X-ray Crystallography

X-Ray Diffraction in Crystals, Imperfect Crystals, and Amorphous Bodies. A. Guinier. Translated from the French edition (Paris, 1956) by Paul Lorrain and Dorothée Sainte-Marie Lorrain. Freeman, San Francisco, 1963. x + 378 pp. Illus. $11.

In 1956 Guinier produced a masterful text on x-ray crystallography, entitled *Théorie et Technique de la Radiocristallographie*. That text has been studied, though not widely enough, simply because it is in French. It is, moreover, too complete for the general scientific student and perhaps a little too theoretical for the scientist who is primarily interested in practical applications. Nevertheless, many of us have often thumbed its pages thinking that one should produce an English translation. But, as the years went by, one felt more disheartened because it was getting rather late.

Guinier evidently thought otherwise, and he obtained the collaboration of Paul Lorrain, better known as a nuclear physicist, and Dorothée Lorrain. Without great loss to the English-speaking reader, who can use several other introductory books, the Lorrains lightened their task by translating only the most important last part of the five parts of the original book; they also added an introductory chapter and substituted a few references to critical literature published since 1956. For the rest they produced a superb translation.

It must be clearly understood that Guinier did not, even in his original text, cover that part of x-ray diffraction which deals with crystal-structure determination. In his book, as in his own principal contributions, Guinier is concerned with departures from crystal perfection, the effects of crystal size, temperature, and strain, as well as solid-solution and long-range effects. His elegant Fourier technique enables him to build up the subject from diffraction by media without lattice order. There can be no doubt that this is a most important and successful book in that field. There are, however, limitations that arise from the passage of time. The subject is a very active one, and in the time that has elapsed since the volume was first published our knowledge has been extended, for instance, with regard to anomalous diffraction effects by nearly perfect crystals.

The author claims that "This book should be useful for solid-state physicists, metallographers, chemists, and even biologists." I hesitate, and ask: Should they not be given texts in which structural information obtainable by x-ray diffraction is integrated and contrasted with that from other techniques?

I do, however, feel great pleasure that, in the future, there will be no language excuse for disregarding Guinier's important book, which I recommend warmly to x-ray diffractionists, as well as to writers of textbooks and reviews of slightly wider fields.

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Comprehensive Résumé

The Chemistry of Wood. B. L. Browning, Ed. Interscience (Wiley), New York, 1963. x + 689 pp. Illus. $25.

Every man, woman, and child is familiar with trees, and most of us derive a great deal of pleasure and satisfaction from their everchanging beauty. But few realize, or even suspect, the biological, morphological, and chemical complexity of trees or of industrially important wood around which our modern lives revolve. Browning has performed a singular service in bringing together 16 collaborators to discuss in 12 chapters the many aspects of wood science. Each contributor has had many years of active research experience in his field, and we are thus assured of an authoritative treatment of the subject.

After a brief introductory chapter in which the supply and uses of wood are considered, the structure of wood is discussed in considerable detail from the anatomical viewpoint. Physical properties and a variety of wood defects are also considered. The composition and chemical reactions of wood are discussed in the next chapter. The presentation of the chemistry and physics of cellulose, which constitutes a separate chapter in this book, is by far the best available one-chapter treatise on cellulose, and it is recommended to all newcomers to this field. The chapters on the hemicelluloses and wood lignins are also excellent presentations of these complex substances which frequently seem to defy clear presentation. The extraneous components of wood, which are apparently classified as those substances that are neither cellulose, hemicellulose, or lignin, are discussed in the next chapter. The chemistry of developing wood is treated from the biochemical point of view, while the next chapter (on wood-water relationships) presents excellent discussions of such technologically important subjects as water sorption, surface area measurements, the thermodynamics of sorption, swelling, and shrinkage. The manufacture of wood pulp by the several chemical and mechanical methods of current industrial interest and a discussion of wood as a chemical raw material constitute the next two chapters. In the final chapter, the chemistry of bark is discussed, and it is interesting to note the many differences between the center wood and the bark.

Each chapter has its own list of references which appear to be quite extensive and complete. The book is well reproduced, and all illustrations are clear and informative. In general terms, this book is an excellent presentation of a complex subject, which should prove useful to both the novice and the experienced researcher.

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Chemical Technology

Fuel Cells. Will Mitchell, Jr., Ed. Academic Press, New York, 1963. xvi + 442 pp. Illus. $15.

This book, one of several state-of-the-art reports on fuel cells, consists of an introduction and nine chapters, each written by well-known contributors to research and development on fuel cells. Considerable quantitative information is included; this is of special value to the well-informed reader who is interested in making comparisons and evaluations. Although the symbols used for various quantities are not uniform from chapter to chapter, they are not difficult to follow. I noted only a few minor errors: for example, on page 53, an aldol condensation identified as a Cannizarro reaction.

