MAGNETIC AND NEUTRON DIFFRACTION STUDY OF THE REENTRANT TEMPERATURE TRANSITION «HEISENBERG ANTIFERROMAGNETIC-SPIN GLASS»

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During the last decade the reentrant phenomena in spin glass systems were investigated intensively. From these works follows that in some antiferromagnetics after cooling to a temperature lower than the Neel point the so-called antiferromagnetic spin glass state appears. In this state the degene-

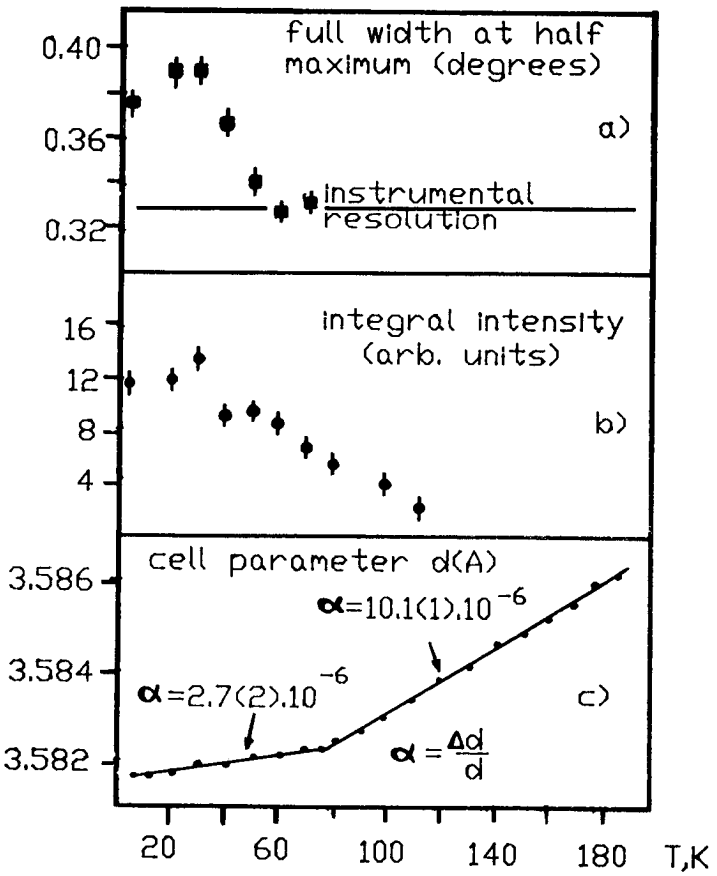

Fig. *a)* Temperature dependence of full width at half maximum of magnetic peak (if peak is approximated by gaussian). Solid line corresponds to resolution of diffractometer (with error 0.001 degree); *b)* Temperature dependence of integral intensity of magnetic peak; *c)* Temperature dependence of cell parameter

rated spin glass and the long antiferromagnetic ordering coexist. It was shown using the neutron diffraction method, that the transition to the reentrant spin glass state in the Ising system did not led to the destruction of the long antiferromagnetic ordering. This question, concerning for the reentrant transition in the Heisenberg system, is still open.

Antiferromagnetic fcc iron alloys are very attractive for the experimental study of this problem. Firstly, there are reentrant temperature transitions in these alloys. Secondly, the exchange energy is much higher than the anisotropic energy and they can be considered as a Heisenberg antiferromagnetic.

For our study we have chosen the alloy $Fe_{52}Ni_{28}Mn_{20}$ /1/. The neutron diffraction measurements were carried out on the 48-counter powder diffractometer with a neutron wavelength of 2.555Å. The graphite filler allowed us to reduce the $\lambda/2$ contaminations to a value of about 0.5%.

From the magnetic susceptibility measurements follows that under cooling of the alloy in the antiferromagnetic region below 120K, at a temperature of about 60K, the transition to the reentrant spin glass phase occurs. We have investigated the peak (110), caused by antiferromagnetic ordering. The

temperature dependence of the integral intensity of this peak and its full width at half maximum (if the peak is approximated by gaussian) are shown in figure. The solid line corresponds to the resolution of the diffractometer (with error 0.001 degree). The last one was obtained from the measurements of the nuclear (220) reflection from the neutrons with $\lambda/2$, which appears at the magnetic peak place, if the graphite filter is removed. The increasing of the peak width below the 'freezing' temperature means that a long magnetic ordering is destroyed. From this broadening one can evaluate the inverse correlation radius as 700Å.

From the measurements of the nuclear reflection position an interesting peculiarity in the temperature dependence of the cell parameter revealed (See fig.) near the 'freezing point'. Assuming this dependence to be linear beyond this point we have calculated by the least squares method the value of the thermal expansion coefficient a: at $T<T$ $a=2.7(2)\times10^{-6}$ $(\text{degree})^{-1}$; and at $T>T_f$ $a=10.1(1)\times$ $\times10^{-1}$ $(\text{degree})^{-1}$. It is necessary to emphasize that at the Neel point there are no peculiarities. We have no explanations of this behaviour as yet.

REFERENCE

1. *Golosovsky I. V. et al.* Pisma v JETF, 49. 1989. 214.