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X-ray diffraction study of $CeRu_2Al_{10}$ at low temperatures and high pressures

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1 Introduction

$CeRu_2Al_{10}$ crystallizes in the orthorhombic *Cmcm* crystal structure[1]. $CeRu_2Al_{10}$ exhibits anomalous antiferromagnetic transition at T_N ~27 K. This phase transition is attracted attention for its high T_N[2-3]. Although magnetic moment is observed below T_N by neutron diffraction study[4], the drive force of this high T_N is still controversial. One proposed idea is that Charge Density Wave (CDW) transition induces antiferromagnetic transition. If CDW transition happens at T_N, there must be structural change or modification at T_N. In addition, T_N drops at the critical pressure (P_C) ~ 4 GPa in the pressure dependence. The sudden disappearance of phase transition against pressure suggests the structural change at P_C. In order to investigate the structural change on $CeRu_2Al_{10}$ around T_N or P_C, we performed synchrotron X-ray diffraction study at low temperatures and high pressure.

2 Experiment

Single crystals of $CeRu_2Al_{10}$ were made using Al self-flux method and were crushed into fine powder. The grains of the samples were uniformed by sedimentation. The X-ray diffraction measurements under high pressures were conducted using synchrotron radiation. An imaging plate was used as a detector. The pressure was applied using diamond anvil-type pressure cell. The pressure cell was cooled by GM refrigerator. A 4:1 mixture of methanol/ethanol was used as a pressure-transmitting medium. The applied pressure was determined by a ruby fluorescence method.

3 Results and Discussion

Figure 1 shows the X-ray diffraction patterns of $CeRu_2Al_{10}$ under pressures and low temperatures. Neither peak splitting nor peak disappearance is observed down to 10 K and up to 6.5 GPa. These results indicate no structural change in $CeRu_2Al_{10}$ around T_N or around P_C. Fig. 2 shows temperature dependence of lattice constant on $CeRu_2Al_{10}$. Each lattice constant is independent of temperature, which indicates there is no structural modification in this experimental accuracy.

In order to investigate crystal structure in detail, Rietveld analysis of $CeRu_2Al_{10}$ is now in progress.

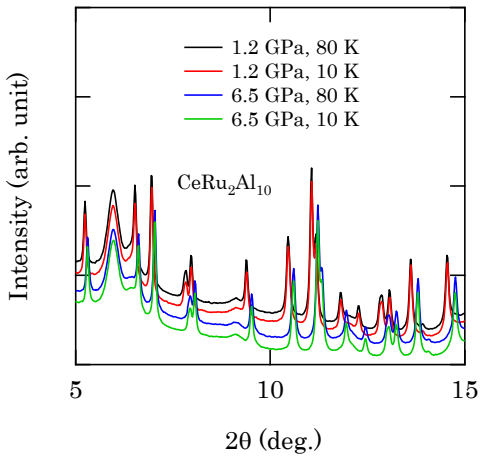

Fig. 1: X-ray diffraction pattern of $CeRu_2Al_{10}$ at 1.2 GPa, 80 K(black), 10 K(red) and at 6.5 GPa 80 K(blue), 10 K(green).

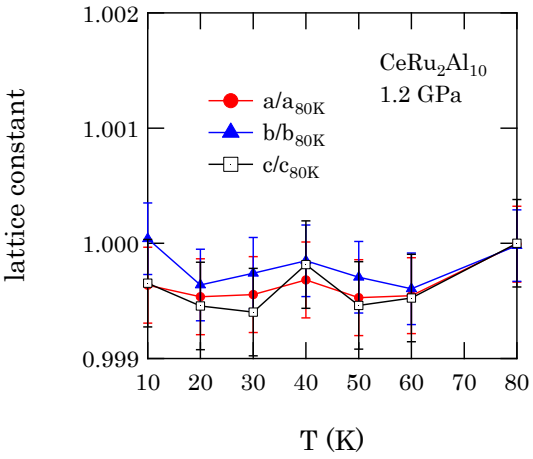

Fig. 2: Lattice constant normalized at 80 K a/a_{80K} (circle) b/b_{80K} (triangle) c/c_{80K} (square).

References

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