Role of solid asperities on dry foam flows

This internship offer is part of the ANR grant *AsperFoam.* This ANR includes an open PhD position for 3 years that will start in October 2020 at Laboratoire de Physique des Solides in Orsay.

Liquid foams are complex networks of packed bubbles. This material is largely composed of gas added to a small amount of water, surfactant molecules and eventually additives to stabilize them. The combination of these two phases generates unique properties: they are lightweight, they can be flown in a pipe, they are excellent sound and heat insulators. These properties are used in many applications such as for surface cleaning, body and hair washing, food engineering, fire fighting, production of various solid cellular materials.

The rheology of aqueous foams has been the subject of several reviews (e.g. [1]) and the flow description is still largely debated. When performing foam rheology, a particular caution must be taken for the boundary conditions at the material/solid interface where a slippage behavior has been revealed by Khan *et al.* [2].

In the *AsperFoam* project, we aim to provide a better description of the foam flow with respect to the physical properties of the solid interface. In particular, we will elucidate (i) the effect of the foam confinement in the flow properties, (ii) the precise role of the shape, size, spacing and organization of the asperities, (iii) the effect of the foam polydispersity. The applicant will develop knowledge in rheology, tribology, soft condensed matter physics and fluid mechanics, with experimental skills and scaling law analysis.

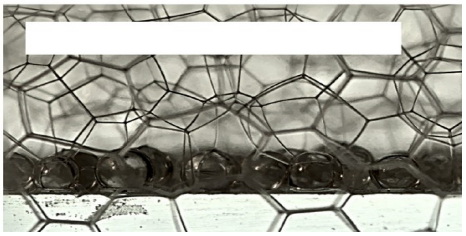

Figure 1: Dry liquid foam around a rough glass slide (scale bar: 5 mm)

The intership will focus on the first aspect (i) for which we will perform force measurements and direct visualizations of foam flows with variable confinements. This understanding will be crucial to rationalize the effect of the geometries used in rheological measurements on the flow properties.

The internship will take place at Laboratoire de Physique des Solides in Orsay, in the group Matière Molle aux Interfaces (MMOI https://www.equipes.lps.u-psud.fr/mmoi) composed of 5 permanent researchers, 2 emeritus, 1 engineer, 2 postdocs and 8 PhD students. The intern will be directly supervised by M. Marchand (PhD student) and F. Boulogne (CNRS researcher). The collaboration involves F. Restagno, E. Rio and R. Weil from the laboratory.

We are looking for an enthusiastic candidate in Master 2 motivated for pursuing a PhD in experimental physics, with a background in Soft Matter Physics and Fluid Mechanics. Applicants should apply via e-mail with a CV, a motivation letter (half-page) and addresses of at least two references.

Contact: François Boulogne francois.boulogne@u-psud.fr

[1] Cohen-Addad, S.; Höhler, R.; Pitois, O., Flow in Foams and Flowing Foams, Annu Rev Fluid Mech, 2013
[2] Khan, S. A.; Schnepper, C. A. & Armstrong, R. C. Foam Rheology: III. Measurement of Shear Flow Properties Journal of Rheology, 1988