

put off by this rather difficult chapter and should skip when the going gets too hard. Mastery of the mathematics is only necessary for those who wish to understand the proof of every relationship. It is not necessary for the understanding of the rest of the book and for the application of crystallographic relationships in practice.

Chapter 2 explains the film methods of recording X-ray diffraction patterns and the interpretation of these patterns. It then goes on to discuss the generation and absorption of X-rays, with practical application in the selection of the most appropriate target material and filter, and of the voltage and current settings. Chapter 3 is concerned with all the various types of symmetry that may be associated with a crystal structure and with an X-ray diffraction pattern, the practical application here being, of course, the determination of space groups. It also includes a discussion of the Fourier-series representations of electron densities in crystals and of structure factors. Chapter 4 explains the operation of a four-circle diffractometer and includes discussions of the statistics of intensity counts and of the choice of crystal and scanning mode.

Chapter 5 is an excellent one on methods of solving the phase problem. It gives detailed and practical accounts of the Patterson and direct methods and even goes through, in detail, the beginning of a sign-determining process for a centrosymmetric crystal. Chapter 6 gives the theory of least-squares refinement of structural parameters and then outlines various practical considerations in applying the method. Finally, it discusses molecular-geometry calculations and the pictorial representation of crystal structures.

It is remarkable how much theory, practical application, and detailed example have been incorporated in the 312 pages of this excellent book. The price is rather high for anyone buying this as their first crystallographic book but it is not unreasonably high, since it will serve all the crystallographic needs of many of its readers. The printing and binding are also of a high quality. In fact, the only aspect of the book that can be seriously criticized is the title – X-ray analysis, these days, suggests the techniques of X-ray fluorescence spectroscopy and X-ray photoelectron spectroscopy, which this book is definitely not about. The book can be strongly recommended as a sound practical guide for the novice in crystal structure determination and as a handy compendium of theory and practical hints for those already familiar with the techniques.

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*Acta Cryst.* (1981). B37, 493

**Gems made by Man.** By K. NASSAU. Pp. xviii + 364.

Radnor, PA 19089: Chilton Book Co., 1980. Price US \$28.50.

This book will surely become the definitive work on this subject that the foreword (by the President of the American

Gemological Institute) anticipates. The author, who is known also for his earlier pioneering of laser technology, has been active in solid-state science, crystal growth and gem technology for the past 25 years and is a widely respected authority in the science of gemology (gemmology in the UK).

The overall emphasis is on the production and characterization of gem materials. After two chapters on preliminaries, four large sections, each of three or four chapters, deal with the four largest families of gems: ruby, quartz, emerald and diamond; further sections then take in almost the whole range of other gem materials, including garnet, spinel, rutile, opal and alexandrite, and many more. The book gives systematic attention to the history of the subject, relating the early attempts and successes in each of the various areas (ruby by Verneuil growth; diamond – a saga with considerable drama; garnet by Czochralski pulling...) and proceeds from these beginnings to detailed accounts of the most modern, commercial techniques. The coverage of the book is exhaustive, the attention to detail impressive; its readability is superb, and the numerous, excellent illustrations make the book quite hard to put down; cross-referencing is frequent and most useful, and the index is meticulous. There are also practical suggestions for further reading. The book is characterized by a happy combination of scientific and technical detail with artistic appreciation and with the intimacy of craftsman's knowledge. It is only a pity that the current technological capabilities of laboratories outside the USA and France – notably in the Soviet Union – could not be included in the illustrations.

For the crystallographer, there is not much here specifically on the crystallographic aspects of these materials, although the two chapters on crystal growth and the origin of colour in crystals are both sound and well written. But, for sheer enjoyment of a masterly presentation of a field in which crystals are the centre of attention, this book is very highly recommended.

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*Acta Cryst.* (1981). B37, 493–494

**X-ray analysis and the structure of organic molecules.**

By JACK D. DUNITZ. Pp. 514. Ithaca: Cornell Univ. Press, 1979. Price US \$55.00, £33.00.

Professor Dunitz's book is one of the well known series based on the George Fisher Baker non-resident lectureships in chemistry at Cornell University. Attendance at the lectures must have been a stimulating experience, and inevitably something of the excitement is lost in the expansion to book form. To use the author's own analogy, it is difficult to provide a comprehensive guidebook (on crystal analysis methods for chemists) which readers will want to read from cover to cover. Some of the lecturer's anecdotes do not transform well to the printed page. The conversation on pages 213–215, for example, would be very effective in a lecture, but it seems unnecessarily wordy (the author thinks perhaps frivolous) in book form.

The first part of the book, Chapters 1–6, deals with the methods of X-ray crystal structure analysis: X-ray diffraction, symmetry, structure solution, refinement, treatment of results, and experimental aspects. The coverage in general is selective but good. The chemist may find some of the matrix notation in Chapters 4 and 5 rather heavy going, but the sections on anomalous dispersion and direct methods in Chapter 3 should prove particularly useful.

Chapters 7 (*Crystal Structure and Chemistry*) and 8 (*Electron Density Distributions in Molecules*) should prove to be the most interesting and instructive for the chemical reader. Chapter 7 contains some beautifully illustrative examples of how the results of crystal structure analyses can contribute to the solution of problems of chemical interest, including studies of chemical reaction pathways. The topics in Chapters 9 and 10 (cyclic molecules and conformational maps) are rather too specialized for the general reader.

The book is well produced, and relatively free from printing errors. It does not really succeed in its effort to be a comprehensive guide, but it will certainly be well worth the chemical reader sampling those parts which particularly interest him.

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*Acta Cryst.* (1981). **B37**, 494

### Book Received

*The following book has been received by the Editor. Brief and generally uncritical notices are given of works of marginal crystallographic interest; occasionally a book of fundamental interest is included under this heading because of difficulty in finding a suitable reviewer without great delay.*

**The molecular physics of liquid crystals.** Edited by G. R. LUCKHURST and G. W. GRAY. Pp. xii + 494. London: Academic Press, 1979. Price £20.00, US\$46.00. A review of this book, by G. H. Brown, has been published in the January issue of *Acta Crystallographica*, Section A, pages 139–140.