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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Out of the crystal maze. Chapters from the history of solid-state physics. Edited by L. Hoddeson, E. Braun, J. Teichmann and S. Weart. Pp. xxiii + 697. Oxford: Oxford University Press, 1992. Price £50.00. ISBN 0-19-505329-X.

Physicists engaged in the study of quantum mechanics, relativity or nuclear physics were members of well defined scientific disciplines from the moment that these ideas appeared on the scientific horizon. The history of these fields of study has been recorded in numerous books, but a comprehensive historical treatment of solid-state physics is lacking. Unlike the previously mentioned topics, the lack of cohesiveness and the breadth of the subject of the physics of the solid state present a formidable obstacle to such an undertaking. The present volume is an outgrowth of an international effort to rectify this omission, involving English, US, German and French science historians, with assistance from Italian and Japanese colleagues. It is the story of the emergence of a science whose unifying theme is the understanding of real solids, and of its practitioners, many of whom were active in industrial laboratories and were therefore relegated to second-class status in the professional physics societies of those days, dominated as they were by academic physicists. It is difficult to pinpoint the emergence of the field but unquestionably the discovery, in 1912, of X-ray diffraction must be considered a keystone in its development. Interestingly enough, this discovery, which played such a vital part in the understanding of solids, developed an identity of its own, unlike some of the other early separate topics such as the physics of metals and of textiles, semiconductor physics *etc*., all of which eventually merged into the broad field of the physics of the solid state. This history stops at 1960 because the authors felt that at that point in the development of the field a plateau had been reached, so many phenomena having been placed on a firm footing. The phrase 'condensed-matter physics' never makes an appearance.

The volume is divided into nine chapters. Chapter 1 deals with the major scientific and social developments, beginning with the discoveries of the late 19th century. Crystallographers will be especially interested in the description of the Laue experiment, the beginnings of structure determination and applications to powder diffraction. Chapter 2 presents an overview of the development of the quantum-mechanical electron theory of metals during the years 1926–1933. This topic is further developed in Chapter 3 for the period 1933–1960. Chapter 4 delves into the development of defects of all types in ionic crystals, while Chapter 5 deals with investigations of the mechanical properties of solids and their interpretation on the basis of dislocation theory. Chapters 6, 7 and 8 deal with magnetism, semiconductor physics and collective phenomena, respectively. Chapter 9 is entitled *The solid community* and is a fascinating tale of how the solid-state community emerged as a unified discipline from the confluence of a great many separate scientific endeavors devoted to the study of solids. Reading this chapter brings to mind the daily newspaper descriptions of the political compromises and horse-trading that are required in a democracy to achieve a political objective. The establishment of a Division of Solid-State Physics in the American Physical Society (APS) involved many similar efforts to convince the traditionalists in the physics community to support the establishment of divisions in APS and to persuade them that this would not constitute a 'balkanization of physics'. On the contrary, its creation pre-empted the establishment of many societies that would otherwise have come into existence, because APS was not serving their active constituencies. Thus, the Optical Society of America and the American Vacuum Society were early outgrowths of such a perception by the physicists working in these fields. The creation of special interest groups (SIGs) in the American Crystallographic Association serves that same purpose today.

Crystallographers will be especially interested in the emergence of the American Crystallographic Association (ACA) from the merger of the American Society for X-ray and Electron Diffraction (ASXRED), founded by Maurice Huggins, and the Crystallographic Society of America (CSA), formed through the initiative of Martin Buerger. Similar developments occurred in England, with the formation of the X-ray Analysis Group within the Institute of Physics. The giants in the field, Ewald, Bragg and others, foresaw the need for an international organization, which led eventually to the formation of the International Union of Crystallography (IUCr) and its international journal *Acta Crystallographica*. Thus, ironically, the seminal discovery of X-ray diffraction, which laid the foundation for solid-state physics, has led to the development of a separate discipline. The story is well known and many books on this topic have been written (see, for example, *Crystallography in North America*) but Spencer Weart, of the History Center of the American Institute of Physics, brings a new perspective to this story by integrating it into the development of solid-state physics.

The chapters provide a most readable nonmathematical overview of the development of the various fields of solid-state physics, suited to the nonspecialist. It is not a book to pick up and read in one sitting; it is best enjoyed during moments of leisure when a chapter, or parts of several chapters, can be read just for the joy of learning more about one's science than appears in the technical journals. The many photographs definitely add to this enjoyment. Parts of this volume, designated as assigned reading, would add materially to the education of undergraduate and graduate students enrolled in the usual academic courses. Indeed, there are many fascinating nuggets that an instructor could introduce into a course on solid-state physics to give life to the names that students encounter during their years of study. The book contains very extensive notes and references at the end of each chapter. It is a volume well worth having on one's bookshelf.

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Random, non-random and periodic faulting in crystals. By M. T. SEBASTIAN and P. KRISHNA. Pp. xv + 383. Reading: Gordon and Breach Science Publishers, 1994. Price £85.00. ISBN 2-88124-925-6.

This book extends considerably a previous useful effort: *Polymorphism and polytypism in crystals* (A. R. Verma and P. Krishna, 1966). The new title promises a general treatment of faulted crystals, but discussion focuses mainly on layer structures. The book contains five chapters: introduction, stacking faults in close-packed structures, diffuse X-ray scattering from randomly faulted close-packed structures, phase transformations and non-random faulting in close-packed structures, and periodic faulting in crystals: polytypism.

Although the authors face the obstacle of the absence of a single comprehensive theory of faulting, they succeed in achieving a useful result. I found it a real pleasure to peruse this well written book by credentialed experts. Besides their own early and significant studies, the authors cite nearly 1100 references, although, surprisingly, they omit an important early theoretical study by Landau and Lifshitz in 1937.

Chapters 3 and 4, on diffuse X-ray scattering and phase transformations, comprise the new book's heart and about 60% of its length. Except, perhaps, for some dusty unpublished doctoral thesis sitting somewhere, these chapters are the most thorough existing treatment of these topics.

My principal disappointment with the book is its less than thorough treatment of what is arguably the single most important faulting parameter: stacking-fault energy γ. The authors provide little description of how γ changes with composition, pressure or temperature; nor of how γ relates to many solid-state phenomena. They fail to tabulate two closely related properties: surface energy and twin-boundary energy, and they almost ignore the tremendous recent strides in calculating γ from theory, using more powerful computers and better computational models.

However, I like the book and find it correct and useful. I like its basic setup: author and subject indexes, good accessibility, lots of diagrams and figures and sensible organization. Anyone, from undergraduates to advanced researchers, who is fascinated by crystalline faults will enjoy consulting this book and will profit from the authors' expertise. Also, I share the view, expressed by the authors in their concluding remarks, that we should keep an Aristotelian, non-Baconian approach to science. We should pursue the mystery, savor the knowledge and treat applications as byproducts. That ABX_3 perovskites and many of the new perovskite-based high-T_c oxide superconductors show polytypic structures is perhaps application enough!

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Books Received

The following books have 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.

Band theory of solids: an introduction from the point of view of symmetry. By S. L. ALTMANN. Pp. xiv + 286. Oxford: Oxford Science Publications (OUP), 1994. Price £19.50 (paperback). ISBN 0-19-855866-X. This is a reissue, in paperback and with corrections, of the author's original 1990 book of the same title. The original work was designed to 'bridge the gap between the current elementary texts on band theory and the more advanced treatments of the group theory of solid state'. Though intended to appeal to all physical scientists, the book is directed mainly at chemists.