

## Reviews

THE RAMAN EFFECT AND ITS CHEMICAL APPLICATIONS. By J. H. HIBBEN, with a Theoretical Discussion by J. H. HIBBEN and E. TELLER. Pp. 544. American Chemical Society Monograph; published by Reinhold Publishing Corporation. 1939. Price 66s. net.

Since the announcement by Sir C. V. Raman in 1928 of the peculiar scattering of light rays by molecules, nearly two thousand communications on the subject of Raman spectra have been published by chemists and physicists. The universal interest aroused springs from the fact that the theoretical discussions have led to far-reaching conclusions on the structure of molecules and on molecular symmetry. The chemical application of the study may be considered quite apart from the physical processes which give rise to Raman lines. It is one of the objects of this monograph to present the facts, and deductions from them, in so far as they interest chemists. It is beyond question that the Raman effect can be correlated with certain kinds of chemical binding between atoms. Two examples, taken at random, may be given. In ethylenic compounds the  $C = C$  link is associated with a frequency shift of 1600 to 1680 wave-numbers; the presence of a halogen derivative can be detected in a hydrocarbon mixture by means of the Raman shifts.

Chapters 3 to 6 deal with the theory of the Raman effect. While these are necessarily based on modern mathematical treatment, the method of presentation gives a clear picture of the processes involved, and with a little persistence it can be grasped readily. The rules which govern the appearance of Raman lines, their polarisation and the relation of these to the symmetry of the molecule are clearly set out.

For those who do not desire to study the theory but are interested in the application to inorganic and organic chemistry and to biochemistry, Parts II and III, forming the major portion of the volume, can be read independently of the theoretical aspects of Part I. For the busy chemist this is a fortunate circumstance, since he can use the book with advantage in attacking many chemical problems. For example, it is stated that the Raman spectrum shows citral to contain no  $\alpha$ -form, whilst citronellal is a mixture of the  $\alpha$ - and  $\beta$ -forms. Again, the Raman spectra of certain sugars, such as glucose, sorbose, xylose and others, do not show a Raman shift in the region 1600 to 1700 wave-numbers, and, as this is the region where the carbonyl frequency should appear, it is concluded that aldehydic or ketonic structures are absent from these substances. Hibben points out that the Raman effect offers great promise for investigating industrial problems and also in applied biochemistry. The reviewer agrees with this view, and would point out that the Raman effect and the complementary infra-red spectrum are now coming into the field of analytical chemistry. The volume is by no means difficult to read and is fully up to the high standard of this series of Chemical Monographs.

The bibliography is complete and is arranged alphabetically, but the index could be improved, in the reviewer's opinion, if a different system were adopted, namely, a general index giving page numbers. This is, however, a minor matter and in no way detracts from the excellence of the volume for study and reference.

J. J. Fox

THEORETICAL AND APPLIED ELECTROCHEMISTRY. By M. DE K. THOMPSON. Pp. xxi + 535. 3rd Edition. New York: The Macmillan Company. 1939. Price 22s.

The general plan of this book is similar to that of the second edition, published in 1925, but the subject-matter has been brought up to date without any expansion of the text. The first part is theoretical, and deals with electrolysis, dissociation and migration of ions, conductance, electrokinetic phenomena and polarisation. Part II includes sections on electro-analysis, plating, the extraction and refining of metals, electrolytic oxidation and reduction, the production of oxygen and hydrogen, primary and storage cells, applications of electrokinetic phenomena and corrosion. The final section is concerned with electric furnaces and their products, and includes electrothermic metallurgy. No single volume could be expected to deal extensively with each of the many applications discussed, but the author has succeeded in presenting a broad survey of electrochemical processes.

In the theoretical section facts and theories are given briefly and the reader must look up the references given in the copious footnotes in order to amplify the lecture-note type of information of the text. Indeed, these footnotes and the bibliography at the end of each chapter combine to enhance the value of this book for reference purposes.

By contrast, some sections in Part II contain a wealth of detail: dimensions of plant, operating conditions, diagrams, drawings, photographs and the like. The information was presumably made available to the author by the various companies to whom acknowledgment is made in the preface. The descriptions of some processes, for example, the manufacture of fused quartz, probably owe something to the patent literature—a source that is not always a true guide to current practice.

