Books

Solid State Physics: Advances in Research and Applications, Vol. 6. Edited by Frederick Seitz and David Turnbull. 429 pp. Academic Press Inc., New York, 1958. $12.00. *Reviewed by D. J. E. Ingram, University of Southampton.*

THE high standard set by the previous volumes in this series is well maintained in the present case. The subjects dealt with in this sixth volume cover a relatively wide field from the general treatment of the macroscopic properties of solids to the detailed consideration of secondary electron emission.

The first two articles, "Compression of Solids by Strong Shock Waves" by Rice, McQueen, and Walsh and "Changes of State of Simple Solid and Liquid Metals" by Borelius, are quite closely related and deal with the general problem of compression. The first is mainly experimental in character but the general theory required for an understanding of the shock-wave methods is included. Quite a large proportion of the article is devoted to tables or graphs summarizing numerical data, which seems a little out of place in a review of this type. There is, however, a good comparison of the work of different groups in the field and it forms a useful introduction to the possibilities of these techniques.

The second article is of a more theoretical nature and deals with the general energy and entropy relations governing the process of melting and other order-disorder transformations. Such basic theory is essentially limited to simple solids, and cubic metals alone can be treated in detail. The general theme of this work is a division of energy, entropy, and volume into vibrational and structural parts and the calculation of the changes in these quantities with temperature and pressure. The comparison of these calculations with the experimental results obtained on the different cubic metals is then presented in a precise and impressive manner.

The other article concerned with macroscopic properties is by C. S. Smith on general symmetry relations in crystals. This introduces a rather abstract and difficult subject in a very logical and coherent manner and endeavors to work through from basic concepts without assuming any specialized knowledge of the subject. It is essentially of a theoretical nature although some reference to experimental work on elastic constants and the like is included at the end.

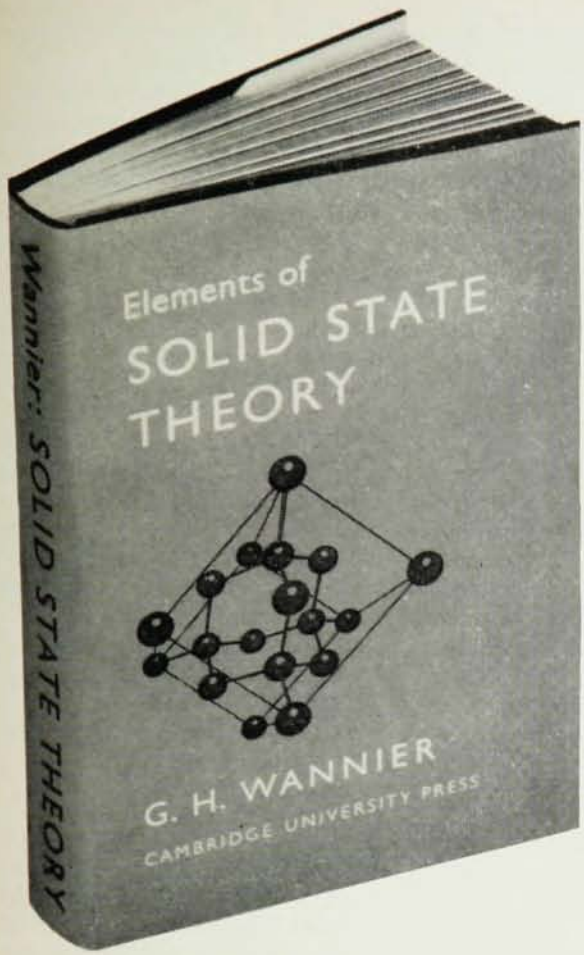
Two articles on electron behavior in solids are included, one on electroluminescence by Piper and Williams and one on secondary electron emission by Dekker. Both of these are well written and easy to read and should form a useful introduction to the large number of publications now appearing on these subjects. The former presents its subject from a more physical point of view and detailed mathematical treatment is avoided, whereas in the latter both the simple and more sophisticated theories of secondary emission are summarized in some detail.

Finally, two articles on optical properties are included. The first, by Parker Givens, introduces the general theory of the optical properties of metals and summarizes the experimental techniques that have been used, whereas the second, by D. C. Dexter, is concerned with imperfections in nonmetals. The general formalism of the subject is presented somewhat abruptly in this case, but its application to different types of defects is explained carefully in the succeeding sections.

The volume can in fact be said to contain seven authoritative articles and should find its place with others of the Series on the shelves of most solid-state specialists.

Solid State Physics: Advances in Research and Applications, Vol. 7. Edited by Frederick Seitz and David Turnbull. 525 pp. Academic Press Inc., New York, 1958. $14.00. *Reviewed by A. A. Maradudin, University of Maryland.*

