Book Reviews

Works intended for notice in this column should be sent direct to the Editor (A.J.C. Wilson, Department of Physics, The University, Birmingham 15, England). As far as practicable books will be reviewed in a country different from that of publication.

Reports on progress in physics, Volume XXVIII. Edited by A.C. STICKLAND. Pp. iv + 517. London: The Institute of Physics and The Physical Society, 1965.

The 1965 volume of *Reports on Progress in Physics* should be of a more than usual interest to crystallographers. The opening contribution is Sir Lawrence Bragg's account of the early stages of the long way to the X-ray analysis of proteins, in particular of myoglobin. D.W. Pashley writes on *The direct observation of imperfections in crystals*. The exposition is kept elementary and concise and avoids successfully the danger of delving into too much detail. It should therefore be attractive to the non-specialist. In a theoretically orientated article A.A. Maradudin discusses the effects of point defects on the lattice vibrations of crystals, a subject which has recently seen promising advances both on the experimental and on the theoretical side. In a review of the techniques of X-ray microscopy V.E. Cosslett comes to the conclusion that the scanning microscope has left behind in importance all the older methods.

Other articles of interest to the solid state physicist are *Photoconductivity* by T.S. Moss, reviewing in particular the experiments on Group IV elements as well as III–V and II–VI-compounds, *The equation of state of dense systems* by J.S. Rowlinson, discussing mainly some of the modern approaches to the theory of dense liquids, *Thermomagnetic effects in semiconductors and semimetals* by R.T. Delves, and *Solid-state polymerization induced by radiation* by A. Charlesby. N.M. Hugenholtz's *Quantum theory of many-body systems*, which treats one of the most difficult problems of solid state theory with admirable lucidity, deserves special mention.

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Boron. Vol. 2. Preparation, properties and applications. Edited by G.K. GAULÉ. Pp. xvi + 345. New York: Plenum Press, 1966. Price $12.50.

Volume 1 was reviewed in *Acta Cryst.* **14**, 442 (1961), and the general description still holds. The book is photographically reproduced from justified typescript, and the appearance is as attractive as this method of production permits. Volume 1 contained no indexes; it is gratifying to note that Volume 2 has at least a subject index.

There are four parts: Preparation, purification, and analysis (six papers); Structure (four papers); Electronic and mechanical properties (thirteen papers); and Applications (two papers). The section on structure is naturally the one of greatest interest to crystallographers. It contains a description of the previously unknown β-rhombohedral boron structure, by J.L. Hoard and R.E. Hughes. This structure was originally announced in the *Journal of the American Chemical Society* and the short report published there is reprinted with an extra three pages of discussion. H.J. Becher describes tetragonal boron and its relation to certain borides, and R.H. Wentorf describes a high-pressure form at present characterized only by its powder pattern. Many of the other papers contain incidental crystallographic material, and F.E. Wawner's paper on 'amorphous' high-strength boron filaments is of considerable interest.

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Methods of X-ray spectroscopic research. By M.A. BLOKHIN. Translated from the Russian to English by F.L. CURZON; edited by M.A.S. ROSS. Pp. xv + 448. Oxford: Pergamon Press, 1965. Price 90*s*.

X-ray spectrochemical analysis is based on the important discovery by Moseley who found the wavelengths of the characteristic line spectra varied in a predictable manner from one element to another. The method was not widely applied because of the requirement to make the specimen in the form of an X-ray tube target. The post-World War II developments of high intensity sealed-off X-ray tubes and high quantum counting efficiency X-ray detectors made it possible to use X-ray fluorescent spectra which simplified the practical problems. Today X-ray spectrochemical analysis is almost as widely used as optical emission spectroscopy for a large variety of chemical studies. Crystallographers often use the method to obtain chemical information to supplement X-ray powder data.

The translation of this book by the distinguished Russian X-ray physicist Prof. M.A. Blokhin of Rostov State University presents an opportunity to study the instrumentation and methodology employed in the Soviet Union. The book deals mainly with chemical analysis using electrons to produce the primary X-ray spectra and X-rays to produce the secondary fluorescent X-ray line spectra. The objective is 'to fill the gap in the literature and to acquaint scientific workers, who specialize in the field of X-ray spectroscopy, with the present-day methods of investigation and with apparatus'. The application to the study of chemical bonding, energy levels and similar problems in solid state physics is not included.

The first two chapters contain a description of several demountable X-ray tubes, methods of smoothing and stabilizing the output, and related vacuum methods. No mention is made of the important problem of anode loading, and the characteristic line intensity is given as $I = ki(V - V_0)^2$ without cautioning that the value of the exponent depends on V/V_0, the self-absorption and the angle-of-view of the anode. The third chapter on the measurement of X-ray intensities devotes 32 pages to film methods including tables of formulae for developers and fixers, and 74 pages to ionization chambers, Geiger counters, proportional and

scintillation counters, counting statistics and the use of monitors. Non-dispersive analysis and the use of multichannel pulse height analyzers are not taken up.

