EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

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:** Study of aqueous solution- gas interfaces by GID measurements	**Experiment number**: SI-1019
Beamline:	**Date of experiment**: from: 22-SEPT-04 to: 28-SEPT-04	**Date of report**: 23-AUG-05
Shifts:	**Local contact(s)**: Bernd Struth	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

C. Gutt, M. Paulus*, M. Sprung*, C. Krywka*

Report:

We report an in-situ grazing incidence x-ray diffraction (GID) experiment to study aqueous solution-gas interfaces of the sodium halogenides NaCl, NaBr and NaI.

The out-of-plane diffuse scattered signal yields information about the lateral structure of the investigated samples surface while detector scans performed at low out-of-plane angles give information about vertically conform structures. The scattered signal can be described using the capillary wave model. Using the Disorted Wave Born Approximation (DWBA) for data analysis, the wave vector dependence of the surface energy can be determined. GID scans of solutions (5 molar) and pure water were performed up to a wave vector transfer parallel to the surface $q_{\|}$ of approximately two invers Angstroms. Furthermore, detector scans were recorded at an out-of-plane angle of 0.5°.

In figure 1 the measured data for the salt solutions and pur water are displayed together with theoretical calculations of the scattered signal based on DWBA using both, a constant surface energy (dashed line) and a wave vector dependent surface energy (solit lines) based on the work of Mecke et al PRE 59 (6) 6766 (1999). For a better description of the data, measurements of the bulk structure factors of all liquids were performed. The refinements of these measured structure factors were included in the calculations of the diffuse scattered signal. In figure 2 the wave vector dependent surface tensions which was used in the calculation of the scattered signal is shown. We observe for all liquids a reduction of the surface energy at short length scales which seems to be similar for all liquids. Figure 3 shows the corresponding detector scans performed at an out-of-plane angle of 0.5°. The absence of oscillations in all scans indicates that no formation of conform fluctuating layer takes place at the liquid-gas interface of all samples.

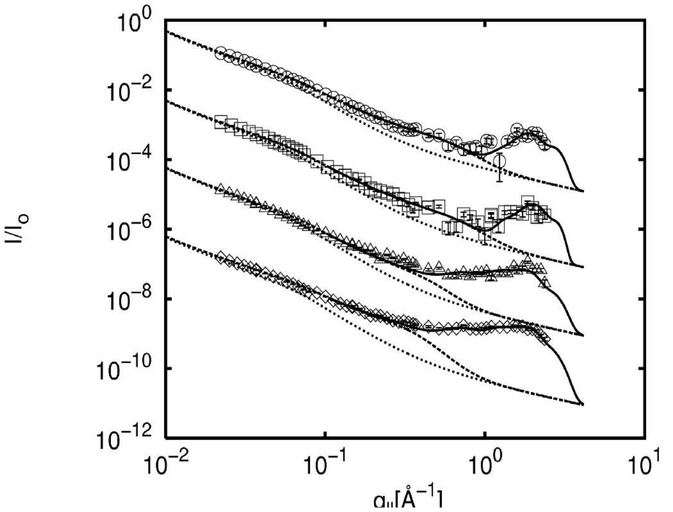

Figure 1: GID scans of water (circles), NaCl (squares) -, NaBr (triangles) - NaI (diamonds) aqueous solution measured at ID10b, ESRF. Solid lines: Fit of the GID scans using a wave vector dependent surface tension and the bulk structure factors measured at BL9 at the electron storage ring DELTA. Dashed line: Fit of the GID scan using a constant surface tension.

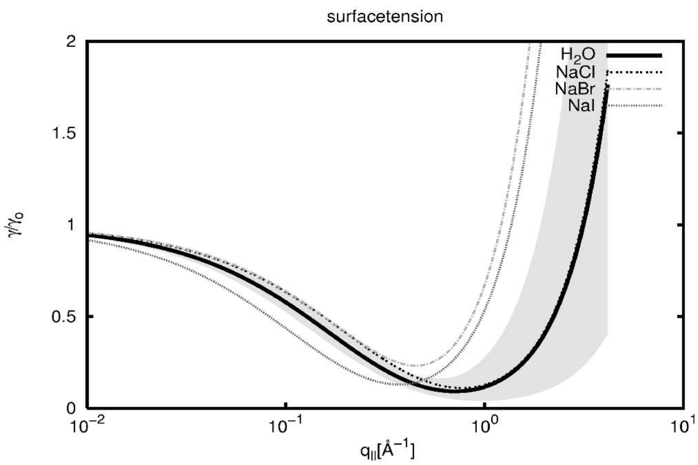

Figure 2: Surface tension γ of water and aqueous solutions normalized to the macroscopic surface tension γ_0. The gray region shows the error channel of the water surface tension.

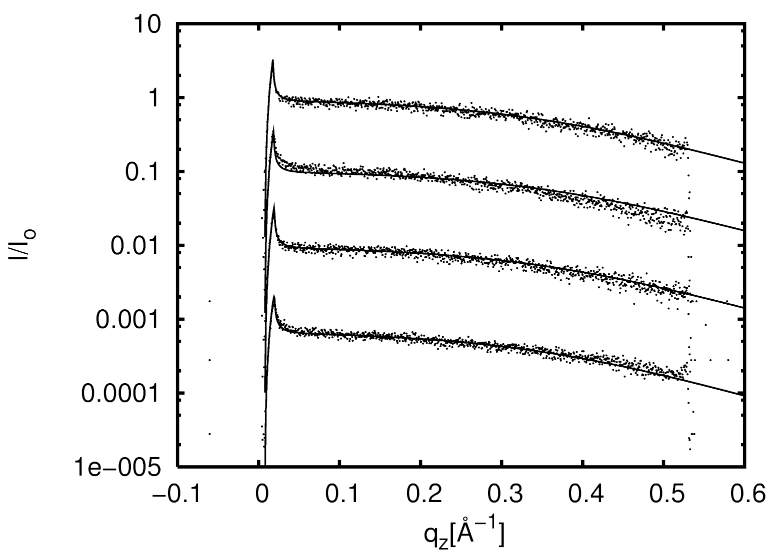

Figure 3: Detector scans of water, NaCl- , NaBr and NaI solution (from top to botton). Solid lines: Refinements of the detector scans.