ESRF	**Experiment title:** Domain size determination on Langmuir monolayers: perfluorinated and hydrogenated amphiphiles mixtures	**Experiment number:** SC752
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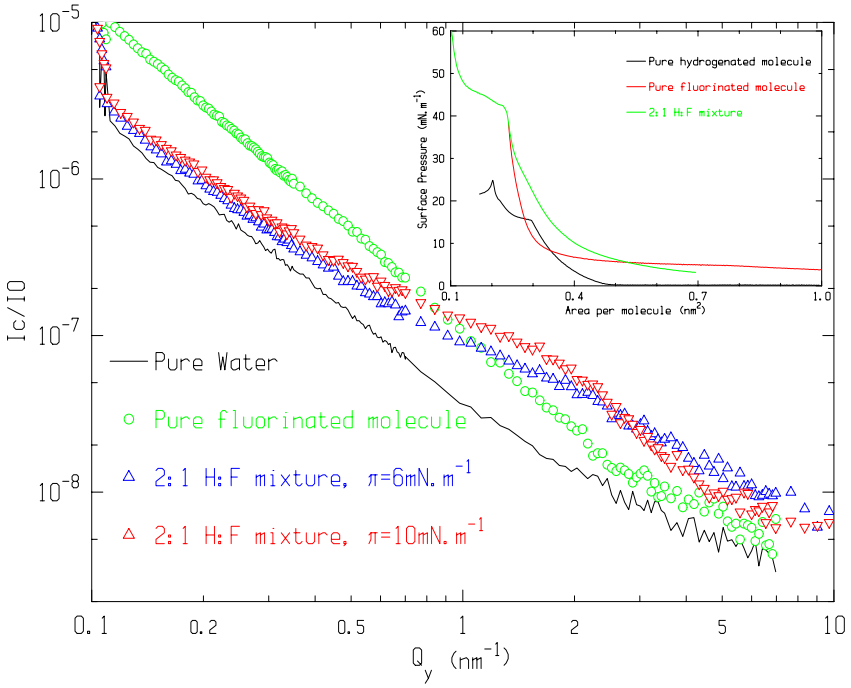
Report:

Langmuir Films are made of insoluble amphiphilic molecules spread as a monolayer at the air-water interface. Mixtures of hydrogenated and fluorinated chains are good candidates as a model system for the study of segregation at 2D and have many applications[1]. In the case of mixture of myristic acid (hydrogenated chain, C_{16}) and perfluorododecanoic acid (hydrogenated chain, C_{12}), Surface Pressure vs. Area per molecule isotherms ($\pi - A$) and Grazing Incidence x-ray Diffraction (GIXD) measurements suggest a segregation of the system in pure, small domains of fluorinated molecules[2]. Due to their reduced size the domains cannot be seen by optical microscopy. To confirm the presence of small domains, we have performed Grazing Incidence Small Angle x-ray Scattering (GISAXS) at the air/water interface on Langmuir monolayers on different mixtures of these fluorinated and hydrogenated fatty acids on the ID10-B beamline.
In a first geometry, where a zero-Dimension detector is moved vertically in the plane of incidence, we have measured diffuse off-scattering reflectivity spectra (q_x–scans) in order to obtain informations about the vertical properties of the electronic density of the monolayer, valuable in the detailed analysis of GISAXS scans.
In a second geometry, where a vertically mounted Position Sensitive Detector (PSD) with a two vertical slits ($300 \times 500 \mu m^2$ collimator) is moved in the horizontal plane of the monolayer (q_y–scans), we have measured the GISAXS spectra of the mixtures of fluorinated and hydrogenated molecules.
This GISAXS signal reveals all the fluctuations of the electron density of the layers at the interface.

Actually, the scattering cross section is a function of the auto-correlation function of the electron density [3].



In figure 1, are plotted the GISAXS spectra (Intensity integrated over the PSD vs. Qy) of the 2:1 mixture ($\pi - A$ isotherms are inset). For the pure case, the scattered intensity decreases as q^{-2}. This behaviour has already be measured and is described as the diffuse scattering by the height fluctuations of the interfaces due to capillary waves[4]. For the 2:1 mixture, the curves exhibits a rather different evolution with the wave vector trannsfer q_y. A broad peak located at $Q_y = 2nm^{-1}$ is superposed to the sloping q^{-2} background. This suggest that in-plane fluctuations exist in this system in addition to the capilary waves. In a rough analysis, this scattered signal may be attributed to presence of the fluorinated domains within the monolayer suggested by the GIXD results. Actually, such domains leads to an in-plane fluctuating electron density due to the large difference between number of electrons in fluorinated and hydrogenated chains. This effectively results in off-specular scattering as described by Daillant & al[3,4].
Compression of the monolayer between 6 to $10mN \cdot m^{-1}$ results in changes of the GISAXS signal probing the fact that the domain's distribution is changing with compression.
More detailed analysis and measurement are needed to extract quantitative information this segregated system. Such work is in progress.

References

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[4] C. Fradin, PhD thesis, Université Paris VI, 1999.