

The Optical Properties of Organic Compounds.

By A. N. WINCHELL. Pp. xviii+487, with 153 figs. New York: Academic Press; London: Academic Books. 2nd ed., 1954. Price \$12.00; 96s.

As the first edition of this work came from a University press in 1943 when World War II was at its height, it is possible that it did not receive the attention which it deserved from scientists outside North America. I was fortunate in obtaining a copy not long after publication and I resorted to it constantly until I was able to transfer my affections to the new edition, which covers the optical properties of nearly 2500 crystalline organic compounds, an increase of more than 50% over the first edition. Affection for a book and appreciation of its usefulness need not, however, blind one to its shortcomings, and the criticisms offered below are made in the belief that there will be sufficient demand to justify before long a new edition in which improvements can be made.

Dr Winchell's objects in this book are first to list all solid organic compounds whose optical properties were described in the scientific literature before October 1952, and secondly to arrange the optical data conveniently for purposes of identification under the microscope. He has very largely been successful in these aims. The compounds are arranged in the main list essentially in accordance with Beilstein's system of classification. Each entry gives the name, formula, summarized morphological and (sometimes) structural information, and optical properties in full; usually the melting point is given, and sometimes the density. For purposes of identification two large charts are provided in a pocket at the end of the book. On the first of these birefringence $\gamma-\alpha$ (for biaxial crystals) or $\epsilon-\omega$ (for uniaxial crystals) is plotted against β or ω , and on the second optic axial angle is plotted against β . These two charts cover about 1900 substances, the refractive indices of which are known accurately; another 600 substances for which incomplete information is available are listed in two determinative tables based on refraction. The 'explanation' of the two charts is not well written, but it is fortunately quite easy to work out how they are to be used. With the data now available the charts are simple and effective, but a 100% increase in the number of entries, which could easily happen in the next edition, would perhaps necessitate some modification. Some simplification could be achieved by transferring all the uniaxial entries to a separate chart.

A notice of a book of this type provides a suitable occasion for some reflections on the functions of crystallographic indexes generally. With Groth's *Chemische Kristallographie*, the Barker *Index*, the *Strukturbericht* and *Structure Reports* crystallographers are exceptionally well served with first-class comprehensive reference works. Experience with the book under review, the corresponding inorganic volume, and Donnay & Nowacki's *Crystal Data* has however convinced me of the enormous value of a *comprehensive single-volume* index to a particular set of properties, optical or X-ray. Any crystallographic index which can be produced at the present time is apt to be criticized, especially if its possible use for determinative purposes is mentioned, on the ground that it can cover only a small fraction of known chemical compounds. This would be a valid criticism if one were foolish

enough to claim that crystal optics, or cell dimensions, could form an exclusive system of identification, but the chemist concerned with identification knows that discrimination in the choice of method is essential to success and that any well-tried addition to the armoury of methods is to be welcomed. Apart altogether from determinative uses, however, it is of the greatest possible value to be able to discover with reasonable certainty, by reference to a single work, whether or not the cell dimensions or the crystal optics of a particular substance have been determined. (As the structure cannot be determined without the cell dimensions an index of the latter can serve as an index to the *Strukturbericht* and the *Structure Reports*.) Since the reasons for wanting to know one or the other are often quite different it is no great hardship to have cell dimensions and optics in two separate volumes, and indeed, having regard to the rate at which data are accumulating, it is best that they should be separate in order to keep the size of the books within reasonable limits. If we go further and agree that inorganic and organic compounds can be separated we can envisage four manageable volumes sufficing for many years, provided that overlapping and the insertion of unnecessary information are avoided.

These considerations suggest various possibilities for the improvement of future editions of the book under review. The author has given unit-cell dimensions for many substances, but by no means all that have been measured, and the inclusions and omissions seem to be arbitrary; in view of the availability of X-ray data in other publications it would be better to omit them altogether from this work. The choice of crystal drawings has probably been determined by their availability in original papers and in Groth, but the result is a very arbitrary distribution, e.g. four diagrams of different habits of one substance which not one reader in a thousand is likely to encounter and only seventeen diagrams to illustrate about 300 alkaloids and their derivatives. The value of the book would not seriously be diminished by the omission of all diagrams and would be increased by adding '(ill.)' after a reference to indicate that the paper in question contains an illustration of the crystalline form of the substance. Each point representing a substance in the two determinative diagrams is given a number, and a 40-page table gives the key to the 1700 substances represented; since there are only about 2500 entries in the main table it would have been simpler to have given every one a serial number and thus saved 40 pages with all their potentialities for additional printing errors.

