substance: FeO ($Fe_{1-x}O$)
property: magnetic properties

Below T_N, the spins of Fe^{2+} lie in ferromagnetic (111) sheets which are antiferromagnetically coupled along [111]. The spin direction is thought to vary depending on the distance from a defect cluster; near a cluster the spins tend to lie close to the (111) plane and in the defect free region they align along [111] [79B]. At high temperatures (970...1500 K) a Curie-Weiss law is obeyed: $\chi = C/(T-\Theta_p)$. (Fig. 1).

parameters of the Curie-Weiss law for $Fe_{1-x}O$

C_m	3.30(3.30)	x = 0	values in brackets: Curie constant	70M
	3.24(3.27)	x = 0.01	C_{Fe} referred to gram-atom of Fe;	
	3.23(3.30)	x = 0.02	C_m in K cm^3/mol, Θ_p in K.	
	3.06(3.28)	x = 0.04	Mean value of C_{Fe}: 3.25 K cm^3/g-atom	
	2.93(3.25)	x = 0.06	corresponding to $p_{eff} \approx$ 5.1 μ_B	
	2.96(3.26)	x = 0.09		
Θ_p	– 10(10)	x = 0		
	– 40(10)	x = 0.01		
	– 40(10)	x = 0.02		
	– 60(10)	x = 0.04		
	– 90(10)	x = 0.06		
	– 100(10)	x = 0.09		

magnetic susceptibility: temperature dependence near T_N shown in Fig. 2.

Néel temperature

T_N	200 K	x = 0.02	varies in a rather complex way	68F
	195 K	x = 0.068	with x	67K
	203 K	x = 0.104		

spin wave spectrum: Fig. 3. Analysis of neutron scattering data [79B] shows that the spin of the interstitial Fe_i^{3+} may be oriented in the (111) plane, pulling neighbouring octahedral Fe^{2+} and Fe^{3+} spins also into the (111) plane (Fig. 4).

parameters of the spin wave Hamiltonian

$H = -\sum_{ij} J_{ij} s_i \cdot s_j + \sum_i D(s_i^z)^2$

J_1^+	+ 3.70 cm^{-1}	T = 4.2 K	For definition of coupling constants	78K
J_1^-	+ 2.06 cm^{-1}	($T < T_N$)	see document	
J_2'	– 6.52 cm^{-1}			
D_1	– 0.68 cm^{-1}			
ε	65		ε is defined as d ln J_1/d ln r with r = internuclear distance	

References:

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67K Koch, F. B., Fine, M. E.: J. Appl. Phys. 38 (1967) 1470.
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70M Michel, A., Poix, P., Bernier, J. C.: Ann. Chim. 5 (1970) 261.
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79B Battle, P., Cheetham, A. K.: J. Phys. C12 (1979) 337.

Fig. 1.

$Fe_{1-x}O$. Crystalline and antiferromagnetic structure below the Néel temperature [58R].

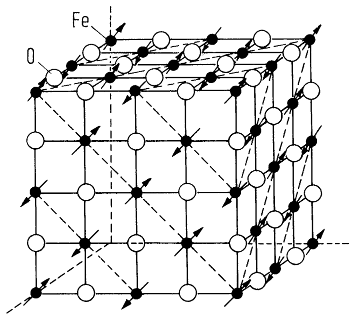

Fig. 2.

$Fe_{1-x}O$. Magnetic susceptibility vs. temperature for two samples of different stoichiometry [67K].

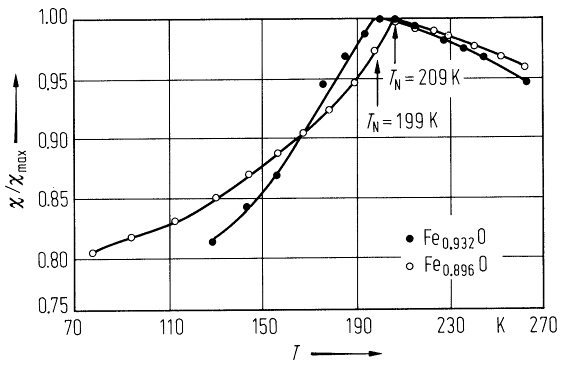

Fig. 3.

$Fe_{0.93}O$. Spin-wave spectrum [78K]. Solid line calculated.

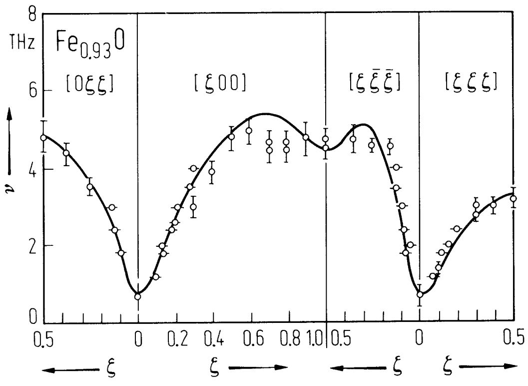

Fig. 4.

$Fe_{1-x}O$. Local spin arrangements about a 4:1 cluster [79B].