Associated Meetings

At present the following meetings are being considered.

1. An *International Summer School on Crystallographic Computing* is planned for the period before the Congress. For further details contact Dr D. Sayre, Research Division, IBM, PO Box 218, Yorktown Heights, NY 10598, USA.
2. A *Symposium on Neutron Diffraction* will be held on 12–13 August 1981 at Argonne National Laboratory, Argonne, Illinois (near Chicago) dealing with recent developments in neutron scattering with special emphasis on pulsed neutron sources; Local Chairman, Dr M. H. Mueller, Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439, USA; Program Chairman, Dr D. E. Cox, Physics Department, Brookhaven National Laboratory, Upton, NY 11973, USA.
3. A *Symposium on Crystallography in the Health Sciences: Crystalline Deposits in Human Tissues* will be held at Mt Sinai Hospital, Toronto, 13–14 August 1981; Local Chairman: Dr P. T. Cheng, Mt Sinai Hospital, 600 University Ave., Toronto, Canada, M5G 1X5. For further details write to Professor S. C. Nyburg, Chemistry Department, University of Toronto, Toronto, Canada, M5S 1A1.
4. A *Symposium on Biologically Active Molecules* will be held at the Medical Foundation of Buffalo, 26–28 August 1981. For details write to Dr W. L. Duax, Medical Foundation of Buffalo, 73 High Street, Buffalo, NY 14203, USA.

Acta Cryst. (1980). A36, 331

Change of Publisher of *Structure Reports, Molecular Structures and Dimensions* and Other Publications

As from 1 January 1980, D. Reidel Publishing Company, PO Box 17, 3300 AA Dordrecht, The Netherlands, has taken over the publication and sales of all the publications of the International Union of Crystallography previously handled by Bohn, Scheltema and Holkema. These publications include *Structure Reports, Molecular Structures and Dimensions, Symmetry Aspects of M. C. Escher's Periodic Drawings, Fifty Years of X-ray Diffraction, Early Papers on Diffraction of X-rays by Crystals*, and miscellaneous other publications of the Union such as the bibliographies and the *Index of Crystallographic Supplies*. Orders for all these publications may be placed direct with the publishers or with Polycrystal Book Service, PO Box 11567, Pittsburgh, PA 15238, USA or with any bookseller.

Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

Acta Cryst. (1980). A**36**, 331–332

Crystallographic groups of four-dimensional space. By H. Brown, R. Bülow, J. Neubüser, H. Wondratschek and H. Zassenhaus. Pp. xiv + 443. New York, Chichester, Brisbane, Toronto: Wiley-Interscience, 1978. Price £27·00.

This book gives an original description of two-, three- and four-dimensional crystallographic objects, primarily by the use of tables. The two- and three-dimensional groups are included for completeness and in order to familiarize the reader with the classification and form of listing suggested by the authors, by using better known crystallographic groups. Complete listings of four-dimensional space groups are mainly computer produced by the group of authors and presented in this book for the first time.

The book has three main sections with a preceding short section on history. Chapter one gives algebraic definitions of the *n*-dimensional crystallographic groups and of various classifications of these groups. The authors define the main dimension-independent crystallographic concepts with the formal apparatus of group theory following the lines of development given by Bierberbach, Frobenius, Burckhard and later by Ascher and Janner.

Classification of *n*-dimensional crystallographic groups is based on distinguishing between the concept of a space group and that of a space-group type; the first means the set of all symmetry operations of a specific crystal structure, for example, of a specific NaCl crystal while the second means the space group of the NaCl-structure type, *i.e.* of $Fm3m$ (or O_h^5) type, to which the space group of the given crystal belongs.

The concept of arithmetic classes isomorphic to the types of symmorphic space groups is central to the suggested system of algebraic definitions.

Chapters two and three offer, for the first time, complete tables of crystallographic objects for dimensions 2, 3 and 4, particularly all types of space groups and invariants of these groups (the table takes 357 pages) and lattices hierarchically ordered according to crystal classes, Bravais types, crystal systems, and crystal families. In four dimensions, the number of space-group types is 4783 (112), the number of arithmetic crystal classes 710 (70), of geometric crystal classes 227 (44), of Bravais types of lattice 64 (10), of crystal systems 33 (7), of crystal families 23 (6). One of the phenomena of four-dimensional space is enantiomorphism, not only of the space-group types but also of arithmetic and geometric classes and Bravais lattices (the number of corresponding enantiomorphic pairs are given in parentheses).

Additionally, as an example, character tables are provided ($n = 4$) and normalizers in the full group of unimodular $n \times n$ matrices ($n = 2, 3, 4$) for the point groups (finite unimodular groups), used in the Zassenhaus algorithm.

The Appendix discusses the relevance of crystallographic groups in the general theory of symmetry groups.

The book will be supplied with an *errata* sheet in which the authors of the book correct some misprints and an error in the definition of the dimension-independent concept of the crystal system, found by them just after the book had been published. Not to mislead the reader by the old definition of a crystal system, the author's corrected text is quoted here.

