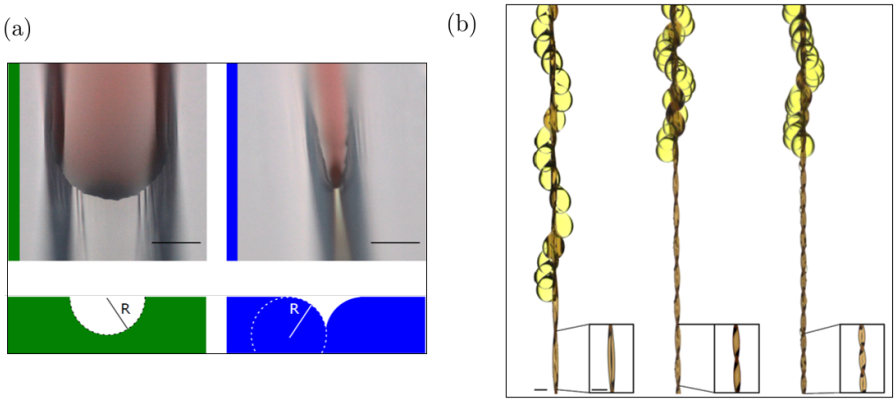

Figure 1. (a) Pictures of the liquid front of a red-dyed droplet spreading in a concave groove and a convex groove. Both grooves have the same radius of $R = 1.37$ mm. One observes that the groove's curvature influences the advancing front shape of the droplet. (b) Superposition of successive pictures of a droplet traveling down two twisted fibers with a helical groove substructure. From left to right, the number of fiber twists increases. With small twist values, the droplet adopts a motion that mirrors the underlying helical structure. However, at higher twist values, the droplet has a mixed motion of translations and rotations. Scale bars in the images represent 1 mm.

Références

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