SCIENCES SORBONNE UNIVERSITÉ

Master thesis proposal

Campus Pierre et Marie Curie
Tower 23 – 3rd floor – 23-22
Director: Massimiliano Marangolo

Title: **Influence of the perfluorinated block length on the self-assembling properties of semifluorinated alkanes at the water surface.**

Keywords:
Langmuir monolayer, 2D structure

Scientific description:

Semi-fluorinated alkanes ($C_nF_{2n+1}C_mH_{2m+1}$, FnHm), which exhibit a lipophobic and hydrophobic character, are able to form stable monolayers on the water surface (Langmuir monolayers), although they are completely hydrophobic. We demonstrated by GISAXS experiments on synchrotron source that these molecules form at non-zero surface pressure an hexagonal network of nanodomains (hemimicelles) with a large parameter (>30 nm), structure that we recover by AFM on solid substrate (figure). We also observed that the hemimicelles <<<size varies with the hydrogenated block length (m value). Using molecular dynamics simulations, we developed a model for the molecular arrangement inside the hemimicelles that explains such a variation (figure). The next step is studying the influence of the perfluorinated block length (n value).
FnHm molecules for (n=10, m=14, 16, 18, 20) and (n=12, m= 16, 20) have been synthetized. The proposed research aim is determining the thermodynamic and structural properties of the Langmuir monolayers formed by these molecules by surface pressure versus surface density isotherms, Brewster Angle and AFM microscopies (after transferring the film on solid substrate for AFM). The lattice parameters should be determined by GISAXS experiments scheduled on synchrotron sources (ESRF in February 2024). A measurement on the SOLEIL synchrotron source will be also done if the beam time is allocated and scheduled in the corresponding period.

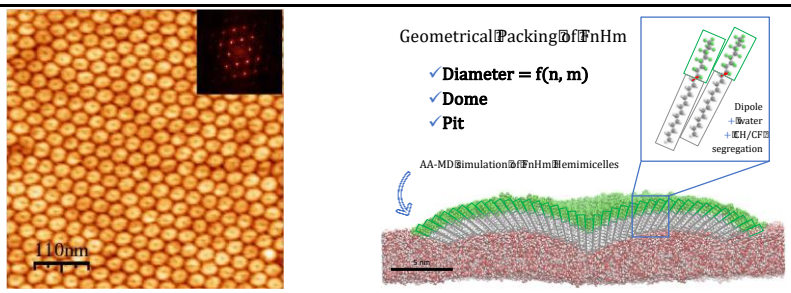

Figure:left: AFM image of a F8H18 monolayer on a silicon wafer. right: Scheme depicting the geometrical packing of the FnHm molecules within the hemimicelles, obtained from molecular dynamics simulations.

Techniques/methods in use: Surface Pressure/surface density Isotherm, Brewster Angle Microscopy, AFM, Liquid surface GIXD and GISAXS (on synchrotron source)

Applicant skills: experimental activities

Industrial partnership: N (specify the company)

Internship supervisor(s) (name, email, phone, webmail): **Michel Goldmann & Marie-Claude Fauré, Michel.Goldmann@insp.jussieu.fr, 01 44 27 45 20**

Internship location: **22-12 3ème étage Sorbonne Université– 4 place Jussieu 75005 Paris**

Possibility for a Doctoral thesis: Yes if an allocation from the ED397 is obtained