


実験報告書様式(一般利用課題・成果公開利用)

(※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。)

 <b>MLF Experimental Report</b>	提出日 Date of Report 2014/6/21
課題番号 Project No. 2013B0242 実験課題名 Title of experiment Study on in-plane magnetic structure of neutron polarizing multilayer mirrors 実験責任者名 Name of principal investigator Ryuji Maruyama 所属 Affiliation J-PARC Center, Japan Atomic Energy Agency	装置責任者 Name of responsible person Masayasu Takeda 装置名 Name of Instrument/(BL No.) BL17 実施日 Date of Experiment 2013/03/14-2013/03/19

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.
Fe/Ge multilayer consisting of 30 bilayers with a d-spacing of 10 nm

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.
<p>Off-specular scattering (OSS) measurement with polarization analysis was performed for the sample stated above. An external field to the sample was chosen to be 60 Oe, where the sample is magnetized approximately to 70% of saturation so that both the spin-flip and non-spin-flip scattering from magnetic domains is expected because the average deviation angle of magnetization with respect to the external field is regarded to be 45 degrees. The data are collected by a single <math>^3\text{He}</math> tube because a 2-D position sensitive detector was not available in this beam time. The measured OSS images are shown in Fig. 1. The specular reflection is located on <math>\alpha_i - \alpha_f = 0</math>. The first, second, and third Bragg peaks are observed at <math>\lambda = 0.7, 0.4, \text{ and } 0.28 \text{ nm}</math>, respectively. The scattering arising from the roughness correlation is seen in <math>I_{++}</math> channel under the condition in which <math>q_z</math> satisfies the Bragg condition (corresponding to <math>(\alpha_i + \alpha_f)/\lambda = \text{const.}</math> in Fig. 1). Intense spin-flip scattering is clearly observed in <math>I_{+-}</math> and <math>I_{-+}</math> channels under the condition in which the incident or exit angle corresponds to the first Bragg condition for spin-up neutrons (corresponding to <math>\lambda = 0.68 \text{ nm}</math> and <math>\alpha_f/\lambda = 1 \text{ deg/nm}</math> in <math>I_{+-}</math> and <math>I_{-+}</math> channels, respectively, in Fig. 1). The obtained data demonstrated that BL17 has ability to measure OSS images with polarization analysis.</p>

## 2. 実験方法及び結果(つづき) Experimental method and results (continued)

The coverage in  $q_x$ - $q_z$  space was not enough to deduce something interesting and important from scientific point of view because the 2-D position sensitive detector was unavailable. The preparation of a detector covering a wide range in the scattered angle is definitely needed to increase the efficiency of OSS measurements.

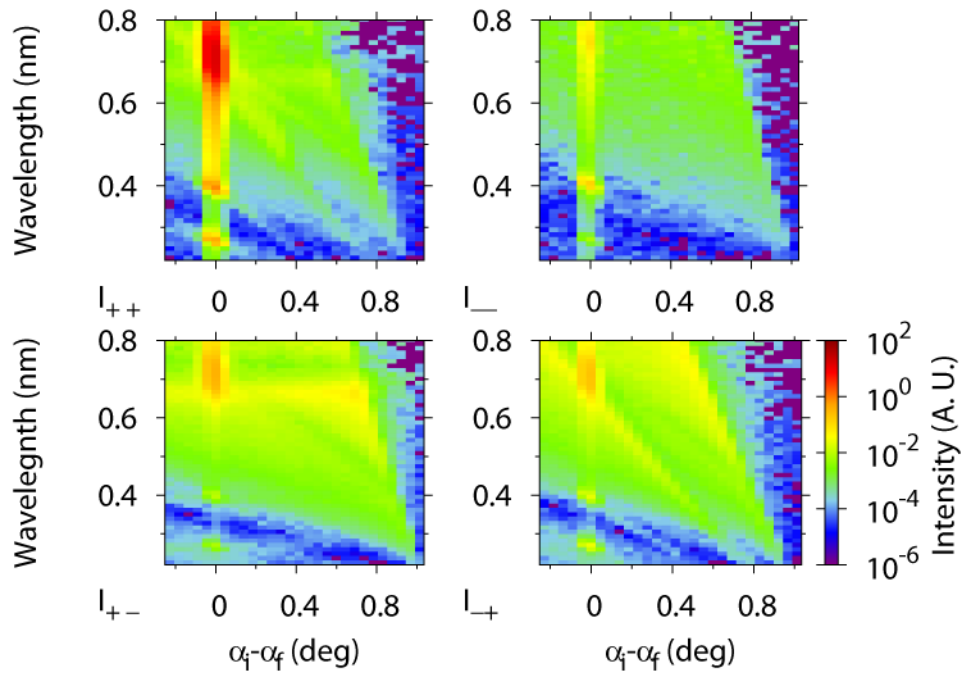


Figure 1: Measured OSS images with polarization analysis for Fe/Ge multilayer consisting of 30 bilayers with a period of 10 nm.