Elastocapillary effects in transient networks

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Abstract

Soft materials, due to their lower elasticity, unfold new physical phenomena at short length scales when their surface elasticity becomes comparable to their bulk elastic ones, giving rise to elasto-capillary effects.

In this work, a study of these elasto-capillary effects on the dynamic of mechanical deformations is conducted by impacting droplets on a repulsive surface, allowing one to reduce shear dissipation during the droplet expansion. The investigated systems are Maxwell fluids of low elastic moduli and various relaxation times giving access to a large range of Deborah numbers with respect to the time of the experiment. Interestingly enough, this particular situation was never examined before and allows one to approach the transition between a regime dominated by the bulk elasticity and a regime at which the surface tension prevails.

We measure the maximal expansion of the droplets and evidence, for sample with a characteristic time comparable to the experimental time, an enhanced expansion as compared to solid and liquid samples and to transient networks with much shorter or much longer characteristic time, thus highlighting the role of viscoelasticity in elasto-capillarity.

Keywords : Elasto-capillarity, visco-elasticity, drop impact, Inverse Leidenfrost