PROBING SOAPY INTERFACE AT THE NANOSCALE WITH NON-LINEAR OPTICS

LABORATORY : Institut Lumière Matière

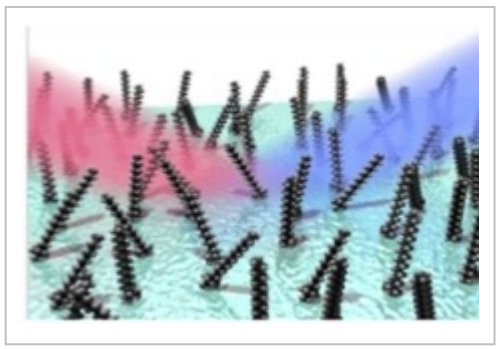
LEVEL : M1 / M2
TEAM(S) : LIQ@INT

CONTACT(S) : BENICHOU Emmanuel
BONHOMME Oriane

CONTACT(S) DETAILS: emmanuel.benichou[at]univ-lyon1.fr /
oriane.bonhomme[at]univ-lyon1.fr / Tel. 0472448412

KEYWORD(S) :

SCIENTIFIC CONTEXT :



The physical and chemical properties of fluid interfaces decorated by surface-active species such as surfactants, proteins, or particles, play a key role in food engineering, cosmetics, sustainable material design as well as in biomedical applications. Tuning the molecular nature or the concentration of surfactants can modify drastically foam or bubbly flow properties: bubble velocity, coalescence, foam rheology or stability... Thermodynamics and mechanics of surfactant-covered surfaces are generally probed at macroscopic or mesoscopic scales but are assumed to depend on the microscopic structure of the interface: chemical composition, molecular organization of the first two molecular layers. However, quantitative, and dynamic characterizations of these interfaces at the molecular level are limited, as is their impact on the interfacial thermodynamics and mechanics. It is essential to fill this gap and establish an explicit link between the molecular organization of liquid surfaces covered with surfactants, their thermodynamic properties, and their mechanical response. These questions constitute the overall objective of the ANR MS-DOS project (funding 2026-2030).

MISSIONS :

In this context, the Second Harmonic Generation (SHG) technique will be applied to probe surfactant-covered surfaces at the molecular level. This method, among 2nd order non-linear optics, is inherently surface sensitive as it is based on a photon conversion forbidden in centrosymmetric materials. It is thus a tool of choice to catch signals generated at interfaces where the centrosymmetry is intrinsically broken. The SHG intensity depends on the number of molecules adsorbed at the interface, of their orientational distribution and of the electrostatic environment nearby.

In this internship, we plan to probe the surfactant organization and dynamics at interface on soapy interfaces. The intern will use an existing SHG setup and will participate to the development of a phase-sensitive SHG setup to determine the phase of the susceptibility tensor, which will enable the electrical potential to be determined.

OUTLOOKS :

This internship may potentially lead to a PhD opportunity within the ANR-funded MS-DOS project

published on 24/09/2025