Magnetic structure of a pressure-induced magnetically ordered phase in YbAgGe with a quasi-kagome lattice

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The heavy-fermion antiferromagnet YbAgGe with the ZrNiAl-type structure undergoes two magnetic transitions at TM1=0.8 K with an incommensurate propagation vector k1=[0, 0, 0.324] and TM2=0.65 K with k2=[1/3, 0, 1/3] .[1,2] An expanded tail in specific-heat C(T) above TM1 is consistent with the magnetic frustration.[1] Recently, an anomalous phase diagram of YbAgGe under pressures has been constructed from the resistivity and C(T) measurements.[3,4] With applying pressure above 0.5 GPa, the resistivity anomalies at TM1 and TM2 merge into a sharp drop at TM=0.85 K.[3] In the pressure range 0.5 $<$ P $<$ 1.5 GPa, magnetic ordering temperature TM(P) remains constant, while above P* = 1.6 GPa, TM(P) increases linearly. Concomitantly, the anomaly of C(T) at TM converts from a first-order type sharp peak to a second-order type jump of a conventional magnetic compound without geometrical frustration. Additionally, the magnetic entropy at TM rises for P $>$ P*, while Kondo temperature does not change.[4] These findings suggest that the sudden rise of TM(P) for P $>$ P* is a due to the release of the magnetic frustration. In the present work, in order to determine a magnetic structure above 1.6 GPa, we performed neutron diffraction experiments under high pressure.

Measurements were preformed on a single crystalline sample prepared by the Bridgman method. In neutron diffraction experiments, the sample was cooled down to 35 mK with a 3He-4He dilution refrigerator. A pressure of 0.6 GPa was applying by a piston-cylinder cell (Cu-Be alloy, outer diameter=14mm) using Daphne oil as a pressure transmitting medium.

We found magnetic Bragg reflections at Q=(1/3, 0, 1/3), (1/3, 0, 2/3), (2/3, 0, 1/3) and (2/3, 0, 2/3) at T=35 mK. Fig. 1 shows the omega scan of the magnetic Bragg reflection at Q=(2/3, 0, 2/3) performed at T=0.3 K and 1.13 K $>$ TM. However, we observed no super lattice reflection with the propagation vector k1=[0, 0, 0.324]. In order to investigate the magnetic structure above 1.6 GPa, we are planning to perform neutron diffraction measurements under higher pressures.

[1] K. Umeo et al.: J. Phys. Soc. Jpn, 73 (2004)537.
[2] B. Fak et al.: Physica B378-380 (2006)669.
[3] K. Umeo et al.: Physica B 359-361 (2005)130.
[4] H. Kubo et al.: J. Phys. Soc. Jpn, 77 (2008) in press.

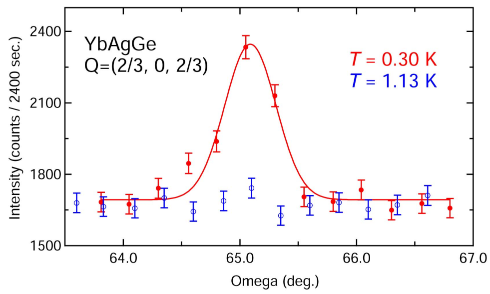

Fig. 1. Omega scan of the magnetic Bragg reflection at Q=(2/3, 0, 2/3). The closed and open circles correspond to the data at T=0.3 and 1.13 K, respectively. The curves is a result of Gaussian fitting.