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:** Diffuse scattering from GP-zones in the Al-Zn-Mg alloy system	**Experiment number**: **01-02- 898**
Beamline: BM01A	**Date of experiment**: from: 17-07-2010 to: 20-07-2010	**Date of report**: 10-11-2010
Shifts: 9	**Local contact(s)**: Philip Pattison	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Prof. Vidar Hansen, University of Stavanger, Norway

Report:

Data was collected from 7 crystals, from a total of 5 differently heat treated Al-Zn-Mg samples, all containing 5.4 wt% Zn and 1.2 wt% Mg. The aim was to characterise the diffuse scattering in reciprocal space from the GP-zones formed during the heat treatment sequence:

Supersaturated solid solution → GP-zones →η' →η ($MgZn_2$)

Crystal 1 had been solution heat treated at 430^{o}C followed by aging at 100^{o}C for 3 hours. A quick CCD ω scan from -108^o to 108^o with 1^o, 1 s per frame, resulting in 216 frames, was done. The quality of this crystal was not particularly good, looked like a single crystal with much tension in, so no more data was recorded from it.

Crystal 2 had been solution heat treated at 430^{o}C followed by aging at 100^{o}C for 5 hours. A quick CCD ω scan from -108^o to 108^o with 1^o, 1 s per frame was done, giving 216 frames. The Al reflexes were also for this crystal extended, and nothing more was done with this crystal.

Crystal 3 was taken from the same sample as crystal 2, but was of much better quality. In addition to the standard quick ω scan, it was also collected a long ω scan with 1s, 0.5^o giving 432 frames of CCD images. After this an IP 360^o 0.5^o φ scan was collected over night, resulting in 601 frames before it was stopped. The MAR detector images contain less noise than CCD images, which is favourable when detecting this weak diffuse scattering. To further improve the image quality, cryogenic gas was used to reduce the thermal contribution, and a new dataset of 180 frames was recorded at 100 K.

Crystal 4 had been solution heat treated at 480°C followed by aging at 100°C for 3 hours. An IP 360° 0.5° φ scan at 100 K was collected, resulting in 662 frames.

Short IP 1° φ scan at 100 K was recorded from crystal 5 and crystal 6, both taken from a sample solution heat treated at 480°C followed by aging for 5 hours at 100°C. They were not particularly good, so 48 and 109 frames were recorded respectively. At least this will be enough data to see reflexes from the GP(II) zones.

All of the remaining time was spent collecting data from crystal 7, that had been left to age harden at room temperature, and thereby represents a state in the very beginning of the precipitation sequence. An IP 0.5° φ scan at 100 K was recorded, giving 351 frames.

A background image from the air scattering without sample mounted was also recorded. This background is the same for all the recorded MAR data images and has been subtracted from all the raw data in CrysAlis. Reconstructions of reciprocal space in the different directions have been done, giving the foundation needed to continue with appropriate image processing preparing the data for calculation of the 3D pair correlation function. Chimera will also be used for the 3D visualisation. This will form the basis of further analysis.

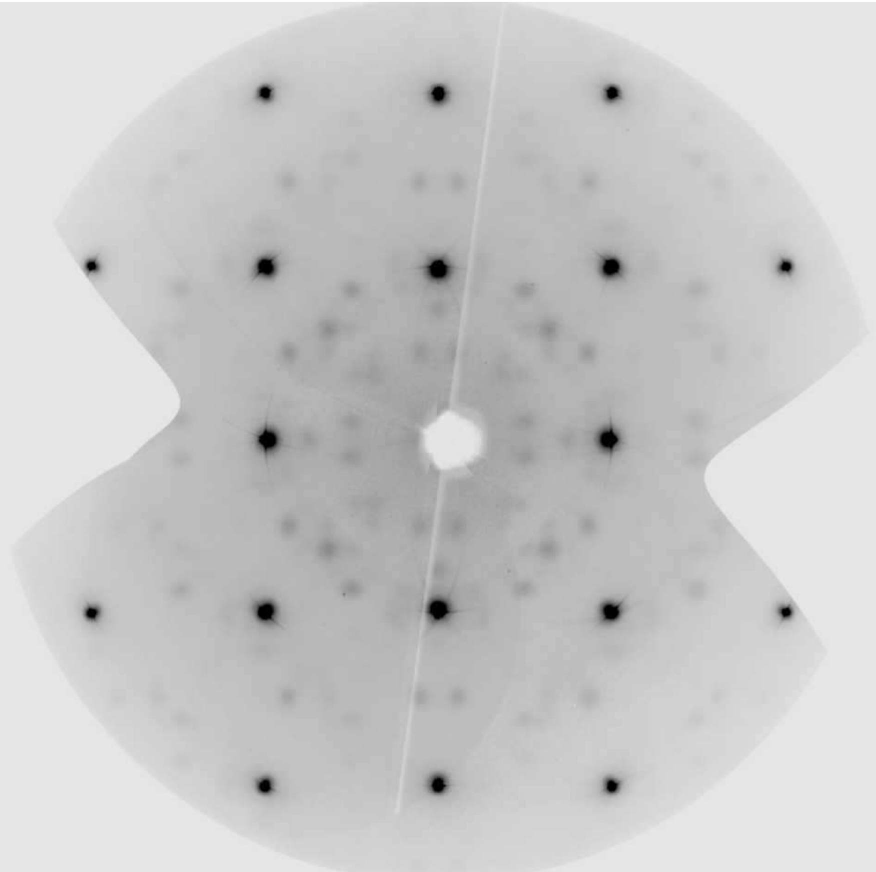

Figure 1. Reconstruction of a <001> layer from crystal 4, showing significant diffuse scattering inbetween the strong Al reflextions.