THREE long articles dominate the present volume. They are, in order, "Lattice Thermal Conductivity" by P. G. Klemens, "Electron Energy Bands in Solids" by Joseph Callaway, and "The Elastic Constants of Crystals" by H. B. Huntington. These articles have one feature in common: each can in a sense be regarded as an appraisal of the theory underlying the experimental aspects of its subject. This, however, is but one of their features. The article which will probably be found to be the most useful from a practical point of view is the one by Huntington. After a summary of the formalism of elasticity theory to which a discussion of topics such as the recent Laval-Raman theory of elasticity, third-order elastic constants, and the effect on elastic properties of other matter tensors, e.g., piezoelectric, pyroelectric, is added, a good review of the various experimental techniques available for the determination of elastic constants is given. A tabulation of the elastic moduli and moduli of compliance is presented for about eighty different crystals arranged according to the various crystal systems. A survey of theoretical treatments of the elastic constants and the equation of state of metals and of the alkali halides completes the article. No less valuable is the review by Callaway in which he confines himself to a discussion of theoretical and experimental results for the band structures of some forty materials which have been well studied. This article is thus complementary to the more theoretical reviews by Reitz, Ham, and Woodruff which appeared in preceding volumes of this series. Klemen's article, on the other hand, is quite similar to his recent article in the Flügge *Handbuch der Physik* and differs



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from it primarily in a somewhat greater emphasis on the theoretical as opposed to the experimental side of the problem of thermal conductivity.

The three remaining articles, "Wave Packets and Transport of Electrons in Metals" by H. W. Lewis, "Study of Surfaces by Using New Tools" by J. A. Becker, and "The Structures of Crystals" by A. F. Wells, can also be regarded as possessing a common feature, that of novelty. In the case of the article by Becker this is exemplified by a presentation of new results regarding the nature of surfaces and of surface processes obtained through the use of two new tools, the fast-responding ion gauge and the field emission microscope. The remaining reviews take problems which have been extensively studied in the past and re-examine them from a new viewpoint. Thus Lewis through an application of degenerate perturbation theory and the mean value theorem offers a new resolution of the problem of reconciling the usual treatments of transport properties in metals which are dominated by impurity scattering with the fact that the assumption regarding the magnitude of the collision time in terms of the absolute temperature is usually not satisfied. Similarly, in a fascinating article Wells discusses the problem of crystal structures from a topological point of view in which it is attempted to determine and explain the structures from the bonding arrangements of the atoms or other structural units rather than by starting from the symmetry of the crystal.

The usefulness, and hence success, of such a series of review articles depends critically on the choice of topics and reviewers. The success of the editors with the preceding volumes is repeated in the present volume. The only criticism that this reviewer can make with respect to the series as a whole concerns the relatively high cost per volume which coupled with the rapid rate at which successive volumes are turned out means that the purchase of these books eats rather deeply into one's yearly book budget.

Corpuscules et Champs en Théorie fonctionnelle. By Jean-Louis Destouches. 163 pp. Gauthier-Villars, Paris, France, 1958. Paperbound 4000 fr. *Reviewed by R. Bruce Lindsay, Brown University.*

UNDOUBTEDLY one of the great methodological problems in modern physical theory is the appropriate relation of the particle and field schemes of description. The author of this book has long been interested in this matter and in 1956 published a book *La Quantification en Théorie fonctionnelle des Corpuscules* in which he developed the view that a physical particle should not be represented by a point as in classical physics or the ordinary wave mechanics but by a function of space and time obeying a nonlinear equation. He applied this theory to the nonrelativistic case of particles without spin. In the present treatise he extends the theory to particles of various spins and treats the relativistic case. He also discusses the photon and obtains a nonlinear theory of electromagnetism. Finally he develops a unitary nonlinear theory of gravitation and electromagnetism.

The idea in essence appears to be that since the point particle represents a purely artificial attempt to abstract a single physical system from the universe as a whole, a much more adequate picture will result if one represents such a particle by a function or perhaps more appropriately even by a set of functions constituting a point in function space. Only in this way, the author feels, can one expect to give a sufficiently detailed representation of the proper characteristics of the particle or system. The function in general is taken to be complex. For mathematical convenience, with the function there is associated a continuous fluid with density, velocity potential, etc. defined in terms of the function. In the simplest case the fluid is assumed to obey the principles of classical mechanics. One then establishes that the fundamental function satisfies a nonlinear equation in space and time coordinates. For more complicated particles the fluid equation is modified accordingly, with appropriate extra terms.

The analysis is complicated and the reviewer is not in a position to judge the success of the program. However, in view of the present unhappy state of theoretical particle physics, any program of this kind should be viewed with hospitable interest.

Internal Conversion Coefficients. By M. E. Rose. 194 pp. (North-Holland, Holland) Interscience Publishers, Inc., New York, 1958. $6.25. *Reviewed by W. H. Kelly, Michigan State University.*

THE process of internal conversion has played and is continuing to play an important role in the study of nuclear structure. As the role of internal conversion in nuclear decay became better understood the physical model on which the calculations are based was modified a number of times. The theory has progressed to such a point that the present internal conversion coefficients have been calculated to an accuracy better than that obtained experimentally. A real disagreement between certain experimental and theoretical coefficients may be due to effects of nuclear structure. For this reason, as Rose points out, the next step in the calculations will have to bring in details of nuclear structure. The present tables include, in a way, a first step in this direction in that the K, L_{I}, and L_{II} coefficients have been calculated to include static effects of a finite size nucleus by using electron wave functions modified to include the finite spread of the nuclear charge distribution. (These effects have been taken into account in a slightly different manner than that done by Sliv although the results obtained are not too different from Sliv's.)

The internal conversion coefficients in these tables contain many of those circulated privately by Rose and many not available before. These tables include coefficients for the K shell and for the L and M shell with their subshells for all atomic numbers from 25 to 95 and for a wide range of energies. In addition to the