

Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (R. F. Bryan, Department of Chemistry, University of Virginia, McCormick Road, Charlottesville, Virginia 22901, USA). As far as practicable, books will be reviewed in a country different from that of publication.

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Quasicrystals. A primer. (Second edition.) By C. JANOT. Pp. xvi + 409. Oxford: Clarendon Press, 1995. Price £49.50. ISBN 0-19-851778-5.

This book provides easy access to the world of quasicrystals. The origins of that world date back more than twenty years to when Roger Penrose played with non-periodic tilings of the plane. He found that a non-periodic self-similar pattern with local fivefold symmetry can be constructed using two different types of unit tiles. The simple matching rules needed are contained in the shape of the unit tiles – kites and darts or fat and skinny rhombs, for instance – and additional marks on the edges. A dozen years later, ‘Penrose tiling’ became the prototype of very powerful models explaining the structure of the quasicrystals discovered in rapidly quenched Al–Mn alloys.

Twelve years of quasicrystal research has established the existence of a wealth of stable and metastable quasicrystals with five-, eight-, ten- and twelvefold symmetry, with strange structures and interesting properties. New tools had to be developed for the study and description of these extraordinary materials. This made access to this rapidly growing and diverging field more and more difficult for newcomers. Alongside several thousand research papers, there were only a few monographs on the market, and these were on special aspects of ‘quasicrystallography’ and directed to advanced scientists already working in the field. Thus, Christian Janot’s textbook *Quasicrystals. A primer* really filled a gap when it appeared in 1992. He has now published this revised and improved second edition, still the only single-author textbook on quasicrystals available.

Christian Janot is one of the pioneers in quasicrystal research. His broad experience and expertise, especially in neutron diffraction from icosahedral quasicrystals, is reflected in the structure of the book. Its six chapters discuss selected questions concerning the description, preparation, structure, dynamics and properties of quasicrystals. Each chapter closes with problems (but no solutions) that allow readers to check their understanding.

The book starts with the question ‘How to fill space with atoms in condensed matter states’. After a review of basic principles of classical crystallography, a short discussion of the amorphous state is given. One- and two-dimensional quasiperiodic orderings are explained using as examples the 1D Fibonacci chain and the 2D Penrose tiling. The higher-dimensional approach to the description of quasiperiodic structures is introduced and used nicely to explain why quasicrystals show sharp Bragg reflections. ‘Real quasicrystals: preparation and characterization’ (Chapter 2) provides insight into the experimental difficulties connected with the growth of quasicrystals and points out the importance of their correct characterization, with emphasis on electron microscopy and electron diffraction methods. The reader is rewarded with beautiful scanning electron microscopy photographs of well

faceted quasicrystals and impressive high-resolution transmission electron microscopy images of quasicrystal structures with different types of order.

‘High-dimensional crystallography’ (Chapter 3) deals mainly with the 6D description of icosahedral quasicrystals. The way of embedding as well as the different kinds of indexing and some of the properties of reciprocal-space images of quasicrystals are discussed. The techniques of actual structure analysis of quasicrystals are exemplarily presented in ‘Where are the atoms?’ (Chapter 4). The lattice dynamics of quasicrystals as well as the new type of excitations and disorder typical for quasicrystals are reviewed in ‘Phonons, phasons, and dislocations in quasicrystals’ (Chapter 5). Different mechanisms for quasicrystal growth and transformations are introduced in the last chapter ‘A little more about quasicrystals’, and the interesting electronic transport behaviour of quasicrystals is also presented briefly.

Janot has revised and enlarged his primer by some 90 pages in this second edition. Besides including new results in quasicrystal research, he also allocates more space to questions that in the first edition were not given the attention they deserved. However, the strengths and the weaknesses of the book are not altered. It remains a very personal reflection of the fields the author has been involved with in his own research. A comprehensive well balanced and systematic introduction to all fields concerning quasicrystals still needs to be written. Nevertheless, Janot’s primer, which has no pretensions to such status, is an indispensable, very useful and easily readable textbook for all who are interested in the fascinating world of quasicrystals.

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Electron density and bonding in crystals. By V. G. TSIRELSON and R. P. OZEROV. Pp. xiii + 517. Bristol and Philadelphia: Institute of Physics Publishing, 1996. Price £120, US \$240. ISBN 0-7503-0284-4.

The subtitle of this book is *Principles, theory and X-ray diffraction experiments in solid state physics and chemistry*. As is reflected by this subtitle, the book spans a broad range of both theoretical and experimental subjects, and includes reports on a large number of experimental studies. Because