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 via the User Portal: *https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do*

Deadlines for submission of Experimental Reports

Experimental reports must be submitted within the period of 3 months after the end of the experiment.

Experiment Report supporting a new proposal ("relevant report")

If you are submitting a proposal for a new project, or to continue a project for which you have previously been allocated beam time, you must submit a report on each of your previous measurement(s):

- even on those carried out close to the proposal submission deadline (it can be a *"preliminary report")*,
- even for experiments whose scientific area is different form the scientific area of the new proposal,
- carried out on CRG beamlines.

You must then register the report(s) as "relevant report(s)" in the new application form for beam time.

Deadlines for submitting a report supporting a new proposal

- 1st March Proposal Round - **5th March**
- 10th September Proposal Round - **13th September**

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.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report in English.
- include the experiment number 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.

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Experiment title: Utilizing Bragg coherent diffraction imaging to understand the role of anisotropy on the self-organization of gas bubble superlattice	**Experiment number**: MA4711

Beamline:	**Date of experiment**: from: 10 June 2021 to: 14 June 2021	**Date of report**: 06/23/2021
Shifts:	**Local contact(s)**: Dr. Steven Leake	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Report:

Participants: Ericmoore Jossou (PI), Simerjeet Gill, Ian Robinson, Ana Suzana, Tadesse Assefa, Steven Leake

In a 4-day experiment at ID01, we performed BCDI measurements of tungsten samples implanted with different doses of helium and krypton. The samples of 1.0 µm^3 tungsten were lifted out of the bulk using Focused Ion Beam milling and attached to silicon substrates using platinum. The sample was mounted by the beamline scientist; Dr. Steven Leake. To avoid radiation damage from the full coherent beam, we used different filters depending on the photon counts observed on the detector.

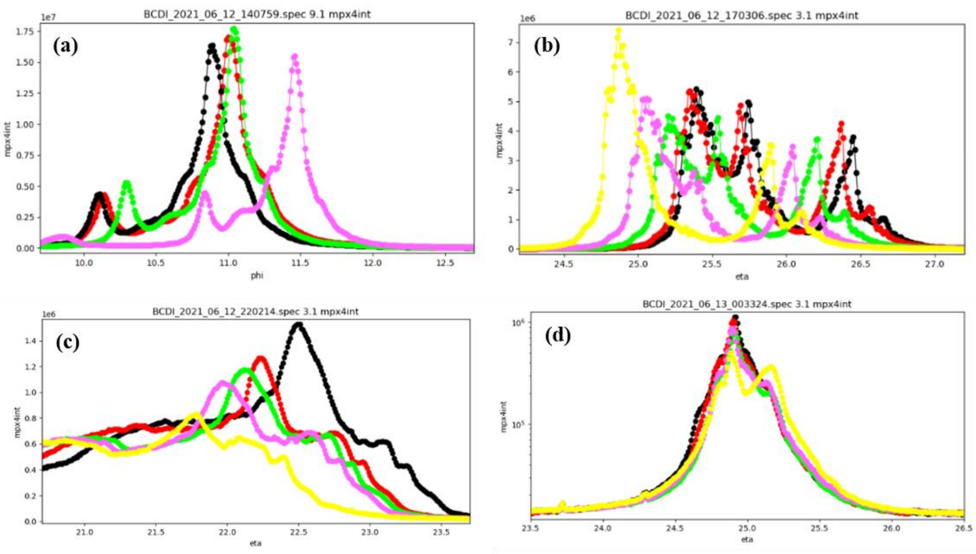

Figure 1. Integrated rocking curves of 1.0 µm^3 tungsten implanted with He to a fluence of 7.5×10^{17} ions/cm^2. These are integrated curves for the following crystallographic reflections (a) $(0\bar{1}1)$ (b) (200) (c) (103) (d) (013).

Finding the Bragg reflection was not trivial because we the crystallographic orientation of the sample was not know a priori. To find the reflection, the beamline scientist calculated a series of delta and nu values which provide the compound 2theta given the detector has a 5.5^{o} solid angle. This strategy allows us to make scans on only the powder rings rather than everywhere.

Due to the need to reconstruct the full six-component strain tensor, we measured four BCDI data sets from noncoplanar Bragg reflections: $(0\bar{1}1)$, (200), (103), (013) for the sample with fluence of 7.5×10^{17} ions/cm^2. For each reflection, the crystal was rocked from -1.5^{o} to 1.5^{o} relative to the reflection center in 200 steps with a 1.0 s exposure. This scan was repeated 6 times, aligning the sample to the X-ray beam center before each scan to compensate for drift. However, we observe drifts in the rocking curves (See Figure 1) which may be due to drifts in the phi and eta motor. Overall, we are able to reproduce the curves for each Bragg reflections which is more important.

Reconstructions of the data have begun. The W-He diffraction patterns seem to reconstruct reliably and give reproducible cubic crystal shapes. Full strain analysis will help us determine and understand the role of He and Kr ion irradiation induced damage as function of dose in tungsten. Tungsten metals serve as model materials for studying effect of ion irradiation in metallic systems as they are single component materials with well-defined crystalline peaks suitable for elucidating strain