MAGNETIC PROPERTIES OF NICKEL FERRITE-ALUMINATES

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Magnetic properties of nickel ferrite-aluminates $NiFe_{2-t}Al_tO_4$ were investigated with neutron diffraction, magnetometric and Mössbauer effect methods. The experimental details are described elsewhere /1/.

Results of early Mössbauer effect investigations /2/ for the samples with $t \geq 1$ were interpreted as an evidence of the non-collinear spin ordering in the A sublattice. Two Zeeman patterns were attributed both for the t=0.2 and 0.5 sample, four- for the t=1.0 sample and three- for each of the t=1.4, 1.6, 1.8 samples. Our Mössbauer absorption spectra measured at 78K for t=0.75, 1.0, 1.25 and 1.5 do not confirm this assumption. They are easily interpreted as being due to two six line hyperfine patterns corresponding to ^{57}Fe in the A and B positions. The presence of non-collinear spin ordering in spinels should be evidenced as an additional /200/ reflex in the neutron diffraction patterns which is not observed in our neutron spectra. The results of magnetization measurements proved the collinear ordering for the samples with t_{up} to 1.25. The magnetic saturation of these samples was obtained in the fields of about 4kOe. However, for the t=1.5 sample no saturation of the magnetization at 78K was obtained even in the fields up to 80kOe.

The explanation of the variation of the saturation magnetic moment per molecule σ with a chemical composition t /Fig.1/ is based on the assumption of the collinear spin ordering, the cation distributions previously reported /3/ and the values of

iron and nickel magnetic moments derived from neutron diffraction patterns. The discrepancy between measured values of σ and the fitted curve for the samples with t>1.5 /Fig.1/ together with the slight increase of the magnetization of the t=1.5 sample in high magnetic fields may be interpreted as an evidence of the superparamagnetic behaviour of these samples. The Mössbauer spectrum in Fig.2 seems to support this interpretation.

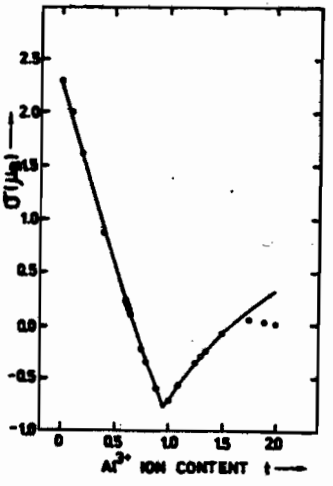

Fig.1. Variation of σ measured at 78K with t

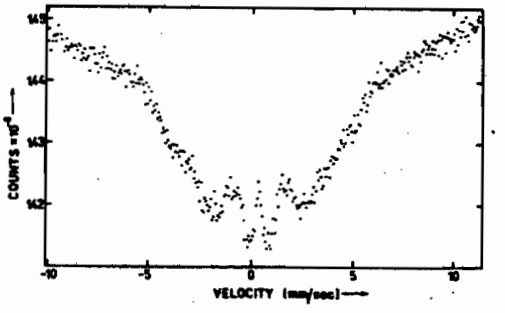

Fig.2. Mössbauer absorption spectrum of the t=1.25 sample measured at 295K

References:
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/3/ J.J.Bara, submitted to phys. stat. sol.