

X-Ray Studies on the Preferred Orientation of Carbon Fibers^{*}

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The knowledge of the preferred orientation in carbon fibers is of importance for the understanding of the relation between structure and physical properties. The data so far available (R. Bacon and Tang 1964, Shindo 1964) give only qualitative information. The determination of preferred orientation in fibers by X-ray diffraction methods is in principle the same as in extruded graphite samples as described by G. E. Bacon (1956). The rather high disorder present in most of the carbon fibers poses, however, some problems which generally do not occur in studies of graphitic carbons. In the present paper, a method is developed which overcomes these difficulties in using a development in a Fourier series of the distribution of the integral intensity on the (002) ring as function of the angle φ between the fiber axis and the direction of measurement in reciprocal space. The required corrections are carried out on the Fourier coefficients from which various orientation parameters are computed directly.

The applicability of the method is demonstrated in a study of the carbonization of cellulose fibers. It is shown that the preferred orientation in the starting material is destroyed with the destruction of the cellulose structure; only a very small orientation effect remains and stays nearly constant up to about 1000°C HTT. Further heating produces a reorientation which can attain and even surpass the degree of preferred orientation in the starting material. No evidence for a direct correlation between the preferred orientation in the starting material and the carbonized product has been found.

References :

- G. E. Bacon (1956), J. Appl. Chem. 6, 477.
R. Bacon and M. M. Tang (1964) Carbon 2, 221.
A. Shindo (1964) Carbon 1, 391.

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