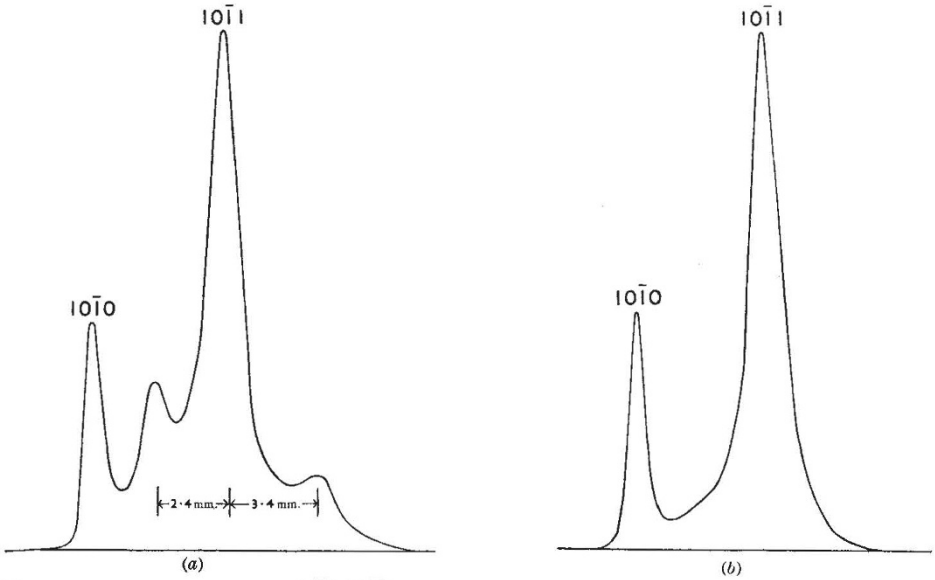
Anomalous Diffractions in the Hull-Debye-Scherrer Spectrum of Graphite

IN the course of an electron diffraction study of several graphites, Finch and Wilman[1] discovered a number of extra diffractions which could not be indexed in the normal way on the basis of the accepted crystal structure of graphite[2]. Of the extra diffractions, two embracing the 1011 reflexion are clearly observed and cannot easily be accounted for. Because these extra lines occurred with graphites from very different sources, Finch and Wilman concluded that the possibility of impurity could be ruled out. Their main conclusion pointed to the presence of packets of planes with a thickness of 4 unit cells (or 9 layer-planes), in the direction of the c-axis. This would enable lines with fractional l indices to appear, because by analogy with a ruled grating with a few lines, the subsidiary maxima would begin to have the same order of magnitude as the principal diffractions. Thus the lines on either side of the $10\bar{1}1$ would seem to be $10\bar{1}\frac{2}{3}$ and $10\bar{1}\frac{4}{3}$.

We have repeatedly observed the extra lines with X-rays using a great variety of natural and artificial graphites. They are *not* a phenomenon entirely associated with the electron diffraction method. With cobalt K_α radiation, a Debye-Scherrer camera 19 cm. in diameter of the Bradley type, and a fine cylindrical specimen 0·3 mm. in diameter, very high resolution of these extra lines is obtained (Fig. *a*). The fact that all the spectra are reasonably sharp and no cross-grating spectra occur indicates that the graphite crystals are at least of the order of 1,000 A. in size. Careful cleaning of the graphite until the ash was zero failed to influence the intensity of the extra lines, so that the effect of impurity could be discounted. Only a very special chemical treatment affects the graphite. After all the inherent impurities have been removed by the usual methods, the graphite is wet-oxidized in a heated mixture of concentrated nitric and sulphuric acids in a 2 : 3 ratio by volume for 24 hours. This reduces the extra lines to almost zero intensity, but the other spectra remain unchanged (Fig. *b*). No other acid combination appears to work except concentrated sulphuric acid, which required more than 400 hours to produce the same effect.

The extra diffractions may arise from the dynamic stratification of the crystals in the manner suggested by C. V. Raman and P. Nilakantan[3], who observed extra spectra in the Laue photograph taken along the trigonal axis of diamond. Similar anomalies in Laue photographs have since been reported[4]. The wet oxidation treatment may reduce the size of the crystallites (although still bigger than 1,000 A.) so that the dynamic stratification becomes unstable because of edge effects and the extra lines are unable to appear. To some extent the dynamic stratification is analogous to the static packets of planes 4 unit cells deep as suggested by Finch and Wilman. It would be interesting to see if the dynamic stratification theory can be applied quantitatively to the appearance of these extra Debye-Scherrer reflections.



MICROPHOTOMETER CURVES, $10\bar{1}0$–$10\bar{1}1$ GROUP, FOR CEYLON GRAPHITE (*a*) CLEANED WITH HYDROFLUORIC AND HYDROCHLORIC ACIDS, (*b*) CLEANED WITH HYDROFLUORIC AND HYDROCHLORIC ACIDS, AND 30 HOURS IN CONCENTRATED SULPHURIC PLUS NITRIC ACID MIXTURE.

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[3] Raman, Sir C. V., and Nilakantan, P., NATURE, **145**, 667 (1940).
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Nature of the Feulgen Reaction with Nucleic Acid

DURING the course of investigations into the probable chemical constitution of the nuclear contents in plants, many observations have been made in addition to the nucleolar staining reaction. Under existing conditions, it seems improbable that a full description of this work can be made for some time, and a note on an apparently significant point is offered here in the hope that it may lead to further useful developments.

The use of the Feulgen nucleal reaction in connexion with cytological technique is proving to be