

mic as produced in chemical reactions. In the apparatus developed by Calvet, Prat and co-workers the sensitivity has been increased to the point where the incredibly small power of 0.2 microwatt (1.5 cal./yr.) can be recognized. The fundamental idea which makes this possible was originally proposed by A. Tian in Marseille in 1923 (whose apparatus was used by Calvet for his doctoral research). Tian suggested that the heat generated or adsorbed in the reaction under study be compensated by electrical cooling (Peltier Effect) or heating (Joule Effect). The present authors over a period of twenty years have developed the apparatus to the sensitivity mentioned above and by means of ingenious innovations as well as of sound theoretical analyses of error brought the science of microcalorimetry to a high state of perfection.

The book has been written in three sections, the first two by Calvet and the third by Prat. The first on apparatus and methods gives detailed mathematical analyses of errors, heat leaks, thermal unbalance in the calorimeter, etc., as well as a description of the calorimeter, methods of forming the thermocouple junctions, electrical circuits (which are relatively simple), etc. In order to avoid unknown heat losses due to temperature gradients along the exterior surface of calorimeter and interior surface of jacket (a difficulty commonly overlooked by many calorimetrists), Calvet covers nearly the whole surface of the calorimeter with thin silver plates each connected to a thermocouple. Thus in his calorimeter heat leaks are magnified, but controlled and measured. This is perhaps the outstanding feature of his technique. It would be interesting to know how such a scheme works at high temperatures where heat exchange by radiation becomes dominant.

The second part describes the special methods and results of calorimetric studies of heats of solution, dilution, mixing, gelatinization, esterification, hydrolysis, saponification, immersion, decomposition and hydration (especially of cements). A large and important part of this section is devoted to the description not only of total heats but also of kinetic heat effects. The apparatus can also be used for specific heat and thermal conductance measurements although in these two fields the special advantages of the Tian-Calvet calorimeter are not so marked.

The final part describes chiefly Prat's work on biological systems such as heat effects of germination and respiration of seeds, bacteria, tissues, invertebrates and vertebrates. Of especial interest here are the kinetic heat effects which make it possible to recognize and measure quantitatively different stages in growth cycles as well as the effects produced on the organisms by herbicides, hormones, variations of temperature and humidity, etc.

The authors make no attempt to review the whole subject of microcalorimetry, their purpose in writing this book being to expound their own techniques. A general bibliography is given as well as indices and a table of contents. F. D. Rossini in his capacity of President of the Commission of Chemical Thermodynamics of the I. U. P. A. C. generously contributed an appreciative preface.

DEPARTMENT OF CHEMISTRY
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MALCOLM DOLE

Treatise on Inorganic Chemistry. Volume II. Sub-Groups of the Periodic Table and General Topics. By H. REMY, Professor of Inorganic Chemistry, University of Hamburg, (Germany). Translated by J. S. Anderson, F.R.S., Professor of Inorganic Chemistry, University of Melbourne (Australia), Formerly Deputy Chief Officer, Atomic Energy Research Establishment, Harwell (England). Edited by J. KLEINBERG, Professor of Inorganic Chemistry, University of Kansas, Lawrence, Kansas (U.S.A.). D. Van Nostrand Co., Inc., 126 Alexander Street, Princeton, New Jersey. 1956. xxviii + 800 pp. 18 × 25.5 cm. Price, \$17.75.

The English translation of this famous German textbook by Professor Remy is a welcome addition to the number of treatises in inorganic chemistry which have appeared in the last few years. Professor Anderson who has translated this book has been successful in keeping basic objectives of Professor Remy intact.

As the title indicates, a large part of this book pertains to the treatment of the various groups in relation to their position in the periodic table. However, several chapters have been added which treat subjects of great present interest.

The first chapter is a discussion of the metals and the intermetallic phases emphasizing the theoretical and practical aspects of this subject. Chapters 2, 3, 4, 5 and 6 discuss the first five periods of the transition elements. Chapter 7 discusses the 8th sub-group divided into the metals of the iron series and the metals of the platinum series. This division, unfortunately, produces a loss of some of the significance of the electronic structure in the sub-groups of group VIII. Chapters 8 and 9 discuss the 1st and 2nd sub-group of the periodic system and chapter 10 discusses the Lanthanum group.

Chapters 2 through 10 start with a general discussion of the groups such as their valence, basicity of the hydroxides, oxides and salts, properties of the metals, alloys, etc. Much of this discussion is of the type which still adheres to the memory type discussion which was so typical of German treatises. The other parts of the chapter consist of the discussion of the physical and chemical properties of the metals and their compounds including their analytical chemistry. Energy relationships which are so important in discussion of trends in the groups are unfortunately not included for most groups. In many cases certain aspects of a group are discussed in great detail whereas other parts are just barely mentioned. Some compounds are discussed as Werner type complexes although this has not been fully established.

