of Fourier transformation could have been most illuminating. In spite of this criticism of its scope, the book is, however, a very welcome addition, and the crystallographer who is engaged on theoretical problems will do well to get acquainted with it.

P. P. EWALD

Polytechnic Institute of Brooklyn
Brooklyn 2, N.Y., U.S.A.

Gmelins Handbuch der anorganischen Chemie. Titan. Pp. xxii+41 with 100 figs. Weinheim/Bergstrasse: Verlag Chemie. 8th ed. 1951. Price DM. 113.

The present volume on titanium is the first complete section (System No. 41) to appear as part of the Gmelin Handbook after the interruption of this fundamental work through the war. A preface tells of the difficulties encountered in re-establishing the damaged and dispersed archives, and of the help received from many scientific and industrial quarters as well as from the Science Officers of the German Control Commission, Drs Roger Adams and B. N. Blount.

The objective of this book is to offer a full account of titanium the element, its alloys, and its inorganic compounds, and also of the reactive properties of its ions. This is done in uniform style with great clarity and in a very convenient form. Among the physical data listed and discussed are thermodynamical data (melting, boiling and transformation temperatures, specific heats, entropy, conductivity, expansion) and optical data (refraction, dispersion, absorption, infra-red, electro- and magneto-optical effects, luminescence, band-spectra, X-ray absorption structure).

The physical properties, including the crystal structure, are fully covered as far as known. In the case of titanium oxides, for example, they fill 34 pages, for TiN 5 pages, for $BaTiO_3$ 18 pages. Chemical properties, stability and modes of preparation are of course fully reported.

The crystallographer will find that Gmelin comes nearest to a revised edition of Groth's *Chemische Krystallographie*, the need of which has often been felt and discussed. It contains much more information than Groth ever intended to collect, but with the ever increasing integration of crystallography, chemistry and physics this is probably all to the better.

This volume, as the subsequent ones which are to complete Gmelin's Handbook within the next 10 years, includes the literature up to 1 January 1950. This uniformly applied termination will make it possible to issue supplementary parts in order to keep the work up to date.

In spite of many subsidies, the Gmelin volumes are very expensive. This is, unfortunately, unavoidable in a work compiled by a large staff of highly qualified scientists. The Handbook should be considered as an instrument for research, and its price compared with that of a spectrometer or other indispensable high-precision equipment. Judging by the references, each page is based, on the average, on 15–20 original papers which had to be read and condensed. To find out that nothing is to be found in the literature, including the patent literature, about a certain property of a substance is usually even harder than finding observed data, and yet it is often essential in planning research. Gmelin's Handbook offers the closest approach to giving an answer to this question because, by all tests the reviewer could think of, it came out as giving a complete coverage.

In the case of high-precision measurements we are accustomed to pay more money for finding a reliable figure of the last decimal than for all the previous ones taken together, and we know that this expenditure often gives an important return. In a collection and digest such as Gmelin the corresponding achievement is completeness, and it is inevitable to have to pay for the reasonable certainty that nothing significant can be found in the literature beyond what has been reported. The savings in time and effort achieved by using a reliably complete work of reference should be remembered in balancing the expenditure for Gmelin.

P. P. EWALD

Polytechnic Institute of Brooklyn
Brooklyn 2, N.Y., U.S.A.

Crystal Growth. By H. E. BUCKLEY. Pp. xv+571, with 257 figs. New York: Wiley; London: Chapman and Hall. 1951. Price $9·00; 72*s*.

This book is a welcome survey of the theories and observed facts of crystal growth. Particular attention is paid to the growth of macroscopic single crystals from aqueous solution, and a detailed account, perhaps overlong, is given of the special field of habit modification by adsorption of dyes and other co-solutes. Written at an elementary level, it is a useful supplement to the more specialized account of various aspects of the field given in the recent Faraday Symposium. The book should prove of value to the lay worker in many fields outside that of formal crystallography.

Following a chapter on solubility and supersolubility, a lengthy and useful description is given of practical methods for growing large single crystals from solution or melts. The surface energy, diffusion and structural approaches to the problem of growth mechanism and the growth velocities of crystal faces are discussed in four following chapters. Solution phenomena, the ideal–real crystal problem and habit modification are then dealt with as major topics. Three additional chapters are largely a composite of smaller topics, including the pressure of growing crystals, vicinal faces, dendrites and spherulites, oriented growths and inclusions in crystals. The subject of the formation and distortion of growth twins is not entered, although the matter is relevant and its literature extensive.

The work is occasionally marred by inexpertness variously in the statement of fact, organization of material, or point of view. This could be the lot of any author venturing to write a comprehensive treatise in a field as broad and intricately partitioned into specialities as the present one. The documentation of the text is adequate but on the whole not critical, and apparently a number of important contributions, especially in recent literature, have not been used. The chapter on peculiarities of crystal growth does not discuss the work of Morse and Donnay on spherulites, and Bernauer's monograph on twisted crystals is not cited. Reference is not made to Seifert's exhaustive monograph on anomalous mixed crystals, or to the books on crystal growth by Tertsch

and Shubnikov although they are alluded to in the Preface. A few misprints were noted, among them 'Mg_2AlO_4', 'Schottsky', and on p. 410 'kainite' should read 'kyanite.' The octahedral cleavage of bismuth-containing galena is suggested to be due to organic impurities, but this has been shown to be due to the precipitation from solid solution of oriented lamellae of a bismuth compound. A closer and more fundamental correlation also could have been made with allied phenomena in other fields, especially metallurgy and surface- and colloid-chemistry. Buckley's book, however, in spite of its shortcomings, goes far to fill the long-standing need for a survey text in English on crystal growth.

