WALL SLIP OF COMPLEX FLUIDS

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IN COOPERATION WITH : iLM

LEVEL : M2
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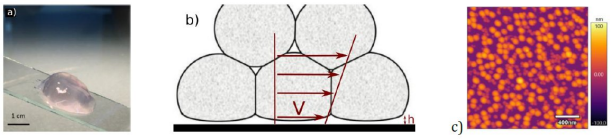
KEYWORD(S) :

SCIENTIFIC CONTEXT :



Complex fluids such as foams, emulsions, polymer gels (fig.a) are ubiquitous and exhibit properties intermediate between solids and liquids. At low stresses they respond like elastic solids and at high stresses they flow like fluids. These complex fluids also exhibit slip when flowing along smooth walls [1, 2]. Understanding this phenomenon of wall slip and its microscopic origin is an important fundamental and practical (wetting, microfluidics, soil remediation, etc.) issue. During this internship, we propose to study the **slip of a model complex fluid made of polymer microgels, along walls of various roughness**.

At microscopic scales, wall slip is due to the existence of a **lubrication layer** located between the solid wall and the complex fluid, for which we recently found a ~100 nm thickness [3]. Is it possible to disturb this liquid layer (and wall slip) by changing the roughness of the solid wall? What is the minimum wall roughness that would reduce or even suppress the slippage phenomenon?

MISSIONS :

To answer these questions and quantify wall slip, we will use µPIV (particle image velocimetry) to measure flows of complex fluids (polymer microgels) in glass capillaries. We will vary the roughness scale from 10 to 500 nm, by sintering colloids [3] and characterize it with **atomic force microscopy** (AFM, fig. c). The measured roughness will be compared to other relevant length scales like microgel radius (~µm).

We are looking for a candidate with a taste for experiments.

OUTLOOKS :

Possible PhD continuation (Ecole doctorale): interfacial effects in complex fluids (slip, wetting)

BIBLIOGRAPHY :

1] Péméja, et al., Physical Review Fluids 4.3 (2019): 033301.

[2] Bonn et al., Reviews of Modern Physics 89.3 (2017): 035005.

[3] M. Gunny et al., « Near-surface colloidal dynamics in jammed and slipping microgel suspensions », 2026, arXiv: arXiv:2609.03540. doi: 10.48550/arXiv.2609.03540.

[3] R. Lhermerout, « Mouillage de surfaces désordonnées à l'échelle nanométrique », (thèse de doctorat, 2016, Paris)

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