12.7-1   A NEW METHOD TO INVESTIGATE TEXTURES: TEXTURE TOPOGRAPHY. By E. Born, Technische Universität München, Germany.

Measurements of textures yield useful values only when a homogeneous texture can be assumed. The texture is said to be homogeneous when all volume elements of the specimen which contain a sufficient number of grains for the statistical relevance have the same texture (H.J. Bunge et al., Experimental Techniques of Texture Analysis, Proc. DGM Verlag 1986). Thus a method showing textural inhomogeneities within a sample under inspection is required. An X-ray diffraction method yielding images of the inhomogeneities has been proposed (E.Born, Theoretical Results in Texture Analysis, Proc, DGM Verlag, 1987). This method is based on mapping the diffracted X-ray intensity originating from different volume elements of the specimens surface. Almost parallel planes from different grains contribute diffracted intensity to the image. Thus the image exhibits different densities with respect to a small area in the pole figure. This area will be the center of the pole figure when the diffraction geometry of a diffractometer is used (with a diaphragm instead of the r .asuring slit and a subsequent image unit parallel to the specimen located behind the diaphragm with the same distance like the specimen is separated from it). With increasing degree of texture the possibility of increasing inhomogeneity arises. On the other hand, the possibility to get an informative image of textural inhomogeneities is related to the existence of a well developed texture. Therefore, the correct interpretation of contrasts appearing in the topographs is only possible using the information given by the pole figure of the same reflection used to produce the topograph. If the pole figure has a low density in the center, one can use an asymmetric diffraction arrangement of any kind described previously (E. Born, as above). The applications of the method have the most advantages in metallography so far showing a great deal of inhomogeneities introduced by the deformation of the metal or by thermal treatment.

12.7-2   CRYSTALLITE SIZE MEASUREMENTS BY THE WARREN-AVERBACH TECHNIQUE. By T.R. Finlayson, J.M. Long and R.J. Pollard, Department of Physics, Monash University, Victoria 3168, Australia.

The Warren-Averbach analysis has been applied to the diffraction peak profiles from different powder samples. In principle the technique can provide both mean crystallite size and strain parameters, as well as a measure of the size distribution. Two specimens were selected in order to gauge the general applicability of the method and to assess the reliability of the results.

The first sample was brass powder produced by rubbing a solid block on P1200 grade silicon carbide paper. In this case the diffraction profiles were broadened on account of both crystallite size and strain effects. These have been separated with the aid of a "standard" sample of annealed brass powder and using the Fourier deconvolution procedure on both the (111) and (222) diffraction peaks.

The second sample consisted of fine iron particles specially prepared by reducing mono-dispersed γ-Fe_2O_3 magnetic recording material in hydrogen at 600°C for two hours. The X-ray pattern showed only α-Fe peaks, and transmission electron micrographs showed cylindrical shaped particles of diameter 60-100 nm and length 100-180 nm. The axial ratios were 1.7±0.3. In this case a well-annealed pure iron sample served as a most suitable "standard" for the instrumental line profiles. Analysis of the (110) and (220) peak profiles yielded a mean column length perpendicular to these planes of 105±6 nm.

For the second sample the diffraction measurements were combined with electron microscope observations to form a consistent view for the particle microstructure. Each particle is composed of either one or two crystallites with a high degree of [110] orientation along the particle length. Such a model for the Fe particles is similar to that proposed for the γ-Fe_2O_3 starting material (S.J. Andress, A. Benedetti, A.R. Corradi and G. Fagherazzi, IEEE Trans. Magnetics, 1986, MAG-22, 1341-1348).

Methods of implementing the Warren-Averbach technique, in particular the determination of the background level and the selection of a portion of a powder-scan for analysis, will be discussed based on these examples. The accuracy and limitations of the technique employed to determine crystallite sizes will be assessed.