INTERNSHIP PROPOSAL

Laboratory name: Institut des NanoSciences de Paris
CNRS identification code: UMR 7588
Internship director'surname: Sylvie Cohen-Addad & Olivier Pitois
e-mail: sylvie.cohen-addad@insp.upmc.fr Phone number: 01 44 27 94 69
Web page:https://w3.insp.upmc.fr/recherche-2/equipes-de-recherche/mecanique-multi-echelles-des-solides-faibles/
Internship location: Institut des NanoSciences de Paris, Sorbonne Université, 4 place Jussieu

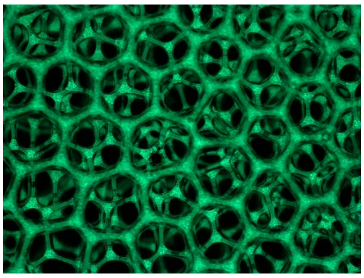
Thesis possibility after internship: YES
Funding: YES If YES: French Space Agency (CNES)

Coarsening of foam made from particle loaded fluids

Keywords: Experiments, Soft condensed matter physics, Complex fluids, Fluid mechanics

Foams provide a promising route towards smart sustainable applications in a variety of domains (innovative construction, soil remediation, tissue engineering, smart filters, …). However, controlling the morphology and the functional properties of foamed materials constitutes a difficult task. This is due to the intrinsic aging processes at play in liquid foams before the hardening step [1], among which coarsening or Ostwald ripening remain challenging to be counteracted. Actually, strong scientific questions remain about coarsening, especially in the case of liquid foams made with complex fluids, such as particle suspensions, concentrated emulsions or colloidal pastes. Here we propose to study coarsening dynamics of aqueous foams made from particle loaded fluids. The objective is to identify the control parameters driving the coarsening, and to elaborate a scaling model predicting coarsening arrest.

Image of a complex foams made from a particle suspension. Average bubble size : 500 µm



The experimental study will be based on the foaming of a particle loaded fluids thanks to micro- or milli-fluidic devices using technics already tested in our labs (see image on the left). Coarsening will be investigated using probes and methods such as: videomicroscopy of the sample surface, diffuse-transmission spectroscopy (DTS) to measure bubble size, and diffusing-wave spectroscopy to measure the dynamics of bubbles rearrangements in the bulk. This study will benefit from results of coarsening experiments currently performed on-board the International Space Station [2, 3], where parasitic gravity effects are totally suppressed. The results will be interpreted in order to identify the conditions for which coarsening is efficiently counteracted by the particles confined between the gas bubbles, in terms of particle concentration, particle shape, particle/bubble size ratio, and rheology of the carrier fluid.

[1] "Foam: Structure and Dynamics", Cantat, Cohen-Addad, Pitois, *et al*, Oxford University Press (2013)
[2] Pasquet, Cohen-Addad, Pitois, *et al*, Soft Matter (2023) 19, 6267-6279
[3] Galvani, Cohen-Addad, Pitois, *et al*, Proc. Natl. Acad. Sci. U.S.A. (2023) 120, e2306551120

Learning outcomes: Scientific and lab work management. Foam Physics. Modelling. Light scattering spectroscopy techniques. Data and image analysis tools.