Magnetic scattering in $CuFePt_6$ ternary alloy

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Ternary alloy $CuFePt_6$ has a single phase at this stoichiometric composition and forms a Cu_3Au type ordered structure below 1313 K[1]. It shows anomalous magnetic behaviors[2]. The alloys with both ordered and disordered states undergo successive transitions of ferromagnetic (at T_C) and and anti-ferromagnetic (at T_N), and the transition temperatures depend on the atomic ordered states. Magnetic susceptibility shows reentrant spin-glass-like behavior bellow T_N with different behaviors for FC and ZFC process. Thus the magnetic structures are quite sensitive to the magnetic field and the atomic arrangements, indicating an existence of magnetic fluctuations due to the competitive interactions. In this study, magnetic structures of the alloy with a Cu_3Au type atomic order was studied at PONTA, JRR3. Magnetic diffraction under zero-magnetic field shows ferromagnetic scattering at 110 (Γ-point) below T_C, and anti-ferromagnetic scattering at 1/2 1/2 0 (*M*-point) below T_N with keeping the ferromagnetic intensities unchanged. Contrary to the results of magnetization measurements, their intensities show the same temperature dependences for the FC and ZRC processes. Magnetic field dependence of the magnetic scattering was investigated up to 8kOe. Intensities of the ferromagnetic reflections increase gradually, but those of anti- ferromagnetic reflections remain constant (fig.1(a)). The results are also contradictory to those of magnetization measurements which show typical ferromagnetic behavior below T_C and the magnetic moment almost saturates at 4kOe. In the ferromagnetic and anti-ferromagnetic scattering, low-energy inelastic components are observed. The inelastic components divided by the Bose factor depend neither temperature nor magnetic field, and observed up to R.T (fig.1(b)). Further study is necessary to understand the origin of the low-energy inelastic scattering and different behaviors between magnetization and neutron diffraction measurements.

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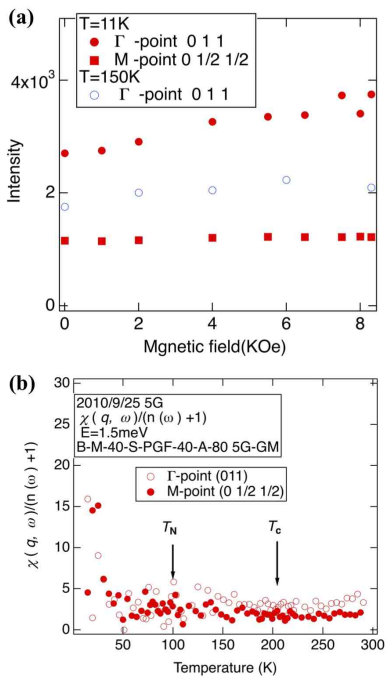

Fig. 1. (a)Magnetic field dependence of magnetic scattering intensities at Γ-and M-points and (b)temperature dependence of inelastic scattering at the same points.