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Magnetic properties and peculiarity of magnetic states in dilute antiferromagnets $Mn_{1-x}Zn_xF_2$

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Abstract. The dependence of magnetic moment and susceptibility on temperature, magnetic field and frequency of some single crystals $Mn_{1-x}Zn_xF_2$ ($x \approx x_e = 0{\cdot}75$—percolation limit) were experimentally investigated. Our experiments show that (Bazhan and Petrov 1984; Cowley *et al* 1984; Villain 1984) in these crystals the nonequilibrium magnetic state of spin-glass type with finite correlation length appears as temperature decreases $T < T$ in weak magnetic fields. This state is determined by fluctuation magnetic moments $\sqrt{n}\,\mu$ (where n is the number of magnetic ions, corresponding to finite correlation length and μ the magnetic moment Mn^{+1}).

In the experiments in low magnetic fields and frequencies there are no peculiarities in the magnetic susceptibility temperature dependence at $T \neq T_f$. At temperatures $T > T_f$ and $T < T_f$ magnetic susceptibility is determined by

$$\chi(T > T_f) = \frac{N\langle\mu\rangle^2}{3k(T+\theta)} = \frac{N\langle\sqrt{n}\mu\rangle^2}{n\ 3k(T+\theta)} = \chi(T < T_f).$$

In strong magnetic fields and large frequencies there are peculiarities in the $\chi(T)$ dependence at $T = T_f$. At $T < T_f$ and strong magnetic fields $\chi(T) = \chi_0$ and $T < T_f$ and at large frequencies $\chi(T) = \chi_0 + \alpha/T$.

The dependences of magnetic susceptibility on the frequency are determined by the magnetic system relaxation. Calculations and comparison with experiments show that the relaxation of the investigated magnetic systems at $T < T_f$ follows the relaxation law $M(t) = M(0)\exp[-(t/\tau)^r]$, suggested in Palmer *et al* (1984) for spin-glasses relaxation taking into account the time relaxation distribution $\tau_0 \ldots \tau_{max}$ in the system and its 'hierarchically' dynamics.

Keywords. Magnetic properties; antiferromagnets.

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