Descriptions of some new developments, for example the electric melting of glass, are so brief as hardly to warrant inclusion. There is a tendency to neglect sources other than American; among the tests for electroplating there is no mention of S. G. Clarke's B.N.F. Jet Test, and the information on the "salt spray" test is out of date. Much attention has been devoted to electrolytic oxidation and reduction processes in America of recent years, and a number of commercial processes are described in the book, among them the production of iodoform by oxidation and the reduction of glucose to give sorbitol and mannitol. Electrolytic analysis is allotted only six pages, and the analyst may not, therefore, expect to profit greatly from a perusal of this chapter, which deals only with general principles. The chapter on corrosion, new to this edition, begins with the statement that the American oil industry lost 175 million dollars in 1927 as a result of corrosion, but as only two pages are devoted to the subject, they might well have been omitted.

The book is well produced and misprints are few, but there is some careless usage of words. It must be one crystallite of graphite, not one molecule, that contains only 30 atoms (p. 421); electrolytic  $\alpha$  brass has a micro-structure, not a crystal structure, different from cast brass of the same composition (p. 154).

The problems following each chapter, extended solutions to which are given at the end of the book, contribute towards an understanding of the subjects

discussed. Though primarily written for students, this book should be equally useful for reference purposes since a large part of it is devoted to practical industrial applications.

R. C. CHIRNSIDE

FLUORESCENCE ANALYSIS IN ULTRA-VIOLET LIGHT. By J. A. RADLEY and JULIUS GRANT. 3rd Edition. Pp. 424 + 28 photographs. London: Chapman & Hall. 1939. Price 22s. 6d.

Judging by the number and range of papers regularly published on fluorescence analysis there is no lack of interest in this subject. In recent years there has been no outstanding advance; but extension of application is evident in almost every branch of applied chemistry. There is thus ample justification for the appearance of this new edition which brings the subject-matter right up to date.

The general arrangement follows that of the two previous editions, accounts of which have already been recorded (*ANALYST*, 1934, **59**, 209; 1936, **61**, 215). Each of the first 19 chapters contains the material of the last edition (slightly revised and edited), together with additional matter published within the last few years. The final chapter is almost wholly new and comprises 17 pages dealing with recent work in the dyestuffs industries in connection with the laws of fluorescence, classification or identification of dyes, accelerated fading and the detection of faults. Nine more photographs are included.

The additions result in an increase of about one-third in the size of the book and quantitatively it may be said that 30 per cent. more pages have been provided for a 7 per cent. increase in price. Yet qualitatively the new material is more valuable than the old, for exaggerated claims, referred to in the review of the last edition as occurring in much early work, have been succeeded by more cautious estimates.

The authors have now on three occasions provided an admirable, up-to-date collection of the published work on fluorescence analysis. The latest volume approaches the limiting size for convenience, and for a subsequent edition it may be necessary to delete some of the information and references now included to make room for newer work. The task of separating the chaff from the grain will be difficult; but it is hoped that the authors will not shirk this winnowing, as it would improve the harvest for the increasing number of people who utilise the seed that has been garnered for them.

J. R. NICHOLLS

TECHNICAL METHODS OF ORE ANALYSIS FOR CHEMISTS AND COLLEGES. By A. J. WEINIG and W. P. SCHODER. Based upon the text by A. H. Low. Eleventh Edition. Pp. x + 325. New York: John Wiley & Sons, Inc., London: Chapman & Hall, Ltd. 1939. Price 22s. 6d.

All analysts engaged in metallurgical practice will welcome the new edition of the late Dr. Low's well-known manual, revised by A. J. Weinig, Director, and W. P. Schoder, Chemist, of the Experimental Ore Dressing and Metallurgical Plant of the Colorado School of Mines.

The greater part of the text is a revised and up-to-date reproduction of Dr. Low's excellent work, and since this is (or should be) on the bookshelf of every metallurgical laboratory, further commendation appears superfluous. The reviewer's remarks are therefore confined to the new features of the present edition.

