reactions permits a clearer comparison between the two reactions.

Volume VI is highly recommended to all those who are concerned with petroleum hydrocarbons and catalysis and it is an indispensable book for all those who deal with the field of petrochemistry.

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Fortschritte der Physikalischen Chemie. Band 4. Gleichgewichts- und Wachstums-formen von Kristallen. By DR. B. HONIGMANN, Wissenschaftlicher Oberassistant am Fritz-Haber-Institut der Max-Planck-Gesellschaft Berlin-Dahlem. Dr. Dietrich Steinkopff Verlag, Holzhofallee 35, Darmstadt, Germany. 1958. xii + 161 pp. 15.5 × 23 cm. Price, M D 26.

Research and application of solids depend to a high degree on our knowledge of the fundamental processes of crystal growth and the technical preparation of single crystals of the desired quality and size. Neither of these problems is solved at present. On the other hand, the demand for new and better crystals grows rapidly. The importance and interest in single crystals is clearly demonstrated by the number of important conferences held and books published on this subject in recent years. The present book is another valuable contribution in the field of crystal growth. The scope of the book is limited to the treatment of crystal habits in the equilibrium and growing states. In the first chapter the definitions and concepts of nucleation and habits of crystals are given. In the second chapter is given a short description of crystal growth from the vapor, solution and melt. The third chapter gives the experimental data of crystal habits of covalent and ionic crystals and the influence of additives. In chapter four the experimental methods for determination of crystal habits and in chapter five methods for study of single faces are given. In the last and the longest chapter the theories of crystal habits according to Gibbs, Vollmer, Kossel, Stranski, Kaischew and others are presented. Unfortunately, some of the new results published recently, *e.g.*, by Chalmers, Sears and others, which belong to this field, are missing. This book should be very useful to anyone interested in the study or preparation of crystals.

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Der lichtelektrische Effekt und seine Anwendungen. Edited by DR. H. SIMON, Professor an der Humboldt-Universität und stellv. Direktor des Instituts für Festkörperforschung der Deutschen Akademie der Wissenschaften zu Berlin, and Dr. R. SUHRMANN, o. Professor und Direktor des Instituts für physikalische Chemie und Elektrochemie der Technischen Hochschule Hannover. Springer-Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf, Germany. 1958. xii + 747 pp. 16.5 × 23.5 cm. Price, DM 97.50.

The senior authors of this book, Professors H. Simon of Berlin and R. Suhrmann of Hannover, have attempted in one volume a complete presentation of all available information concerning the photoelectric effect and its various applications to basic research and to technology. In order to cope with the complexity of such a task, five specialists have contributed the 12 chapters of the Book.

In a brief "Introduction," Chapter I (6 pages), R. Suhrmann describes the various photoelectric effects based on phenomenology rather than on modern theory of solid state physics. His use of the term photo-electromotive force, for example, in this connection is confusing and basically meaningless (43 basic references).

From the point of view of the researcher, the next two chapters constitute the important part of the book.

In Chapter II (133 pages), on "The Laws of the External Photoelectric Effect," R. Surhmann tries to organize an enormous amount of data into a reasonably self-consistent and readable presentation of the material, a herculean and perhaps somewhat thankless task in the absence of a sufficiently detailed general theory. The work of R. H. Fowler and L. A. DuBridge, which describes the photoelectric effect in pure metals near threshold, is admirably presented in its complete form, including all necessary tables.

Temperature dependence of photoemission, energy distributions of ejected electrons, correlations between optical properties of photocathodes (reflected and absorbed light intensities, polarization, etc.) and photoelectric yields—all these phenomena are treated in such a manner as to be of great aid to the beginning researcher in this field. Unavoidable discrepancies in published photo-yield measurements on the same, presumably pure, photo-cathode materials are valiantly dealt with, perhaps in excessive detail. For the beginning student it will be difficult not to be confused by the mass of experimental data concerned with crystal structure, with adsorbed foreign atoms, molecules and ions, with monomolecular and thick layers, etc., and with all their combined subtle and, in many instances, little-understood influences on the measured yields. The interpretation of an equally large number of data for composite photocathodes is closely related to the above problems with the same attendant difficulties.

Perhaps a greater selectivity of the literature discussed here might have improved the readability of this chapter. In spite of this, Professor Suhrmann did succeed in acquainting the reader with the published work on the subject matter and with its manifold problems (249 references).

