EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

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.

ESRF	**Experiment title: Synchrotron X-ray Diffraction and Spectroscopy Studies of Cr doped UO2**	**Experiment number**:
Beamline:	**Date of experiment**: from: 1/June/2021 to: 04/\june/2921	**Date of report**:
Shifts:	**Local contact(s)**: Christoph Hennig (email: hennig@esrf.fr) Volodymyr Svitlyk (email: svitlyk@esrf.fr)	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Report:

Experiment outline:

Cr doped UO_2 is an accident tolerant nuclear fuel used for nuclear power generation in European and global reactors. The experiment sort to examine Cr doped UO_2 samples with variable Cr concentrations prepared at constant oxygen potential as powders and single crystals using high-resolution synchrotron X-ray diffraction and spectroscopy (XANES) under ambient conditions at BM20 ROBL. High resolution structural models of the Cr doped UO_2 system above and below the Cr solubility limit and particularly understand the mechanism of Cr incorporation w.r.t changes to lattice parameters, crystal structure and redox states in powder samples were targeted as the aim.

Experimental outcome

High resolution structural models were obtained for Cr doped UO_2 above and below the solubility limit with doping amounts of 0, 250 , 500, 750, 1250, 1750 and 2250 ppm. The models obtained, via modelling the high resolution powder diffraction data and using the Rietveld method produced significant insight into the changes of the lattice structure. This has not been achieved before previously. The figure below illustrates the trend of lattice parameter w.r.t to Cr doping content. The results of this investigation are bing prepared for publication.

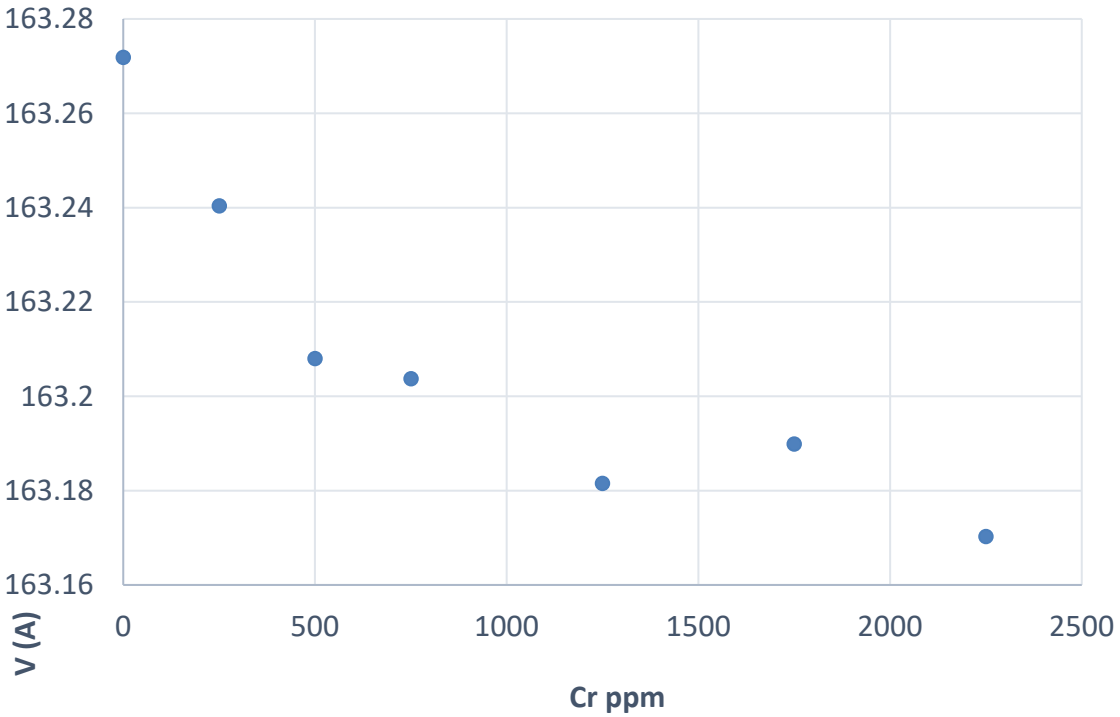

Figure: Lattice volume as a function of Cr doping in UO_2 from Rietveld refinments against high resolution powder X-ray diffraction.