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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:**<br>Composition effects on a novel 3-D hexagonal lyotropic lipid phase and its phase transitions | **Experiment number**:<br>SC-2800 |
| **Beamline**:<br>ID02 | **Date of experiment**:<br>from: 6/11/2009 to: 9/11/2009 | **Date of report**:<br>27/8/2010 |
| **Shifts:**<br>9 | **Local contact(s)**:<br>Michael Sztucki | *Received at ESRF:* |

**Names and affiliations of applicants** (* indicates experimentalists):

*Imperial College London, UK*
John Seddon *
Robert Law
Nicholas Brooks *
Oscar Ces *
Richard Templer

*Technical University Dortmund, Germany*
Roland Winter

During our previous work at beamline ID02 we discovered a novel inverse micellar liquid crystaline phase with $P6_3/mmc$ symetry[1], this was the first new lyotropic phases to be discovered in two decades. We discovered this structure in a mixed lipid system consisting of 1:2:1 DOPC : DOG : CHOL in excess water. The work undertaken in experiment SC-2800 has focused on further studying this novel structure, particularly with respect to what factors favour the formation of the $P6_3/mmc$ phase over the previously known Fd3m inverse micellar cubic phase. We have characterised the pressure-temperature phase behaviour of several systems with different ratios of DOPC, DOG and CHOL, and also a wide range of mixtures using different diacyl-PC:diacyl-glycerol: cholesterol mixtures incorporating SOPC, DSPC, SOG and DSG.

The role of cholesterol in tuning the formation of this novel phase is particularly interesting. We have extensively studied the effect of changing cholesterol concentration in these systems and have seen that cholesterol is crucial in the formation and stabilisation of the $P6_3/mmc$ phase (Figure 1 left). The addition of as little as 5% cholesterol induces the preferential formation of the $P6_3/mmc$ phase over the Fd3m phase (Figure 1 right), stabilising the $P6_3/mmc$ phase over a large region of phase space.

This work has made a significant contribution to our recent review of micellar lipid phase and will further form the basis of a substantial manuscript currently in preparation for submission to PNAS.

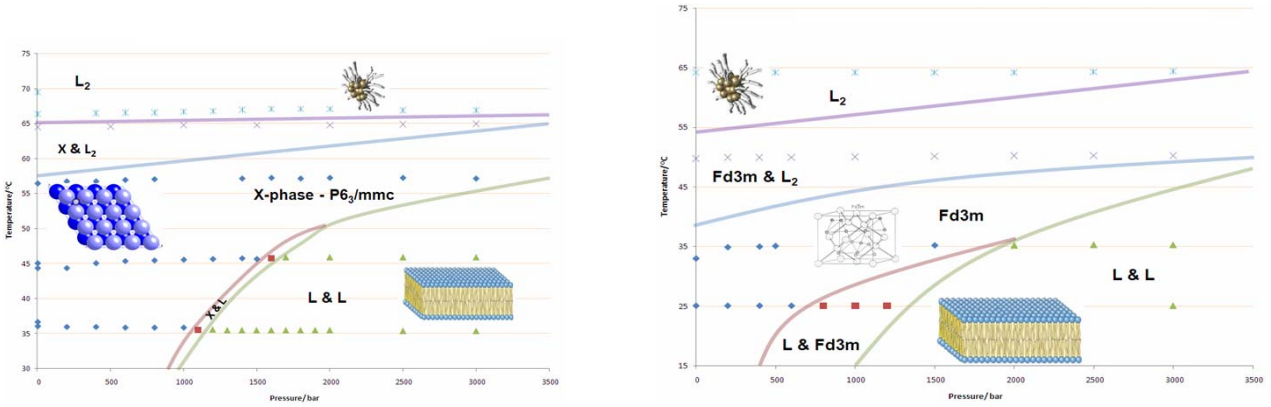


**Figure 1** Pressure-Temperature phase diagrams of, *Left:* 6:12:1 DOPC / DOG / CHOL *Right:* 3:6 DOPC / DOG

## Abbreviations

| | |
|---|---|
| DOPC | dioleoyl-phosphatidylcholine |
| SOPC | stearoyl-oleoyl-phosphatidylcholine |
| DSPC | distearoyl-phosphatidylcholine |
| DOG | dioleoyl-glycerol |
| SOG | stearoyl-oleoyl-glycerol |
| DSG | distearoyl-glycerol |
| CHOL | Cholesterol |

## References

1. "A 3-D hexagonal inverse micellar lyotropic phase" Gemma Shearman, Arwen Tyler, Nicholas Brooks, Richard Templer, Oscar Ces, Rob Law and John Seddon, *Journal of the American Chemical Society*, 2009, **131**, 1678 - 1679
2. "Ordered micellar and inverse micellar lyotropic phases" Gemma Shearman, Arwen Tyler, Nicholas Brooks, Richard Templer, Oscar Ces, Rob Law and John Seddon, *Liquid Crystals*, 2010, **37**, 679 – 694