

実験報告書様式(一般利用課題・成果公開利用)

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 <b>MLF Experimental Report</b>	提出日 Date of Report 2013/03/25
課題番号 Project No. 2012B0165 実験課題名 Title of experiment Magnetic structure analysis on single crystal neutron diffractometer SENJU 実験責任者名 Name of principal investigator Takuro Kawasaki 所属 Affiliation J-PARC center, Japan Atomic Energy Agency	装置責任者 Name of responsible person Takashi Ohhara 装置名 Name of Instrument/(BL No.) SENJU / BL18 実施日 Date of Experiment 2013/1/17 - 1/21

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.  1) TbCoGa <sub>5</sub> , 2.6 x 2 x 1.8 mm <sup>3</sup> , 30 mg, single crystal 2) HoCoGa <sub>5</sub> , 1 x 1 x 2 mm <sup>3</sup> , 30 mg, single crystal 3) DyCoGa <sub>5</sub> , 1.2 x 1.2 x 2 mm <sup>3</sup> , 35 mg, single crystal
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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.  The sample was attached to the vanadium stick with the diameter of $\phi$ 0.5 mm using an adhesive and it mounted to the SENJU standard goniometer on the 4K-cryostat. The measurements were performed by the standard procedures for SENJU.  The data reduction to obtain the integrated intensity of the reflections and visualization were performed using the software STARGazer. The software JANA2006 was used to analyze the nuclear and magnetic structure of the samples.  Although three compounds used in this experiment have tetragonal HoCoGa <sub>5</sub> -type structure (so-called 115 system), the magnetic structures of these compounds have an orthorhombic symmetry, and two magnetic domains are coexisting in the antiferromagnetic phase. Therefore, these domains were treated as the twin structure in the analyses. Though the analyses are not completed, fundamental procedures for a magnetic structure analysis on SENJU were demonstrated.  The result and status of the analysis for each compound are listed below.
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## 2. 実験方法及び結果(つづき) Experimental method and results (continued)

### 1) TbCoGa<sub>5</sub>

The diffraction data were measured at 4.7 K, 10 K and 50 K for antiferromagnetic phase I, phase II and paramagnetic phase, respectively.

Magnetic superlattice reflections were observed at  $h/2, k, l/2$  and the intensity was enhanced with the temperature goes down.

Nuclear structure was refined using the fundamental reflections for the three temperatures. All the structural parameters were converged to the reasonable value. The magnetic structure of the phase II was refined as shown in Fig. 1. The resultant reliability factor,  $R = 6.06\%$ , is a rather good value. The obtained magnetic moment of Tb<sup>3+</sup> ion along  $c$ -axis,  $8.56 \mu_B$ , well agreed with the previous reported value obtained from neutron powder diffraction data. The analysis for phase I is now in progress.

### 2) HoCoGa<sub>5</sub>

The diffraction data were measured at 4.7 K, 8 K and 20 K for the antiferromagnetic phase, incommensurate magnetic phase and paramagnetic phase, respectively.

Magnetic reflections were observed at  $h/2, k, l/2 \pm 0.287$  and  $h/2, k, l/2$  at 8 K and 4.7 K, respectively.

The analyses for HoCoGa<sub>5</sub> are now in progress.

To obtain the integrated intensities of the reflections which appeared in an incommensurate phase conveniently, the improvement of the data reduction software is required.

### 3) DyCoGa<sub>5</sub>

Experiment was not performed.

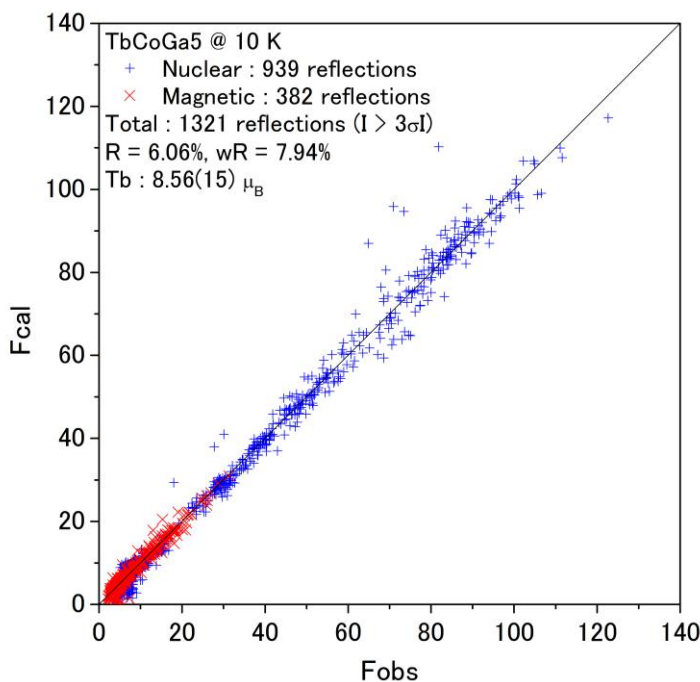


Fig. 1. Observed and calculated structure factor of TbCoGa<sub>5</sub> at 10 K.