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Report:

We have used ID2 to investigate the phase transition between a lamellar phase and a nematic phase in a ternary lyotropic liquid crystal : DMPC (the lipid) C12E5 (non-ionic surfactant) and WATER the solvent. Previous experiments using small angle neutron scattering suggested that the transition is induced by defects which are at the origin of the lost of the long range order in the lamellar phase.

The aim of this experiment was :
- 1st to study the Bragg peak profile when we are close to the transition in order to characterise the ETA parameter which is related to the product of elastic constants B and K of the lamellar phase
- 2nd to study the scattering at smaller angles which characterise the form factor of these defects.

Actually by using SANS experiment only the geometry where the qz vector is perpendicular to the beam direction could be investigated and a good orientation of the lamellar phase could not been assume between quartz layers with 300 micron spacing.

For our proposal we succeed to orient the lamellar phase in flat quartz

of 100 micron thickness (thermal treatment and verification of the planar orientation under microscope - crossed polarised light). By collimating the beam horizontally to less than 100 micron we succeed to send the beam in the 100 micron gap of the capillary. The observed Bragg was so strong in this geometry (very good orientation of the lamellar phase inside the capillary and of the capillary itself in the beam) and the collimation of the anti-scattering slits was so well settled that the scattering from the capillary walls did not interfered with the tails of the Bragg peak. Moreover by setting the 2-D gas-filled detector at 10 m (and shifting it horizontally) we had a very good spatial resolution (Dq/q = 5.10-4) to analyse the profile of the peak (comparable with the Bonse & Hart optics but in 2-D And with less radiation damage - need less flux at the sample position).

The planar orientation was also investigate and the optimising the flux and the exposure time (around 1 hour by shoot) and the scan on different part of the sample we succeed to observe an isotropic ring (1000 times less intense than the Bragg peak) and which characterise a correlation length between defects in the lipid-surfactant membranes.

We have lost some time (3 shifts) in order to optimise the scattering geometry, but also due to electron beam lost (about 6 hours) and due to some problem of the temperature control (l shifts) of the experimental cell (which is crucial in our case in order to approach as close as possible the Tc). So only two samples have been investigated (2 shifts / sample - temperature scan need to be very slow in order to avoid thermal induced undulations and deorientation).