INTERNSHIP PROPOSAL

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Quantify friction forces in forced wetting on polymer layers

Due to their potential applications, wetting of polymer layers has recently received renewed attention. These grafted or absorbed polymer layers are nano-coated **adaptive substrates**: they modify their physicochemical properties (e.g. wettability, topography) during the spreading of a liquid, leading to a **coupling between the hydrodynamics of liquid wetting and the substrate dynamics**. The **mechanisms of energy dissipation** at the contact line on these adaptive surfaces are still largely unknown. This project proposes to directly measure the friction forces involved at the contact line in order to better understand the mechanisms at play during adaptive wetting.

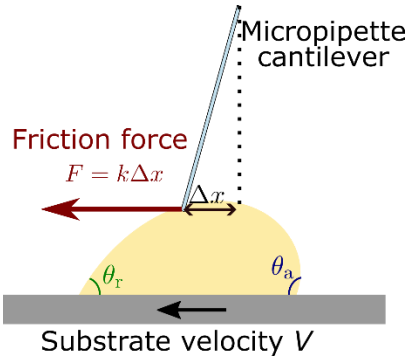

Figure 1: Illustration of the droplet tribometer. The friction force *F* will be measured for different substrate velocity on polymer layers.

In this internship, the student will build a **droplet tribometer**[1,2] to measure this friction force F down to tens of nN (Fig. 1). The force is directly obtained through optical detection of the deflection (Δx) of a micropipette cantilever. The substrate velocity will be controlled by a motorized stage, allowing to probe a wide range of velocity V. This setup was proven robust on atomically flat surfaces but remains to be systematically used on polymer layers. If time allows, this setup could be mounted on an inverted microscope: this will allow monitoring with a good precision the advancing θ_a and receding θ_r contact angles and thus linking the measurement of friction to the hysteresis of the contact angle.

References: **(1)** Gao, N.; Geyer, F.; Pilat, D. W.; Wooh, S.; Vollmer, D.; Butt, H.-J.; Berger, R. How Drops Start Sliding over Solid Surfaces. Nat. Phys. 2018, 14 (2), 191–196. https://doi.org/10.1038/nphys4305.
(2) Khattak, H. K.; Karpitschka, S.; Snoeijer, J. H.; Dalnoki-Veress, K. Direct Force Measurement of Microscopic Droplets Pulled along Soft Surfaces. Nat. Commun. 2022, 13 (1), 4436. https://doi.org/10.1038/s41467-022-31910-.