

BOOKS

Electrochemical Systems, John S. Newman, Prentice-Hall, Inc., Englewood Cliffs, New Jersey (1973). 432 pages.

Electrochemical Systems attempts to cover a broad breadth of material in a relatively few pages, and to a large degree the author has been successful. This book covers nearly all facets of electrochemistry and electrochemical engineering including thermodynamics, kinetics, fluid mechanics, thermal transfer, and potential theory. In nearly all of the discussions, Newman carefully and logically takes the reader through a derivation of the controlling mechanisms and laws. Consequently, for the reader who is willing to carefully assimilate the various treatments, the book will greatly enhance an appreciation for and understanding of electrochemical systems and the interrelationships of the many complex phenomena involved therein.

The material is obviously presented for those who are somewhat familiar with electrochemistry or electrochemical systems and have a good grasp of physical chemistry and mathematics (calculus and vector analysis). The book is separated into four sections. The first section, which the reviewer enjoyed the most because of its brief yet comprehensive treatment of a very difficult subject, deals with thermodynamics. This section starts with a logical development of chemical potential, phase equilibria, and electric potentials and ends with a treatment of the more complex types of liquid junctions. The second section deals with all aspects of electrode kinetics, including electrophoresis, streaming potentials, and electrocapillary phenomena. The third section concludes the more fundamental treatment of electrochemical engineering by developing the mechanisms for the various transport processes (including thermal) that can occur within an electrochemical cell. There is some duplication between the third section and earlier sections; however, this duplication increases the readability of the book, making it possible to understand the third section without the prerequisite of the earlier sections. The fourth section which is intended to be a discussion of the applications of the laws developed in the earlier sections is somewhat limited in its treatment of such applications. It does cover a few of the application

problems that confront the engineer such as supporting electrolytes, limiting currents, and current distribution.

The author has apparently restricted this last section to the development of those application tools that he felt most meaningful in light of the previous sections.

The four major sections of the book are preceded by an excellent introductory section that can be easily read and understood by engineers, managers, or students lacking the background to fully assimilate the remainder of the book. This introduction very quickly reviews some of the more basic concepts of electrochemical engineering in simple terms and serves as an excellent background on the subject.

Electrochemical Systems should be considered as an authoritative textbook on the subject in that it can only be understood and appreciated by those having the interest and the physical chemical background. For those having this interest and background, this book is highly recommended as a very compact, well-developed, and most comprehensive treatise.

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Physical Properties of Hydrocarbons Volumes I and II, Robert W. Gallant, Gulf Publishing Company, New York (1972). Vol. I, 225 pages. Vol. II, 200 pages. \$17.95 each.

Over the years, Robert W. Gallant published a series of papers on hydrocarbon processing which presented, in graphical form, physical and thermodynamic properties of many chemicals commonly used in the chemical processing industry. Now, the entire series has been published as a two-volume set in hard cover. Volume I covers paraffinic hydrocarbons, alcohols, oxides, and glycols. Volume II covers other oxygenated hydrocarbons, nitrogen containing materials, aromatics, naphthenes, and materials having sulfur in the structure.

Almost 170 compounds are included. Graphs are given for most compounds to determine as a function of temperature, the vapor pressure, heat of vaporization, as well as vapor and liquid

heat capacity, density thermal conductivity and viscosity. In some cases, the surface tension variation with temperature is also shown.

For each compound, the source of the data (or estimation method) and an error band are given. Cgs units are employed except for vapor pressure where psia-°C scales are used. On most of the graphs, the grid lines are sufficiently fine so that one can obtain a precise number.

The author is to be commended for the final product. The labor involved must have been enormous. I have had many occasions to use these graphs and, in almost all cases, the result was judged as reliable.

Although the books are somewhat expensive, they are invaluable in those cases where property values are needed quickly.

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Ultrasonics, The Low- and High-Intensity Applications, Dale Ensinger, Marcel Dekker, Inc., New York, N. Y. (1973). 570 pages. \$24.50.

During the past two decades the growth of industrial ultrasound applications and the concomitant research activity in this area have produced a need for a concise collection of these results suitable for students and engineers involved in ultrasonics. Mr. Ensinger's book will help considerably to fill that need. Following an initial overview of the subject, two chapters cover the fundamental theory of acoustics and ultrasound and the important equations for ultrasonic design and application in about 100 pages. The author includes enough of the foundations of acoustics to refresh one already familiar with the subject, but someone just entering the field may need to consult more basic sources using this reference as a guide. Chapters 4 and 5 deal with design of horns for processing applications and the basic design of ultrasonic transducers. These two chapters should be of special interest to all workers in ultrasonics.