The division of material into six of the chapters was made on the basis of types of cells and operating conditions: that is, high pressure hydrogen-oxygen cells, high-temperature cells, ion-exchange membrane cells, sodium amalgam-oxygen continuous feed cells, low

temperature hydrogen-oxygen cells, and carbonaceous fuels. These topic headings indicate considerable overlap in the material, and some consolidation might have been made in order to save space. However, the division of subjects is logical in terms of the experiences of the authors, and it is easy to skip over the repetitious parts (but one hopes this repetition did not very seriously affect the price of the book).

Each of these chapters includes a discussion of the special features and advantages of a type of fuel cell, a brief treatment of thermodynamic and possibly kinetic considerations, details of one or more cell designs, and performance data in terms of current-cell (or electrode) potential curves. Electrode materials and designs are treated extensively from the point of view of development. Only occasional attention is given to studies of electrode reaction mechanisms and catalysis. The bibliographies are complete, but not extensive, up to 1961, with only a very few references to 1962 publications.

The three remaining chapters are concerned with relatively general consideration of fuel cells: thermodynamics, kinetics, and catalytic aspects as well as research techniques. After the first reading, the usefulness of these chapters is variable and depends upon the individual reader. My opinion is that they will not replace the standard reference works and texts, many of which are cited. This is particularly true with respect to the chapter on kinetics and catalysis, which appears to be pedagogically unsound; the major fault is that many statements are unnecessarily specific and are given in the guise of generalities. In addition, the definitions of terms are not rigorous and often are misleading. Readers should carefully consider any statement within its context before attempting any generalizations. Even then, some parallel reading would be helpful.

Although the glamour of fuel cells has faded as a result of slower than expected development and application, the rate of advance of technology in this area is indeed significant. General interest is widespread and is occasionally stimulated by reports from the popular press. This timely and comprehensive review of the current status of the different types of fuel cells should find a wide reception.

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Care of Museum Objects

Recent Advances in Conservation. A conference held at Rome in 1961. G. Thomson, Ed. Butterworth, Washington, D.C., 1963. xvi + 224 pp. Illus. $21.

The need to conserve natural resources is widely recognized. It is far less frequently realized that it is also necessary to conserve the materials stored in museums. Yet, ill-considered methods of handling, display, storage, and repair can often ruin museum objects. At the very least, lack of proper attention gradually erodes away their number and quality. In honor of its tenth birthday, the International Institute for the Conservation of Historic and Artistic Works held a conference in Rome in 1961 to consider these matters. Although this professional society has less than 1000 members, it publishes a technical quarterly and a biannual set of abstracts. The field is young and rapidly growing, however, and there are few books that describe, even in a general way, the technical methods of examining and treating museum objects. Hence, this publication of the conference papers is a valuable contribution, for it provides a review of the present state of the art by 46 prominent specialists.

The 47 papers, eight of which are in French, are varied in character. There are reviews of the literature, statements of policy and philosophy, descriptions of methods and techniques, and disclosures concerned with new findings in research. The subjects considered include museum climate, physical and chemical methods of analysis, fungicides and insecticides, new varnishes and problems encountered in removing varnishes, the examination and treatment of metal objects, transferring frescos, the consolidation of fragile objects, the examination and conservation of glass, reinforcing and transferring wood-panel paintings, the treatment and repair of textiles, and the training of conservators and restorers. Understandably, there is little discussion of archeological problems *per se* and practically nothing about the restoration of architectural monuments. Notably missing are contributions from Belgium and India. The extensive halftone illustrations are not of the highest quality, and they detract from the overall attractiveness of the volume.

This is not a how-to-do-it handbook of specific treatment and analysis. Rather, it is a survey and statement of fundamental problems. Although the volume is addressed primarily to professional colleagues, the language is simple and direct. It will be a valuable reference, for it introduces the nonspecialist to the people, the literature, and the basic problems concerned with the care and examination of museum materials.

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Chemical Engineering

The Thermodynamics of Gasification and Gas-Synthesis Reactions. N. V. Lavrov, V. V. Korovov, and V. I. Filippova. Translated from the Russian edition (Moscow, 1960) by G. H. Kinner. Pergamon, London; Macmillan, New York, 1963. viii + 116 pp. Illus. $6.50.

Essentially this monograph is composed of two distinct parts; the first is a quite adequate review of the calculation of thermodynamic data by statistical methods and of chemical equilibrium constants from thermodynamic functions. This section also includes tabulations of thermodynamic functions, which are based on data derived in large measure from Western sources. My spot checks show that the data in these tabulations generally agree with American tabulations which use the same sources. However, several of the enthalpies of formation, ΔH_0°, do not agree with those tabulated by Pitzer and Brewer in their revision of Lewis and Randall's *Thermodynamics* (for example, ΔH_0° for SO_3, SO_2, H_2S, $COCl_2$, CH_2O_2 and HF). As a result, one should check the original sources before using the tabulations of thermodynamic properties given by Lavrok and his co-authors for precise calculations. In general the literature citations are adequate, but occasional references are insufficient (see reference 75 on p. 72).

The second half of the monograph should be useful to process engineers in the organic chemical industry. In this half, equilibrium constants, equilibrium concentrations, and percentage conversions for several chemical synthesis processes are recorded. Unfortunately, in this respect the Russians have