

## 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>

### 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 from 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

- 1<sup>st</sup> March Proposal Round - **5<sup>th</sup> March**
- 10<sup>th</sup> September Proposal Round - **13<sup>th</sup> 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.



	<b>Experiment title:</b> Phase relations in the Fe-Si-C ternary system at extreme conditions	<b>Experiment number:</b> ES-1144
<b>Beamline:</b> ID15B	<b>Date of experiment:</b> from: 14 June 2022 to: 18 June 2022	<b>Date of report:</b> 13 September 2022
<b>Shifts:</b> 12	<b>Local contact(s):</b> Michael Hanfland	<i>Received at ESRF:</i>
<b>Names and affiliations of applicants</b> (* indicates experimentalists):  Efim Kolesnikov*, Ilya Kuppenko*, Xiang Li*, Carmen Sanchez-Valle  Institut für Mineralogie, University of Münster, Corrensstr. 24, 48149 Münster, Germany		

## Report:

During the experiment, we performed X-Ray diffraction (XRD) measurements upon compression of iron alloyed with silicon and carbon up to 120 GPa. The XRD experiments were conducted using the facilities of the ID15B beamline. The high-pressure chambers for the experiment were prepared from Re gaskets. The alloys in the Fe-Si-C system were pre-synthesized at the University of Münster employing piston-cylinder and multi-anvil high-pressure apparatuses. The synthesized materials were characterized by the microprobe and diffraction analysis. Polycrystalline samples with linear dimensions of  $\sim 10 \times 10 \times 10 \mu\text{m}^3$  were loaded into the pressure chamber together with the KCl that served as a pressure transmitting medium. Data processing is currently in progress. During the diffraction experiment, we measured the pressure dependence of the unit cell volume of hexagonal Fe-1.5 wt % Si-0.2 wt % C alloy up to 100 GPa and of Fe-2 wt % Si-2 wt % C up to 120 GPa (Fig. 1). These data will be used to construct the P-V equations of state of these alloys. Laser heating experiments were performed ex-situ employing the facilities of ID18 and later analyzed with diffraction at ID15B. Heating of Fe-1.5 wt % Si-0.2 wt % C, Fe-2 wt % Si-0.4 wt % C and Fe-2 wt % Si-2 wt % C alloys at 20, 40, 60 and 80 GPa and 2400 K GPa lead to decomposition of the corresponding hcp-Fe alloys and formation of Fe<sub>3</sub>C and face-centered (fcc) iron-silicon-carbon alloy (Fig. 2) which retained to 20 GPa upon decompression. We also determined the P-V equations of states of the run products upon decompression. The recovered samples are currently being analyzed by the microprobe for their full chemical characterization.

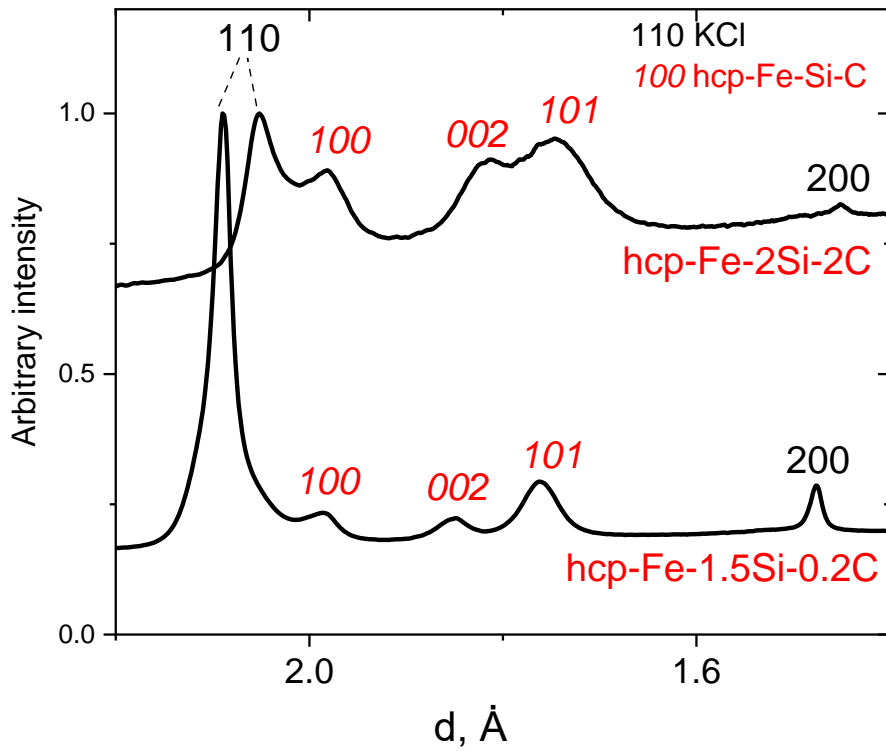


Figure 1. XRD pattern of Fe-1.5 wt % Si-0.2 wt % C alloy at 100 GPa and Fe-2 wt % Si-2 wt % C at 120 GPa.

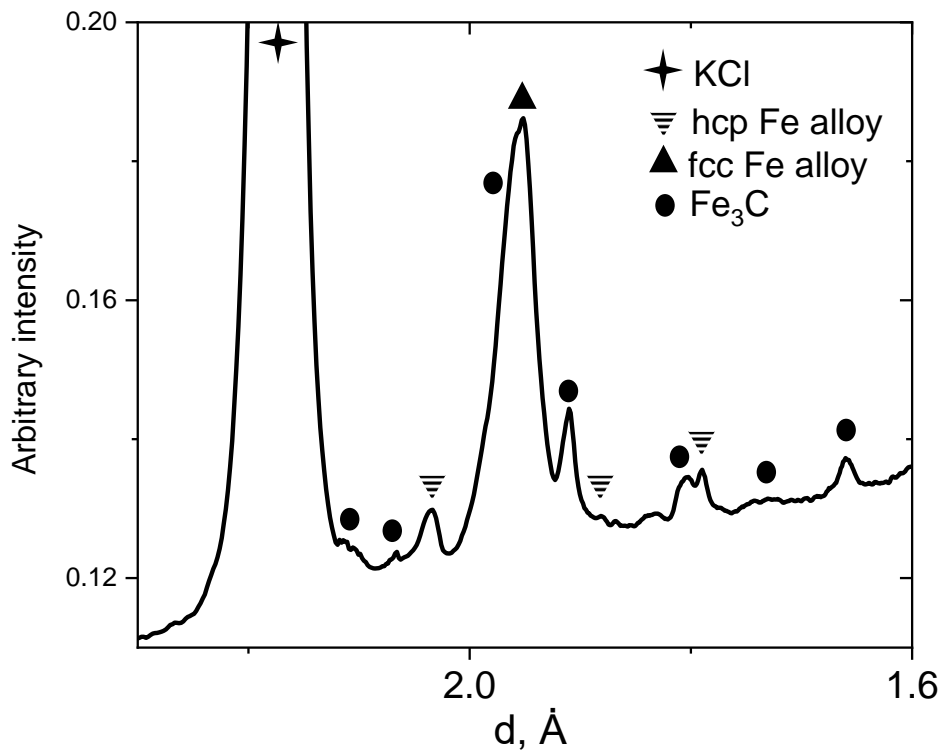


Figure 2. XRD pattern of Fe-1.5 wt % Si-0.2 wt % C alloy at 60 GPa after heating at 2400 K.