Polarization analysis neutron scattering study of magnetic correlations in random magnet Fe65(Ni-Mn)35

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A previous neutron scattering study showed that the short-range ferromagnetic and antiferromagnetic correlations coexist in wide concentration and temperature ranges of a random magnet system Fe65(Ni-Mn)35 [1]. Magnetic field variations of diffuse scattering patterns arising from these ferromagnetic and antiferromagnetic correlations have shown that the regions of these two kinds of correlations coexist separately in this system [2]. In this report, we present the result of polarization analysis experiment of this system.

The magnetic diffuse scattering patterns arising from ferromagnetic correlations (ferromagnetic clusters) observed around (111) Bragg point are well traced by a Lorentzian (LOR) function. Figure 1 (A) and (B) show the magnetic field variations of the amplitude (AL) and the width (κ L) of the spin-flip and non-spin-flip components, respectively. The result shows that the number and the average size of ferromagnetic clusters decrease with increasing field. This seems to be inconsistent with the magnetization behavior. We have made a scenario of magnetic field variation of ferromagnetic clusters consistent with the results of the neutron scattering and magnetization measurements [2].

The diffuse scattering signals arising from antiferromagnetic correlations (antiferromagnetic clusters) have been measured around (100) and (110) Bragg points. These patterns are well traced by a LOR function. The field variations of the amplitude and the width of the spin-flip and non-spin-flip components are shown in Fig.1 (C) and (D), respectively.

Based on the unpolarized [2] and the present polarization analysis measurements, we will determine the magnetic field variations of the number, size and orientation of the ferromagnetic clusters as well as the magnetic structure of the antiferromagnetic clusters.

[1] K. Motoya and K. Hioki, J. Phys. Soc. Jpn. 72 (2003) 930.

[2] K. Motoya et al., Phys. Stat. Sol. (submitted)

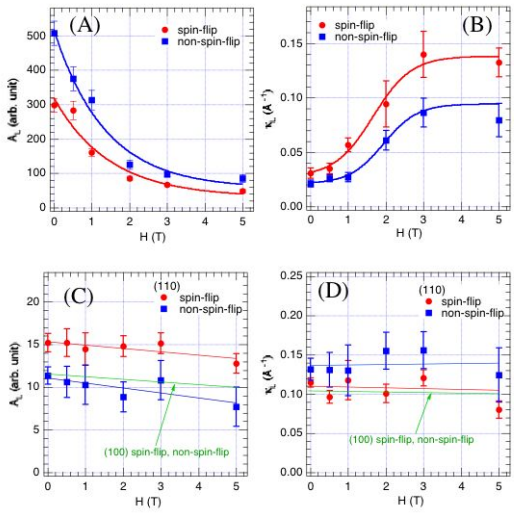

Fig. 1. Magnetic field variations of the amplitude and the width of the scattering patterns arising from ferromagnetic and antiferromagnetic clusters.