



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 via the User Portal:

<https://www.esrf.fr/misapps/SMISWebClient/protected/welcome.do>

Reports supporting requests for additional beam time

Reports can 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.



Experiment title:
Mesoscopic order in a homologous series of ionic liquids

Experiment number:
SC-3808

Beamline: ID15B	Date of experiment: from: 2/7/2014 to: 7/7/2014	Date of report: <i>Received at ESRF:</i>
Shifts: 15	Local contact(s): Marco Di Michiel	

Names and affiliations of applicants (* indicates experimentalists):

Moshe Deutsch*, Julia Shulgan*, Diego Pontoni*, Ben Ocko,

Report:

The nanosegregated bulk structure, and its evolution with the cation's alkyl length n , were measured by x-ray scattering for an unprecedentedly broad homologous series of a model room-temperature ionic liquid, $[C_nMIM][NTf_2]$ ($n=4-22$). As observed in (a) in the figure, a tri-periodic local structure is found, with three broad lines, denoted I, II, and III. Of the lateral periodicities corresponding to these lines, d_{II} and d_{III} are independent of n , and a longitudinal one, d_I , linearly increases with n (see inset (b)).

These results are consistent with a local structure comprising alternating layers of polar headgroups and apolar, interdigitated, partly overlapping, cations' alkyl tails. The analysis of these curves by fits to a sum of Teubner-Strey-like lineshapes yields the periodicities d_i and the layering decay lengths ξ_i . It shows a slope decrease in the linear $d_I(n)$ obtained, suggesting a change from a lower to a higher rate of increase with n of chain overlap for $n \geq 12$. The order decay lengths of the layering, and of the lateral chain packing, increase with n , as expected from the increasing van der Waals interaction's domination of the structure. The headgroups' lateral packing decay length decreases with n , due to increasing frustration between the longer lateral periodicity preferred by the headgroups, and the shorter lateral periodicity preferred by the chains.

Due to lack of beamtime only a partial set of temperature dependences of these curves has been measured, for $n=16-22$. The ambient temperature measurements have been fully analyzed and published in *Soft Matter* (doi: 10.1039/c7sm01464c).

