Magnetic and Neutron Diffraction Study on Ni2In type Mn65(Sn1-xTx)35
T=(Ga,Ge)

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The hexagonal Ni2In type (P63/mmc) Mn65(Sn1-xTx)35 T=(Ga,Ge) compound shows a single phase in the range of 0.2≤x≤0.5 for T=Ga and 0≤x≤0.8 for T=Ge. The sample of x=0 has a collinear ferrimagnetic structure showing glass-like phase at lower temperature range. We made the magnetization measurements and the ac susceptibility measurements for Mn65(Sn1-xTx)35 T=(Ga, Ge) compound.

The concentration dependence of lattice constants a and c at room temperature is shown in Fig.1(a). The ferrimagnetic Curie temperature increases monotonously for Mn65(Sn1-xGax)35 system and decreases for Mn65(Sn1-xGex)35 system.

In order to determine the distribution of the atoms in the Ni2In type crystal structure, the neutron diffraction (ND) experiments were carried out for several samples at paramagnetic state and the data was analyzed with the Rietveld refinement methods. The refined pattern at T=295 K for x=0.5 of Mn65(Sn1-xGax)35 system is shown in Fig.1(b). The determined distribution of atoms among the sublattice is as follows; 2(a) site is occupied by Mn(1.0), 2(d) site is occupied by Mn(0.64) and 2(c) site is occupied by Sn(0.50) and Ga(0.50).

Fig.1(c) shows the observed ND intensity at T=20K for x=0.5 of Mn65(Sn1-xGax)35 system. In the lower angle of ND pattern, the magnetic super lattice line (0 0 1/2), (1 0 1/2) is clearly observed in the low temperature, which means the existence of the magnetic unit cell with two times of the chemical one in the c direction. ND pattern for x=0.3 and x=0.5 of Mn65(Sn1-xGex)35 system showed only weak and broad magnetic reflection. In the temperature range of the cluster glass for Mn65(Sn1-xGex)35 system, large size and small size of ferrimagnetic and ferromagnetic clusters may exist coupling each other. The nonmagnetic 2(c) site atoms play important rule to formation of the magnetic super lattice in the hexagonal Ni2In type Mn65(Sn1-xTx)35 T=(Ga, Ge) compound.

Fig. 1. (a) The concentration dependence of lattice constants a and c at room temperature for Mn65(Sn1-xTx)35 T=(Ga, Ge) compound