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## REVIEWS

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*Reports on Progress in Physics* (Vol. 24: (Published by the Institute of Physics and the Physical Society, 47, Belgrave Square, London S.W. 1), 1961. Pp. 424.

The volume under review of the *Reports on Progress in Physics* for the year 1961 contains the following eight articles: (1) The theory of the superconductive state by H. Frolich, (2) High current gas discharges by A. A. Ware, (3) Cosmic radio-waves and their interpretation by J. L. Pawsey and E. R. Hill, (4) Magnetic domains by D. J. Craik and R. S. Tebble, (5) Photoelectric image intensifiers by J. B. McGee, (6) Ferrimagnetism by W. P. Wolf, (7) Theory and applications of the density matrix by D. Ter Haar and (8) The dynamics of high temperature plasmas by W. B. Thompson. In this review we shall only indicate the main contents of each article. Each article is authoritative and takes the reader to the latest developments in the particular field.

Amongst the theories of properties of solids the theory of superconductivity has played a unique role. Discovered in 1911 by Kamerlingh-Onnes this phenomenon did not find any satisfactory and consistent theoretical explanation for a long time, and even now it cannot be said to be a completely understood phenomenon. The first break-through in the explanation occurred in 1950, when Frolich, based on the field theory of solid state physics, brought in the electron-phonon interaction into the treatment of superconductivity. According to this the ions of the lattice—or more strictly the lattice vibrations in their quantized normal modes (phonons)—play an important role in determining the energy levels of the electrons in the solid. Thus superconductivity, like many other processes in solid state physics, should find its natural explanation based on the interaction which exists between the electron system and the lattice vibrational field. This interaction is naturally temperature-dependent. Now we know that the electron-phonon interaction which at higher temperatures is responsible for ordinary conductivity can, at very low temperatures, lead to an extremely small energy change connected with the setting-up of an energy gap and with a violent change in most electronic properties.

High current discharges are taken to be those discharges where self-magnetic fields play an

important role in their behaviour. Such discharges have been studied in connection with the quest for controlled thermonuclear reactions. In this article the author, following a historical introduction, presents a set of plasma equations and explains the physical concepts associated with the theory. The author also discusses pinch discharges and magnetohydrodynamic stability in plasma theory.

The discovery of radio-waves from cosmic sources has opened an exciting chapter in astronomy. In the third article the authors present the main contributions of radioastronomy to our understanding of our own galaxy and other external galaxies, and show how the discovery of radio galaxies has provided a fresh approach to cosmology.

The article on Magnetic Domains reviews the recent methods of investigation of ferromagnetic domains and discusses the main results obtained in relation to domain structure, domain nucleation and magnetization processes. Examples of the application of methods using Bitter patterns, electron microscopy and magneto-optic effects are given for a wide variety of materials ranging from metallic single crystals to polycrystalline ferrites.

McGee confines his article on photoelectric image intensifiers to intensification methods using free electrons. Thus he deals with single- and multi-stage image intensifiers, and positive feedback image intensifying systems. Outlines of the use of image tubes in astronomy, nuclear physics, spectroscopy and radiology are indicated.

The sixth article is an excellent review article on the physical properties of ferrimagnetic materials and their applications in science and industry. Ferrimagnetics being mostly non-conductors of electricity, unlike the ferromagnetic substances, enable experiments to be carried out over the entire range of the electromagnetic spectrum without interference from eddy currents. Thus bulk samples can be used for investigation even at high frequencies, and this has important technical applications.

Density matrix is a mathematical technique whose importance and application in various branches of physics are growing. It was first used by von Neumann to describe statistical concepts in quantum mechanics. The author gives in this article the general properties of



the density matrix including a discussion of Green function techniques which find application in a number of many-body problems.

Research in plasma dynamics has attained increased stimulus in recent years because of the technological promises it offers. Of course the most spectacular is the hope of the controlled release of energy from thermonuclear reactions. Professor Thompson in this last article of the volume deals with the idealised plasma and describes the theoretical models that have been studied in an attempt to understand plasma dynamics. Because of the author's special interest in thermonuclear research, the bias throughout the article is towards the study of plasma stability.

