

**International Tables for X-ray Crystallography. Volume I. Symmetry Groups.** Edited by N. F. M. HENRY and K. LONSDALE. Pp. xii+558 with 237 figs. Published for the International Union of Crystallography. Birmingham: Kynoch Press. 1952. Price 105s. (60s. to individual members of approved scientific societies).

During the years since 1935 X-ray crystallographers have made great use of the *International Tables for the Determination of Crystal Structures*, prepared through the informal cooperation of scientists in several countries, and initiated at a conference in Zürich in 1929. These tables are now being revised, under the supervision of the Editorial Committee of the International Union of Crystallography (M. J. Buerger, C. H. MacGillavry, N. F. M. Henry, J. S. Kasper, and K. Lonsdale (Chairman)). The first volume, on symmetry groups, has appeared; it is beautifully printed on fine paper, and has an interesting odor (an unusual feature). It will be followed by a volume of mathematical tables and a volume of physical and chemical tables.

The book contains detailed descriptions of the one-dimensional, two-dimensional, and three-dimensional lattices, the two-dimensional and three-dimensional point groups, and the two-dimensional and three-dimensional space groups, in a form designed to be of the greatest usefulness to X-ray crystallographers.

Some major changes and many minor ones have been made in the principal part of the book, the description of the 230 space groups. A significant feature is the tabulation of Fourier series for the electron density, for each of the 230 space groups; this information, which was not given in the earlier *Tables*, was first published in the book *Structure Factor Tables* by Kathleen Lonsdale (London: Bell, 1936). An improvement that will be greatly appreciated by crystal-structure investigators is the introduction of alternative descriptions, with the origin at a center of symmetry, of space groups such as  $Fd\bar{3}-T_h^4$ , for which the only description given in the earlier *Tables* referred to an origin at a non-centrosymmetric point with higher symmetry. The coordinates of equivalent positions for the space groups are given essentially as in the earlier *Tables*, together with a statement of extinctions for the general positions and the special sets. The expressions for the structure factors in the new *Tables* have been amplified to include explicit expressions for special classes of forms for which a significant simplification occurs.

A useful innovation which facilitates cross reference is the assignment of a serial number to each space group. The Editors mention in the preface that the monoclinic point groups and space groups are described in two ways, with the  $y$ -axis and the  $z$ -axis, respectively, as the unique axis, and that the agreement was reached at the Stockholm General Assembly of the International Union of Crystallography in 1951 that the setting with the  $y$ -axis as the unique axis should be accepted as standard for

morphological and structural crystallographic studies, with the alternative setting used when there was a special reason for its use. It is to be regretted, in view of this decision, that the recommended setting is given in the new volume as the second setting, rather than the first.

I am one of the X-ray crystallographers, perhaps constituting a small set, who made great use of the diagrams for cubic space groups that were given in the original *International Tables*. I feel that the study of these diagrams provides the student or investigator with an understanding of the space groups that it is otherwise difficult to obtain, and I deplore the decision of the Editors and the Editorial Committee to omit from the new volume the diagrams for the cubic space groups. Many workers, especially the older ones, have, of course, the earlier *Tables*, to which they can refer; but in general the younger workers can be expected to have only the new volume at hand, and the absence of the diagrams will interfere with their obtaining the familiarity with and understanding of the cubic space groups that is necessary in an investigation of a cubic crystal structure that goes beyond the application of routine methods.

Aside from this point (which many people may consider to be a minor one), it is hard to find points of criticism of the volume. The eleven Laue symmetry groups are discussed on p. 30; an increase in usefulness of the book could have been achieved by introducing heavy lines on pp. 26 and 27 as boundaries of the rectangles enclosing the stereograms of the point groups in such a way as to enclose those point groups belonging to the same Laue group; this could have been done with no rearrangement of the stereograms.

My co-workers and I have been strikingly unsuccessful in the search for errors. Aside from a couple of obvious typographical errors, we have turned up only one mistake. On p. 505 there is a confusion in reference for space group  $P4_332$  to the enantiomorphous space group  $P4_332$ : the pairs (9) and (13), (12) and (16), (11) and (15), and (10) and (14) need to be interchanged.

I feel a sense of personal indebtedness, which I am sure is felt by all of my fellow X-ray crystallographers, to the Editors of this beautiful and useful volume and to the members of the Editorial Committee of the International Union of Crystallography and the other workers who contributed in one way or another in the preparation of the new *International Tables*. With the Editorial Committee, I am glad to express my sincere gratitude to UNESCO and to the United States National Research Council (National Committee for Crystallography) for the generous financial support which made possible the publication of the work at a price permitting it to be purchased by all workers in the field.

LINUS PAULING

*Gates and Crellin Laboratories of Chemistry  
California Institute of Technology  
Pasadena 4, California, U.S.A.*