Dr Winchell remarks (p. 441) that 'Of course no substance can be identified by measuring its physical properties unless these properties have been measured previously on samples of known substances'. This remark is somewhat ambiguous but the meaning I take it to have could certainly be challenged, and in fact I suggest that the value of the book for determinative purposes would be slightly increased by including a few substances for which optical data are not yet known, namely, those such as basic beryllium acetate and hexa-aminobenzene which are known from X-ray work to be isometric. It would indeed be possible (although I do not suggest that Dr Winchell should do it) to calculate reasonable good refractive indices for such substances from densities and atomic refractivities, but even without an actual value

for the refractive index the information that a substance is isotropic would be valuable. The amount of extra space required for this would be negligible; on the other hand several pages could be saved by omitting fibres, which can hardly be treated in the same way as truly crystalline substances and which are dealt with adequately in various specialized monographs.

The usefulness of the book would be greatly increased by the provision of a formula index. As Dr Winchell remarks, the choice of names is somewhat arbitrary; it is in fact sometimes very arbitrary, as will be seen from the fact that whereas $(p\text{-Br.C}_6\text{H}_4)_2\text{SO}_2$ is named 4·4' dibromodiphenylsulphone, $(p\text{-Br.C}_6\text{H}_4)_2\text{S}$ is named phenyldibromosulphide. It is sometimes difficult, therefore, in the absence of a formula index, to be certain whether a particular substance is recorded or not.

The printing of the new edition is by letterpress, and not only is it much more pleasant to read than the typescript photolithography of the first edition but it has enabled the bulk of the book to be kept about the same in spite of a 50% increase in content.

Dr Winchell has taken the opportunity to bring some

of the older entries into line with modern practice by altering acute monoclinic angles β to obtuse. He has also re-orientated a number of orthorhombic crystals to make $b > a > c$, but he has not been consistent in this.

It is not humanly possible to produce a book of this kind free from omissions and errors, and, although it is easy to find both, the errors on the whole are not serious and the omissions probably not numerous: it is to be hoped, however, that with the increasing volume of original crystallographic publication some means, preferably on an international basis, will be found for pooling all X-ray and optical data so that in later editions substantially 100% coverage can be achieved.

I hope that the foregoing criticisms will not obscure the very great merits of this book, which deserves to be widely used and which will, I hope, stimulate a more intelligent interest in chemical microscopy among organic chemists and crystallographers.

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Books Received

The undermentioned works have been received by the Editors. Mention here does not preclude review at a later date.

Glans en Gloed. By UIT DONKERE DIEPTEN. Pp. 83 with many coloured plates. Arnheim: Levensverzekeringmattschappijen.

Microstructures of Diamond Surfaces. By S. TOLANSKY. Pp. viii+67 with 143 plates. London: N. A. G. Press. 1955. Price 40s.

Struktur und Eigenschaften der Kristalle. By H. G. F. WINKLER. Pp. viii+313 with 111 figs. and 82 tables. Berlin; Göttingen; Heidelberg: Springer. 2nd ed. 1955. Price DM. 25·80; cloth binding DM. 29·60.

Small-Angle Scattering of X-rays. By A. GUINIER and G. FOURNET. (Translated from the French by C. B. WALKER.) Pp. xi+268 with 78 figs. New York: Wiley; London: Chapman and Hall. 1955. Price \$7·50; 60s.

Les Dislocations et la Croissance des Cristaux. By W. DEKEYSER and S. AMELINCKX. Pp. viii+184 with 80 figs. and 23 plates. Paris: Masson. 1955. Price 2,000 fr.

Les Lacunes des Cristaux et leurs Inclusions Fluides. By G. DEICHA. Pp. 126 with 13 figs. and 12 plates. Paris: Masson. 1955. Price 950 fr.

Handbuch der Physik. Band 7, Teil 1. Kristallphysik. Edited by S. FLÜGGE. Pp. vii+687 with 321 figs. Berlin; Göttingen; Heidelberg: Springer. 1955. Price DM. 122·50.

Structure Reports for 1942-1944. Edited by A. J. C. WILSON, N. C. BAENZIGER, J. M. BIJVOET and J. M. ROBERTSON. Pp. viii+448 with many figs. Published for the International Union of Crystallography. Utrecht: N.V. A. Oosthoek's Uitgevers Mij. 1955. Price 65 Dutch florins; \$17·50; £6.6.0.