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:** X-ray holography on organic molecules using “pink beam”	**Experiment number**: MI-550
Beamline: ID22	**Date of experiment**: from: 8/02/2002 to: 14/02/2002	**Date of report**: 25/03/2002
Shifts: 18	**Local contact(s)**: A. Simionovici	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Miklós Tegze* Res. Inst. for Solid State Physics and Optics, Budapest, Hungary
Gyula Faigel* Res. Inst. for Solid State Physics and Optics, Budapest, Hungary
Gábor Bortel* Res. Inst. for Solid State Physics and Optics, Budapest, Hungary
Michel Belakhovsky* CEA Grenoble, France
Olivier Ulrich* CEA Grenoble, France
Stefano Marchesini* LBNL, Berkeley, USA
Alexandre Simionovici* ESRF, France

Report:

The aim of the experiment was to use the “pink beam” to decrease the measuring time of x-ray holography. In a series of earlier experiments at ESRF (MI-174, MI-228, HS-508, MI-272, MI-326, MI-377) we were able to decrease this time from the original 2 months [1] to few hours [2] for a bulk sample. This advancement made possible the measurement of x-ray holograms on crystals containing light elements [3] and quasi-crystals [4]. Unfortunately, many interesting samples are either small (small crystals or thin layers) or contain the fluorescent atom in small quantities (doped crystals or large organic molecules). To compensate for the small fluorescent intensity of these samples the incident x-ray flux has to be increased. X-ray holography require monochromatic beam, but the bandwidth of a single line of the “pink” undulator radiation is suitable for imaging the local environment of the fluorescent atom. The larger bandwidth also means (2-3 orders of magnitude) higher intensity. In our previous experiment (MI-377) we have tested this idea. That time the appearance of Bragg reflections in the hologram inhibited the calculation of atomic images (see report of MI-377). In the present experiment we applied an improved graphite analyser before the detector and suppressed the higher harmonics of the undulator by reflection on a mirror. We used NiO as a test crystal. The measured hologram is shown on fig. 1. The hologram is free of Bragg peaks. As expected, the x-ray standing wave lines are weaker than in the monochromatic case. Analysis of the low frequency part of the hologram showed that noise is still masking the holographic information. The origin of the noise could be either

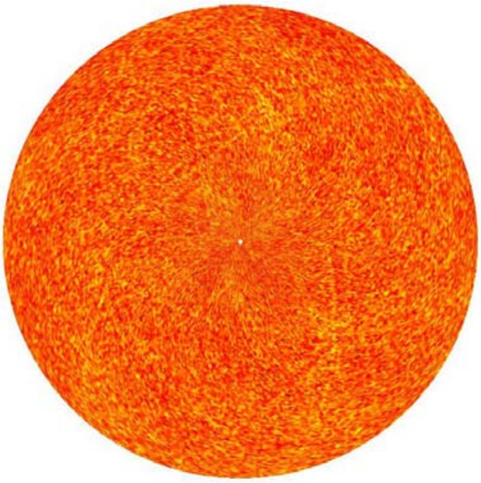

Fig. 1. Hologram of NiO crystal recorded with "pink" beam at E=10.74 keV

mechanical vibration in the analyser system or instabilities of the incident beam. A more detailed evaluation of the recorded detector and monitor signals is needed to decide which.

Since, despite the improvement, the quality of the hologram recorded with "pink" beam remained still behind the one taken with monochromatic beam, we decided to use monochromatic radiation for the rest of our allocated beamtime. We measured three samples: $[Rh(en)_3][Mn(N)(CN)_5],H_2O$, $La_{0.6}Se_{0.4}MnO_3$, and ThAsSe. The first sample is a crystal of organic molecules containing about 2 atomic percent of Mn. We found, that the Mn fluorescent intensity was too low to get good statistics in reasonable time. On the other two samples we got good results. The $La_{0.6}Se_{0.4}MnO_3$ is a colossal magneto-resistance (CMR) material. Holograms of the same sample were recorded earlier at lower energies at the ALS in Berkeley. We have measured a hologram at 15keV. The ThAsSe is an interesting material, which shows Kondo-like behaviour in its transport properties at low temperature. It is attributed to a two-level system [5] connected to atomic displacements in the crystal. The exact nature of these displacements is still unclear. We recorded holograms at four different x-ray energies (12.5, 17, 18, and 19 keV). One of these is shown on fig. 2. The full evaluation of the measured data is in progress.

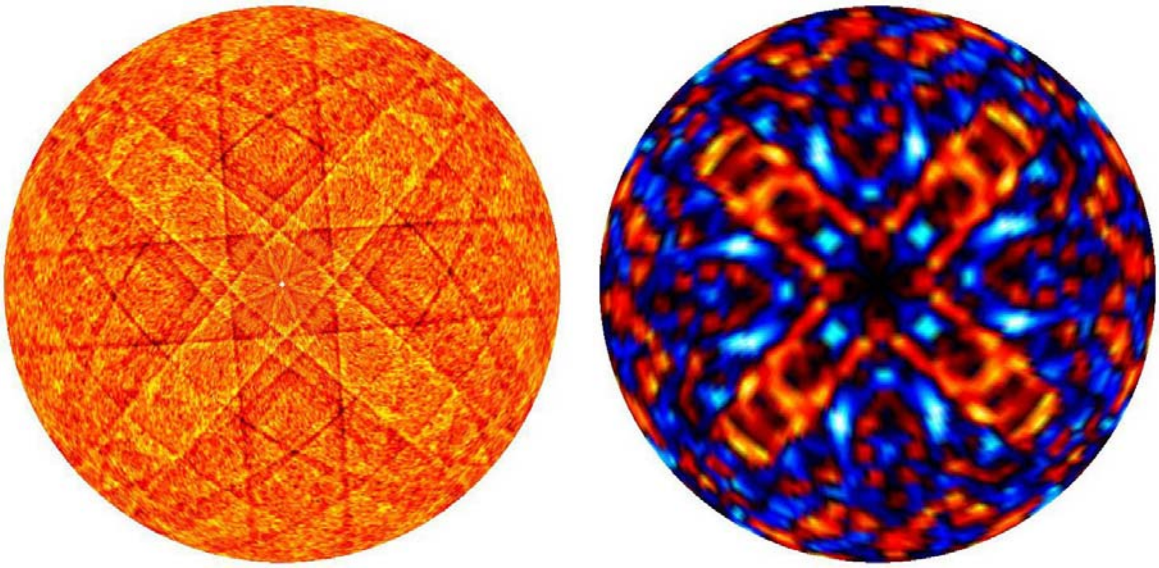

Fig. 2. Hologram of ThAsSe at E=18 keV (left panel). The right panel shows its low frequency component.

References

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