the condition of undergoing no directional change, and, secondly, the condition which determines the occurrence of the $\{259\}_\gamma$ habit in martensite containing more than 1·4 % carbon. Further work on the present lines may lead to the appreciation of a more general condition which determines the habit plane, but it is at least an interesting property of the habit plane over a very wide range of carbon concentrations which the present investigation has brought to light.

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Short Communications

Contributions intended for publication under this heading should be expressly so marked; they should not exceed about 500 words; they should be forwarded in the usual way to the appropriate Co-editor; they will be published as speedily as possible; and proofs will not generally be submitted to authors. Rapid publication will be easier if the contributions are without illustrations.

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The space group of phenanthrene.

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Phenanthrene is the parent body of a series of important organic compounds, namely, sterols and others, the structures and stereochemical pictures of which are still the subject of controversy in organic chemistry. It is also a member of a series of compounds of similar structural formulae, e.g. naphthalene, anthracene, chrysene, pyrene, etc., whose structures have already been determined. The main difficulty about this substance is to obtain single crystals of convenient dimensions. On the other hand, it possesses the advantage, in common with the above compounds, that all the atoms of the molecule are of the same scattering power (except, of course, hydrogen, the scattering power of which may fairly be neglected). The most difficult part of the structure determination by the Fourier synthesis method, namely, the determination of the signs of Fourier terms, can therefore be done by the algebraical method of Banerjee (1933). A few tolerably good crystals were obtained from a solution of a mixture of acetone and alcohol, and hence an attempt at a complete determination of the structure has been undertaken.

Phenanthrene has previously been studied by Mark & Hengstenberg (1929), who found the space group to be C_{2h}^5–$P2_1/c$ with four molecules in the unit cell. We have taken rotation photographs about the three crystallographic axes and have found the following values for axial lengths and angles:

$a = 8{\cdot}57$ A., $b = 6{\cdot}11$ A., $c = 9{\cdot}47$ A., $\beta = 97°\ 30'$.

There are two molecules per unit cell.

Overexposed photographs about the c axis from very clear crystals failed to reveal any faint layer line in between the main layer lines as noted by Mark & Hengstenberg (1929). Oscillation and Weissenberg photographs about the three axes have shown that extinction occurs only for odd orders of $(0k0)$ planes; hence the possible space groups are C_2^2–$P2_1$ or C_{2h}^2–$P2_1/m$.

Now since there are two molecules per unit cell, there can be only two possible orientations for the phenanthrene molecule if the space group is C_{2h}^2–$P2_1/m$, the existence of a molecular centre of symmetry being impossible. One orientation is with the molecular plane coincident with the plane of symmetry, in which case the (020) reflexion will be very strong and subsequent orders will decrease uniformly but slowly. The experimental evidence is against this, the (020) being moderately strong, (040) very weak and (060) stronger than (040). The only other possible orientation is with the plane of the molecule symmetrically at right angles to the plane of symmetry. But this arrangement also is not possible from steric considerations, assuming a planar configuration for the molecule and taking 1·41 A. as the C–C distance; the length of the molecule becomes too long to be accommodated in the unit cell. From these considerations the space group C_{2h}^2–$P2_1/m$ is discarded and the crystal is assigned the space group C_2^2–$P2_1$. The structure factors of a large number of different planes have been determined experimentally, and a complete determination of the structure is being attempted by the help of Fourier analysis.

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