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 via the User Portal:

https://wwws.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.

ESRF	**Experiment title:** **High-pressure powder X-ray diffraction study of the transition metal monogermanides**	**Experiment number**: HC2161
Beamline:	**Date of experiment**: from: 30.10.2015 to: 02.11.2015	**Date of report**: 10.06.2016
Shifts:	**Local contact(s)**: Michael Hanfland	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Report:

Single-crystals of MnGe, $Mn_{0.1}Co_{0.9}Ge$ were selected and prepared for high-pressure x-ray diffraction experiment. The experiment was mostly focused on low-temperature study of MnGe elastic properites below magnetic ordering temperature (the ordering temperature is around 150 K), $Mn_{0.1}Co_{0.9}Ge$ was used as an almost non-magnetic reference. We used diamond anvil cells filled with He as a pressure-transmitting medium. Helium cryostat was utilized to maintain the temperature of 100 K over the whole pressure range. Single-crystal x-ray diffraction images were further analyzed using the computer program CrysAlisPro in order to determine the orientation matrices and estimate the lattice parameters. X-ray diffraction images, taken upon continuous rotation of the DAC from -20◦ to +20◦ on omega (referred to as wide-scan images) were analysed with GSE ADA software. As a result, the dependences of the unit cell parameters on pressure were obtained.

Fig 1 presents the Ff-plots (Eulerian stress-strain diagram) along with our previously measured room temperature data. The equations of state (EOS) were fitted by EosFit7 in terms of Birch-Murnaghan 3-rd order model. The quality of fit is seen in Fig. 1. The corresponding parametrs are summurized in the Table 1. It is seen that the elastic properties of $Mn_{0.1}Co_{0.9}Ge$ at room temperature and at 100 K coinside within the error. Unlike that the bulk modulus for MnGe is markedly different below and above the magnetic transition temperature. The further investigation of this anomaly including *ab initio* calculations is to be done.

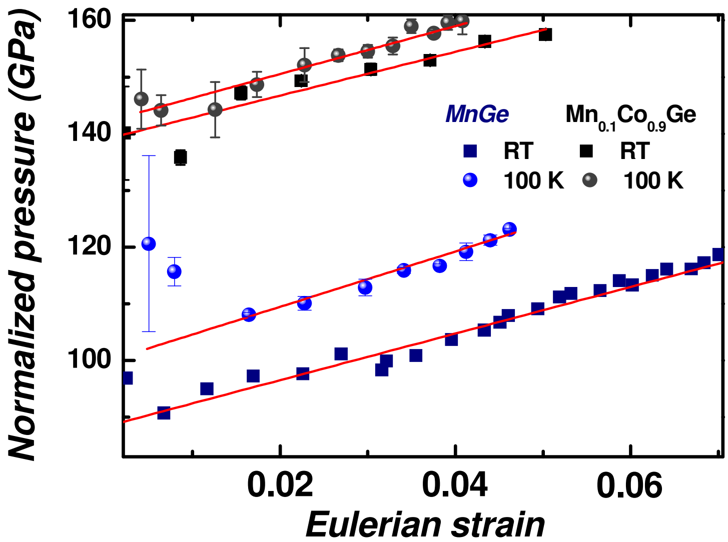

Fig. 1. Experimental and fitted Ff - plots related to the EOS of MnGe at room temperature and 100 K as well as of $Mn_{0.1}Co_{0.9}Ge$ at the same temperatures.

Table 1. Unit cell volume at ambient pressure V_0_fit, bulk modulus *B*, its pressure derivative *B′* of MnGe and $Mn_{0.1}Co_{0.9}Ge$ solid solutions obtained from the fitting of the EOS to 3rd order Birch-Murnaghan equation. V_0_exp the experimental value obtained from our previous temperature-dependent powder diffraction study.

	V_0_exp, Å^3	V_0_fit, Å^3	B_0, GPa	B’
MnGe (RT)	110.288 ±0.003	110.29±0.01	88±1	7.1±0.1
MnGe (100 K)	~ 109.33	109.33 (fixed)	100±2	7.3±0.3
$Mn_{0.1}Co_{0.9}Ge$ (RT)	100.94	100.92± 0.03	139±3	5.9±0.4
$Mn_{0.1}Co_{0.9}Ge$ (100 K)	~ 100.2	100.41± 0.05	142±4	6.0±0.4