STRUCTURAL STUDIES OF THE $CoAl_{1-x}Mn_x$ SYSTEM

A.S. Saleh

Physics Department,
Yarmouk University.

Introduction

The binary alloy CoAl crystallizes into the B2 [CsCl] type structure and is paramagnatic (1). The substitution of a transition metal, like Ti, for Al leads to a change in structure to $L2_1$ type at the Heusler composition $CoAl_{0.5}Ti_{0.5}$ (2,3) and the alloy becomes ferromagnetic. It may be expected therefore that the substitution of another transition metal, like Mn, may lead to similar results.

In this work, we report the results of structural measurements performed on $CoAl_{1-x}Mn_x$ system using x-ray and neutron diffraction techniques. The value of x was varied from 0.5 to 0.40.

Experimental

The appropriate amounts of mixtures of the high-purity metals were melted in an arc furnace in an atmosphere of pure argon gas. The ingots were annealed in vacuum sealed silicon tubes at 830°C for 24 hours, and quickly quenched in water at room temperature. Powdered specimens were prepared by crushing the ingot and using suitable sieve. X-ray photographs were obtained using Ievins-Straumanis Camera and the iron K_{α} radiation. Neutron diffraction measurements were made at room temperature at AERE, Harwell and Grenoble.

Results and Discussion

X-ray diffraction films were obtained for all samples (x=0.05 to 0.40), and the observed ring diameters recorded. The results indicate a single-phase compound with a lattice parameter that remains almost constant at the value 2.862Å. The (111) family of lines are not present in the diffraction pattern, and the observed lines were indexed: (100), (110), (111), (200), (210).... . This result shows single ordering of the cubic B2 type for all samples, which indicates that the compound keeps this structure for all values of x studied.

Neutron diffraction offers a more sensitive probe than x-rays for studying atomic ordering in these alloys. Because neutron scattering lengths for the atoms differ appreciably (Mn has a negative scattering length), the variations in the intensities of the observed peaks may be detected more easily. Another advantage of the neutron probe is that the information is undistorted by this probe by virtue of the weak neutron-atom interaction.

