EUROPEAN SYNCHROTRON RADIATION FACILITY

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ESRF

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office using the **Electronic Report Submission Application:**

http://193.49.43.2:8080/smis/servlet/UserUtils?start

Reports supporting requests for additional beam time

Reports can now be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

?? fill in a separate form for each project or series of measurements.

?? type your report, in English.

?? include the reference number of the proposal to which the report refers.

?? make sure that the text, tables and figures fit into the space available.

?? if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** Small Angle Scattering from Clay-Nematic Composites	**Experiment number**: SC-1278
Beamline: BM02	**Date of experiment**: from: 26/11/2003 to: 30/11/2003	**Date of report**:
Shifts: 9	**Local contact(s)**: Dr Erik Geissler	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Report:

It is possible to create stable liquid crystal colloidal suspensions using anisometric particles such as clay platelets. It is, however, difficult to predict which systems will result in stable suspensions as the affinity of the host solvent for the particle must be carefully optimised.

Claytone AF, a commercial quaternary ammonium surfactant treated montmorillonite with an aspect ratio of up to 1:2000, has been shown to self-organise into stacks in suspension with a characteristic spacing that depends on the solvent, but surprisingly does not change with concentration or temperature, i.e. the nematic or isotropic phase of the liquid crystal. For example, the spacing in 5CB is on average 37Å whereas the same particle suspended in MBBA results in a spacing of 48Å.

In order to determine which factors govern this spacing we suspended Claytone AF in two liquid crystalline solvents, 4-pentyl-4'-cyanobiphenyl (5CB) and n-4'-methoxybenzylidene-n-butylaniline (MBBA) and 10 other organic solvents with a range of molecular sizes, dielectric constants and refractive indices. We determined the spacing between suspended Claytone plates by small angle X-ray scattering (SAXS) measurements performed at the European Synchrotron Radiation Facility at beam line BMO2.

The measurements with samples in Lindemann capillaries were successful and the different spacings recorded can be seen in figure 1.

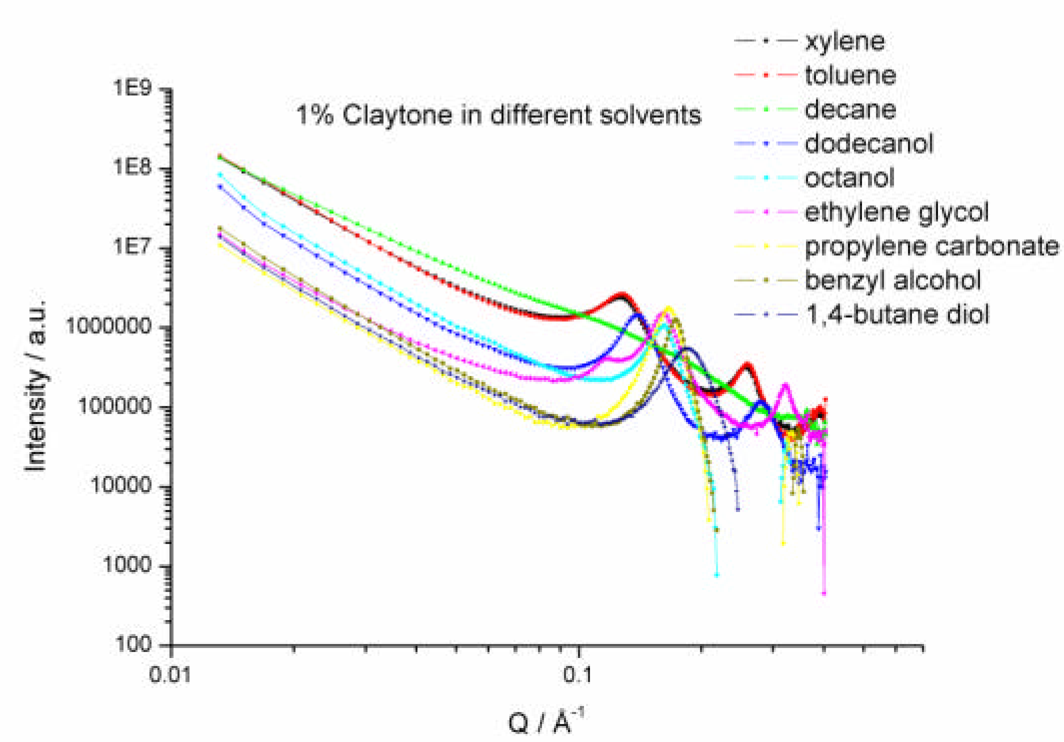

Figure 1. Scattering data from 1% Claytone suspensions in different organic solvents.

This data allows us to explore the mechanism governing the self-organisation occurring within the suspensions. Surprisingly, the long chain alcohol suspensions used showed an alignment effect in the magnetic field similar to that observed in the liquid crystalline samples. The detector images for these measurements are shown in figure 2.

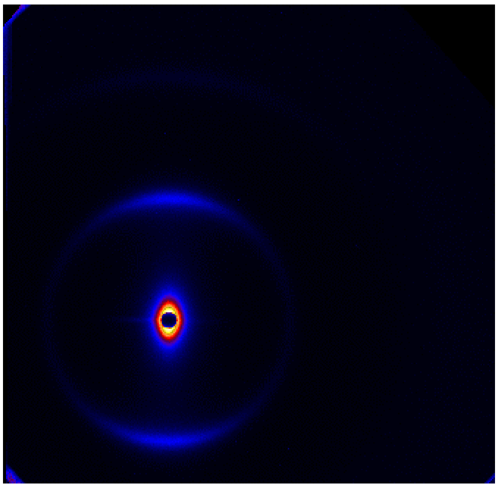
Figure 2. Detector image for 1% Claytone in dodecanol aligned in a 1T magnet field.

Unfortunately we were not as successful with the experiments involving confined geometries. The samples were contained in cells made from surface treated microscope cover slips spaced with 10 and 100 ?m spacer beads. The glass was so flexible that the cells actually bowed inwards and the two substrates were so close in the centre of the cell that the quantity of sample in this region was not sufficient to generate a scattering signal. In addition to the 200 samples prepared with microscope slides, we also examined 4 real display cells, i.e. switchable by an electric field, prepared from ITO glass of 1mm thickness. It was possible to use these rigid cells with the high energy X-rays available at beam line BM02 (18keV), however the sample thickness (10?m) was so weakly scattering before detector overflow occurred that very little signal was recorded. As a result, we have designed a new type of cell with a varying thickness across the cell.