# P R E F A C E

Many physical properties of solids are dependent on the way the atoms are arranged in them. In the attempts to develop theories correlating various physical properties of solids with their atomic arrangements, crystalline solids have been very largely investigated because of their internal symmetries. Since every real crystalline solid is characterised by the crystal imperfections inherent in it, any realistic physical theory must take into account these crystal imperfections. That is why the study of the crystal imperfections becomes so important. Since the X-ray diffraction pattern is a transform of the atomic arrangement, it is possible to investigate this structural change by X-ray diffraction method. Atomic disarrangement causes the X-ray diffraction lines to be broadened and thus the X-ray line broadening becomes a measure of the imperfections in crystalline solids.

X-ray line broadening investigation of deformed metals has mostly been concentrated on the cubic class. Metals having h.c.p. structures excepting cobalt have received so far scanty attention. That is why the X-ray line broadening study of two h.c.p. metals namely magnesium and cadmium was undertaken.

The study of imperfections depends on the estimation of an accurate intensity profile. For this, the background should be correctly ascertained. Therefore, the present investigation starts with a theoretical investigation of how the error due to acceptance of a wrong background affects the X-ray diffraction parameters. A method has also been developed for determining the true background level from the multiple measurements of the integral breadth at several assumed background levels.

The effect due to temperature diffuse scattering on the intensity profile is not inappreciable always. Therefore, a theoretical investigation has been made to derive an expression for temperature diffuse scattering for hexagonal powders on the basis of the one phonon model and assuming the Brillouin zone to be spherical.

In the present investigation, a single reflection technique for line-shape analysis has been developed to determine particle size and strain in cold-worked magnesium and cadmium. Method of variance has also been used for this purpose. The results obtained are discussed and the differences are explained.

Lastly, a theoretical investigation has been made to derive expressions for the relationships between particle sizes and strains determined by different methods, viz., integral breadth, Fourier coefficients and variance of a diffraction profile. In this respect, copper-nickel alloys of four different percentage composition have been studied. The results have been interpreted in the light of the above investigation.

A certain part of the work incorporated here has been published and the corresponding references and reprints have been added as foot note and appendix respectively.

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