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 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.

ESRF	**Experiment title:** ***In situ* SR XRD study of hydrogen absorption - desorption in a Sn-substituted $LaNi_5$-based alloy**	**Experiment number**: 01-01-604
Beamline:	**Date of experiment**: from: 31.01.03 to: 03.02.03	**Date of report**: 01.04.03
Shifts: 9	**Local contact(s)**: Hermann Emerich, SNBL	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Report:

In situ SR XRD study of hydrogen absorption - desorption in a Sn-substituted $LaNi_5$-based alloy

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$LaNi_5$-based intermetallic hydrides enjoy a broad range of applications in hydrogen storage with nickel-metal hydride batteries standing as the most important one. Doping by tin reduces significantly intrinsic degradation of the alloy during the absorption-desorption cycling thus increasing the lifetime of the battery electrode material. The goal of the present project was to study phase-structural transformations during hydride formation and decomposition in such an advanced alloy. A specially designed cell for *in situ* studies in H_2 atmosphere was attached to a metal hydride hydrogen storage unit developed at IFE providing hydrogen gas at convenient pressures in a range 2-3 bar H_2. The studied sample was kept in a quartz glass capillary. Heating-cooling cycle in the temperature range 20 – 100 ^oC was accompanied by hydrogen absorption or desorption. The diffractometer is equipped with 6 detectors thus facilitating the measurement process (one data set was collected in two minutes).

The present setup was for the first time used for the *in situ* studies of the absorption processes by intermetallic alloys. The experiment shows that studies of the kinetics of H absorption and desorption can be easily accomplished at SNBL using the developed equipment.

The results obtained are presented in Fig.1-2. They can be summarized as follows:

- A large temperature-dependent homogeneity range of the β-hydride has been found.
- Hysteresis in the formation-decomposition of the β-hydride is evident.
- No evidences of the strains in both hydride β-phases or α-solid solution have been found.

A more detailed analysis of the data is in progress. Further plans are to employ the setup together with the MAR detector system and to look at the kinetics of the processes.

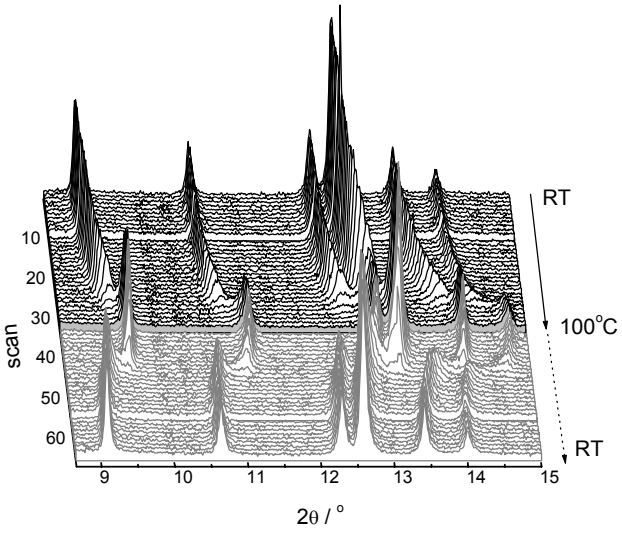

Fig. 1. Hydrogen desorption/absorption following heating/cooling of the sample in the temperature range 20 – 100 °C

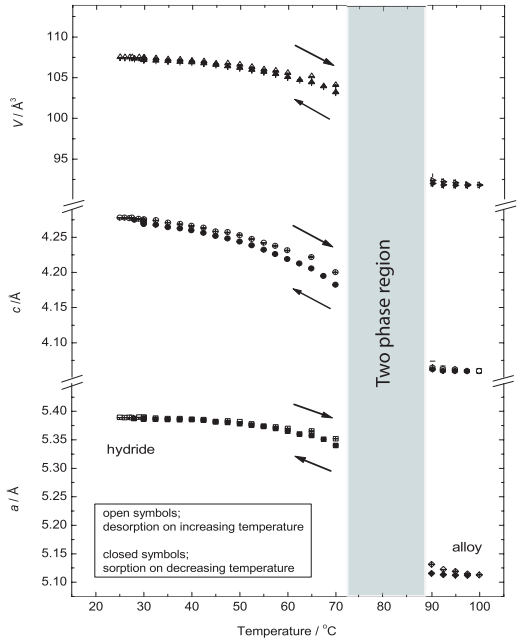

Fig. 2. Phase-structural transformations in the system β-hydride $LaNi_{4.7}Sn_{0.3}H_6$ - α-phase $LaNi_{4.7}Sn_{0.3}H_{0.1\text{-}0.2}$ *vs* temperature of the system.