of thin sections, for the staining of certain selected minerals and for micrometric analysis, with brief mention of other methods. The remainder of the book divides into three sections, one on igneous rocks (84 pages), a second on sedimentary rocks (71 pages), and the third on metamorphic rocks (103 pages). The comprehensive account of igneous rocks is based on a simple mineralogical classification and each class is described under four sub-headings: definition, mineralogy, textures and microstructures, and occurrence. It is under the second of these that the treatment in this book shows most advances over older textbooks on petrography. An attempt to describe sedimentary rocks under the same subheadings is less successful and inevitably breaks down in the descriptions of the clays. A distinctive feature of the sedimentary section is a welcome account of the petrography of the evaporites, illustrated by line drawings based on those of F. H. Stewart. The classification adopted for the metamorphic rocks breaks away from the conventional and by many will be regarded as unsatisfactory in its omission of reference to grade or initial nature of the rocks. The book is mercifully free from too many varietal names, though the principles of selection that have led to the retention of 'unakite' but the rejection of 'enderbite' are not obvious. The photomicrographs give a clear idea of the actual appearance of rocks under the microscope, but, as is widely recognized, are less suited to the illustration of textural detail than good line drawings can be. No references to original papers are given, the short bibliography referring to various books that will enable the reader to extend his enquiries into the field of petrogenesis.

The crystallographer seeking general descriptions of the natural occurrences of minerals in rocks will have difficulty with this book—it is much more a volume to be read by geologists or even specialist petrologists.

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**Landolt–Börnstein, Zahlenwerte und Funktionen. Band 1: Atom- und Molekularphysik; Teil 4: Kristalle.** Compiled by W. Biltz†, W. Döring, Th. Ernst, A. Faessler, W. Fischer, A. M. Hellwege, E. Hertel†, S. Koritnig, H. Krüger, G. Leibfried, U. Meyer-Berkhout, K. Molière, H. Pick, W. Schröck-Vietor, H. Seidel, F. Stöckmann, R. Suhrmann; edited by K. H. Hellwege. Pp. xi+1007 with 930 figs. Berlin, Göttingen, Heidelberg: Springer. 1954. Price DM. 318.

To collect all the known numerical facts about crystals within the covers of a single volume might seem a wellnigh impossible task. Such a book would have to include the greater part of the *International Tables*, nearly the whole of the *Strukturbericht* and *Structure Reports*, together with an almost equally great volume of material relating to the absorption and re-emission of X-ray, ultra-violet, visible, infra-red and micro-wave radiation by crystals. This stupendous task has in fact been accomplished in the present volume of *Landolt–Börnstein*, with a completeness, accuracy and degree of detail that is altogether surprising.

The broad aim of the work is to include those facts of crystal physics which are susceptible to treatment by the methods of atomic physics and of which a fairly complete picture can be given. This includes all detailed X-ray structural studies; it also includes spectroscopy of crystals in general; but subjects like crystal phosphorescence and semi-conductors are not included. Just what has been accomplished in this big volume of over 1000 large and closely printed pages can perhaps best be made clear by giving a brief resumé of the contents.

The first section (§ 1501, 14 pp.) presents an admirable and compact summary of the crystal classes, translation groups and space groups, with an enumeration of their symmetry elements. Both the Schoenflies and shortened Hermann–Mauguin symbols are used, with all the transformations for different orientations of the reference axes. One excellent and most useful reference feature is that the slightly different nomenclatures used in the 1935 and 1952 *International Tables* are set out side by side in adjacent columns.

The next section (§ 1502), occupying 504 pages, or almost exactly half of the volume, is devoted to lattice types, structure and dimensions of crystals. The inorganic sub-section, by Th. Ernst, gives first a fully illustrated description of all the structure types of the Ewald–Hermann *Strukturbericht*, and this is followed by a table giving the structure type, space group and unit-cell dimensions of the elements and some 4239 inorganic compounds and alloys. This is an invaluable collection of material, conveniently and systematically arranged. A list of mineral names and 3056 literature references, to the end of 1951, complete this part. The organic subsection, by E. Hertel, is even more detailed. It is well known that these compounds cannot be usefully classified into a small number of structure types, and the chemical molecule itself is generally the unit of structure about which information is sought. A different kind of arrangement is therefore required, and the one used meets the need well. All the compounds for which unit-cell data are known (to mid 1953) are first listed in an extensive 'review' table. This gives first the molecular formula, according to which the compounds are arranged (C–H, C–H–Halogen, C–H–O, etc.), followed by the name, with any necessary phase data, the full structural formula, the space group, unit-cell dimensions and contents, a cross reference to the following illustrated table of organic structures, and the literature references. This comprehensive table contains data for over 1000 organic structures. In the illustrated table which follows there are 219 entries and these include most of the important structure determinations up to the end of 1952. In this section the entries are arranged according to symmetry and the number of molecules per unit cell, and so to find a given substance it is of course necessary to get its reference number from the previous chemically classified list. This beautifully illustrated table is undoubtedly a very major contribution to the literature of the subject. The diagrams are all specially drawn to a uniform style, and although they are projections they do succeed in portraying the details of the structure in a very clear and concise manner. In addition, coordinates are given in full, together with some of the important interatomic

distances and occasionally other details. A collection of over 1000 literature references completes this part.

