Experiment Report Form

The double page inside this form is to be filled in for each experiment at the Rossendorf Beamline (ROBL). This double-page report will be reduced to a one page, A4 format, to be published in the Bi-Annual Report of the beamline. The report may also be published on the Web-pages of the HZDR. If necessary, you may ask for an appropriate delay between report submission and publication.

Should you wish to make more general comments on the experiment, enclose these on a separate sheet, and send both the Report and comments to the ROBL team.

Published papers

All users must give proper credit to ROBL staff members and the ESRF facilities used for achieving the results being published. Further, users are obliged to send to ROBL the complete reference and abstract of papers published in peer-reviewed media.

Deadlines for submission of Experimental Report

Reports shall be submitted not later than 6 month after the experiment.

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 / experiment 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.
- bear in mind that the double-page report will be reduced to 71% of its original size, A4 format. A type-face such as "Times" or "Arial" , 14 points, with a 1.5 line spacing between lines for the text produces a report which can be read easily.

Note that requests for further beam time must always be accompanied by a report on previous measurements.

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ROBL-CRG	**Experiment title:** IN-SITU MONITORING THE PHASE TRANSFORMATION OF MN IN GE MATRIX	**Experiment number**: 20-02/709
Beamline: BM 20	**Date of experiment**: from: 20.04.2011 to: 23.04.2011	**Date of report**:
Shifts:	**Local contact(s)**: Artem Shalimov	*Received at ROBL:*

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Report:

Mn doped Ge is promising as a magnetic semiconductor. To confirm the realization of a magnetic semiconductor, we need to exam if there is secondary phase present beside the diluted matrix. Therefore, synchortron based XRD with is especially needed for this purpose. During the experiment, we focused on two questions: (1) by in-situ annealing of Mn implanted Ge, we want to check if Mn-rich secondary phases formed, (2) if Mn-rich secondary phases formed in pulsed laser annealed Ge:Mn.

The samples were prepared by Mn ion implantation into Ge(001) and Ge(111) wafers. The experimental at BM20 was done with an x-ray wavelength of 0.1078 nm.

(1) In-situ annealing at vacuum: Figure 1 shows the XRD 2θ-θ scans during increasing annealing temperature for Mn implanted Ge(001) wafers.
During annealing, 2θ-θ scans were measured to monitor the possible secondary phase formation. Up to 500 °C, one only see the Ge(001) peak and cannot detect any secondary phases within the detection limit. However, due to the possible contamination of O_2 in the chamber, the Ge wafer was decomposed with increasing temperature. This has been verified after taking sample out from the chamber.

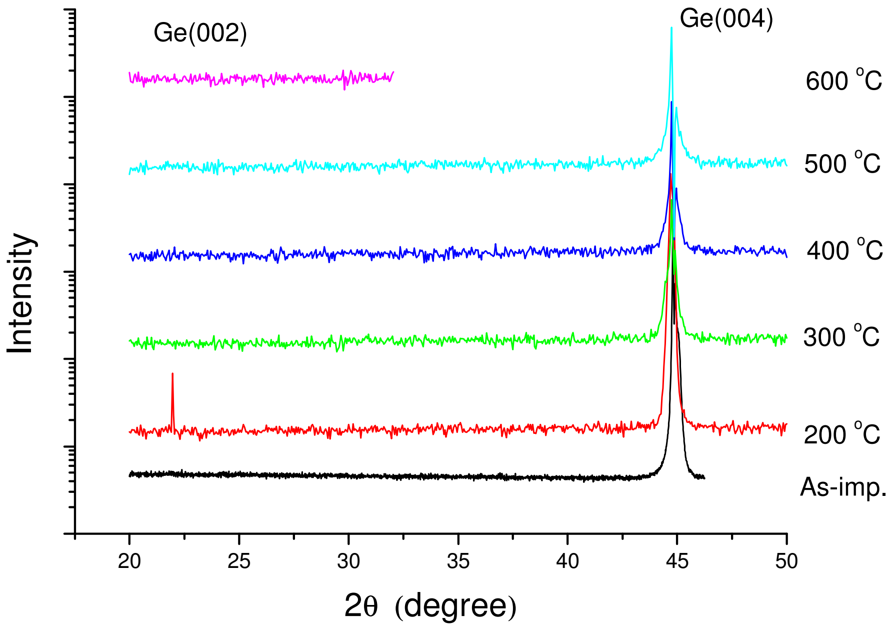

Fig. 1 XRD 2θ-θ scans of Mn implanted Ge(001) wafer with in-situ vacuum annealing.

(2) In-situ annealing in Ar atomosphere: Figure 2 shows the results of Mn implanted Ge(111) annealed in Ar atomosphere. The max. annealing temperature reached is 500 ℃. No secondary phase is detectable. After taking sample out from the chamber, we verify that the sample was not decomposed.

