

**The Structure of Glass. Vol. 2.** English Translation of the Proceedings of the 3rd Russian conference on the Glassy State, Leningrad, November, 1959. (Consultants Bureau, New York, 1960). Pp. XII+480. Price \$25.00; vols. 1 and 2 \$40.00.

Three conferences have been held in Leningrad on the Glassy State, in 1939, 1953 and in 1959. An English translation was published of the 1953 conference (Consultants Bureau, New York, 1958) and now this English translation of the 1959 conference has also been made available.

The proceedings are divided into the following sections; General problems of the Glassy State, Silicate Melts and Mechanism of Glass Formation, Optical properties and structure, electrical properties, physicochemical properties and Vitreous systems of special character. The proceedings of this last section are most interesting.

In the section on 'General Problems of the Glassy State', eleven papers are concerned with the methods and results of glass structure studies, relationship of structure to properties and the nature of the chemical bond in glasses. Many of the contributions are rather general and no real advance in technique or theory can be claimed. Porai-Koshits discusses some interesting low-angle X-ray scattering observations from two-phase glasses and Myuller the nature of the chemical bonding.

The section on optical properties and the structure of glasses is concerned with infra-red studies and extensive experimental data are presented. An electron-diffraction study, using the rotating sector method, of lead silicate glasses is described by Bagdyk'yants and Alekseev when some computed diffraction curves of a simplified nature are compared with the experimental observations.

The contributions in the section devoted to 'Electrical Properties of Glasses' are mainly concerned with phenomenological detail. Myuller discusses the relation of electrical properties to glass composition and several papers discuss electrical properties of various complex industrial silicate glasses. Two studies of the diffusion of metal ions in silicate glasses are reported.

In the section on the physicochemical properties of glasses, studies are reported on the 'Colouration of glasses and action of Radiation', 'Mechanical and certain Technical properties of glasses', and the 'Chemical Properties of Glass'. The contributions are either of a very general nature or discuss the properties of complex industrial glasses. Two papers discuss the properties of glass fibres.

The section on 'Some Vitreous Systems of Special Character' is most rewarding. The semiconducting Chalcogenide glasses (solid solutions of  $As_2S_3$ ,  $As_2Se_3$  and other sulphides, selenides and tellurides) are discussed in a very interesting series of papers. The composition range of glass formation is discussed, the electrical properties, optical properties and structure, and these properties are compared with those of the crystal forms of the same composition. The electrical conductivity varies over extreme ranges, with high values of thermal e.m.f. and photoelectric effect. The five contributions present a well balanced account of the studies and are introduced by a short review by Kolomiets. A paper is also presented on the semiconducting properties of glasses based on  $V_2O_5-P_2O_5$  and  $V_2O_5-P_2O_5-BaO$ .

In the last section of the conference, the microporous glasses derived from sodium borosilicate are discussed

in some detail in nine papers. Various aspects of the relation of thermal history to microstructure are discussed.

It is, of course, not an easy matter to render Russian scientific text into clear English and whilst the translations are adequate, a knowledge of the subject matter is sometimes needed to interpret the English (see in particular article by Kolomiets, p. 403).

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**Crystal Structures.** By RALPH W. G. WYCKOFF. Supplement V. Interscience Publishers, Inc., New York 1960. Price \$26.50.

R. W. G. Wyckoff's great work *Crystal Structures* began publication in 1948 in small sections and loose leaf form, and for this reason only one of its larger sections has been reviewed in this journal (J. M. Robertson (1954), *Acta Cryst.* 7, 867). The present Supplement V and index 'completes' the work in the words of the Publisher's announcement. This event is to be compared to the opening of the span of a bridge on which work has long been going on. It provides an occasion to look at the whole structure.

The work is, indeed, one of art and science combined. Its aim: to provide a current survey of all crystal structures which the author considers to have been determined with reasonable certitude and accuracy. Each substance fully entered occurs in four places:

(1) In the 'text', where a general description is given including the cell dimensions, space group, positions occupied in terms of general parameters, and a short and usually very lucid explanation in words of the atomic coordination and general features of the structure.

(2) In the 'table', where the parameters of the positions and usually a code of reference to the bibliography section are to be found.

(3) On a page of 'illustrations'; here a 'packing drawing' of the structure is given which illustrates and amplifies the general description given under (1).

(4) On one of the bibliography pages, provided a code was given under (2).

The author's critical understanding shows up in the selection of the structures admitted to the collection, and in the formulation of the essential features of each structure both in the text and in the aspect chosen for the illustration. The illustrations themselves are works of art. Great skill is required in producing 'packing drawings' such as these: in spite of overlapping atoms, they remain transparent enough to show the arrangement inside the structure. These illustrations often give projections differing from those of the authors in the original paper and from those contained in *Structure Reports*. A comparative study of the different drawings sometimes leads to a better three-dimensional understanding—and quite often reveals a superiority in Wyckoff's rendering.