Pp. 16–17: In the definition of the concept of a crystal system the following claim is made:
'However, for any **Q**-class **C** there is a unique holohedry **H** such that each f.u. group in **C** is a subgroup of some f.u. group in **H** but is not a subgroup of any f.u. group belonging to a holohedry of smaller order.'

This statement is correct from dimensions 1, 2, 3, and 4. However, it follows from the results of Plesken & Pohst that there is a counterexample to it in seven-dimensional space.

To formulate the definition of 'crystal system', the authors of the book use the intersections of **Q**-classes and Bravais flocks as introduced on p. 17 and they define the classification of the set of all **Z**-classes into crystal systems as follows:
'*Definition*: A crystal system contains full geometric crystal classes. The **Z**-classes of two (geometric) crystal classes belong to the same crystal system if and only if these geometric crystal classes intersect the same set of Bravais flocks of **Z**-classes.'

The book clearly demonstrates the variety and complexity of crystallographic groups in four dimensions in comparison with lower dimensions. In four dimensions there exist point-symmetry operations of orders 5, 8, 10, and 12; nonsolvable groups occur as point groups; the centered hypercube has higher symmetry than the primitive hypercube; non-symmorphic space groups, other than $P\bar{1}$, exist, containing only translations and point-symmetry operations; the difference between crystal system and crystal family becomes much more apparent, *etc*. Therefore, the description of the four-dimensional crystallographic groups provides a better insight into dimension-independent crystallographic properties and, thereby, a deeper understanding of crystallography in two and three dimensions.

The book may be of interest to crystallographers, physicists and chemists, as well as to mathematicians, whom the last section of Chapter I and the Appendix are meant to attract.

The reference list cites 112 names.

T. S. KUNTSEVICH

Gorky Lobachevsky State University
Gorky Physico-Technical Research Institute
Gorky
USSR

Acta Cryst. (1980). A**36**, 332

Disorder in crystals. By N. G. PARSONAGE and L. A. K. STAVELEY. **International series of monographs on chemistry.** Pp. xxviii + 926. Oxford: Clarendon Press, 1979. Price £28·00.

This book is a good survey of the present knowledge of many aspects of disorder for a great selection of stoichiometric crystalline substances; the problems of defects, defect structures, and their order–disorder transformations are therefore not included. The book deals with three kinds of disorder: positional disorder, orientational disorder and magnetic disorder.

The book has twelve chapters, each with a detailed list of references. The short introduction provides some definitions. By disorder of position is meant, as one type, that the lattice is one in which there are more sites to accommodate a particular kind of particle than there are particles of that kind available and that there is some randomness in the way in which the particles are distributed among the sites in question (but nothing is said about such problems as distribution coefficients or site preferences), and, as another type, that there are N A atoms and N B atoms which together occupy $2N$ sites in a partially or wholly random way. Not included are problems of polytypism and OD structures. Orientational disorder can arise when diatomic or polyatomic molecules or ions have access to different orientations in the crystal lattice which are distinguishable. Magnetic disordering is a disordering of the orientations of magnetic spins. While the crystal may have to pass through more than one transition to reach a completely ordered state, these order–disorder transitions are also discussed but only in connection with the special examples and not in a general or complete form.

Two chapters deal with the theoretical background. The classification of transitions, ferroelectrics and antiferroelectrics, and hysteresis phenomena are discussed in terms of thermodynamics. Much attention is devoted to statistical mechanics, especially to the Ising model, its solutions and its general applications to order–disorder systems. The next chapter is a review of the more important experimental methods, such as thermodynamic studies, diffraction methods, NMR, IR and Raman spectroscopy, neutron scattering spectroscopy and other spectroscopic techniques (NQR, ESR), and dielectric properties.

The following chapters deal with detailed results on many examples: alloys; positional disorder in inorganic compounds; orientational disorder in salts, ice and hydrates; disorder in molecular solids, clathrates and channel compounds; and magnetic systems. Here, one can find a lot of detail on the disorder problems of many substances – but not of all, for example, the interesting case of minerals. The text is completed by many instructive figures and tables. There is a substance index and a subject index.

The book is written by two chemists engaged in research work in this field. It gives a detailed survey of modern knowledge of the field of disorder in crystals and is recommended for chemists, crystallographers, physicists and material scientists who are interested in order–disorder problems and phenomena in a general or special way.

H.-J. BAUTSCH

Sektion Physik
Humbolt-Universität
Invalidenstrasse 43
104 *Berlin*
German Democratic Republic

Acta Cryst. (1980). A**36**, 332–333

Phase transitions in solids. By C. N. R. RAO and K. J. RAO. Pp. 330, Figs. 168, Tables 20. Maidenhead, England: McGraw-Hill, 1978. Price £18·15.

There are at least two common approaches to the subject of phase transitions. On the one hand, the emphasis may be on a theoretical understanding of critical phenomena where terms such as order parameter, critical exponent, model Hamiltonian and (in recent years) renormalization group