C. FRONDEL

Harvard University
Cambridge, Mass.
U.S.A.

Elements of Optical Mineralogy: an Introduction to Microscopic Petrography. Part II. Descriptions of Minerals with Special Reference to their Optical and Microscopic Characters. By A. N. WINCHELL, with collaboration of H. WINCHELL. Pp. xvi+551, with 427 figs. New York: Wiley; London: Chapman and Hall. 4th ed. 1951. Price $12·50; 100*s*.

The third edition of Winchell's book appeared in 1933 and covered 442 pages of text with 362 text figures. The present revised edition, though larger by ninety pages and an addition of more than fifty illustrations, follows the general pattern of its well-known predecessor. Descriptions of most of the minerals recorded since 1930 have been incorporated and a number of discredited species, though not all, have been omitted. There have been some changes in nomenclature, particularly the adoption, which will be welcomed, of N_Z, N_Y and N_X in place of N_g, N_m and N_p and the application of Schuster's rule, previously confined to the feldspars, to the extinction angles of other monoclinic and triclinic minerals.

The greatest change in treatment is in that of the silicates. In the third edition many silicates (described in 43 pages) were placed under the heading 'silicates not yet classified by X-ray studies'. In the new edition this heading has disappeared. The nomenclature of the structural classification now follows closely that of Strunz (*Mineralogische Tabellen*, 1941) and the classification is extended to all silicates though it is clearly recognised that with many rarer types the X-ray data are still to be sought. Furthermore, for each mineral, where that is possible, a brief statement of X-ray data under the heading 'structural' is now added. As a result of the new data, a considerable number of minerals has been given new crystallographic elements (compared to those in the third edition) but without corresponding change in the accompanying figure relating the position of the indicatrix axes to the morphology. Discrepancies thus occur between some of the text descriptions and the related figure. Either the diagrams should have been revised, or, if that was thought inadvisable, a note of indication of the discrepancy added for the benefit of the reader.

A conspicuous feature of the book is the wealth of diagrams purporting to present the relation between chemical composition and physical (principally optical) properties. The number of such diagrams has been increased from 56 to over 120 in the new edition. A continual striving to attain precise relationships of this kind is in the forefront of mineralogical investigation, but the student should be warned, in view of the present lack of accurately tied data, to treat many of these diagrams with reserve. Some that are presented are so confused with inconsistent data that they should have been omitted—notably those depicting relationships in the chondrodite, cordierite and beryl series. Some other diagrams are of doubtful value. In the treatment of the amphiboles, it is difficult to see the purpose of inserting the complex triangular prism diagrams for 'eight end members (calciferous hornblende)' shown in figures 14 and 15, and repeated in figures 318 and 325; or again for that of the montmorillonite system in figure 275.

The section devoted to the feldspars, profusely illustrated as before, has been increased by seven pages, principally by an exposition of Nieuwenkamp's method (1948) for the determination of the plagioclase feldspars in random sections. The exposition is insufficiently detailed to be applied by the student without reference back to Nieuwenkamp's memoir, and in a book of this character a much briefer statement should have sufficed. The revision of the feldspar section was fated to be completed before the recent notable advances on the polymorphism and in the thermal and X-ray study of this group had been recorded (1950), and much of the section will accordingly need to be rewritten in the light of these later researches.

Despite some shortcomings to which reference has been made in the preceding paragraphs, Winchell's book retains the deservedly high reputation it enjoyed through successive earlier editions as the outstanding compendium on the optical properties of minerals and as a standard of reference indispensable to every research worker in the field of mineralogy and petrology.

C. E. TILLEY

Department of Mineralogy and Petrology
University of Cambridge, England

Phase Transformations in Solids. Edited by R. SMOLUCHOWSKI, J. E. MAYER and W. A. WEYL. Pp. 660 with many figures and tables. New York: Wiley; London: Chapman and Hall. 1951. Price $9·50; 76*s*.

Au cours du dernier Conseil de Physique Solvay, Sir W. L. Bragg rappelait que l'on pouvait, il y a quarante ans, réunir des 'physiciens' pour parler de 'physique'. Maintenant, l'on ne saurait songer à une telle réunion sans en délimiter étroitement le sujet. Et, même dans un tel cadre, les spécialistes sentent souvent qu'ils sont loin d'être au courant de tout ce qui leur est nécessaire.

C'est pourquoi, maintenant, les livres écrits par un seul homme sont remplacés peu à peu par des œuvres collectives où sont rassemblés les articles d'un grand nombre d'auteurs traitant les différents aspects d'une question. Tel est le cas de *Phase Transformation in Solids* qui reproduit les communications et—très sommairement d'ailleurs—les discussions d'un Symposium tenu à Cor-