Thus it would be wrong to see in this work only a compilation; instead, this monumental collection of probably more than 5200 type-written pages, assembled

during the years when he was most active in electron microscopy, bears as lively a testimony to the author's scientific personality as any of his previous books. He and his publisher ventured on an experiment in the organization of this publication which is to be regarded as the expression of the author's strong conviction that a collection of data, especially for a rapidly growing subject, should be given a form which makes deletion of obsolete and addition of new material easy. The loose-leaf form of publication was the logical outcome.

Undoubtedly, alas, this loose leaf form has contributed much to delaying the acceptance of these tables. Not infrequently one hears, on asking, yes, we have the Tables, but they are not really being used. The reviewer himself must confess that he made attempts at various times at obtaining specific information but always gave up before having succeeded. One of the reasons was the unavailability of a general index. Another reason was that the reviewer had not taken the time to throw out obsolete, and insert supplementary pages as they appeared. This, he knows, happened in other cases too; the buyer of a book is not accustomed to having to spend several hours in putting it in shape. A further aggravating feature was the change-over from the originally planned three-volume work to one of five volumes in the course of publication—a feat which gives testimony to the versatility of the scheme but rather baffled the occasional user.

Now, after having put the house in order, what is the situation? You look up your substance in the Index. This refers you to one of the Tables. Since there is no pagination, you have to understand the symbol of the Table and to keep in mind the sequence of Text, Tables, Illustrations, and Bibliography, which is standard in all Chapters.

Assume, for example, you are interested in  $P_2O_5$ . The Index informs you first that the full crystal structure is discussed and next tells you to look up VD:1(1); VD:1a(1). Here V means the fifth chapter, and you will soon learn to know that it is contained in Vol. II. All pages of this Chapter carry the identification heading *V. Compounds  $R_mX_n$* . The Table section begins with Table VA, 1 and in due course we arrive at VD, 1. On the first of the three pages of this Table we find  $P_2O_5$  and  $P_2O_5$  metastable. Following on this Table we see Table VD, 1a and here among the substances  $P_2O_5$ (III)—the bracket indicating the third modification.

Let us assume that it is this modification we want to learn about. Table VD, 1a lists three items of information:

Table	Paragraph	Literature
D, 5	d4	1949, MG, D & N.

Now we should know that the first entry refers to Table VD, 5. This is on one of the next pages, and we find there a list of the parameter values  $x, y, z$  of the two P and four O atoms. We further find the indication to look under V, d4—which signifies the same reference as given under 'Paragraph' and refers to the Text part.

Turning to this, we find the description (in words) of the structure, including the meaning of the parameters, and the cell dimensions. In this text, and nowhere else, we also find reference to the Illustration, Fig. VD, 5. Following this, we get to the drawing of the projection of the structure.

We still don't know by whom the structure was determined. Using the reference given above under Literature the Bibliography section of the Chapter shows that it was done by McGillavry, Decker & Nyland.

This procedure, given as an example, is also offered as an excuse for those who have been slow in recognizing the usefulness of the Tables. Many users surely can find their target without the index from the logical chemical sequence followed in the Tables. It will, however, never be possible to find the whole information for a substance without a lot of page-turning; in particular it would seem desirable that direct access to the illustration of the structure be made available through the index. There may be good reasons for listing cell dimensions in the text, atomic parameter values in the tables and atomic distances mainly in the figures (in special 'text-figures' in the organic chapters) but this separation of the numerical data belonging to the same substance does not facilitate the gathering of information.

In spite of such inconveniences, probably unavoidable with the system adopted, the reviewer would like to end with a strong appeal to all those who have not yet followed the very clear instructions for putting the main work and its supplements in a working condition to do so, and in doing it to familiarize themselves with the technique of extracting from this magnificent work the wealth of critical information it contains. And to do this *right now* in order to reap the advantage which this collection has over *Structure Reports* of a closing date about the middle of 1955—three years ahead of *Structure Reports*.

It need hardly be said that *Structure Reports* does not so much report structures as crystallographic papers,—structures being, as it were, incidental; besides, apart from pointing out obvious mistakes, no critical appraisal or selection of papers is being attempted within the scope of the abstracting scheme of *Structure Reports*. Wyckoff's emphasis, on the other hand, is on the actual structures which he considers reliable. There exists thus a fundamental difference of aim and outlook between the two ventures which makes them not competitive, but, if in any close relation, complementary. The yearly volume of *Structure Reports* has become a nearly obligatory tool for crystallographers and chemists and it is to be assumed that this collection will be continued. Wyckoff's Tables have been fundamentally designed for continuation and easy rejuvenation. It would be a great pity to have to take at its face value the publisher's notice about their 'completion'.

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