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The elastic constants of zincblende, determined from thermal diffuse scattering of X-rays.

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Following the method of Ramachandran & Wooster (1949), the elastic ratios, c_{12}/c_{11} and c_{44}/c_{11}, of zincblende have been determined by measurement of the diffuse scattering of X-rays. The specimen used was a piece of lemon-yellow Santander blende; all measurements were made on a well-developed, natural, rhombic dodecahedral face, at room temperature, with a Geiger-counter spectrometer (Wooster, Ramachandran & Lang, 1948) using Cu $K\alpha$ radiation. Measurements of diffuse scattering around the reciprocal-lattice point 220 in the axial directions [110], [100], [001] and [111] give the elastic ratios $c_{12}/c_{11}=0{\cdot}65$, $c_{44}/c_{11}=0{\cdot}34$. The compressibility of zincblende has been determined twice, by Madelung & Fuchs (1921), and by Bridgman (1925), and their values for the compressibility $3/(c_{11}+2c_{12})$, combined with these elastic ratios, give the elastic constants as follows:

$$c_{11}=10{\cdot}0\times10^{11},\quad c_{12}=6{\cdot}5\times10^{11},$$

$$c_{44}=3{\cdot}4\times10^{11}\text{ dynes cm.}^{-2}.$$

The accuracy of the elastic ratios is about 5 %.

It is interesting to note that the elastic ratios are in agreement, within the experimental error, with those calculated from the constants published by Bhagavantam & Suryanarayana (1944), namely

$$c_{12}/c_{11}=0{\cdot}67,\quad c_{44}/c_{11}=0{\cdot}38\quad(c_{11}=10{\cdot}79\times10^{11},$$

$$c_{12}=7{\cdot}22\times10^{11},\quad c_{44}=4{\cdot}12\times10^{11}\text{ dynes cm.}^{-2}),$$

but these absolute values for the elastic constants are not in good agreement with the previously published compressibility data.

References

BHAGAVANTAM, S. & SURYANARAYANA, D. (1944). *Proc. Indian Acad. Sci.* A, **20**, 304.

BRIDGMAN, P. W. (1925). *Amer. J. Sci.* **10**, 483.

MADELUNG, E. & FUCHS, R. (1921). *Ann. Phys., Lpz.*, **65**, 289.

RAMACHANDRAN, G. N. & WOOSTER, W. A. (1949). *Nature, Lond.*, **164**, 839.

WOOSTER, W. A., RAMACHANDRAN, G. N. & LANG, A. (1948). *J. Sci. Instrum.* **25**, 405.

Notes and News

Announcements and other items of crystallographic interest will be published under this heading at the discretion of the Editorial Board. Copy should be sent direct to the British Co-editor (R. C. Evans, Crystallographic Laboratory, Cavendish Laboratory, Cambridge, England).

The Barker Index of Crystals

It is common knowledge that, except in the cubic system, the angles between the faces of the crystals of any substance capable of existing as a crystal are specific. These characteristic interfacial angles can therefore be used for the identification of crystalline material, provided that some guiding principle can be established to enable a choice to be made from the multiplicity of angles present in many crystals. With such a principle established, crystals as small as a cubic millimetre can be measured and identified without loss or destruction of material. The identification could be established if all known crystal measurements were tabulated in the numerical order of their measured angles, and the principles of choice agreed upon.

Fedorov, the great Russian crystallographer, devised a method of classification based on his theory of crystal structure. This he used to compile a great index of crystals published in 1920 as *Das Krystallreich*. It contained a list of all crystals measured up to that date, and any substance in the index could be identified. The methods used, however, were complicated and involved laborious calculations.

The late Dr T. V. Barker of Oxford, who had been a pupil of Fedorov and a collaborator in *Das Krystallreich*, after much work devised a system of more practical use than that of Fedorov. The methods of Barker were based on the geometrical properties of the crystal, more especially the crystal angles, while those of Fedorov were based on a theory of crystal structure. In 1930 Barker produced a book, *Systematic Crystallography*, in which he first described a set of rules based on the 'principle of simplest indices'. He proposed to make these rules the foundation for a workable index of crystals. In this index, under each crystal system, a certain angle was to be given in order of increasing magnitude. The rules ensured that no ambiguity could arise in the choice of the classification angles. Unfortunately, Dr Barker died in April 1931. A number of crystallographers met in Oxford after his death, and after some trials of his methods decided to prepare an *Index* based on Barker's rules. The headquarters of the work was the Department of Mineralogy at Oxford. It was decided to follow Barker's plan of first dealing with the 7000–8000 substances described in Groth's *Chemische Krystallographie*, in which work of five large volumes they are arranged according to their chemical composition.