The fourth chapter on the resolution of X-rays into a spectrum contains descriptions of various geometries using crystal monochromators to disperse the spectrum in the region up to 20 Å. Table 4 lists crystal monochromators, *d*-spacings (some to 5 decimals for crystals such as gypsum and muscovite) and relative intensities which are not always in accord with other published observations (*e.g.* NaCl (200) = 120, quartz ($10\bar{1}1$) misprinted ($10\bar{1}0$) = 35 whereas in practice they are about equal). Other important monochromators such as silicon, KDP, ADP, the stearates, *etc.* are not listed. Only a few pages are devoted to the electron microprobe.

The fifth chapter on the treatment of experimental results takes up such diverse topics as the recording distortion caused by time constant and scanning speed, and the use of Fourier series to correct the observed profiles. Chapters IV to VIII describe the basis of qualitative and quantitative analysis, the use of internal and external standards and a short section on measuring the thickness of coatings. Very little is given on such important practical problems as preparing specimens and calibration standards and the multitude of technical details that the user must know to be a successful analyst. The last chapter describes absorption analysis.

The book is written from the viewpoint of a physicist and the serious reader will welcome the author's wide use of mathematical methods to provide a basic understanding of the descriptive matter. The reviewer found these descriptions to be interesting and helpful.

Perhaps the most serious criticism is that the book is out-of-date. The instrumentation and methods described were published before the mid-50's and a few supplemental references (up to 1960) were added after the main text was completed. Important key papers published in the 50's are not included while short relatively unimportant papers, often superseded by later publications of the same authors, are listed. For example, the widely-used X-ray fluorescence spectrograph with flat crystal and Soller slits developed by Friedman and Birks is illustrated by their first instrument published in 1948.

References to Russian publications are extensive. However, the practical chemical analyst will still have to search the literature to find the various methods which have been developed for specific types of analyses. The availability of such books as Liebhafsky *et al.* on absorption and emission methods (1960), Cosslett and Nixon on X-ray microscopy (1961), the extensive paper by Sandström in Vol. 30 of *Encyclopedia of Physics* (1957), the several books containing papers presented at international conferences edited by Cosslett, Engström and Pattee, the series of books on the annual proceedings of the Denver meetings entitled *Advances in X-ray Analysis, etc.* should be studied to obtain a good working background in the subject (these books should be considered for translation into Russian). The printing and illustrations are good, the price reasonable, relatively few misprints were found and the translation is good.

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Diffraction of X-rays by proteins, nucleic acids and viruses. By HERBERT R. WILSON. Pp. iv + 137. London: Edward Arnold (Publishers) Ltd, 1966. Price 30*s*.

Compressed between the covers of this little book are the fundamental concepts of molecular structures, the basic principles of X-ray diffraction techniques and a description of the current state of knowledge about biologically interesting structures. The author has, with reasonable success, presented a thorough survey of the application of X-ray diffraction methods to the study of the structures of proteins, nucleic acids, nucleoproteins, and viruses. The result is definitely a textbook to accompany a course of lectures. Understanding this book without concurrent instruction or additional reference material would probably prove difficult for a beginner.

Although the author has not fully related his discussions to the excellent illustrations, a good student should have no difficulty in comprehending their significance. A section of some 200 references is included. This volume which transmits much valuable information in a readable manner will certainly be of interest to all students of molecular biology.

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Thermoelectric properties of semiconductors. Édité par V. A. KUTASOV, traduit du russe par A. Tybulewicz, Pp. 109, 84 figures. New York: Consultants Bureau, 1964. Price $17.50.

Ce recueil contient 23 articles d'auteurs soviétiques. Quelques uns ont été présentés à la première conférence sur la thermoélectricité (1960) et la plupart l'ont été à la seconde (date non précisée). Ils ont été publiés en 1963 en russe.

Outre une mise au point sur le spectre d'énergie des porteurs dans les matériaux thermoélectriques, on trouve des travaux concernant la description de nouveaux matériaux, les problèmes d'élaboration pour assurer l'homogénéité et la stabilité des composés. L'utilisation pratique des méthodes de mesure de la résistivité et du pouvoir thermoélectrique est décrite et discutée. Enfin, plusieurs auteurs traitent de l'application des propriétés thermoélectriques à la production d'énergie électrique ou à des dispositifs de refroidissement divers.

Un index permet de repérer rapidement les sujets abordés.

Il ne s'agit évidemment pas d'un traité systématique sur les phénomènes thermoélectriques dans les semi-conducteurs. Mais ce recueil peut donner aux physiciens et aux ingénieurs d'utiles informations sur une variété de problèmes, principalement technologiques, récemment étudiés dans ce domaine.

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