"Internal Photoeffects" are treated by K. W. Böer in Chapter III (82 pages). Actually, the title is slightly misleading in as much as the work is primarily concerned with a very lucid and easy to read introduction to the concepts of solid state physics, including energy band models, crystal defects, significance of donor and acceptor mechanisms, electron excitation and recombination, and others. These phenomena are discussed systematically in terms of the important experimental parameters and supported with carefully selected data. The internal photoeffects are briefly discussed within this framework (277 references).

In Chapter IV (71 pages), H. Simon discusses the "Construction of Photocells for the External Photoeffect." Various laboratory techniques are described, in some instances perhaps unnecessarily detailed for students in U. S. universities who to-day are very rarely concerned with individual preparation of vacuum greases. Data on principally German-manufactured glasses are presented, followed by descriptions on how to produce pure metals and pure gases in the laboratory. The manufacture of some important complex photocathodes is explained in useful detail (104 references).

Chapter V (34 pages), also by H. Simon, deals in a similar manner with the "Construction of Photo-Resistive Cells (semiconductors)," with stress on selenium, thallium sulfide, lead sulfide and potassium sulfide. Additional information on spectral sensitivity, particularly in at least approximate absolute units, would have been useful (101 references).

"Secondary Electron Amplification" is discussed by F. Eckart in Chapter VI (51 pages). The yield factor as a function of primary electron energy is presented for a variety of surfaces in the form of curves and summarized in a well-referenced table. This is followed by details on construction and properties of some special compounds and alloys of high yield, such as silver–magnesium and copper–beryllium. Different mechanical forms of multipliers, with and without focusing properties, are described together with spectral sensitivity, amplification factor, dark current, noise, and other properties. A final table lists more commercially available photomultiplier tubes than this reviewer ever knew existed. All their important characteristics are included (223 references, with titles!).

In Chapter VII (132 pages), W. Leo and R. Suhrmann are describing "Methods and Apparatus for Photoelectric Measurements." A good deal of space is devoted primarily to classical electrical and electronic measuring techniques, containing some useful hints. In contrast, the remainder of the chapter goes into worthwhile detail with respect to the procedures necessary for the determination of both relative and absolute spectral sensitivity curves (115 references).

The "Applications of the Photocell to Photometry" are discussed by W. Leo and R. Suhrmann in Chapter VIII (88 pages, 91 references).

"Applications of the Photocell in Electron-Optical Image Tubes and in X-Ray Image Amplifiers" are briefly treated by F. Eckart in Chapter IX (35 pages). The basic aspects

of their electron optics, employing electrostatic and/or magnetic lenses, together with various technical forms of image converters and amplifiers are schematically presented, and some special applications are discussed (115 references, with titles!).

A similarly schematic treatment acquaints the reader with the uses of "Photocells in Television Technique" in Chapter X (51 pages, 75 references with titles!) and with "Special Applications of Secondary Electron Multipliers" in Chapter XI (19 pages, 158 references with titles!), both chapters written by F. Eckart.

The final chapter, XII (28 pages), by W. Leo and H. Simon, again on "Special Applications of the Photocell," concerns itself with technological applications in sound film, in control devices, and in monitoring of X-ray dosimetry (48 references).

In summary, this reviewer feels that the authors' attempt to be all-inclusive detracts from the main purpose. This age of specialization has provided excellent monographs on vacuum techniques, electrical and electronic measuring devices, electron optics, quantitative spectroscopy, and other subjects which either could have been omitted here or treated more selectively. The publisher's effort toward this volume reflects the usual excellent tradition of the Springer-Verlag.

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Progress in Metal Physics. Volume 7. Editors, BRUCE CHALMERS, D.Sc., Ph.D., Division of Engineering and Applied Physics, Harvard University, Cambridge, Massachusetts, and R. KING, Ph.D., Assistant Director, Davy Faraday Research Laboratory, The Royal Institution, London, W. 1. Pergamon Press, Inc., 122 East 55th Street, New York 22, N. Y. 1958. viii + 408 pp. 16 × 25.5 cm. Price, $16.00.

This book is another volume in a well established series and, consistent with the trend, larger than its predecessors. There are four chapters on subjects not covered in previous volumes and one chapter extending a previous presentation of the properties of metals at low temperatures.

This latter discussion written by H. M. Rosenberg emphasizes the studies of thermal conductivity of metals below 90°K. Of particular interest is the material on the thermal conductivity of superconductors. The reader will find here a clear discussion of the "thermal switch."

