TEMPERATURE DEPENDENCE OF THE STRUCTURAL AND MAGNETIC PROPERTIES OF $Mn_{1.11}Al_{0.89}$ *

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Braun and Goedkoop (1963) investigated the crystal and magnetic structure of $Mn_{1.11}Al_{0.89}$ at room temperature using the methods of x-ray and neutron powder diffraction. They found that the unit cell is tetragonal (a=2.77, c=3.54 A) with $Mn_{0.97}Al_{0.03}$ at (0,0,0) and $Mn_{0.14}Al_{0.86}$ at (1/2,1/2,1/2)(for their sample) and that the manganese magnetic moments, having the opposite directions at the two positions in the unit cell, are along the c-axis. They also showed that in the neutron case the nuclear reflections with h+k+l odd and the magnetic reflections with h+k+l even depend on the degree of order of the alloy while the nuclear reflections with h+k+l even and the magnetic reflections with h+k+l odd do not.

We studied the degree of order and the magnetic properties of the manganese-aluminum system of the same composition in the temperature range from 22 to 425 C by neutron powder diffraction technique. The intensities of purely nuclear (001) and mixed (100) and (111) diffraction maxima were measured at 18 temperature points on heating and at 5 temperature points on cooling our polycrystalline sample. The diffraction

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* These results will be published elsewhere in detailed form.

and

$$\gamma = \gamma_1 + \frac{\tilde{m}^2 \omega_{pe}^2 s_e^2 V_F}{\rho e^2 s_t^2 \ell} R_3 \, , \quad \begin{cases} \frac{s}{\delta_0}\left(\frac{s}{V_F}\right)^{1/2} \ll \omega \ll \frac{s}{\delta_0} & , \frac{s}{\omega} \ll \ell \ll \delta_0 \left(\frac{V_F}{s}\right)^{1/2} \frac{\omega^3}{\omega_{em}^3} \\ \frac{s}{\delta_0} \ll \omega \ll \frac{V_F}{\delta_0} & , \frac{s}{\omega} \ll \ell \ll \frac{V_F^2}{s\omega} \end{cases} \qquad /9/$$

where ω_{pl} is the plasma frequancy of the electrons, ρ is the density of the crystal lattice, e is the elementary electric charge, $\delta_0 = \frac{c}{\omega_{pl}}$, c being the speed of light, $\omega_{em} = \frac{s}{\delta_0}\left(\frac{s}{V_F}\right)^{1/2}$; γ_1 is independent of ℓ and is determined by /8/.The coefficients R_i / $i = 1, 2, 3$ /depend in an involved way on $\frac{s_l}{s_t}$ and the parameter ξ .They are of order of magnitude of the coefficients of absorption of bulk longitudinal and transverse waves.

It is easy to see that the results /7/-/9/ represent, up to a constant factor,a linear combination of the corresponding coefficients of absorption of bulk longitudinal and transverse sound waves.Since γ for longitudinal sound waves in the bulk for high frequencies / $|\varkappa \tilde{\ell}| >> 1$ / is independent of ℓ ,the temperature dependence of the Rayleigh sound waves is strongly dependent on the temperature dependece of the coefficient of absorption of transverse sound waves /5/.

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Reference

/1/ A.M.Grishin,E.A.Kaner,Zh.eksper.teor.fiz.,36,1217,1973
/2/ K.Scharnberg,B.Kummer,J.of Phys.F,6,349,1976
/3/ L.D.Landau,E.M.Lifshic,Teorija uprugosti,Moskva,1967
/4/ V.M.Kontorovič,Zh.eksper.teor.fiz.,45,1638,1963
/5/ G.J.Ivanovski,Phys.stat.sol./b/,72,K53,1975