analysis and presentation of the basic atomic theory of general aspects of gas radiance, excitation, and depopulating processes, covering both theory and experiment, is exceptionally lucid, up to date, and, in fact, superb. It adds practical value and usefulness to the subject content of both volumes under review.

Chapter 4, "Electrical arcs and thermal plasmas," by W. Finkelnburg and H. Maecker, in German, constitutes the *pièce de résistance* of this volume. It alone makes the purchase of this book imperative for the modern worker in gaseous electronics. In 1950, before publication of volume XXII, I asked Finkelnburg to write a chapter on arcs for a contemplated and still only partially completed book on the electric breakdown of gases. He replied that he felt not enough was known about arcs for him to write such a chapter. After joining the group at the Sieman's Laboratory in Erlangen, Finkelnburg and Maecker, with their able coworkers, cracked the mystifying cipher of the electric arc behavior. As a result of their modern and versatile experimental techniques and modern and sound, but often laborious, theoretical physical analyses, they are able to present, in this chapter, the most advanced and complete description yet given of that group of phenomena classified as arcs—a description which is physically sound and satisfying. Thanks to their activities, these phenomena are now perhaps the best understood of all the breakdown forms. Much work yet remains to be done, but with my past experience, I stand in awe of this achievement. For all those venturing into high temperature plasma work, a careful study of this chapter is imperative.

Chapter 5, "Electrical breakdown of gases with steady or direct current impulse potentials," by Loeb, starts with basic definitions of electric breakdown and spark breakdown in terms of current potential relations. Next, the temporal growth of the Townsend discharge is developed. This leads to the threshold equation and its implications. Then follows a treatment of statistical fluctuations in terms of theory and experiment, which leads to concepts of time lags. Breakdown in nonuniform fields at highly stressed anodes is discussed in terms of photoionization in gases, leading to the Geiger counter pulse and the streamer mechanism. Spark breakdown, through streamers, is related to the Townsend thresholds through time-lag studies of Fisher and Bandel. This is followed by an analysis of steady breakdown to Townsend discharge in coaxial cylindrical and point-to-plane gaps for various gas types, both from highly stressed anodes and cathodes.

Chapter 6, by Sanborn C. Brown, in English, deals with the breakdown in gases in alternating and high-frequency fields. In his characteristic clear and concise style, this leading experimental investigator develops the basic concepts in an admirable fashion. The more esoteric theory based on the Boltzmann transport equation is then developed, and about it as a framework is developed the theory upon which interpretation and computed comparison with experiment is made. The work of the author's school is effectively collected and summarized in terms of solutions for various container forms with superimposed direct-current and magnetic fields. Further discussion covers electron attachment, controlled breakdown, and mobility controlled breakdown and introduces the amplitude oscillation limit concepts. The secondary electron resonance controlled breakdown is also treated. A notable omission is the lack of any discussion of the alternating-current breakdown for the low-frequency cases with external electrodes or internal electrodes, at frequencies much below 10^5 cycles—a field of current interest which merits the critical techniques and analyses of this excellent group of investigators.

Chapter 7, "The lightning discharge," by B. F. J. Schonland, in English, is a remarkably fine summary of this complicated phenomenon by the world's leading expert. It is beautifully written and (unlike his more popular booklet, *Flight of the Thunderbolts*) is a highly valuable, scientific, professional treatise on methods, results, and interpretation (as of 1956), and encompasses all important contributions, including his own.

In summarizing the contents of this volume, I can only say that the appearance of volume XXII has rendered unnecessary the completion of my own half-written volume on electric breakdown of gases and represents an essential addition to the library of all workers in the field.

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Solid State Physics. Advances in research and application. vol. III. Frederick Seitz and David Turnbull, Eds. Academic Press, New York, 1956. 588 pp. Illus. $12.