The rest of the chapters consider general phenomena important in inorganic chemistry. Chapter 11, for example, considers radioactivity and isotopes, and chapter 12, isotopes of the stable elements; chapter 13, artificial radioactivity in nuclear chemistry and chapter 14, the Transuranic elements in general. This discussion covers about 150 pages and is quite well organized and presented. Chapter 15 considers geochemistry in general and could possibly be included in this group.

Chapter 16 discusses colloids and surface; chapter 17, catalysis and reaction kinetics; chapter 18, reactions in non-aqueous solutions and chapter 19, reactions of solid substances. These chapters are well organized but consider phenomena which can, because of space limitation, be only discussed superficially. In such a case, naturally, the specific interest of the author determines the treatment of the subject matter.

In general, this second volume of Remy's *Treatise on Inorganic Chemistry* is a very welcome addition to the shelf of general reference books in inorganic chemistry. The author, the translator and the American editor are to be congratulated for having undertaken to make this reference book available to those research chemists in inorganic chemistry who are not too familiar with the German language.

DEPARTMENT OF CHEMISTRY
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HANS B. JONASSEN

Organic Analysis. Volume III. Editorial Board: JOHN MITCHELL, JR., I. M. KOLTHOFF, E. S. PROSKAUER and A. WEISSBERGER. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1956. viii + 546 pp. 16 × 23.5 cm. Price, \$11.50.

This latest publication in the series "Organic Analysis" marks another forward step in the projection originally set forth by its editors of consolidating and critically evaluating the extensive and widely scattered literature of the field. It is gratifying to note in this connection that the contributors to Volume III have completed their assignments with distinction.

The book contains six chapters, the first four of which deal with functional group analyses (1. Organic Acids, 2. Organic Anhydrides, 3. Amines and Amides, and 4. Olefinic Unsaturation), the fifth with a relatively new instrumental technique, analytical mass spectrometry, and the sixth with synthetic organic resin coatings. The chapters are all of uniformly high quality, their treatment showing ample evidence of both painstaking scholarly care and of broad

practical experience with the subject matter in hand. The coverage of the many and varied chemical and instrumental techniques pertinent to the above mentioned functional groups is inclusive and well documented: there is a generous selection of proven methods accompanied by procedural details and tabular surveys of compounds to which the methods apply. The chapter on olefinic unsaturation, certainly the largest undertaking in the book, is probably unique in its breadth and excellence, and is one which will be welcomed by organic chemists generally. The fifth chapter opens with a clear and concise theoretical discussion of mass spectrometry, but appropriately limits its treatment of specific applications to those of interest to the structural organic chemist. Because of the expensive equipment which this method entails this chapter is addressed unfortunately to a rather restricted audience. The last chapter is a survey of a variety of separation procedures and determinations which have been applied successfully in the field of resin coatings. As such the information in it will no doubt find daily use in the laboratories engaged in the field, and will definitely come as a boon to the analyst who is confronted with a problem in it only occasionally. In summary, this is a useful volume indeed, and is highly recommended as an addition to the library of the organic analyst.

DEPARTMENT OF CHEMISTRY
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Rheology. Theory and Applications. Volume I. Edited by FREDERICK R. ERICH, Polytechnic Institute of Brooklyn, Brooklyn, New York. Academic Press, Inc., Publishers, 111 Fifth Avenue, New York 3, N. Y. 1956. xiii + 761 pp. 16.5 X 23.5 cm. Price, \$20.00.

The importance of rheology to the chemist is constantly growing, with both the variety of materials available for various purposes and the demands of the applications in which these materials are put to use. Rheology, originally the science of flow, has become the science of the response of materials or objects to many kinds of steady or cyclical stresses. Its subject matter ranges from the viscosities of very dilute polymer solutions through the behavior of lubricating oils, paints, printing inks, doughs, plastics, fibers and rubbers, to the deformation of metals and the behavior under stress of soil and concrete.

The chief cause of this increase in practical importance has been the extensive development of the science of rheology itself, particularly during the last ten or fifteen years. The science is in need of systematization and of standardization of terminology and nomenclature. There is need for books, both systematic introductions and also advanced expositions of the progress of the science on its many fronts. This present book is in the latter category; it might well be called a source book of theoretical and applied rheology. Many of the scientists who have contributed most heavily to the recent development of the science have written chapters summarizing their special fields.