Two presentations in this volume may be considered to be outstanding from the point of view of their clarity. One is an article by J. N. Hobstetter on "Equilibrium, Diffusion and Imperfections in Semiconductors." The other is a very thorough discussion of Martensitic transformations by L. Kaufman and M. Cohen.

The chemist will be interested in Hobstetter's summary of the mass action treatment of the solubilities of impurities in semiconductors. This is the only source known to the reviewer where this theory is summarized and a complete set of references given. The discussions of diffusion and dislocations in semiconductors are short and not as clearly presented as the one on equilibrium properties.

Both the thermodynamics and kinetics of Martensitic transformations are thoroughly discussed by Kaufman and Cohen. The reader will find a wealth of data in the form of free energy diagrams for a number of iron alloys together with empirical equations giving the changes in free energy for the various phase transformations as functions of the temperature. The article also gives a clear presentation of both the classical nucleation theory and the Knapp–Dehlinger treatment of the formation of Martensite. Some of the data and ideas presented in this article are original and have not appeared in print before.

The two remaining chapters deal with the metallurgy of titanium alloys and the concept of stored energy of cold work.

The discussion of the process of cold working by A. L. Titchner and M. B. Bever is very pertinent in view of the amount of current interest in this subject. The authors have compiled a truly fine bibliography and summarized nearly all the known experimental data in an extensive table. This summary will be very valuable to anyone interested in the subject.

In his presentation of the current status of the physical metallurgy of titanium alloys, R. I. Jaffee has compiled an extensive set of phase diagrams for titanium systems. The article is a rich source for the equilibrium data of such systems. It also gives a good summary of the plastic deformation properties of titanium alloys.

For the specialist in the field this volume contains an excellent summary of experimental data and an extensive bibliography on each subject.

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Cahiers de Synthèse Organique. Méthodes et Tableaux D'Application. Volume V. Degradations. By JEAN MATHIEU and ANDRÉ ALLAIS. Published under the direction of Leon Velluz. Masson et Cie., 120, Boulevard Saint-Germain, Paris, VI, France. 1959. 394 pp. 16 × 22.5 cm. Price, broché, 7.800 Fr.; relié, 8.500 Fr.

This fifth volume of a proposed set of ten volumes on organic synthesis is concerned with degradative methods and is divided into two chapters. Chapter twelve deals with one carbon degradations involving terminal functional groups. Chapter thirteen deals with cleavage of carbon chains and opening of rings. The presentation in each chapter is organized in the same way as in Volume IV.[1]

An excellent summary of degradative methods in organic chemistry is present in this volume. A table at the back of the book lists the various functional groups and combinations of functional groups that are discussed in the book. The system of indexing and cross-indexing is complete but simple so that it is easy to find specific information about various types of compounds and reactions. References appear to be adequate through 1957 with an occasional date in 1958. Some references refer to earlier volumes in the series, but the lack of their availability should not impair the usefulness of this book as a unit by itself.

This volume is recommended for all organic chemists. The style, content and organization are such that it will be of considerable value to those learning, practicing or reviewing chemical French. Although other volumes in the series were not available for examination by the reviewer, it appears from the present volume that this set should be a valuable complement to those "standard" sets ("Organic Reactions, Organic Syntheses") now in use.

(1) R. L. Shriner, THIS JOURNAL, **80**, 6468 (1958).

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Nuclear Magnetic Resonance. Applications to Organic Chemistry. By JOHN D. ROBERTS, Professor of Organic Chemistry, California Institute of Technology. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 1959. viii + 118 pp. 16 × 23.5 cm. Price, $6.00.

In the opening sentence of his short exposition, Professor Roberts states "The development of nuclear magnetic resonance spectroscopy subsequent to the initial discoveries by Purcell and Bloch in 1946 is now recognized as one of the most important events in the last fifty years for the advancement of organic chemistry." Many organic chemists in this country have recognized the truth of this statement, and anyone who can pretend to any degree of knowledge in this field is asked again and again "Where can I find an intelligible introductory article explaining the principles of NMR and describing its applications to problems in organic chemistry?" Until now no satisfactory single answer could be given. "Nuclear Magnetic Resonance" was written to fulfill this urgent need.

The author begins by discussing briefly nuclear spin, and its relation to other nuclear properties, the behavior of magnetic nuclei immersed in magnetic fields, the origin of the resonance phenomenon, and the nature and effects of relaxation processes. By liberal use of physical models and analogy, the phenomena observed are presented in a clear and understandable way with a minimum of mathematical analysis. (The most important relations concerning the resonance phenomena are derived from the Bloch equations in Appendix A.) Both in the introductory chapter and in