This section of the book, which aims at bringing together and summarizing the results of all significant crystal-structure determinations, is clearly a work of major importance to crystallographers. It has, of course, been done before, in the pages of *Strukturbericht* and *Structure Reports*, and most notably in Wyckoff's *Crystal Structures*. But the present volume is unique in that all this, and much more besides, is brought together within the covers of a single volume. The aim of the work is excellent. How far this aim has been achieved, and the importance of the result will depend chiefly on two factors, accuracy and completeness. These are necessarily rather difficult to estimate except after prolonged use and detailed study. Some misprints are of course inevitable in a work of this size. Most of those noticed here by my colleagues and myself have been fairly trivial, e.g. on p. 249 *d*-Dulcit should be *i*-Dulcit or better simply Dulcit (but this is taken from an error in *Strukturbericht*). The reference given (464) is, however, wrong. On p. 261 a space-group symbol and the reference for Dibenzoylperoxyd are wrong. On p. 280, the alternative space group for Thiophen ($C_{2v}^{17}$–*B*2*ab*) is omitted, and reference 167 does not apply. On the same page reference 212*a* should be 212*a**. On p. 286 the formula $C_{22}H_{28}O_2S$ is missing in the first column. On p. 309 the $\beta$ angle of 91° 40′ is missing for the alternative description of *p*-Nitranilin. On p. 310, for *p*-Dinitrobenzol, *a* should be 11·05 instead of 11·5, and here and on p. 391 reference 1*a* does not apply. On p. 413, seventh line from foot, *C*2/*a* should be *C*2/*c*. On p. 506 Donohue is misprinted three times as Donohne. On p. 512 the second part of reference 517 is wrong. On p. 869 two wrong references occur in the same line. With regard to completeness, the coverage seems to be good. Only the unimportant omission of 4-aminosalicylic acid (*Structure Reports*, 1950, p. 534) has been noted.

The part of this volume which deals with crystal-structure data is completed by two further relatively small sections covering ionic and atomic radii (§ 1503, 15 pp.) and lattice energies of crystals (§ 1504, 12 pp.). The ionic radii include data from Goldschmidt, Ahrens, Stockar, Zachariasen and Pauling, and appear to be very complete, while the covalent radii include various organic links with effective radii for van der Waals contacts and examples from organic crystals. Lattice energies of crystals are dealt with compactly with an adequate collection of formulae.

The second part of this volume deals, almost exhaustively, with the absorption (and re-emission) of electromagnetic radiation by crystalline solids. In assessing this section of the work I have been helped by my colleague Dr J. C. D. Brand, who has made continuous use of the book over a period of several mouths. Subdivided according to the frequency of the radiation, commencing with the highest frequencies, the sections can be enumerated as follows: (1) X-ray spectra of the sub-valence shells of elements and small molecules (§ 1508, 99 pp.), and the formations of electronic energy bands in metals (§ 1507, 5 pp.). (2) Photo-emission of electrons from metals and metalloids (§ 1506, 4 pp.). (3) Crystal spectra in the visible and near ultra-violet region (§ 1509, 72 pp.): included here are the electron-transfer spectra of ionic crystals; the sub-valence shell transitions of ions of the transition elements, rare earths, and trans-uranic elements; and the spectra of molecular (mainly organic) crystals. Phosphors and semiconductors, however, are not treated. (4) Absorption spectra of alkali halide crystals with deliberately-induced lattice defects (§ 1511, 36 pp.). (5) Vibration spectra of crystals (§ 1505, 212 pp.). This section includes a very large amount of experimental material of which the theoretical interpretation is still incomplete. Most of the data are for polycrystalline mulls, but measurements of the infra-red dichroisms of single crystals are also indexed. (6) Radio-frequency and microwave absorption by crystals (§ 1510, 39 pp.), including nuclear resonance frequencies of diamagnetic crystals and paramagnetic ions in crystals, and nuclear quadrupole spectra. Nuclear magnetic resonance spectra, however, are excluded. The general plan is that in each section and sub-section the tabular material is prefaced by an outline of the theory and, sometimes, of the experimental method; symbols and conventions are also carefully listed. The closure of the literature survey in the various sections is not quite uniform, but, in general, coverage is complete to the end of 1952.

The theory of the absorption of electromagnetic radiation by crystals is still in an early stage of development, and the emphasis in the tables is therefore on an adequate presentation of the experimental material. To physical chemists interested in this field, the value of a work of reference having twenty years' accumulated data within a single bound volume cannot be overemphasized. The compilers are to be congratulated on the care and labour with which several hundred assorted diagrams from the literature have been redrawn systematically on a common scale. The overall picture is of a book written and produced in the best tradition of German scholarship.

The cost of the book is very high, but it is nevertheless good value. Most crystallographers will be immediately concerned only with the first part of the volume, consisting of § 1501–§ 1504, while the second part (§ 1505–§ 1511) is of more interest to spectroscopists and physical chemists. As these two parts are of nearly equal bulk, it seems a pity that they could not be published as separate volumes. A split of this kind would greatly increase the popularity of the work for all those concerned with structure analysis, and the smaller volumes would certainly be far more convenient for everyday use.

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**Petrographic Mineralogy.** By ERNEST E. WAHLSTROM. Pp. vii+408 with 173 figs., 1 plate and 30 tables. New York: Wiley; London: Chapman and Hall. 1955. Price $7·75; 62*s*.

In the latest of his textbooks Prof. Wahlstrom has attempted to bridge the gap between existing texts on the principles of crystal optics on one hand and those which deal with systematic petrography on the other. The purpose of the book is to show the methods by which an elementary student, with some knowledge of crystal optics, on examining a rock slice with a petrographic microscope may first recognize the mineral constituents