A. S. G.

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**The Metallurgy of Welding.** By D. Seferian, Translated by E. Bishop. (Chapman and Hall, London), 1962. Pp. 375. Price 70 sh. net.

The book under review, which can be considered as a very significant and comprehensive progress report on our present knowledge on the subject of welding metallurgy, is a translation of an original French publication. The author brings in between two covers exhaustive information on the relationships between structure, phase transformations and thermal welding cycles, gas absorption weld decay and cracking and the determination of preheating temperatures by mathematical methods. Though the text in this book naturally reveals an accent on French research, important and pioneering work in the field from other parts of the world also finds a place.

This monograph has been conveniently divided into 2 parts, the first containing seven chapters and the second five chapters.

In Part I, the author initially surveys the various welding processes, under the first chapter and proceeds to describe the metallography of the structural constituents of steel and the iron-carbon equilibrium under the second. Under Chapter 3, the mechanism underlying the formation of various microstructures in welds is explained using the isothermal and continuous-cooling transformation diagrams. The formation of Widmanstätten and columnar and other particular structures are also described. In Chapter 4, is developed the basic concepts of the metal-slag equilibria which have special significance in the understanding of the metallurgical role of the electrode in arc-welding and in the consequent design, development and use of electrodes.

Under the caption the absorption of gas by welds, in Chapter 5 the significance and behaviour of gases like Oxygen, Nitrogen and Hydrogen as shown from the most recent researches are described as the present understanding of the harmful role of gases in general and specially the mechanism of hydrogen embrittlement and cracking is rather vague and inconclusive. Then follows a chapter on the disturbing and major problem of cracking succeeded immediately by some significant details on the ameliorating treatment known commonly as 'preheating', especially their causes and determination variables, viz., the popular B.W.R.A. method and the novel Seferian method.

Part II of the book opens with Chapter 8 on the various practical metallurgical and technical weldability tests for the elucidation of the susceptibility of steels to brittle fracture, and some significant details on the concept and utility of the 'brittle transition temperature'. Chapters 9 and 10 deal with the study of the weldability of carbon steels and austenitic chrome nickel steels as a function of their chemical composition and the thickness of the components. Equipments operating above 600° C. and high pressures encountered in power stations necessitate the study of the problem of welding under a totally new dimension and the role and significance and utility of special alloy steels of Nickel Chromium and Molybdenum and lately of newer ones like Boron are discussed at length under Chapter 11, and the heat-resisting low alloy chromium-molybdenum and of special significance to the petroleum and pressure vessels industries and the use of chrom-molybdenum steels in the aircraft industry are dealt with in the last chapter.

This book though aimed primarily towards the serious researcher and user, the welding engineer, it is of no mean significance to the producer, the steel-maker. The volume is exhaustively illustrated by over 320 figures which includes some excellent reproductions of 130 photomicrographs.

A. A. KRISHNAN.

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**Mathematics in Science and Engineering.** (Vol. 4)—*Stability by Liapunov's Direct Method with Applications.* By J. L. Salle and S. Lefschetz. (Academic Press, New York; India: Asia Publishing House, Bombay-1), 1961. Pp. vii + 124. Price \$ 5.50.

Whilst linearity is a specific property defined by the theorem of superposition, non-linearity can only be described as a "non-specification",



As such, the generalisation of solutions of non-linear differential equations becomes exceedingly difficult. The two techniques most commonly used in the study of non-linearities—the first-harmonic approximation and the topological or phase-plane plot rely on linearisation or step-by-step geometrical studies.

