Master 2 Internship position in soft matter physics

Contact line dynamics on superhydrophobic surfaces.
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Wetting phenomena are used in most industrial areas (coatings, food, aviation, etc.). They have been the focus of intensive academic research for decades especially superhydrophobic surfaces that present remarkable anti adhesion properties [1]. In a previous study [2], we have explored receding contact line dynamics on superhydrophobic surfaces, composed of micropillars arrays. We show that superhydrophobic surfaces exhibit a significantly lower dependence of contact angle on contact line speed compared to smooth surfaces (Figure 1a). The results can be interpreted in terms of viscous friction reduction on superhydrophobic surfaces due to the reduction in real contact area on textured surfaces. In addition, on such surfaces, the contact line can be pinned on pillars while it recedes on the surface. Then, contact line is locally deformed on pillars: small capillary bridges are formed on the pillars which can break and leave small droplets on pillars during the receding (Figure 1b). We show that those mechanisms could play a fundamental role in the wetting dynamics.

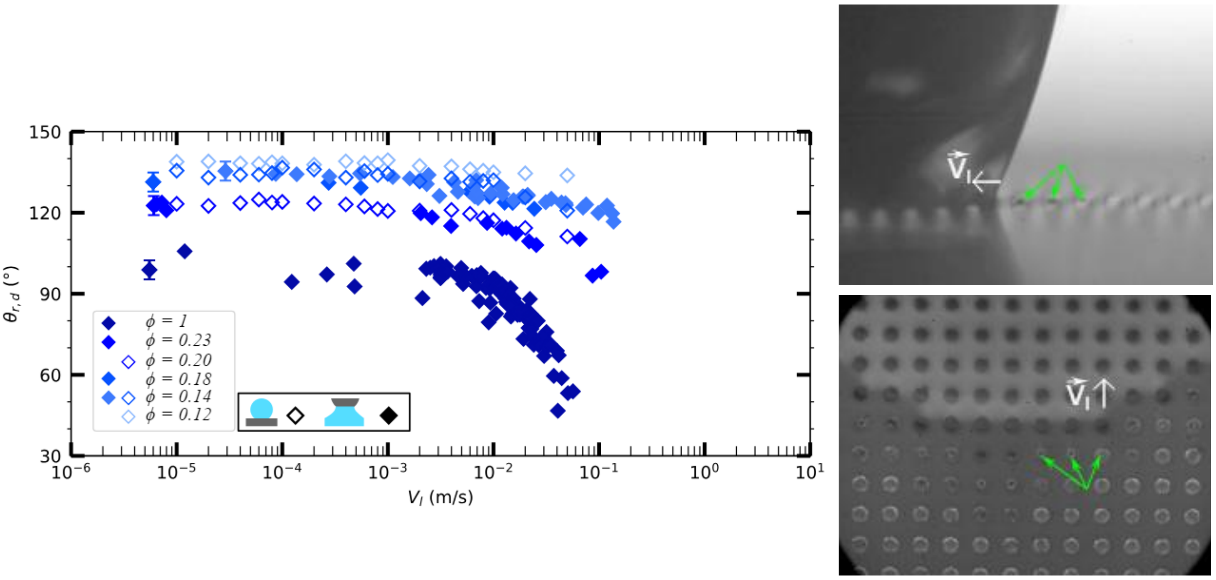

Figure 1. (left) Receding contact angle as function of the contact line speed. The closed and open symbols represent respectively measurements obtained with capillary bridge and sessile drop setups. The blue gradient represents the data for different solid fractions from the smooth surface (darkest) to the smaller ϕ (lightest). (right) Images of a drop from side (a) and bottom (b) views while the contact line has receded on the surfaces. Green arrows show droplets left on pillars during the contact line receding.

The aim of this internship is to identify the relation between these local deformation/droplets pinch off mechanism and the observed contact angle- contact line speed law on superhydrophobic surfaces. We will use a sessile drop setup mounted on an inverted microscope with high-speed camera imaging to measure the velocity threshold from which pinch off droplet is observed as well as the evolution of the size of pinch off droplets with contact line speeds. We will also explore the effect of surface pattern (varying the size of pillars and their disposition on the surface).

[1] Nosonovsky and B. Bhushan, Current Opinion in Colloid & Interface Science 14, (2009).
[2] Betti *et al.*, http://arxiv.org/abs/2408.04992, 2024.

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