only one orientation ($mm = mm2$). Hermann's *Hexagonales System* contains the *h* lattice symmetry and its 15 proper subgroups; his *Rhomboedrisches System* likewise contains the *r* holohedry with its four proper subgroups, and only crystals with a rhombohedral lattice belong to the rhombohedral system. A step backwards was taken in 1952, when this logical and elegant presentation was dropped from the *IT* (1952) to make room for the ill-conceived 'trigonal system'.

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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.

Rare gas solids. Vol. II. Edited by M. L. KLEIN and J. A. VENABLES. Pp. xiv + 643. London: Academic Press, 1977. Price £26.00, $50.75.

The study of rare gas solids has posed a challenge to experimentalists and theoreticians ever since their existence was firmly established approximately one hundred years ago. The experimental difficulties center around the extreme conditions of low temperature and high pressure (for helium) needed to attain and preserve the solid state in these materials, while the theoretical problems are related to the search for suitable quantitative expressions which can adequately describe the interatomic forces responsible for the formation of crystalline rare gases. Equally perplexing are the questions why only specific crystalline phases are formed by these solids and why solid–solid phase transitions occur [as was discussed in the short review of Volume I of this two-volume book which appeared in *Acta Cryst.* (1977), A**33**, 526]. Volume I is largely confined to the theoreticians' account, while Volume II, in which the pagination follows sequentially that of Volume I, contains the experimentalists' contributions.

This volume consists of ten excellent chapters written by fifteen authors. However, a glaring omission is the absence of a comprehensive chapter devoted to a description of the extensive low-temperature X-ray investigations into the structures of the rare gas solids. These materials have been studied by X-ray diffraction techniques for over 50 years, starting with the study of argon in 1924 and continuing today with measurements taken at 30 mK. Unfortunately, in this book the fragmented description of diffraction studies is scattered throughout several chapters. Three chapters should be of special interest to the readers of this journal: *Crystal Growth* (J. A. Venables and B. L. Smith), *Neutron Scattering* (B. M. Powell and G. Dolling), and *Brillouin Spectroscopy* (B. P. Stoicheff).

The chapter on crystal growth (which also includes a discussion of crystal defects) discusses techniques that have been developed for growing crystals from the vapor and from the liquid (at both low and high pressures). Also included is a description of the influence of crystal imperfections (impurities and structural faults) on experimental measurements.

The first third of the neutron scattering chapter describes the principles and techniques of neutron spectroscopy, while the remainder of the chapter is devoted to a detailed analysis of experimental results and theoretical interpretations of neutron scattering studies of neon, argon, krypton, and xenon.

The chapter on Brillouin spectroscopy is noted for its description of cryostat design and crystal growth.

The tremendous ingenuity displayed in preparing and characterizing suitable single crystals of these materials is only hinted at; but this is sufficient to earn the respect of all experimentalists. For example, in one study, single crystals of

argon were identified as such by comparing computer-drawn Laue diagrams with an experimentally obtained Laue film. A crystal was judged to be single when every observed Laue spot on a given photograph was reproduced on the corresponding calculated pattern, and when this criterion was satisfied for several crystal orientations.

The remaining chapters cover thermodynamic, conductivity, dielectric, optical, and electronic transport properties. In general, the level of discussion is excellent, careful attention was paid to coordinating and cross-referencing the various chapters, and the quality of production is high. Numerous references are made to Volume I and the index in this volume covers both volumes.

Since this book is the work of many authors it was inevitable that a few of them were late in completing their manuscripts. As a result, several of the chapters are already out-of-date in this rapidly changing field. However, let us remember that those chapters which are commendable for being up-to-date (with references past 1974) are most probably the chapters which delayed the publication of the book.

Each chapter has a well-written conclusion and/or summary. After reading these, it is clear that the full story of the theory and properties of rare gas solids is not yet known. When the concluding chapters to this story are published we look forward to seeing an equally outstanding job, which will, hopefully, include a more comprehensive treatment of the role of X-ray diffraction.

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Solid electrolytes (Topics in applied physics, Vol. 21). Edited by S. GELLER. Pp. xi + 244. Springer-Verlag, 1977. Price DM72·00, $33.20.

So quickly has this field blossomed that there is no general agreement yet as to what to call the materials that are its subject matter. Various terms, such as *superionic conductors*, *fast ion conductors* and *solid electrolytes* are being used by various authors. The editor of this book prefers the term *solid electrolytes* and he uses it to mean those solids which exhibit sufficiently high ionic conductivity coupled with low electronic conductivity to enable them to be used in electrochemical cells, batteries and other devices. The recent upsurge of interest in these components derives from the considerable advantages which may accrue from the replacement of liquids by solid electrolytes in these systems, as evidenced by the current world expenditure on solid electrolyte research, amounting to many tens of millions of pounds.

The book strikes an excellent balance between the theoretical (H. Sato), the structural (S. Geller, on halogenide solid electrolytes), the electrochemical (L. Heyne, on electrochemistry of mixed ionic-electronic conductors) and the application aspects (J. E. Oxley and A. F. Sammells on applications of halogenide solid electrolytes). Many of these aspects are combined elsewhere in the book, especially in excellent chapters on the β-aluminas* by J. H. Kennedy and on oxide electrolytes by W. L. Worrell. To take but one example, the β-alumina field has developed dramatically in the past ten years and Kennedy's chapter covers the recent developments up to 1976 in both theoretical studies and applications. This chapter is the one text I would recommend, both to late arrivals in the field and, because of its scope, also to those wishing to teach the subject. This rare combination of virtues extends throughout the book and it will be valued not only by physicists but equally by chemists, ceramacists, materials scientists and electrochemists, both in research and teaching. It will also be of value to those simply wanting to learn something about these intriguing materials and their role in the economic use of energy.

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* 'β-alumina' is essentially $Na_{1+x}Al_{11}O_{17+(x/2)}$.