M2 Internship/PhD 2024 advertisement

Coarsening of foam made from particle loaded fluids

Discipline: **Condensed Matter Physics**

Funding: **European Space Agency (ESA) / French Space Agency (CNES)**

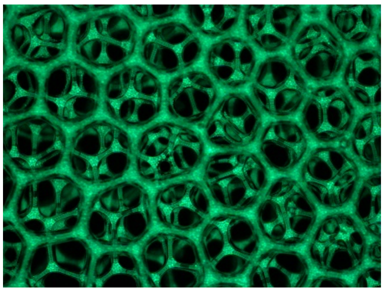
Supervisors and Host laboratories: Pr. Sylvie Cohen-Addad, **Institut des NanoSciences de Paris** (Sorbonne Université) & Dr. Olivier Pitois, **Laboratoire Navier** (Université Gustave Eiffel)

Internship location: Institut des NanoSciences de Paris, Sorbonne Université, 4 place Jussieu, 75005 Paris

Keywords: Experiments, Complex fluids, Fluid mechanics, Microfluidic

Description: 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[1] before the hardening step, among which coarsening remains challenging to be counteracted. This effect is detrimental to the production of well controlled foamed materials. 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 properties of aqueous foams made from particle loaded fluids. The ultimate objective is to counteract coarsening.

[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.



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.

Candidate profile: Background in condensed matter physics, or material science (physics/chemistry) or fluid mechanics. A taste in experimental work is expected.

Skills acquisition: Scientific and lab work management. Physics of liquid foam. Modelling. Light scattering spectroscopy methods. Data and image analysis tools.

Feel free to contact us by email: sylvie.cohen-addad@insp.upmc.fr, olivier.pitois@univ-eiffel.fr
Visit: https://navier-lab.fr/la-recherche/rheophysique-et-milieux-poreux/
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