

raphy, viscosity, boiling point, flash point, pour point, cloud point, vapor pressure, oxygen, density, hydrogen sulfide, total sulfur, spectrometric, moisture, air quality, water quality (including plt), heating value, octane number, thermal conductivity, and refractive index. The related subjects of sample systems, calibration, maintenance, and control are also covered. Although the book focuses primarily on process applications of analyzers, laboratory methods are also included. Its main strength is its comprehensive coverage of the various measurement technologies.

The chapter of each type of measurement includes a description of the products available commercially to perform the measurement. This coverage is very well-done, but unfortunately will become dated as the manufacturers continue with their product development.

The book clearly does not assume that the reader is a chemical engineer. Although review of topics such as the Nernst equation is appropriate, chemical engineers need not be reminded that the forward/reverse arrows signify a reversible reaction. Thus, the orientation is more to instrument specialists than to process engineers.

Those hardware-oriented subjects, such as how the various analyzers are constructed (electrically, mechanically, and otherwise), are covered well. Some attention is directed to the process considerations, such as what type of analyzer is best suited for a particular application and what process conditions could lead to unsatisfactory results. But by not assuming a chemical engineering background on the part of the reader, the book will disappoint those desiring an in-depth coverage of such topics.

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### Pressure Gauge Handbook

By P. W. Harland, Editor, Marcel Dekker, Inc., 1985, 292 pp.

This book focuses on bourdon-type pressure gauges, rather than the strain gauge, capacitance or piezoresistive types that require external energy sources such as electricity to make them function. In essence, the book is concerned with pressure gauges in which some form of elastic member is deflected by pressure and this motion is translated through suitable

links and levers, and gears to the pointer on an indicator scale.

The book starts with an introductory chapter in which the basic ideas of pressure are defined including pressure units and the kinds of pressure. This is followed by chapters 2-4 which present common variations in construction of pressure gauges as well as define the nomenclature associated with these particular types of gauges.

In chapter 5, the accessories available for use with pressure gauges are discussed that improve performance and expand the range of usefulness. For example, for cases where the pressure is pulsating rapidly, the gauge will be rapidly destroyed. By the addition of pulsation dampers that restrict the flow of fluid into the gauge, this destructive effect can be mitigated. Chapters 6 and 7 deal with the selection, installation and recalibration of a gauge to restore its accuracy.

In chapter 8 ways in which pressure gauges can be used to measure temperature are discussed. Although the primary concern of the book is with pressure-driven gauges, chapter 9 is concerned with the general ideas behind externally-powered pressure transducers. This material is included in case the pressure-driven-type gauges are inadequate for a particular application. This chapter, however, is quite limited and does not get into the types of pressure gauges available for applications such as in the plastics industry. Chapter 10 discusses the safety considerations that must be made by users, suppliers, and manufacturers of pressure gauges. In light of a tendency to use different pressure units, chapter 11 shows the relation among various pressure units. Finally, in Chapter 12 is given an outline for ordering and giving specifications to the manufacturer.

As stated in the preface of the book, it is intended for use by practicing engineers who must select pressure-driven-type gauges for various applications. Although the book is limited to just this class of pressure-driven-type gauge, it is quite thorough and detailed. It is a worthwhile reference book for those industries concerned with the processing of low-viscosity fluids and gasses. It is of very limited use for those engineers involved in the processing of polymer melts.

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### Handbook of Separation Process Technology

By Ronald W. Rousseau, Ed., John Wiley and Sons, Inc., XIX, 1010+ pp., 1987, \$69.95

This handbook is a new and welcome addition to the separations literature and represents the first effort of its type in many years. The book features an interesting arrangement, beginning with a good dose of appropriate theory in Part I, General Principles, followed by detailed descriptions of specific separation processes in Part II, Individual Separation Processes.

The chapters have been written by internationally recognized experts and about one half of the authors are from industry or have extensive industrial backgrounds. This provides a good balance of both the practical and the theoretical aspects of the subject. Each chapter in Part II has a good mix of fundamental principles, design procedures, examples of commercial equipment, and discussions of the application of the particular technique. The chapters are concluded with sections on the notation used. This is extensive and well done and is followed by a detailed bibliography.