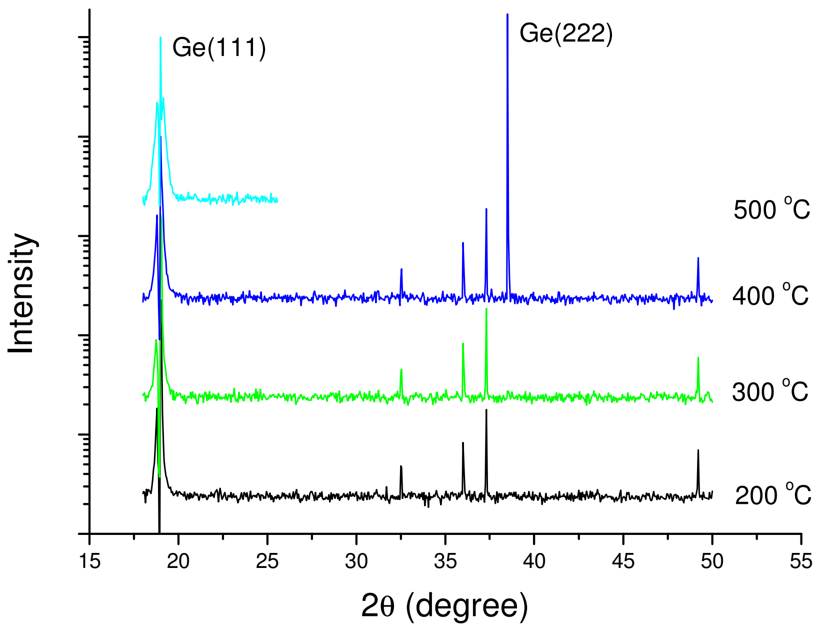

Fig. 2 XRD 2θ-θ scans of Mn implanted Ge(111) wafer with in-situ annealing at Ar atomosphere.

(3) Pulsed laser annealing of Mn implanted Ge(004): Pulsed laser annealing has been performed at Jenaoptic. By transimission electron microscopy, we see indication of Mn-rich phase which is very probably amorphous. We use XRD to verify if there is secondary crystalline phase. The result is shown in Fig. 3. One can clearly see that within the detection limit there is no crystalline phase within the Ge matrix.

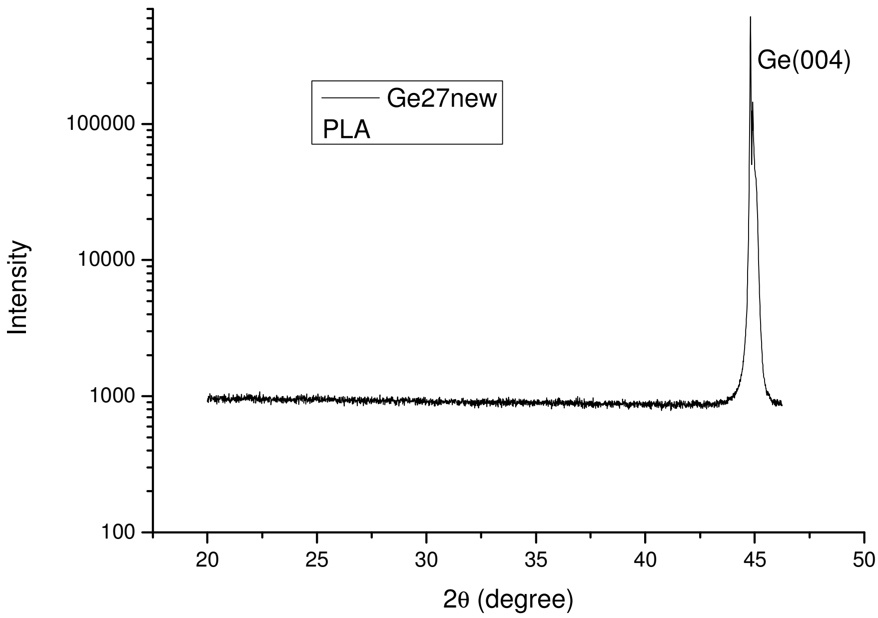

Fig. 2 XRD 2θ-θ scans of Mn implanted Ge(001) wafer after pulsed laser annealing.

In a short conclusion, the proposed experiment 'in-situ annealing of Mn implanted Ge' is feasible at BM20. But we have to anneal the sample in Ar atomosphere to aviod decomposition due to the O_2/H_2O contaminiation on the sample surface. We also have to do some pre-treatment before annealing in vacuum. At this moment, we are measuring the magnetic properties of the annealed sample (in Ar atomosphere). Then we hope to understand what happened in the sample. In the next experiment, we will continue with this topic to understand the phase transformation of Mn implanted Ge.