The remaining chapters deal with specific areas of applicability of ultrasonics, and each chapter constitutes a survey of important work in that area covering the period ending in 1970. Some of the areas of application of low-intensity effects which are covered are determination of properties of materials (an extensive compilation of acoustic properties of solids and liquids is an important feature of this chapter), nondestructive testing and inspection, imaging, process control, and measurement of fluid flow, pressure, and temperature. The areas of application of high-intensity ultrasonics are divided into those based on the mechanical effects and those based on chemical effects. The discussion dealing with mechanical effects includes cleaning, machining, forming, agglomeration, drying, liquid atomization, and drop formation. The discussion of uses based upon chemical effects includes accelerated etching, treatment of sewage, extraction, and demulsification. Although weighted heavily toward the mechanical effects, these chapters contain a great deal of material which will benefit chemical engineers. To complete the wide range of coverage, the final chapter reviews applications of ultrasonics in medicine.

The book is perhaps somewhat more suited to students (in the broad sense of the word) than to practicing engineers because of the extremely broad range of applications which are covered. A worker having a specific problem or interest will find, of course, that depth of coverage in his specialty has suffered because of this breadth of topics. However, anyone having any interest in ultrasonics will find that this book is an excellent reference.

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Latin American Journal of Chemical Engineering and Applied Chemistry, the Argentina Society of Investigators in the Science of Chemical Engineering and Applied Chemistry at the National University of La Plata, Republic of Argentina, Vol. 1, No. 1 et seq. (1971). Subscription is \$10.00/year.

This publication is intended to disseminate for international use the results of pertinent research performed in Central and South America. To date, four issues have appeared as Volume 1 (2 issues) in 1971, and Volume 2 (2 issues) in 1972. Each issue carries a complement of 4 or 5 major technical articles, a list of selected papers pub-

lished elsewhere in Central or South America (primarily Argentina and Brazil, but with a sprinkling from Ecuador and Columbia), notices of international meetings, technical communications, and descriptive material on selected institutes or universities listing their facilities and curricula offerings.

The vast majority of technical papers are products of Argentina so that in its present format the *Journal* is more a national than an international source. Brazil, Chile, and, surprisingly, the United States are lightly represented. The subject matter ranges effectively from engineering sciences to equipment design and performance with both experimental and theoretical presentations although the latter are dominant. It is too early to estimate readership from response, but 75% of the technical communications are from Argentina and represent original work rather than comment on published articles.

In summary, this new journal appears to be meeting rather high and selective standards in accepting major articles and has published material of international quality. Everything appears in both Spanish and English with remarkably good translation of the technical material from the Spanish. A per-page charge of \$5 (U.S.) or equivalent is, no doubt, limiting the quantity of published information. Perhaps this initiation is beneficial. The editorials are interesting but suffer in translation—the editor would be wise to subject editorial material to as rigorous linguistic review as the technical papers. Having survived for at least two years, perhaps the *Journal* can enjoy a lengthy life as it deserves.

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Mathematical Methods In Chemical Engineering, Vol II. First Order Partial Differential Equations with Applications, Rutherford Aris and Neal R. Amundson, Prentice-Hall, Englewood Cliffs, N. J. (1973). 369 pages. \$16.50.

Because a course in applied mathematics rarely treats only the subject of first-order partial differential equations, the subject matter is probably the only limitation to this text. The text provides an excellent treatment of the subject—substantially more thorough than in a general semester course in applied mathematics. It is geared for the graduate student or researcher with a background in advanced calculus and analytical geometry. It will be particu-

larly useful for formulating and solving problems involving single phase convective transport in conjunction with interphase transport or equilibrium.

The authors develop thoroughly the mathematical theorems and discuss the mathematical behavior of first-order partial differential equations and their solutions. The student must master this initial presentation because it is used throughout the text in generating solutions to the posed problems.

The authors present a variety of practical applications of the subject material. The student is well provided with physical interpretation to mathematical maneuvers and thus maintains contact with the physical world.

The text treats problems in chromatography, crystallization, polymerization, heat transfer, and fluid mechanics. It presents a sufficiently broad class of problems so that the user will be well aware of the applications of first-order partial differential equations. I would certainly recommend that this text be included in the library of chemical engineering applied mathematicians who frequently encounter problems in this area.

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The Control of Sulphides in Sewerage Systems, D. K. B. Thistlethwayte, (Ed.), Ann Arbor Science Publishers, Inc., Mich. (1972). 173 pages. \$24.00.

This book is intended as a manual of practice for minimizing corrosion due to hydrogen sulfide in sewers. It was prepared by D. K. B. Thistlethwayte and endorsed by the Australian Standing Committee for Hydrogen Sulphide Corrosion in Sewage Works. The book provides a relatively complete treatment of the processes involved in the acid corrosion of sewers which result when hydrogen sulfide is produced microbiologically under anaerobic conditions. It is written primarily for practicing B. S. level engineers; however, since the problem addressed involves the design of a three-phase flow reactor, the book may also be of considerable interest to academic researchers in search of a good practical problem needing further study.

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