

実験報告書様式(一般利用課題・成果公開利用)

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	承認日Date of Approval 2015/11/30 承認者Approver Yamazaki Dai 提出日Date of Report 2015/11/15
課題番号 Project No. 2014B0082 実験課題名 Title of experiment Investigation of the depth profile of the distribution of magnetic moments in (GaMn)As thin layer. 実験責任者名 Name of principal investigator TAKEDA Masayasu 所属 Affiliation Japan Atomic Energy Agency	装置責任者 Name of responsible person TAKEDA Masayasu 装置名 Name of Instrument/(BL No.) SHARAKU(BL17) 実施日 Date of Experiment 2015/3/15 10:00 ~ 2015/03/16 10:00 2015/3/18 21:00 ~ 2015/03/19 10:00 2015/3/19 21:00 ~ 2015/03/23 9:00

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)  
 Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.  Ga <sub>0.935</sub> Mn <sub>0.065</sub> As on a GaAs substrate
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2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。) Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.  This is a successive experiment of 2014A0136. In the previous measurements, we successfully detected the induced ferromagnetic moment in the ferromagnetic semiconductor Ga <sub>0.935</sub> Mn <sub>0.065</sub> As single layer on a GaAs single crystal substrate (GMA) with thickness of 50 nm. We, however, felt difficulty to find out the structural parameters to reproduce the whole reflectivity curves by the conventional analysis. We suspected that something was wrong with the measurements although we thought we carefully have performed the experiments. We measured the same sample to confirm the previous data and a thinner sample (25 nm) to study the effect of interface on the induced ferromagnetic moments this time.  The polarized neutron reflectivity (PNR) measurements of the GMA with thickness of 50 nm and 25 nm were performed using SHARAKU without a spin-analyzer after the sample. The sample was set in a cryocooler and cooled down to 4.4 K. The cryocooler which was an equipment of BL17 got out of order during this experiment, and a cryocooler of BL15 was employed.
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## 2. 実験方法及び結果(つづき) Experimental method and results (continued)

Figure 1 (a) indicates the PNR of the GMA (50 nm) after the zero-field-cooling (ZFC) process above  $T_c$ . The blue curve shows the reflectivity when the neutron spin is parallel to an external magnetic field of 10 kOe at the sample position, and the red one anti-parallel. The difference between these two curves indicates an existence of the net magnetization in the sample. The PNR profiles of the GMA with the thickness of 25 nm are displayed in Fig. 1 (b). The difference in the profiles between Fig. 1 (a) and (b) originates in the difference of the thickness of layers and of the magnitude of the induced magnetic moment. We supposed that we extracted the information about the effect of the interface on the induced magnetic moments by analyzing these two data.

We, however, noticed that the PNR profiles were not identical between in the previous measurements and this time as shown in Fig. 2. This is an evidence that something is or was wrong with the measurements. We hope that the measurements were properly performed this time, but have to confirm which measurement is true. The data analysis is now in progress.

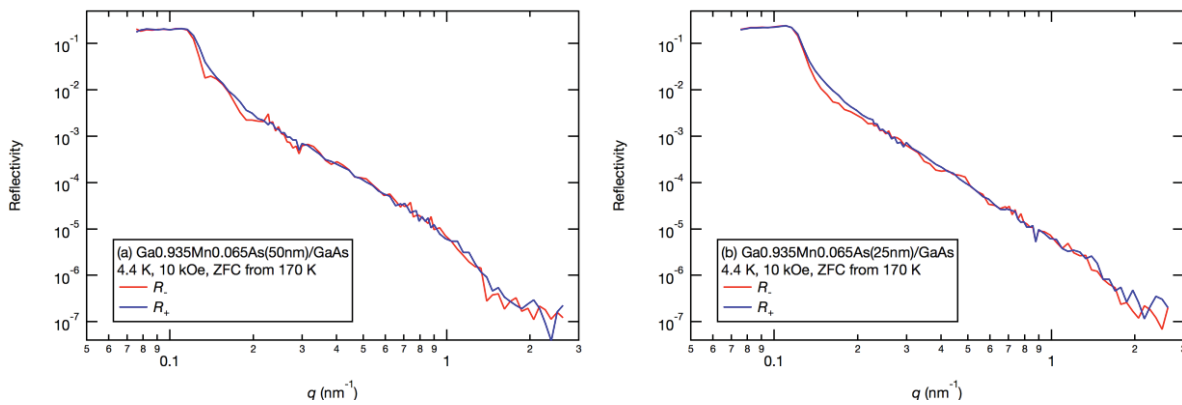


Fig. 1 Polarized neutron reflectivity profiles of  $\text{Ga}_{0.935}\text{Mn}_{0.065}\text{As}$  single layer with thickness of (a) 50 nm and (b) 25 nm on a GaAs substrate under a magnetic field of 10 kOe (a) at 4.4 K after ZFC from 170 K above  $T_c$ .

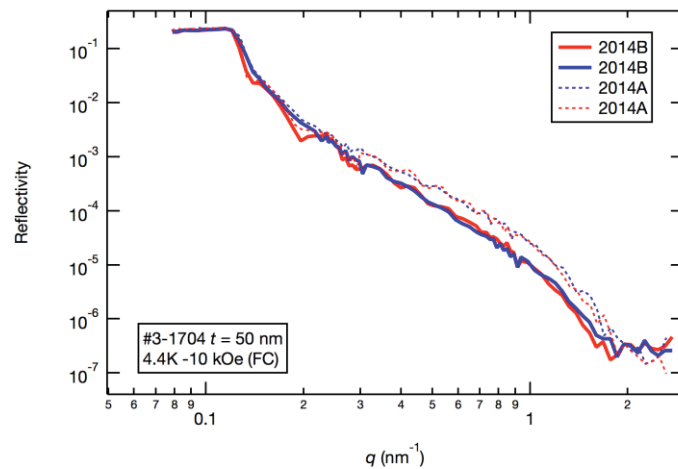


Fig. 2 Comparison between the polarized neutron reflectivity profiles of  $\text{Ga}_{0.935}\text{Mn}_{0.065}\text{As}$  single layer (50 nm) on a GaAs substrate under the same experimental condition in 2014A (dotted line) and those in 2014B (solid lines).