The chapter titles are: Chapter 1. Phase Equilibria, Chapter 2. Mass Transfer Principles, Chapter 3. Phase Segregation, Chapter 4. General Processing Considerations, Chapter 5. Distillation, Chapter 6. Absorption and Stripping, Chapter 7. Extraction-Organic Chemicals Processing, Chapter 8. Extraction-Metals Processing, Chapter 9. Leaching-Metals Applications, Chapter 10. Leaching-Organic Materials, Chapter 11. Crystallization Operations, Chapter 12. Adsorption, Chapter 13. Ion Exchange, Chapter 14. Large-Scale Chromatography, Chapter 15. Separation Processes Based on Reversible Chemical Complexation, Chapter 16. Bubble and Foam Separations-Ore Flotation, Chapter 17. Bubble and Foamation Separations-Waste Treatment, Chapter 18. Ultrafiltration and Reverse Osmosis, Chapter 19. Recent Advances in Liquid Membrane Technology, Chapter 20. Separation of Gaseous Mixtures Using Polymer Membranes, Chapter 21. Membrane Processes-Dialysis and Electrodialysis, and, Chapter 22. Selection of a Separation Process.

The first chapters in Part I cover the fundamental aspects of separations tech-

nology in an elegant and thorough manner. The fourth chapter in this section provides realistic information for the designer and user of separation processes. Included in this chapter are examples and concepts for process synthesis. This development is receiving more detailed attention at the present time as separation sequences, especially for biologicals and high purity materials, become more and more complex. The first chapter in Part II is on distillation, which is still the most widely used of all the separation methods. Following this are chapters on absorption and stripping and extraction, and these have the common thread that they are contacting methods that generally involve staging and/or plate-type columns. Many examples of widely used devices are presented and discussed in these chapters. A chapter on crystallization follows and again the coverage is thorough and complete. This is followed by several chapters on separations whose common ingredient is a solid bed of particulate matter which is used as the foundation for the separation. This part concludes with a chapter on large-scale chromatography, which is becoming increasingly important, especially with the advent of biotechnology and the separations problems peculiar to that discipline. The chapter on separations that involve chemical reactions is a

welcome addition. This is a technique that has great potential for separating materials from dilute solutions. The material of interest is complexed or reacted with some substrate, separated from the mass of unwanted material, and then recovered by reversing the reaction. We can expect to see wider application of this methodology and the chapter is an excellent source of information. This chapter is followed by chapters describing separations using bubbles and foams and again this is a technique that has potential to become more widely used in the near future. Available ore supplies have lower concentrations of desired materials and the need to recover valuable materials from waste is more urgent than in the past. The past part of this separations section is devoted to membrane-based separation procedures and the coverage of these is quite complete. The techniques of ultrafiltration and reverse osmosis find wide use with ultrafiltration being almost the method of choice at the current time for many biochemical process-related separations. Dialysis and electrodialysis have, of course, been around for a long time and the separation of gaseous mixtures using polymer membranes is a vital and growing field.

The section is concluded by Chapter 22 which complements Chapter 4. It dis-

cusses choosing particular separation processes and Chapter 4 describes how to sequence the processes if you have a need for a series of separation techniques. Chapter 22 is a fitting conclusion to the book. Chapters 4 and 22 may be two of the more important chapters in the book. They discuss, in some detail, the reasons for selecting and using, in a unique sequence, particular separation processes. A number of rules of thumb are given, along with sound reasons for picking a separation process and using it in a sequence of methods developed from years of experience.

The chapters are remarkably uniform, well written and up-to-date. There are many references to literature from the 1980's. The book is of high quality, with uniformly good text and figures. I have one slightly negative reaction to the book and that relates to the size of the type. The type is small and I presume that this was done for cost considerations but it does make the reading a bit tedious. I think the book is a good buy and should be on every active separation researcher's bookshelf.

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