Several crystallographers undertook the task of studying the crystal measurements already known and of calculating the appropriate classification angles for the Barker *Index*. Early in the work it was necessary to make minor modifications in his rules; delays also occurred due to misprints and to inaccurate measurements and errors of calculation in the original descriptions. In the *Index* as it stands to-day every calculation has been made independently by two workers and checked by one of the Editors (M. W. Porter and R. C. Spiller). The first volume of the Barker *Index* will contain crystal descriptions of approximately 3000 compounds of the tetragonal, hexagonal, trigonal and orthorhombic systems. The

majority are described in Groth's *Chemische Krystallographie*, while some additional to those in Groth have been obtained from Donnay & Melon's *Crystallo-Chemical Tables*, and other sources.

The first volume of the *Index* will be published in June 1951 (Cambridge: Heffer; price £6). The first part of this volume, containing introductory matter, will also be made available separately (price 35*s*.). The published *Index* will contain, not merely tables of angles, but as complete a description of the substance as possible, so far as concerns the properties which are useful for determinative work. Thus, besides the Barker classification angles, the melting-points, optical properties, specific gravity and X-ray diffraction data are all included, and are also indexed. In addition, reference is made to literature where chemical information about the substance can be obtained. Where possible, references have been made to some standard work, in addition to Groth, such as Beilstein, Mellor, Heilbron, etc. and the American Society for Testing Materials.

This brief note cannot give credit to all who have worked to bring the *Index* to the stage of publication, but, apart from the workers at Oxford, the *Index* owes much to a Dutch group of crystallographers working under Prof. Terpstra, to Prof. Donnay and Prof. Melon, to Dr Hey of the British Museum (Natural History) and to Dr G. M. Bennett, Government Chemist.

Numerous industrial companies and scientific bodies have also helped with grants.

Further information may be obtained from the Secretary of the *Barker Index* Committee, Research Department, Imperial Chemical Industries Ltd., Nobel House, 2 Buckingham Gate, London S.W. 1, England.

A. E. J. VICKERS

American Society for Metals

The American Society for Metals announces a World Metallurgical Congress to be held in Detroit, Michigan, U.S.A. during the period 15–19 October 1951 simultaneously with the Annual National Metal Congress and National Metal Exposition. Further particulars may be obtained from the Secretary, American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio, U.S.A.

Book Review

Works intended for notice in this column should be sent direct to the Editor (P. P. Ewald, Polytechnic Institute of Brooklyn, 99 Livingston Street, Brooklyn 2, N.Y., U.S.A.). As far as practicable books will be reviewed in a country different from that of publication.

Gmelins Handbuch der anorganischen Chemie. Selen *A*2. Pp. 122, with 100 figs. Weinheim: Verlag Chemie. 1950. Price DM. 28.

Gmelins Handbuch der anorganischen Chemie. Gold *A*1. Pp. 100. Weinheim: Verlag Chemie. 1950. Price DM. 22·50.

Gmelins Handbuch der anorganischen Chemie. Calcium *A*1. Pp. 68. Weinheim: Verlag Chemie. 1950. Price DM. 15·50.

It is gratifying to take note of the fact that further volumes of Gmelin's Handbook continue to appear. The present volumes deal with a relatively restricted branch of inorganic chemistry. One point is at once noteworthy, namely, that the references to original literature are complete up to the end of 1949, no mean feat of publication even for a periodical.

The first volume is particularly concerned with selenium and especially its electrical properties. As is consistent with a reference book on inorganic chemistry, the main job is to give a connected outline of the facts with all the relevant references to the literature. The theories of the phenomena are not critically discussed. In addition, considerable descriptions are given of technical barrier-layer photoelectric cells and of selenium rectifiers, together with the methods that have been developed for the preparation of selenium films in a suitable physical state.

The second volume on gold is of a rather different type. It starts with a considerable amount of early history of the metal based on a geographical foundation. The manifold uses of gold in early times are also fully described. Then follow more detailed accounts of its winning and purification as practised at the present time. The properties of gold and its practical uses take up the remainder of this volume.

The third volume on the compounds of calcium, especially chalk, is again largely historical. Special attention is paid to the use of chalk in industry and naturally much attention is devoted to the historically important chemical work on chalk which led to such revolutions in chemical theory. A few of the simpler chemical compounds, such as sulphates, halides and nitrates, are dealt with at the end of this volume.

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Books Received

Struktur und Eigenschaften der Krystalle. By HELMUT G. F. WINKLER. Pp. viii + 258, with 62 figs. and 79 tables. Berlin; Göttingen; Heidelberg: Springer. 1950. Price DM. 16·80.

Structural Inorganic Chemistry. By A. F. WELLS. Pp. xx + 727, with 237 figs. Oxford: Clarendon Press. 2nd ed. 1950. Price 35*s*.

Krystallometrisches Praktikum. Grundbegriffe und Untersuchungsmethoden. By R. SCHROEDER. Pp. viii + 199, with 156 figs. Berlin; Gottingen; Heidelberg: Springer. 1950. Price DM. 15·60.