The only known analytical technique, that could be said to be universal in application, is due to Liapunov. First published in 1892, it has been applied extensively in Russia, but the first Western translations appeared only in 1907 in French and in 1959 in German. The book under review is claimed to be the first comprehensive account of the technique published in English. The basic philosophy of the method lies in choosing a function to satisfy certain simple conditions; conclusions about the stability of the system are derived by examining the derivative of this function. The concept is simple and the result general. It makes it possible to specify a domain in which stability can be guaranteed under all disturbances or to define what disturbances would cause instability. However, one does not easily appreciate how these functions could be defined for a given system and the many examples quoted only tend to confirm the fear that the choice of a Liapunov function is a matter of intuition and skill on the part of the designer. The method does not seem to be very useful for system synthesis and, like all analytical solutions, becomes difficult for all but the simplest problems.

The opening chapters form a sketchy, though useful, review of the mathematical background of vectors, matrices, topology and differential equations, that is essential for the study. The Liapunov function is then introduced, rather abruptly and with barely sufficient explanation. The usefulness of the method, however, becomes readily apparent, when it is used to examine a number of classical non-linear equations the solutions of which are now well established. The Lur'ye transform which enables one to determine the Liapunov function for a certain class of non-linearities is discussed. The authors list together most of the applications of the method used for the study of control systems for the description of Lefschetz stability, boundedness and forced oscillations. They also appreciate the weakness of the solution, in that it is unable to define the degree of stability and have indicated the possibility of using the method to determine, what they term, "practical stability" as opposed to "mathematical stability".

The monograph is fourth in a series dealing with Mathematics in Science and Engineering. It will, undoubtedly, provoke new thinking on the possibilities of the Liapunov criterion. The authors would have been assured of success and would have, indeed, done greater service had they included in their all-too-scanty bibliography, references to the papers by Lur'ye, Malkin, Antosiewicz, Ajzerman, Pestel, Okamura, Yoshizawa and many others whose contribution to the subject have been referred to in the text.

PREM J. BHATT.

#### Reference Electrodes, Theory and Practice.

Edited by David J. G. Ives and George J. Janz.  
(Academic Press, Inc., London), 1961.  
Pp. xi + 651. Price \$ 20.00.

Research workers in the field of electrochemistry are often handicapped for want of an exhaustive and critical account about the reference electrode systems. There are excellent texts dealing with the theoretical aspects of electrochemistry, but, these lack in the experimental applications. As a contrast, some texts dealing with experimental portions, limit themselves, to the barest minimum with respect to theory. The book under review is a happy combination of both the theoretical and also experimental aspects of reference electrodes. In their introductory chapter the two editors have done full justice to theoretical aspects of the subject including the thermodynamic aspects of electrode potentials, liquid junction potentials, reversible and irreversible electrodes and some common experimental problems met with, in the measurement of the electrode potentials. The following reference electrodes are dealt with in the next eight chapters: (1) The hydrogen electrode (G. J. Hills and Ives), (2) The calomel and the other mercury-mercurous salt electrodes (Hills and Ives), (3) The silver-silver halide electrodes (Janz), (4) The glass electrode (R. G. Bates), (5) The quinhydrone electrode (Janz and Ives), (6) The oxide, oxygen and sulphide electrodes (Ives), (7) Electrode reversible to sulphate ions (Ives and F. R. Smith) and (8) Membrane electrodes (Hills). In all these chapters a critical evaluation of the electrode potentials, including the theory and applications, has been presented. The next chapter (Hills) deals with the reversible reference electrodes in individual non-aqueous organic solvent systems, like hydrocarbons, acetone, diethyl ether, etc. Electrode systems involving liquid ammonia, sulphur dioxide and hydrogen fluoride are also



outlined in this chapter. Chapter XI contributed by D. B. Carter and I. A. Silver makes a fascinating and instructive reading both to the physical chemist and also to the biologist. In this chapter the physical chemist would admire the technical developments in the measurement of electrode potentials with serious limitations of quantities, space and other specific biological effects. The last chapter (R. W. Laity) on electrodes in fused salt systems is equally interesting.

The book will be a very valuable guide both to the graduate student and also to the research worker in the field of electrochemistry.

