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.

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Rheology. Theory and Applications. Volume I. Edited by FREDERICK R. EIRICH, 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 × 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 authorative 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 × 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 $3H_2 + 1N_2$ as a function of pressure and temperature, on the heat of reaction at 500° and various pressures, on compressibility of $3H_2 + 1N_2$ 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 $3H_2 + N_2$ 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