The Rossendorf Beamline at ESRF

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.

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ROBL-CRG	**Experiment title:** Structural investigations of SiO_2/Cr/NiFe/FeMn/Cr multilayers representing unusual exchange bias properties.	**Experiment number**: 20-02-687
Beamline: BM 20	**Date of experiment**: from: 21.11. 2009 to: 24.11.2009	**Date of report**: 8.07.2010
Shifts: 9	**Local contact(s)**: Dr. N. Jeutter	*Received at ROBL:*

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Report:

The structural characterization of multilayered magnetic structures of SiO_2/Cr/FeNi/FeMn/Cr and SiO_2/Cu/FeMn/FeNi/Cr has been performed using coplanar and non-coplanar synchrotron x-ray diffraction techniques. According to the aim of experiment, the investigations were subjected to the grain size and strain state analysis of ultrathin permalloy films grown on Cr buffer layers of different thicknesses, where the strong variation of exchange bias has been observed by means of magneto-optical Kerr effect. Grazing incidence diffraction (GID) was employed for the study of in-plane size of FeNi grains, since the crystalline quality of the layers was supposed to play a decisive role in magnetic behavior.

Taking into account high complexity of the measurements and inhomogeneous quality of the samples, the experiment can be considered as a partially successful. It has been found

that samples with ultrathin Cr (Cu) buffer layer (< 2 nm) being of enormously pure crystalline quality, representing randomly oriented small grains. Due to those reasons, the intensity of the diffracted beam was extremely low. Nevertheless, the samples possessing 10 nm thickness Cr buffer layer provide better crystalline quality of the following permalloy film as compared to ones grown on thinner or without buffer layers (e.g. Fig 1). The average grain size of about 6-7 nm was calculated using the diffraction peak width. Therefore, the strong influence of buffer layer on the quality of permalloy has been confirmed.

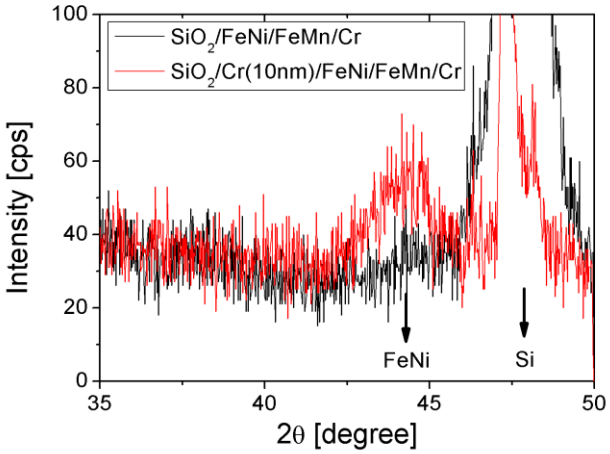

Fig. 1. GID pattern of magnetic multilayered structures representing the better crystalline quality of permalloy film grown on 10 nm Cr buffer layer.

In addition, magnetic structures of as-grown Al_2O_3/Mo/Pt/Co/Pt representing the change of magnetic anisotropy after implantation with Ga^+ have been investigated. On the present stage, x-ray diffraction patterns are being interpreted by self-developed numerical code for an analysis of $2\theta/\theta$ scans and rocking curves allowing determination of strain distribution and static Debye – Waller profile in multilayered systems.