After an introduction by Professor Eirich, Volume I contains chapters by M. Reiner and by William Prager on the mathematical analysis of rheological behavior; by D. C. Drucker on plastic behavior in metals; by G. J. Dienes on "Crystal Properties and Imperfections"; by J. M. and W. G. Burgers on "Dislocations in Crystals"; and by J. Fleeman and G. J. Dienes on "Mechanical Properties of Metals." Next is a chapter by R. B. Dow on rheological behavior under high pressures. A. Bondi then writes on "Theories of Viscosity." R. S. Rivlin summarizes the mathematical theory of large plastic strains, chiefly his own work. There then follow five chapters dealing chiefly with the rheology of high polymers: by T. Alfrey, Jr., and E. F. Gurnee ("Dynamics of Viscoelastic Behavior"); T. G. Fox, Serge Gratch and S. Loshaek ("Viscosity Relations for Polymers in Bulk and in Concentrated Solution"); J. Riseman and J. G. Kirkwood ("The Statistical Mechanical Theory of Irreversible Processes in Solutions of Macromolecules"); H. L. Frisch and R. Simha ("The Viscosity of Colloidal Suspensions and Macromolecular Solutions"); and A. Peterlin ("Streaming and Stress Birefringence"). Finally come a mathematical analysis of the flow of non-

Newtonian liquids, by J. G. Oldroyd, and a brief chapter by R. B. Lindsay on "Acoustics and the Liquid State." The announced contents of Volumes II and III lists roughly as many chapters for each of these volumes, with the chapters somewhat more specialized and, in Volume III, of a more applied nature.

The chapters of Volume I differ considerably among themselves in plan, in thoroughness and in level of difficulty. This reviewer was more at home in the chapters on polymers and found some of them quite useful. With the many additional chapters announced for the subsequent volumes the coverage of polymer rheology will be relatively complete. In contrast the treatment of metals appears not to be extended into later volumes. The chapters on metals in the first volume appear to be of high quality, though outside this reviewer's field of competence.

In view of the nature, scope and price of this volume, and of the set, this reviewer considers that it can be recommended particularly for purchase by libraries of universities and of colleges strong in technical work and by industrial libraries in a large segment of chemical and related industry. The case is somewhat different for the individual chemist. Those working actively in applications of rheology, having considerable knowledge of the field, may find this compilation of authoritative summaries of great value. For the beginning worker in the field, or the chemist in another field wanting orientation in rheology, the work has several drawbacks—its length, the thoroughness and comparative difficulty of some of the treatments, the lack of correlation between the chapters with consequent repetition and variation in terminology, notation and viewpoint, and a lack of unity and coherence in the work as a whole which is an unavoidable consequence of this type of authorship.

AMERICAN VISCOSE CORPORATION
MARCUS HOOK, PENNSYLVANIA M. T. O'SHAUGHNESSY

An Investigation on Promoted Iron Catalysts for the Synthesis of Ammonia. Second Edition. By ANDERS NIELSEN. Jul. Gjellerups Forlag, Copenhagen, Denmark. 1956. 233 pp. 16 X 24 cm. Price, paper bound, 28.00 Danish Kroner; cloth bound, 33.00 Danish Kroner.

During the past five decades the synthesis and decomposition of ammonia on the surface of solid catalysts has been of intense interest to fundamental and applied scientists. Some of the complexities of heterogeneous catalysis have been resolved, and the industrial development of the ammonia synthesis has been accelerated. Nielsen's book presents data of major importance in the rational design of industrial equipment as well as data and discussions pertinent to an understanding of the mechanism and kinetics of the synthesis. A brief introduction outlining the subject matter and purposes of the book is in Chapter I. The second chapter contains thermodynamic data on the equilibrium concentration of ammonia in $3\text{H}_2 + 1\text{N}_2$ as a function of pressure and temperature, on the heat of reaction at 500° and various pressures, on compressibility of $3\text{H}_2 + 1\text{N}_2$ at 10° and 100–400 atmospheres, on the solubility of H_2 , N_2 , A and CH_4 in liquid NH_3 and on the vapor phase composition of $3\text{H}_2 + \text{N}_2$ equilibrated with liquid NH_3 at various temperatures and pressures. After a brief description of laboratory catalyst testing apparatus in Chapter 3, the following chapter presents data on the per cent. conversion, the efficiency factor (ratios of actual partial pressure of NH_3 to equilibrium partial pressure of NH_3), and space-time-yield as a function of temperature, pressure, space velocity. Chapter 4 also contains data on the effect of the ratio of H_2 to N_2 , the partial pressures of inert gases, the per cent. of NH_3 in the feed gas; and includes discussion of the differences between laboratory and industrial converters particularly with respect to temperature gradients and turbulence, and the effect of particle size of catalyst with regard to the extent of reduction and the limitation of reaction velocity by diffusion to and from the surface of the catalyst.

The great utility and limitations of Temkin and Pyshev's equation for the rate of the synthesis are demonstrated in Chapter 5 by an analysis of the variation in rate constants with pressure and temperature. The limitations encountered when the NH_3 partial pressure is low, when diffusion