



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.



Experiment title: EXAFS/XANES investigation of uranium plutonium mixed oxides

Experiment number:
CH-3208

Beamline:
BM20

Date of experiment:
from: 2nd of February 2011 to: 8th of February 2011

Date of report:
24th of February
2012

Shifts: 9

Local contact(s): Andreas SCHEINOST

Received at ESRF:

Names and affiliations of applicants (* indicates experimentalists):

Main proposer:

***Sébastien NOYAU (PhD student at CEA Cadarache)**

Co-proposers:

Dr. Fabienne AUDUBERT (Researcher at CEA Cadarache)

***Dr. Renaud Belin (Researcher at CEA Cadarache)**

Dr. Philippe Martin (Researcher at CEA Cadarache)

Report:

Objectives

In the field of GEN IV reactor applications, determination of the diffusion coefficients is essential at all stages of the fuel cycle (fabrication and in-reactor behaviour). In the future, manufacturing processes could use mixed uranium plutonium oxide as the raw material, with a plutonium concentration ranging between 30 at% and 45 at%. Diffusion processes in uranium/plutonium-based oxides are governed by cationic diffusion. From a more basic standpoint, diffusion coefficient measurements provide a means of ascertaining the nature of defects responsible for atomic migration. The nature of defects and their quantity are directly related to the material stoichiometry (i.e. Oxygen-to-actinides ratio O/M). The aim is to determine this O/M by XANES and the related defects concentration as well as their nature and their location by EXAFS. Two mixed oxides with the same Pu Concentration (45 at%) are studying. One fabricated from the co-grinding and reactive sintering of UO_2 -45% PuO_2 , and the other from the natural sintering of the chemically prepared solid solution. Different sintering setups are studying (Temperature, sintering atmosphere, heating and cooling rates).

Main achievements

XANES data have been exploited and are being interpreted. Differences appear on the values of the O/M ratio according to the experimental method chosen to determine it (XAFS/XRD/TGA/modeling) as well as between the two materials for same sintering setups. We are processing the data in order to:

- get an interpretation and possibly bring information on the way to determine O/M ratio with other experimental methods on such Pu concentrated mixed oxide (not well known material over a Pu concentration of 30 at%)
- understand why there are differences between the O/M ratios of the two materials.

EXAFS spectra are being processed as well. Apart the objectives related to the interpretation of those data, they will possibly bring information to explain why differences exist between the O/M ratios of the two materials for similar sintering setups.

Main delays and difficulties encountered & corrective actions taken

The project progresses according to the frame of the PhD thesis of Sébastien NOYAU (completion foreseen by end of May 2012).

No corrective actions are needed.

Publications

We plan to prepare one publication within May 2012 including this project. It will be dedicated (amongst other correlated studies) to results from the XAFS experiment including O/M ratio determination, relation between O/M ratio and defects nature and concentration, comparison between the two solid solutions obtain by two different ways.

This work will be also published as a part of the PhD thesis of Sébastien NOYAU.

This work has not been yet presented in the frame of an international conference.