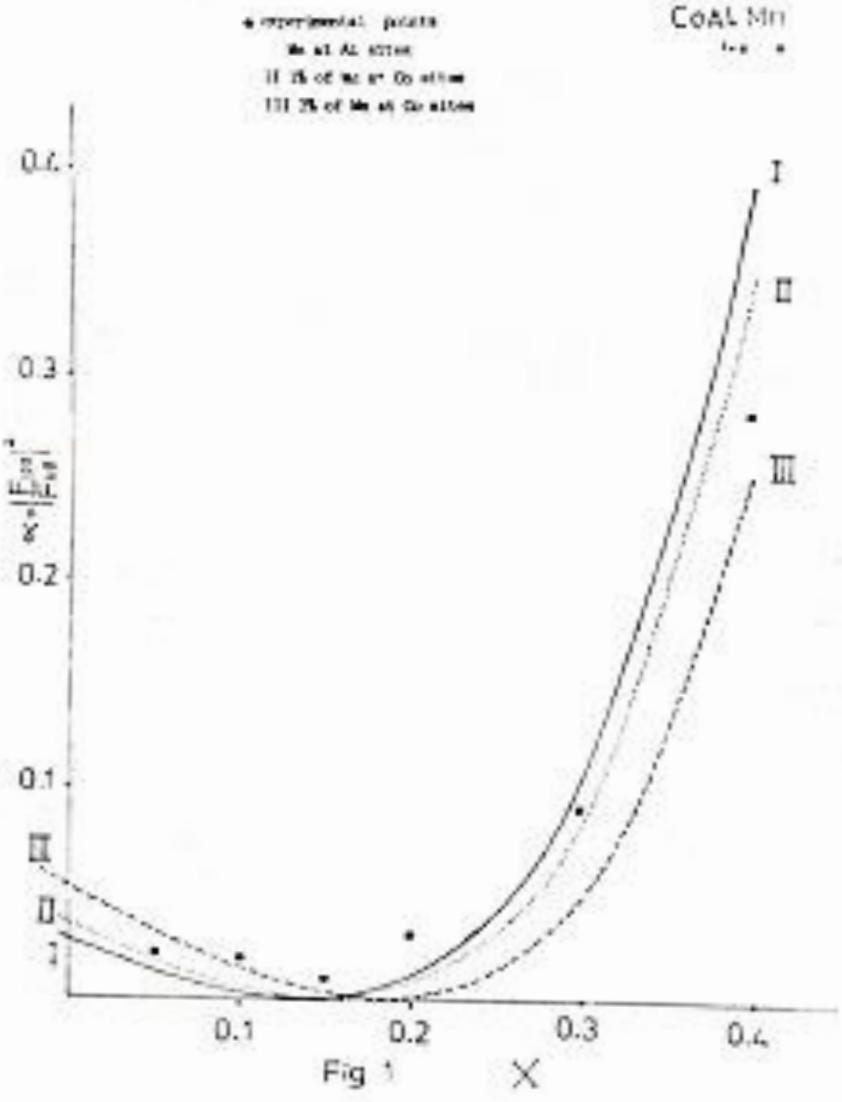
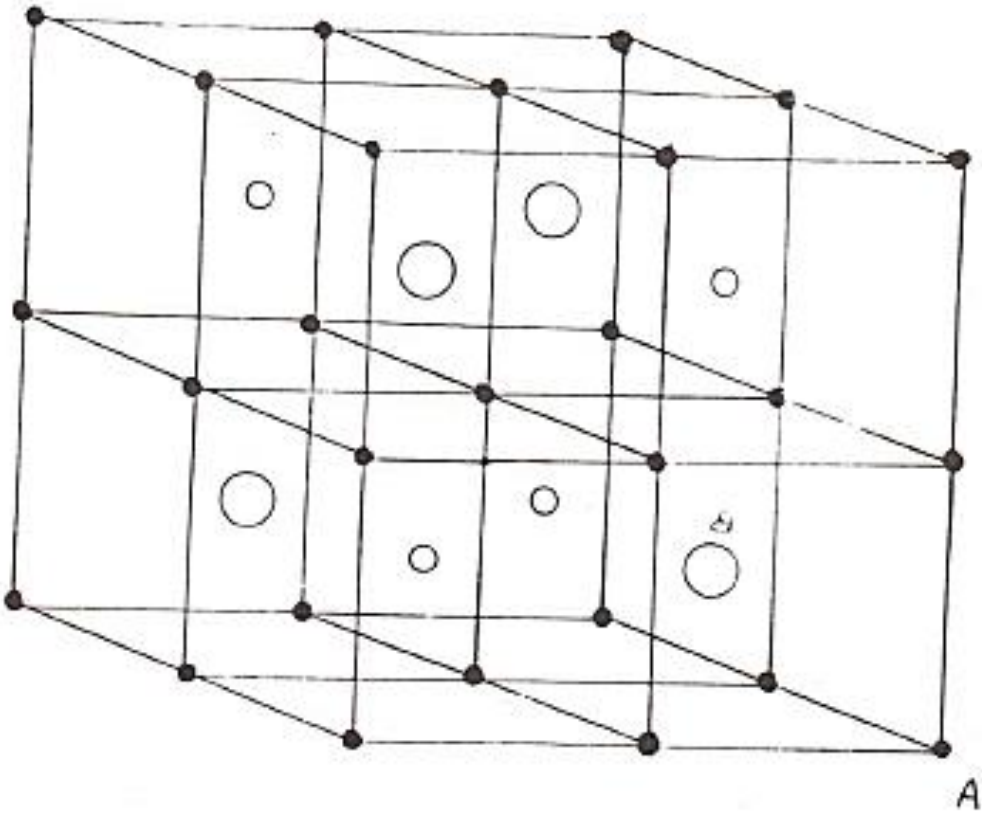


Fig 1



A