This latest volume of comprehensive survey articles on various aspects of solid-state physics contains six articles. The first, by Welker and Weiss, is an almost encyclopedic account of present knowledge about III–V compounds. Extensive references are given to methods of preparation and to physical properties. The main body of the article discusses the electric, magnetic, and optical properties of both pure and doped materials.

The second article, by Eshelby, discusses the continuum theory of lattice defects. This theory is applicable to the study of the deformation and energy changes associated with the presence of defects. The formal theory is given in some detail, and applications to point defects and dislocations are discussed.

The third article, by Guttman, is on order-disorder phenomena in metal alloys. After a short but useful introduction to the subject, the author discusses the various types of short- and long-range order and their description. There are sections on thermodynamic and statistical treatments of the problem and on the kinetics of order-disorder transformations. Many references are given.

The primary purpose of David Turnbull's article on phase changes is to discuss the problem of the formation of one phase of a given substance in another phase of the same substance. The article gives ample references to the field and includes a review of the thermodynamics of phase changes, a discussion of phase stability, and the theory for phase-change kinetics. Nucleation and precipitation are discussed in detail.

In the article on imperfections in crystalline solids, Kroger and Vink consider vacant lattice sites, interstitial atoms, misplaced lattice atoms, foreign atoms, and electrons and holes. The main purpose of the article is to discuss the interdependence among the concentrations of the various types of imperfections, but, in so doing, it covers nearly the entire field of imperfection studies. More than 400 references are given.

The final paper, by Kittel and Galt, is on ferromagnetic domain theory. This is an excellent review of domain theory and its application to the understanding of the behavior of ferromagnetic materials. Many useful references are given.

The diverse subject matter of the review articles in this volume is probably unavoidable. With the present increase in specialization, the survey volume is becoming indispensable, and it is pleasing to see that the high standards for clarity of the first two volumes in this series are being maintained.

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The Encyclopedia of Chemistry. George L. Clark, Ed. Reinhold, New York; Chapman & Hall, London, 1957. 1037 pp. Illus. $19.50.

This encyclopedia provides a thorough and timely coverage of at least 1000 chemical and physical terms, selected mainly, though not exclusively, on the basis of their importance to industrial chemistry. In addition, the work con-

tains useful biographic data and descriptions of professional societies and governmental and private research organizations.

The contributors are men of real stature in their fields, and their contributions are interestingly and authoritatively written, without presupposition of much chemical knowledge on the part of the reader.

The work will be most useful to those of limited technical background who are faced with locating an item of chemical information in its proper context or with developing an understanding of the nature and importance of an industrial process.

Advances in Chemical Engineering. Thomas B. Drew and John W. Hoopes, Jr. Academic Press, New York, 1956. 448 pp. Illus. $10.

This book is volume I of a series. In the foreword, the editor states: ". . . the end *Advances in Chemical Engineering* seeks to serve is to provide the engineer with critical running summaries of recent work: some that bring standard topics up to date; others that gather and examine the results of new or newly utilized techniques and methods of seeming promise in the field. Thereby, we hope to help practitioners of the chemical engineering art to keep abreast of the flood of information they are creating." This is a very worthy objective and one that badly needs attention.

This volume covers seven fields: (i) boiling of liquids; (ii) non-Newtonian technology—fluid mechanics, mixing, and heat transfer; (iii) theory of diffusion; (iv) turbulence in thermal and material transport; (v) mechanically aided liquid extraction; (vi) automatic computer in control and planning of manufacturing operations; (vii) ionizing radiation applied to chemical processes and to food and drug processing.

In the main, this volume accomplishes reasonably well those objectives mentioned in the preface. However, as with so many volumes in which the separate chapters are written by different people, the change of pace and method of approach used by the different authors are disconcerting to the reader. In each case, the bibliography of references at the end of individual chapters appears to be quite complete and is of great value to the reader who is engaged in serious research in that particular area.

