Book Reviews

Works intended for notice in this column should be sent direct to the Editor (A.J.C. Wilson, Department of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332, *U.S.A.). As far as practicable books will be reviewed in a country different from that of publication.*

Mathematical crystallography and the theory of groups of movements. By HAROLD HILTON. 262 pp. New York, Dover Publications Inc. 1963. Price $2.00.

The appearance of a book on pure mathematical – that is geometrical – crystallography at a time when most crystallographers study crystals and determine their structures for no other reason than being interested in the architecture of molecules, would be rather uncommon, if the preface were not dated 16 April 1903! The present volume is a Dover republication of the book Harold Hilton published 10 years before the beginning of the Laue era; it was at that time the only mathematical description in English of the theory of space groups and – curiously enough – it still is, though Martin J. Buerger's excellent treatment, modestly entitled *Elementary crystallography*, comes rather close to the subject.

The book is divided into two equal parts, the first half treating the finite groups (point groups or crystal classes), while the second deals with the infinite groups (space groups). The first chapter gives a very short introduction to the stereographic projection with an elegant proof of its fundamental properties. After a description of the external geometrical features of crystals follows a mathematical treatment of symmetry and some fundamentals of group theory. The point groups of the first and second sort are then derived in a strict mathematical way. Before passing to the infinite groups the author gives some instructive chapters on equivalent points, crystal forms, choice of axes, dependence of physical properties on symmetry, and growth phenomena.

Part II, covering essentially the systematic derivation of the 230 space groups, follows mainly the more elaborate treatment given in the classical work of Schoenflies – the reader will not find the now more familiar Hermann–Mauguin symbolism as this was invented 25 years later – so that reflexion axes are used instead of the inversion axes, that give a more logical structural classification of the hexagonal and trigonal groups. Perhaps it would have been a good idea if the publishers, having corrected the text so carefully according to the 'errata' inserted on p. 1 of the original book, had also added a table of these new symbols, which give more information for X-ray workers than the Schoenflies notation does.

The book concludes with a chapter on 'crystal molecules', demonstrating clearly how difficult it has been to make the step from the mathematical 'game' of deriving all possible arrangements of points to the physical reality that the building units in a crystal were in fact allocated according to these mathematical regularities. Hilton writes, referring to Lord Kelvin: '... all we have done is to obtain every structure which is geometrically possible .... It does not follow that every such structure is mechanically possible, that if particles were arranged in the way suggested by the geometrical investigation they would be in stable equilibrium'. Hilton mentions some attempts to assign certain space groups to particular crystal species (Fedorov), saying: 'He bases this allotment on the optical behaviour of the substances, but further evidence is needed'.

Nowadays this evidence is common knowledge, but the study of Hilton's excellent book can be warmly recommended to all crystallographers who are not contented with knowing only the 'how' and 'where', but want to understand also the 'why' of the space groups forming the firm basis of their structure determinations.

It is quite remarkable that after 60 years of constantly rising prices Dover has succeeded in publishing a book – though paperbound – for $2.00, practically equal to the 14 shillings that the original volume cost in 1903, thus bringing a fascinating classical example of mathematical deduction well within the financial reach of students in solid-state physics and structural chemistry.

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