Forschungszentrum Dresden Rossendorf

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 FZD. 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.

Postal address: FZD, Postfach 510119, D-01314 Dresden; Germany
Telephone: +49 (351) 260 3122; Fax: (0351) 260 3438.
ROBL-CRG at the ESRF, B.P. 220, F-38043 Grenoble Cedex, France
Telephone: +33 (476) 88 24 62; Fax: +33 (476) 88 2505

ROBL-CRG	**Experiment title:** Structural diagnostic of metal doped transparent oxides and germanium employed at photonic, magneto-optical and magnetic applications.	**Experiment number**: 20-02-686
Beamline: BM 20	**Date of experiment**: from: 18.11. 2009 to: 21.11.2009	**Date of report**: 8.07.2010
Shifts: 9	**Local contact(s)**: Dr. N. Jeutter	*Received at ROBL:*

Names and affiliations of applicants (* indicates experimentalists):

Dr. A. Shalimov *
Dr. M. O. Liedke *
L. Li *

Forschungszentrum Dresden-Rosendorf,
Institute of Ion Beam Physics and Materials Research,
FWIN

Report:

During the experiment, the structural properties of FePt magnetic nanoparticles embedded in MgO matrix have been examined as a function of ion beam fluence, and high-temperature annealing regime.

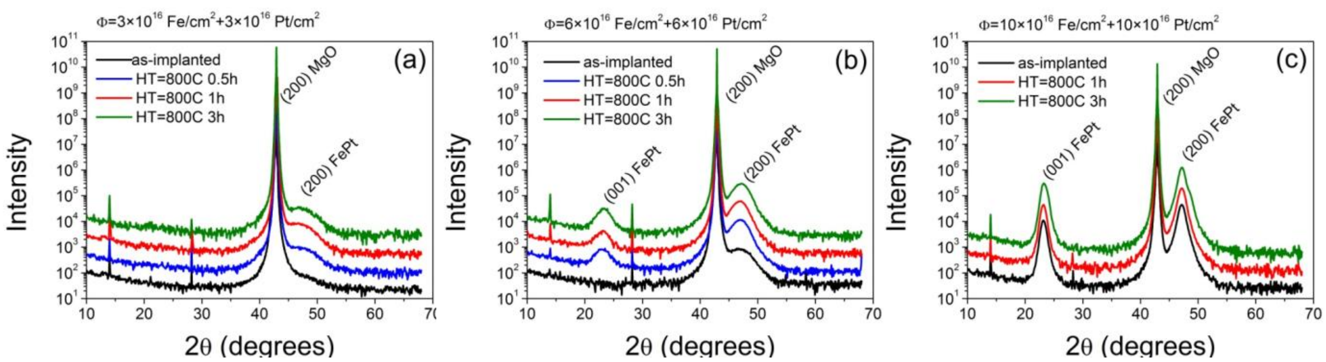

Fig.1. Diffraction patterns (2θ/θ scans) of MgO crystals implanted with Fe^{+} and Pt^{+} with the fluencies: (a) – 3×10^{16} cm^{-2}, (b) – 6×10^{16} cm^{-2}, (c) – 10×10^{16} cm^{-2}. Annealing regimes are indicated in legends.

Diffraction peaks arising from fcc FePt phase with a lattice parameter of *a*=3.58(2) Å were observed for all investigated samples. It was found that the nanoparticles size increase with an increase of ion fluencies, as well after high-temperature annealing: from 3.6 to 4.7 nm for $(3+3)\times10^{16}$ (Fe+Pt)/cm^2, from 5.3 to 7.8 nm for $(6+6)\times10^{16}$ (Fe+Pt)/cm^2; from 3.6 to 4.7 nm for $(3+3)\times10^{16}$ (Fe+Pt)/cm^2, and from 19 to 20 nm for $(10+10)\times10^{16}$ (Fe+Pt)/cm^2. Summarizing this part we found that an optimum for creation of isolated nanoparticles with at least partial chemical ordering, low-current implantation of 6×10^{16}Fe/cm^2 and 6×10^{16}Pt/cm^2 as well as 1h annealing at 800°C has to be performed. Possible origin of the suppressed formation of the $L1_0$ phase is stoichiometric imbalance between metallic Fe and Pt or the cubic surrounding of the clusters.

P-type doped Ge(100) single crystal wafers were implanted with 100 keV Mn ions to a fluence of 1×10^{16} cm^{-2}, which corresponds to a peak concentration of 2% Mn. The samples were held at 300 °C during implantation to avoid amorphization. The SR-XRD 2θ/θ scan confirms the formation of Mn_5Ge_3 nanomagnets. As shown in Fig. 2, beside the main peaks from Ge(004) and Ge(002), the diffraction peaks of Mn_5Ge_3 (111), (002), (310), (222) and (004) are clearly visible.

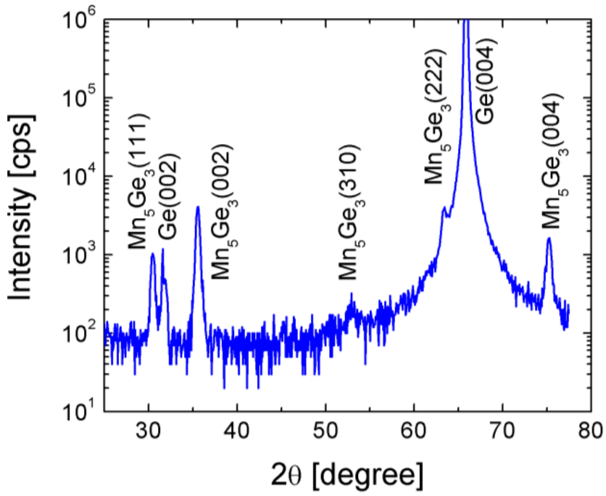

Fig.2. Diffraction pattern of Mn implanted Ge.

Moreover, it was found that low-temperature implanted Ge accompanied with millisecond PLA does not cause the secondary phase formation giving the possibility to production of diluted magnetic semiconductors.

Al doped ZnO films were grown on fused silica substrates by magnetron sputtering using different target concentrations of Al (0-4 wt %) at substrate temperatures Ts ranging from RT to 500°C. 2θ/θ measurements confirmed a dominant c-axis texture in films grown below the optimum Ts. For higher temperatures this preferred orientation is lost and crystallite size decreases. At high Al concentrations and Ts the films become electrically insulating which is accompanied by a strongly disordered film structure. Within the framework of this experiment no secondary phases other then wurtzite ZnO could be identified.