One very interesting commentary on the times is the notation on the source of support which some of the authors had for their research program. Without the support of such federal agencies as the National Science Foundation, the Office of Naval Research, the Office of Ordnance Research, and the Atomic Energy Commission, much of the information in the book would not be available.

For the reader who wishes to keep abreast of the developments in the seven fields covered in this volume, the value of the individual chapters seems to be inversely proportional to the amount of mathematical treatment in the chapters.

The chapter on "Boiling of liquids" illustrates this point. It is written in a very interesting style, but many of the mathematical manipulations have to be taken on faith, unless the reader is an active worker in the area. However, the author does get over his point and shows how little is actually known about such a simple process as boiling. He emphasizes the need for the development of very careful experimental techniques in order to obtain duplicate meaningful results. This contribution alone makes this chapter worth while.

The inclusion of the chapter on "Non-Newtonian technology" (fluid mechanics, mixing, and heat transfer) is a valuable addition to the literature, since few chemical engineers understand the meaning of this subject, and engineers other than chemical have even less cognizance of the subject. The chapter will be of particular value to those who are concerned with manufacture of objects from plastic raw materials.

The chapter on the "Theory of diffusion" contains a large amount of material, garnered from a variety of sources, which has not appeared previously in such concise form. The chapter constitutes a good source reference and gives clues on how to solve a large variety of problems, but in many instances the information is not complete in itself, and the reader must refer to the original literature. This is to be expected in a condensation of this sort.

The chapter on "Turbulence in thermal and material transport" illustrates the difficulty in basing conclusions on incomplete data. The author states: "At present the background of experimental data is sufficiently sparse that most of the prediction of the influence of turbulence upon transport must be made by analogy." If the chapter will stimulate research to answer some of the unknowns, it will have accomplished its purpose.

The chapter on "Mechanically aided liquid extraction" contains some useful descriptive information on means for accomplishing extraction. The mathematics in the chapter detracts from, rather than improves, the reader's understanding of the process involved. The qualitative descriptions are quite good.

In the chapter on "The automatic computer in the control and planning of manufacturing operations," the author has managed to cover the field of usefulness of computers very well in a short space. Although this is not the first time that this has been attempted, in my opinion this is the best condensation to date.

"Ionizing radiation applied to chemical processes and to food and drug processing" is the subject of the final chapter. The authors do a fine piece of work in exploding certain myths about the use of radiation processes. At the same time, they pinpoint the areas where the use of new techniques is very promising.

I consider this volume a worth-while contribution to the literature of chemical engineering in two respects: (i) it brings the general reader up to date in seven diversified areas (he will lose little if he skips the mathematical presentation); and (ii) the active research worker in these fields will find the summaries useful and the literature references valuable.

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Engineering Structural Failures. The causes and results of failure in modern structures of various types. Rolt Hammond. Philosophical Library, New York, 1957. 224 pp. Illus. $12.

The scant literature on structural failures is considerably enriched by this work. Except for a few technical articles on the cause of failures (the number of which is in sharp contrast to the large number of descriptions of successes in engineering work), there have previously appeared only a short book on *La Pathologie du Beton Arme,* by Henry Lossier (1952), and a translation of the 1854 work of Alexandre Colin on *Landslides,* by W. R. Schriever (1956). In recent years I have had published several lectures on the causes and lessons of structural failures, and in so doing, have been subjected to some criticism for suggesting an open forum where all may learn from mistakes made. It is quite evident that the author is similarly restrained, and that much available information is not included in his book.

Eight general classes of engineering structures and problems are covered: earthworks, dams, maritime structures, buildings, bridges, underground works, vibration problems, and welded structures. A chapter follows on "Lessons of failures." If the author had not deviated from his topic by including several interesting and informative discussions not pertinent to the subject, space would have been available for more examples of the many recorded failures in each of the classes covered, thus making it possible to show the generally consistent patterns which seem to be conducive to "incidents" in engineering structures.

The random samples of earthwork