THE CRYSTAL STRUCTURE OF MnGa AND THE DEGREE OF ORDER

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ABSTRACT

The crystal structure of the γ_2 phase in the Mn-Ga system has been determined by the Debye-Scherrer method, and thence the degree of order in the atomic arrangement in this phase region has been estimated as a function of the gallium content.

The structure of the γ_2 phase belongs to the tetragonal system, the space group being D^1_{4h} —$P4/mmm$. The ideal stoichiometric composition is MnGa, and each unit cell contains one formula weight, the manganese and gallium atom occupying (000) and $(\frac{1}{2}\ \frac{1}{2}\ \frac{1}{2})$ positions respectively. It is a distorted form of the B2 structure, and if it is rotated $\pi/4$ about the c-axis, the transformed unit cell can be shown to be of the type LI_0, isomorphous with CuAu-I. At room temperature, the lattice spacings of the original cell at 42.9 at.% Ga are $a = 2.7475$Å and $c = 3.6756$Å.

This phase may be considered as a substitutional solid solution of γ-Mn, stabilized at room temperature due to the partial substitution of manganese atoms by gallium atoms as a tetragonal face-centred ordered structure. In this entire phase region, the degree of order increases with the gallium content.