Wetting on deformable coatings: experiments and modelling.

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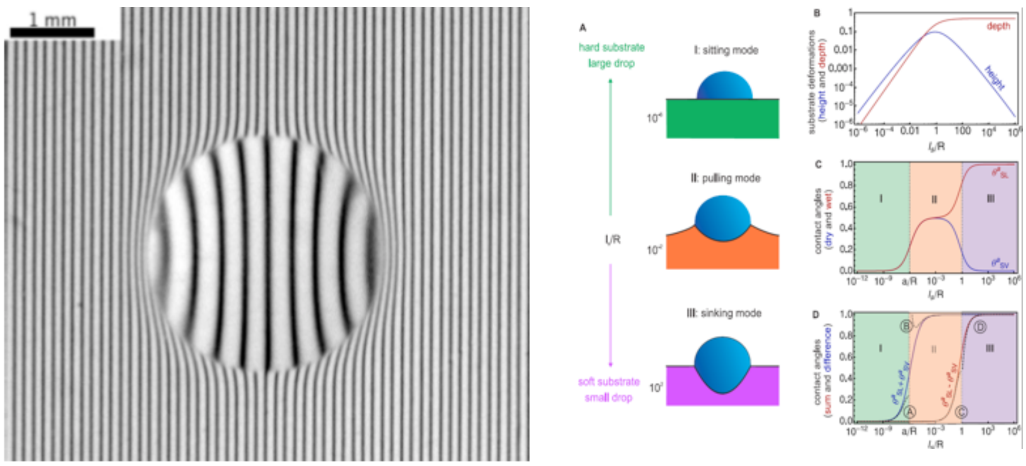

Fig. 1- On the left, a drop of liquid deposited on a soft, transparent gel, whose distortions are revealed by a grid placed just below. On the right, the three major possible distortions that we have calculated analytically for a 2D drop on a elastic basis having a non-zero uniform surface tension, or even two different surface tensions for the dry and wetted part of the substrate.

Wetting properties of liquids on soft solids such as polymer gels are dependent of the mechanical properties of these substrates. In particular, the static or quasi-static properties (shape, contact angle hysteresis) of the contact line, the profile of the substrate surface and their dependence on the mechanics of the substrate are still open questions [1,2]. We have investigated the statics of the contact line of a liquid droplet deposited on poly(dimethyl siloxane). These substrates can be considered elastic, as the ratio of their loss modulus to their storage modulus is smaller than 10, and commonly less than 100. The storage modulus of these gels can be varied over three orders of magnitude, from a few kPa to a few MPa. The viscoelastic properties of these model substrates can be tuned by adding non-reactive silicone oil after crosslinking. We have studied the relation between viscoelastic properties and the statics of the contact line, by characterizing the hysteresis of the contact angle, and the height and shape of the ridge that forms around the droplet. In parallel to this work, we have developed models of elastowetting, based on the use of an adequate Green function, taking into account the surface tension of the substrate [2,3], that can be uniform or two-valued. This method allowed us to calculate analytically the quantities explored experimentally, at least in the simple situation of a surface energy equal to the surface stresses, which is expected to be a reasonable approximation for incompressible media.

References

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