M. R. A.

#### Flourescence Assay in Biology and Medicine.

By Sidney Udenfriend. (Academic Press, New York, London), 1962. Pp. x + 505. Price \$ 14.00.

The book under review deals with the subject of application of flourescence assay in biology and medicine. The progress that has taken place in instrumentation for flourescence assay during the last ten years has been so rapid that the available texts, some published as late as 1953, have become out of date. This volume consists of fourteen chapters. The first four chapters deal with the principles of flourimetry and instrumentation. The remaining chapters are devoted to the application of flourescence assay to several groups of compounds of biological interest such as amino-acids, proteins, vitamins, coenzymes and enzymes, steroids, drugs, etc. This volume will prove highly valuable as a manual of reference to research workers in biochemistry and in various fields of biology and medicine.

M. SWAMINATHAN.

**Viruses.** By K. M. Smith. (Cambridge University Press, 200 Euston Road, London N.W.1), 1962. Pp. 134. Price 21 sh. (Paper 12/6 net).

Viruses are of interest not only to the botanist, the entomologist, the doctor and the veterenarian but also to research scientists in molecular biology and biochemistry. Although records of virus diseases, e.g., smallpox and yellow fever take us back to antiquity, yet the first virus, the tobacco mosaic virus, was described only in 1892, and the first animal virus, foot and mouth disease of cattle, not till 1898.

In spite of serious scientific study during the past three decades, virus still remains the "mysterious particle", defying a positive definition. The best negative definition to the present

day seems to be the following suggested by Lwoff: "Viruses are infectious, potentially pathogenic nucleoprotein entities, with only one type of nucleic acid, which reproduce from their genetic material, are unable to grow and divide, and are devoid of enzymes". As yet we have no definite knowledge of the exact manner in which the virus particle enters a cell and undergoes replication. But, thanks to the discovery of the electron microscope, the once vague picture of the relationship of virus with living cells, particularly with the nucleic acids, is becoming more and more clear.

In this book Dr. Kenneth M. Smith, formerly Director, A.R.C. Virus Research Unit, Cambridge, presents, in a manner that can be understood even by laymen interested in viruses, and at the same time without sacrificing scientific precision, a neat survey of our present state of knowledge, both in theory and in the technique of study, of viruses, of the control of virus disease, and of the uses of viruses as agents in the control of destructive insects. The sixteen pages of plates showing electron micrographs of viruses, some in their biological environment, add value to the book.

The special Paper cover edition of the book priced at a lower level should enable all interested in viruses and virology to own a copy.

A. S. G.

**The Chemistry of Lignin—Supplement Volume, covering the literature for the years 1949-1958.** By F. E. Brauns and D. A. Brauns. (Academic Press, New York; India: Asia Publishing House, Bombay-1), 1960. Pp. x + 804. Price \$ 18.00.

This is a supplement to the earlier volume by F. E. Brauns on the "Chemistry of Lignins". The additional feature of the present volume is the extensive coverage of the Japanese and Russian literature on lignins.

This book comprises of 26 chapters dealing with various aspects of lignin chemistry including its physical properties, thermal and biological decomposition, theories on lignin structure, its linkage in the plant and biosynthesis. There is also a chapter on synthetic lignins. There is a useful appendix of commercial lignins and utilization of lignin. The book is profusely illustrated with graphs, tables, and formulas. It is unlikely that many individual chemists might like to own a copy of this book but it certainly should have a place in any technical library and in the specialists' book-shelf.

S. K. BALASUBRAMANIAN.



*Modern Documentation and Information Practices.* Edited by O. Frank. (Published with the assistance of UNESCO by the International Federation for Documentation, 7, Hofweg, The Hague), 1961. Pp. x + 225.

This is a composite manual of 14 chapters contributed by five persons—all drawn from Europe only. It is somewhat disappointing to note that in a list of "Recommended books and articles" numbering no less than 210 entries, there are only two articles by two Asian authors and that too because they appeared in European organs. This is a measure of the insularity still prevailing among the documentalists of Europe, in spite of Dr. King, the former President of the FID, having been insisting for years that the FID is not a purely European concern.