The introductory chapters of the former editions on apparatus, electrolysis, and logarithms have been omitted and replaced by a 24-page chapter entitled "Semi-micro Methods." This consists of a collection of 42 qualitative spot tests for the most important elements, preceded by an illustrated description of the apparatus required, and supplemented by two handsome coloured plates showing the result of the colour test in each case. These tests are intended to be carried out on a drop withdrawn from the assay solution.

One new chapter—on beryllium—has been added to those devoted to the quantitative determination of the various elements. The reviewer is gratified to find that the method described by the authors for the determination of beryllium is based on the process he advocated as the simplest for the separation of beryllium from aluminium, namely, fusion of the ammonia precipitate with sodium carbonate (ANALYST, 1936, **61**, 235).

Each of the chapters on individual elements now comprises a table giving the most important minerals of the element under discussion, with useful data on properties and associated elements and reagents available for their decomposition. The table on cadmium minerals cites only the rare mineral greenockite; in the reviewer's opinion, it would be preferable to include zinc blende which, though not a cadmium mineral, is the only cadmium ore of commercial importance. Again, the table on silicate minerals does not mention quartz, by far the most abundant source of silica. Zinc blende might have been added to the sulphur minerals, since it is extensively used for the manufacture of sulphuric acid.

It may be suggested that an account of the colorimetric determination of small amounts of bismuth would form a most useful addition to the bismuth chapter.

Among the few misprints that have escaped proof-reading may be noted the atomic weight of hydrogen, in the table inside the back-cover (1·081 for 1·0081); and the gravimetric factors for zirconium pyrophosphate (p. 308). The formula of this compound should read  $\text{ZrP}_2\text{O}_7$  (not  $\text{Zr}_2\text{P}_2\text{O}_7$ ), and the factors for Zr and  $\text{ZrO}_2$  be corrected accordingly.

W. R. SCHOELLER

A TEXT-BOOK OF QUANTITATIVE INORGANIC ANALYSIS. Theory and Practice. By ARTHUR I. VOGEL, D.Sc., D.I.C., F.I.C. Pp. xix + 856. With 4 plates and 130 diagrams. London: Longmans, Green & Co. 1939. Price 18s.

In this book the balance between classical methods, of importance for their instructional value, and those required in commercial work, is struck and maintained in a way that should appeal both to teachers and to those engaged in the practice of analytical chemistry.

In the theoretical section (193 pp.) general theory receives full mathematical treatment and is illustrated by fully-worked examples of the several laws. This is followed by the theory of volumetric and gravimetric analysis, the subject being taken from first principles to its most recent stage of development. Technique (84 pp.) is treated first in general, and then with detailed description of the apparatus, calibrations and manipulation required for volumetric and gravimetric analysis. The chapter on volumetric analysis (195 pp.) contains, in addition to the usual elementary matter, descriptions and exercises on adsorption indicators and methods utilising mercurous perchlorate, ceric sulphate, manganic sulphate, titanous sulphate, liquid amalgams and chloramine-T.

The section on gravimetric analysis (197 pp.) covers simple determinations, systematic analysis (in which 13 of the commoner "rare" elements have not been overlooked), electrolytic determinations, simple separations and analysis of complex materials such as alloys and minerals. The critical discrimination and modern outlook of much of this and the preceding section bear more resemblance in style to that of a work of reference than a text-book; this adds interest for the chemist engaged in general analysis. In selecting methods of determination full use has been made of recently published original papers, including some from the pages of *THE ANALYST*. For all elements a wide choice of procedure is offered.

Colorimetric Analysis receives 62 pages, of which 29 are devoted to theory and instruments; procedures are described for 19 characteristic ions, and a table of reference is provided for 26 other elements and radicals. Gas Analysis (46 pp.) describes and illustrates the use of the Hempel, Bunte, Orsat, Ambler, and Bone-Wheeler apparatus and the Lunge nitrometer. An appendix (65 pp.) contains, in addition to all the usual matter, a table of buffer solutions for standardisation of *pH* measurements, a comprehensive bibliography of analytical chemistry and a table of *five*-figure logarithms. The index (14 pp.) is rendered easy of reference by heavy type for main headings and a system of abbreviations to indicate the class to which a determination belongs.

This work, which is remarkably free from errors, is likely to set a new standard for text-books of quantitative inorganic analysis.

F. L. OKELL

