

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。)

	承認日 Date of Approval 2014/8/18 承認者 Approver Takashi Ohhara 提出日 Date of Report 2014/8/18
課題番号 Project No. 2014A0080 実験課題名 Title of experiment Magnetic structure analysis of high neutron absorbing compounds EuX ₄ (X=Ga, Al) 実験責任者名 Name of principal investigator Takuro Kawasaki 所属 Affiliation 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 2014/5/2 21:00 – 5/5 21:00 (3 days)

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.
EuAl ₄ ・Single crystal ・Size: 2.0 mm x 1.5 mm x 0.5 mm ・Crystallographic space group: I4/mmm ・Lattice parameters: $a = b = 4.398 \text{ \AA}$, $c = 11.11 \text{ \AA}$

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.
[Method] <ul style="list-style-type: none"> ・ The sample was fixed to a vanadium stick and mounted on to the goniometer installed inside the standard closed cycle refrigerator of SENJU. ・ The neutron diffraction intensities from EuAl₄ were measured at room temperature, 4 K, 11 K, 11.5 K, 12.5 K, 13.5 K, 14 K and 30 K in some crystal orientations. ・ Data reduction and visualization were performed using the software STARGazer. [Result] <ul style="list-style-type: none"> ・ Nuclear Bragg reflections were successfully observed and the obtained lattice parameters agreed well with the reported values. ・ Splitting of nuclear Bragg spots in c^* direction was observed below 30 K. The intensity distribution around -200 reflection is shown in Fig. 1. The splitting probably comes from CDW transition of EuAl₄, because the transition was found at 130 K.

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

- Magnetic reflections were appeared at $h \pm \delta$ $k \pm \delta$ l below 16 K and $h \pm \delta'$ k l below 12 K as shown in Fig. 2. These temperatures correspond to magnetic transition temperature of EuAl_4 determined from magnetization measurement. Because the values of δ and δ' are not rational number, the magnetic structure of EuAl_4 should have incommensurate characteristics. The magnetic structure of EuAl_4 is clearly different from the structure of EuGa_4 which is commensurate one, though these compounds have same crystal structure and same atomic valences. The magnetic structures of EuAl_4 are under analysis.

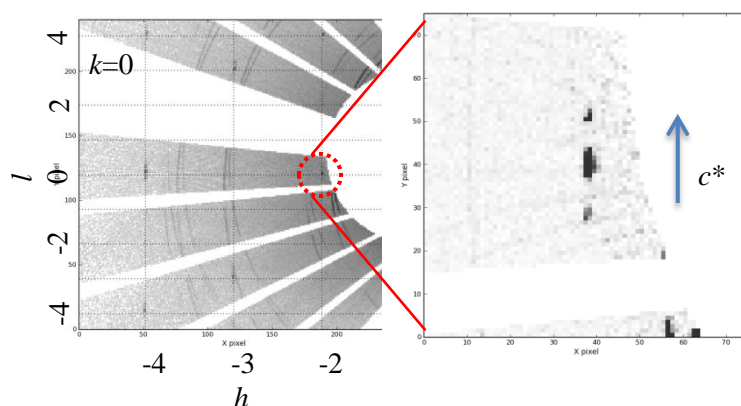


Fig. 1. Neutron diffraction intensities in $(h0l)^*$ reciprocal lattice plane measured at 30 K. -200 reflection is split in the direction of c^* axis.

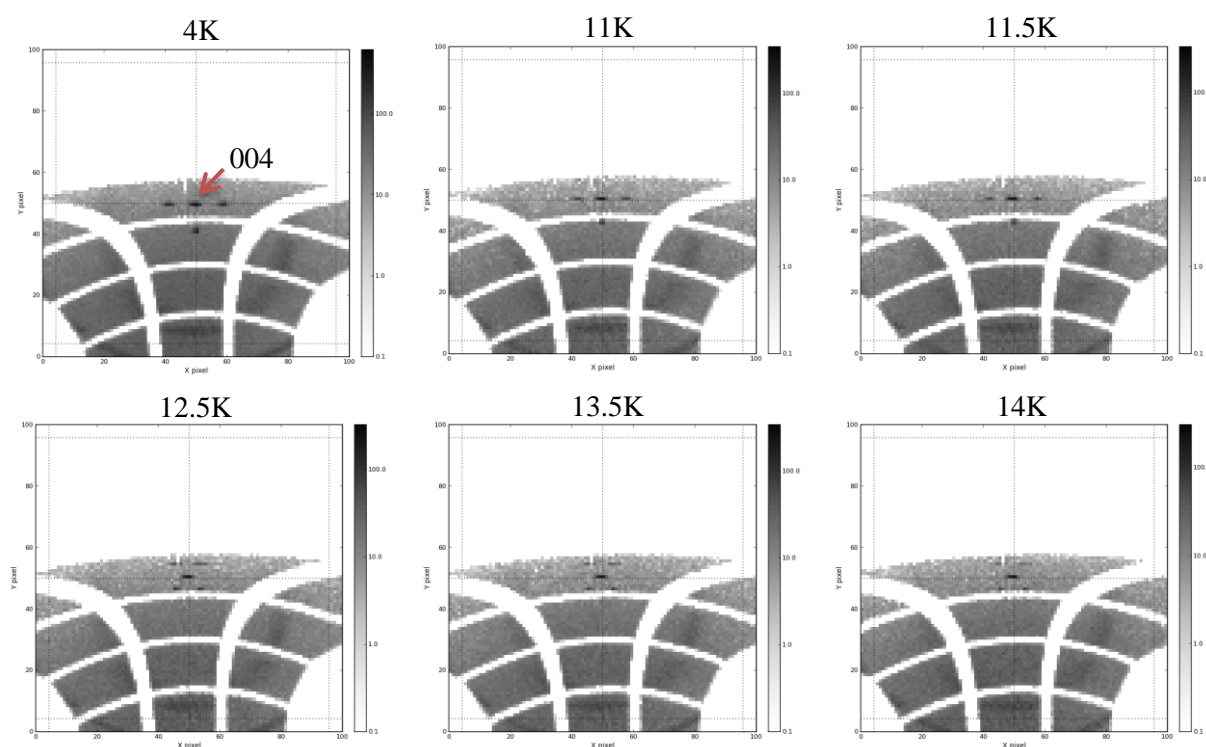


Fig. 2. Neutron diffraction intensities in $(hk4)^*$ reciprocal lattice plane measured at 4 K, 11 K, 11.5 K, 12.5 K, 13.5 K and 14 K. Magnetic reflections have appeared around 004 reflection.