

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>

Reports supporting requests for additional beam time

Reports can 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.



	Experiment title: Test experiment: X-ray Raman Scattering study of ϵ -iron (carbo)nitride and expanded austenite.	Experiment number: MA-2331
Beamline: ID20	Date of experiment: from: 28 August 2014 to: 29 August 2014	Date of report: 08-09-2014
Shifts: 3	Local contact(s): Christoph Sahle & Michael Krisch	<i>Received at ESRF:</i>
Names and affiliations of applicants (* indicates experimentalists): Bastian Brink*, Technical University of Denmark, Department of Mechanical Engineering Sven Kenny Ståhl*, Technical University of Denmark, Department of Chemistry		

Report:

Scientific interest in the ϵ -iron nitride and carbonitride is founded by their metallurgical importance as they are formed on the surface of iron and steel hardened by nitriding and nitrocarburizing. The crystal structure is based on an *hcp* arrangement of Fe atoms with N or N+C in octahedral sites but potential ordering phenomena, i.e. preferential occupation of some sites by carbon or differences in local N and C environments are unclear from neutron diffraction experiments. For austenitic stainless steel (Fe,Cr,Ni), low temperature nitriding and nitrocarburizing produces another structure, the so-called expanded austenite where nitrogen and/or carbon are assumed to occupy octahedral interstitial positions in the F-centered cubic lattice.

For both ϵ -Fe₃(C,N)_{1+x} and expanded austenite, the current understanding of the structure is based primarily on measurements of the metallic structure which provide indirect information on carbon and nitrogen. In order to achieve a full understanding of these structures and prove/disprove the current assumptions, direct measurements of local environments of carbon and nitrogen are needed. Therefore the feasibility of using X-ray Raman Scattering to directly and independently study the local environments of carbon and nitrogen was tested.

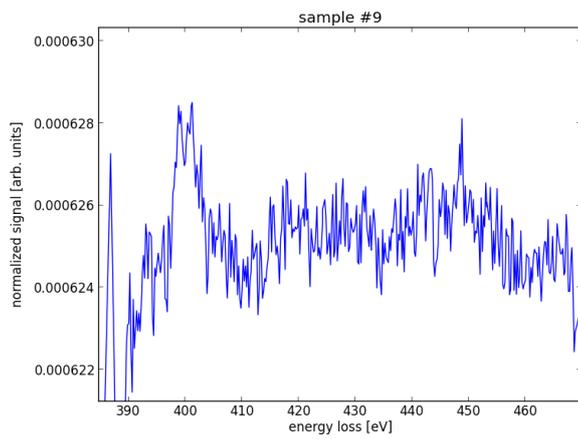


Figure 1: “Edge” scan of expanded austenite sample

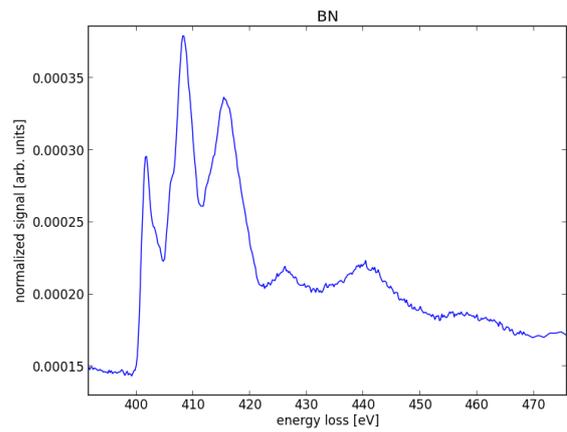


Figure 2: Edge scan of BN for comparison

As shown on figure 1, nitrogen K-edge scans for the expanded austenite yielded only a very weak and noisy signal which, unfortunately, cannot be used for further analysis. Similar spectra were obtained for ϵ -iron nitride. For comparison the edge for boron nitride can be seen on figure 2.

The conclusion is thus that the metallic matrix of iron-based nitrides interferes too much to get a proper signal for nitrogen or carbon with XRS measurements.