ESRF experimental	Experiment title: Surface crystallisation of short alcohols (1-octanol and l-nonanol) ❑ onolayer at the air-water interface.		Experiment number: SC-179
	Beamline(s) used: BL9 Troïka (ID1O)	Date and time of experiment: from: 22-02-1996 to: 28-02-1996	Local contact(s): G. Grübel

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Report

In this experiment we have investigated the crystallisation of two short alcohol chains at the air-water interface, namely 1 -nonanol and 1 -octanol. The aim of this study is to caracterise their **2D** structure and particularly the nature of the melting transition (weakly first order or second order).

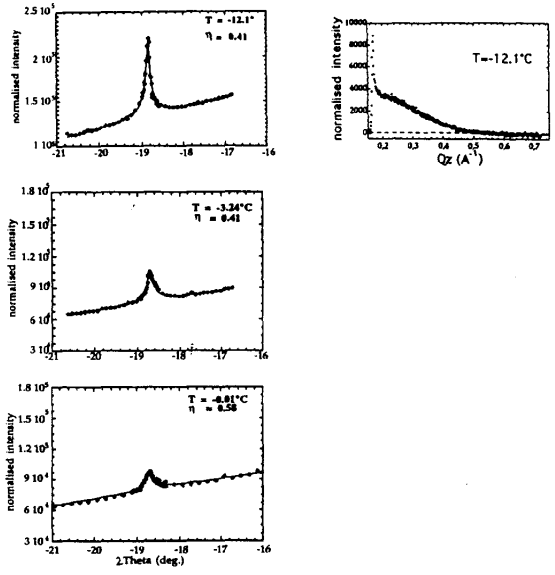
We have shown in a precedent experiment on decanol [exp. n" SC51 on Troïka April 95] that a high resolution set-up brings important information about the shape of the peak [Zakri C.et al., Phys. Rev. B, submitted in **June** 96]. But the first measurement realised on April 95 on a nonanol monolayer has shown that we loose too much flux with this set-up. Indeed, the intensity of the Bragg peak decreases very fastly with the chain length (<10 carbons) because the monolayer is less organised.

As a consequence, we used for this experiment a classical resolution set-up. The incident beam was shaped by the usual diamond monochromator at λ= 1.38& followed by a focusing mirror. The incidence angle on the water surface was 2.0 mrad. The incident beam was sent on the sample inside our specially designed trough having a good thermal stability and homogeneity and a water level regulation to better than 10 µm. We analyse the diffracted intensity with a Soiler slits collimator (resolution 10^{-2}Å^{-1}) and a PSD.

On nonanol monolayer, we realised a systematic study of the diffracted peak versus temperature between -12,1 "C and 3.6°C where the melting occurred. Note that it was necessary to work on salted subphase (LiCl, 10%). At each temperature, we recorded the intensity both in the plane(Q) and along the vertical axis (Qz). To analyse the experimental shape, we used a fitting procedure based on the 2D reeking theory [Dutta P. and Sinha S. K., Phys. Rev. Lett., 47, 1981, p.50].

Figure 1 shows the experimental results for <10> reflection of the hexagonal lattice at three different temperatures; especially for T=- 12.1 'C, we show a record of the intensity along Qz. The continuous line is the fit.

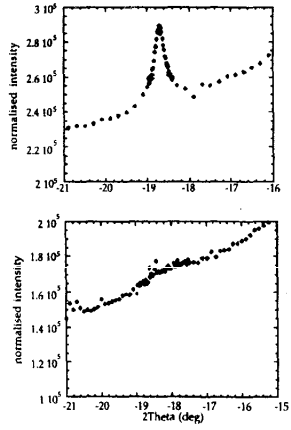
Figure 1



For all temperatures, we observe a single peak of an hexagonal lattice and the rodscan confirms a vertical orientation of the chains. Till now, the analysis has not been completely performed. Nevertheless, the first results obtained from the fit allow us to compare the behaviour of the nonanol monolayer to that of the decanol one. For the nonanol, we see a broadening of the Bragg peak at 4 degrees before melting whereas, for decanol, this broadening occurs at about 2 degrees before. This means a more continuous melting transition for nonanol monolayer.

Concerning the octanol monolayer, we performed a similar study, but with less measurements. We had a lot of problems due to the low temperature (from -28.9 to -16.9°C) and also due to the crystallisation of the drop (

Figure 2



The principal result seems to be the continuous decrease of intensity of the peak with an important broadening up to melting. This result is in good agreement with the thermodynamic calculations [Berge and al., Phys. Rev. Lett., 73, 1994, p. 1652] which predict a continuous transition for octanol monolayer.