Turning to the merits of the book, it is encyclopedic in coverage. There are three chapters on organisation of documentation centres in public and private sectors including their co-ordination and co-operation. Two chapters are turned on the internal organisation and administrative routine of a documentation centre. There are three chapters on the technique of classification, cataloguing, and abstracting, making up documentation work.

One chapter is devoted to the problem of the translation of documents. Three chapters are on the technician's work involved in mechanical retrieval of information and the photo and the chemical methods of production of copies of documents. There is one chapter on the training of documentalists, filled with many copy-book maxims.

It is an irony that this compendious book by the FID should have been produced without an index—the traditional aid to the retrieval of the information scattered within the book and some in unexpected places.

The physical production of the book has been done in a good and pleasing style.

S. R. RANGANATHAN.

#### Books Received

*Practical Plane and Solid Geometry.* By A. Shariff. (Asia Publishing House, Bombay-1), 1962. Pp. xi + 334. Price Rs. 12.00.

*Elements of Tropical Soil Science.* By T. Eden. (Macmillan & Co., London), 1962. Pp. vii + 136. Price 2 sh. 6 d.

*Pure and Applied Physics (Vol. 13) Atomic and Molecular Processes.* Edited by D. R. Bates. (Academic Press, New York 3), 1962. Pp. xv + 904. Price \$19.00.

*Principles of Stratigraphy.* By A. W. Grabau. (Dover Publications, New York 14), 1961. Vol. I: Pp. xxxiv + 581. Price \$2.50; Vol. II: Pp. 583-1185. Price \$2.50.

*Treatise on Sedimentation.* By W. H. Twenhofel. (Dover Publications, New York 14), 1961. Vol. I: Pp. xix + 460. Price \$2.35; Vol. II: Pp. xii + 461-926. Price \$2.35.

*Logic, Methodology and Philosophy of Science.* Edited by E. Nagel, P. Suppes and A. Tarski. (Stanford University Press, Stanford, California), 1962. Pp. ix + 649. Price \$12.50.

*Absorption Spectra and Chemical Bonding in Complexes.* By C. K. Jorgensen. (Addison-Wesley Pub., Reading, Mass., U.S.A.), 1962. Pp. xii + 352. Price \$10.00.

*Elements of Chemical Thermodynamics.* By L. K. Nash. (Addison-Wesley Pub., Reading, Mass., U.S.A.), 1962. Pp. vii + 118. Price \$1.75.

*Annual Review of Biochemistry (Vol. 31).* (Annual Reviews, Inc., Palo Alto, California, U.S.A.), 1962. Pp. vii + 731. Price \$7.00.

*Botanical Monograph No. 2—Marsilea.* By K. M. Gupta. (Council of Scientific and Industrial Research, New Delhi), 1962. Pp. vi + 113. Price Rs. 16.00.

*Barley and Malt—Biology, Biochemistry and Technology.* By A. H. Cook. (Academic Press, New York), 1962. Pp. ix + 740. Price £7/10 sh.

*Micrographia.* By R. Hooke. (Dover Publications, New York 14), 1961. Pp. x + 272. Price \$2.00.

*Introduction to Electron Microscopy.* By S. Wischnitzer. (Pergamon Press, Oxford), 1962. Pp. xi + 132. Price 42 sh.

*Advances in Inorganic Chemistry and Radiochemistry (Vol. 4).* By H. J. Emeleus and A. G. Sharpe. (Academic Press, New York 3), 1962. Pp. viii + 344. Price \$11.00.

*British Medical Bulletin—Electron Microscopy*—Vol. 18, No. 3, September 1962. (Medical Department, The British Council, 65 Davies Street, London W. 1), Pp. 179-254. Price 35 sh.

*Theoretical Electro-Magnetism.* By R. H. Atkin. (William Heinemann, 15-16 Queen Street, London W. 1), 1962. Pp. vii + 260. Price 30 sh.