



Membranes In Separation

D.R. Paul



Membranes In Separation:

Synthetic Membranes and Membrane Separation Processes Takeshi Matsuura, 2020-09-10 *Synthetic Membranes and Membrane Separation Processes* addresses both fundamental and practical aspects of the subject. Topics discussed in the book cover major industrial membrane separation processes including reverse osmosis, ultrafiltration, microfiltration, membrane gas and vapor separation, and pervaporation. Membrane materials, membrane preparation, membrane structure, membrane transport, membrane module, and separation design and applications are discussed for each separation process. Many problem solving examples are included to help readers understand the fundamental concepts of the theory behind the processes. The book will benefit practitioners and students in chemical engineering, environmental engineering, and materials science.

Membrane Processes in Separation and Purification J.G. Crespo, Karl W. Böddeker, 2013-11-11 The chapters of this book are based upon lectures presented at the NATO Advanced Study Institute on Membrane Processes in Separation and Purification, March 21–April 2, 1993, Curia, Portugal, organized as a successor and update to a similar Institute that took place 10 years ago. Eds. M. Bungay, H. K. Lonsdale, M. N. de Pinho. *Synthetic Membranes: Science, Engineering and Applications*, NATO ASI Series, Reidel, Dordrecht, 1986. The decade between the two NATO Institutes witnesses the transition from individually researched membrane processes to an applied and established membrane separation technology, as is reflected by the contents of the corresponding proceeding volumes. By and large, the first volume presents itself as a textbook on membrane processes still valid, while the present volume focuses on areas of separation need as amenable to membrane processing. *Biotechnology and Environmental Technology*. Accordingly, the contributions to this volume are grouped into Membranes in Biotechnology (11 papers), Membranes in Environmental Technology (6 papers), and New Concepts (4 papers). This is followed by one contribution each on Energy Requirements and Education, i.e. membrane processes within an academic curriculum. The book thus amounts to a state of the art of applied membrane processing and may well augment the more fundamental approach of its predecessor.

Membrane Separations Technology R.D. Noble, S.A. Stern, 1995-01-17 The field of membrane separation technology is presently in a state of rapid growth and innovation. Many different membrane separation processes have been developed during the past half century, and new processes are constantly emerging from academic, industrial, and governmental laboratories. While new membrane separation processes are being conceived with remarkable frequency, existing processes are also being constantly improved in order to enhance their economic competitiveness. Significant improvements are currently being made in many aspects of membrane separation technology, in the development of new membrane materials with higher selectivity and/or permeability, in the fabrication methods for high flux asymmetric or composite membranes, in membrane module construction, and in process design. Membrane separation technology is presently being used in an impressive variety of applications and has generated businesses totalling over one billion U.S. dollars annually. The main objective of this book is to present the principles and applications of a variety of

membrane separation processes from the unique perspectives of investigators who have made important contributions to their fields Another objective is to provide the reader with an authoritative resource on various aspects of this rapidly growing technology The text can be used by someone who wishes to learn about a general area of application as well as by the knowledgeable person seeking more detailed information

Membrane Separation Systems R.W. Baker,1991 Describes research needed to bring energy saving membrane separation processes to technical and commercial readiness for commercial acceptance within the next 5 to 20 years NDICE Volume I 1 Executive Summary 2 Assessment Methodology 3 Introduction 4 Government Support of Membrane Research 5 Analysis of Research Needs Appendix A Peer Reviewers Comments Volume II Introduction to Volume II 1 Membrane and Module Preparation 2 Pervaporation 3 Gas Separation 4 Facilitated Transport 5 Reverse Osmosis 6 Microfiltration 7 Ultrafiltration 8 Electrodialysis 9 Glossary of Symbols and Abbreviations

Membrane Engineering for the Treatment of Gases Enrico Drioli,Giuseppe Barbieri,2011-07-06 Membranes already have important applications in artificial organs the processing of biotechnological products food manufacture waste water treatment and seawater desalination Their uses in gaseous mixture separations are however far from achieving their full potential Separation of air components natural gas dehumidification and sweetening separation and recovery of CO₂ from biogas and H₂ from refinery gases are all examples of current industrial applications The use of membranes for reducing the greenhouse effect and improving energy efficiency has also been suggested New process intensification strategies in the petrochemical industry have opened up another growth area for gas separation membrane systems and membrane reactors This two volume set presents the state of the art in membrane engineering for the separation of gases It addresses future developments in carbon capture and utilization H₂ production and purification and O₂ N₂ separation Topics covered include the applications of membrane gas separation in the petrochemical industry implementation of membrane processes for post combustion capture commercial applications of membranes in gas separations simulation of membrane systems for CO₂ capture design and development of membrane reactors for industrial applications Pd based membranes in hydrogen production modelling and simulation of membrane reactors for hydrogen production and purification novel hybrid membrane pressure swing adsorption process for gas separation molecular dynamics as a new tool for membrane design and physical aging of membranes for gas separations Volume 1 focuses predominantly on problems relating to membranes

Industrial Membrane Separation Technology K. Scott,R. Hughes,2012-12-06 Membrane science and technology is an expanding field and has become a prominent part of many activities within the process industries It is relatively easy to identify the success stories of membranes such as desalination and microfiltration and to refer to others as developing areas This however does not do justice to the wide field of separations in which membranes are used No other single process offers the same potential and versatility as that of membranes The word separation classically conjures up a model of removing one component or species from a second

component for example a mass transfer process such as distillation In the field of synthetic membranes the terminology separation is used in a wider context A range of separations of the chemical mass transfer type have developed around the use of membranes including distillation extraction absorption adsorption and stripping as well as separations of the physical type such as filtration Synthetic membranes are an integral part of devices for analysis energy generation and reactors cells in the electrochemical industry Membrane Technology and Applications Richard W. Baker, 2012-10-01 the best handbook on membrane technology which is currently on the market Membrane News on the previous edition Building on the success of the previous edition Membrane Technology and Applications Third Edition provides a comprehensive overview of separation membranes their manufacture and their applications Beginning with a series of general chapters on membrane preparation transport theory and concentration polarization the book then surveys several major areas of membrane application in separate chapters Written in a readily accessible style each chapter covers its membrane subject thoroughly from historical and theoretical backgrounds through to current and potential applications Topics include reverse osmosis ultrafiltration pervaporation microfiltration gas separation and coupled and facilitated transport chapters on electrodialysis and medical applications round out the coverage NEW TO THE THIRD EDITION New sections on the use of membranes in the chlor alkali industry membrane distillation pressure retarded osmosis and constant flux variable pressure ultrafiltration Zeolite and ceramic membranes submerged membrane modules and fuel cell membranes Substantially enhanced chapters on ultrafiltration pervaporation and membrane contactors Updates to every chapter to reflect the developments in the field

Handbook of Membrane Separations Anil Kumar Pabby, Syed S.H. Rizvi, Ana Maria Sastre Requena, 2008-07-07 The Handbook of Membrane Separations Chemical Pharmaceutical and Biotechnological Applications provides detailed information on membrane separation technologies as they have evolved over the past decades To provide a basic understanding of membrane technology this book documents the developments dealing with these technologies It explores

Membrane Technology in Separation Science Mihir Purkait, Randeep Singh, 2018-02-19 The book explains fundamental and advanced topics related to the field of membrane science including extensive coverage of material selection preparation characterization and applications of various membranes Explores both preparation and wide range of applications for all possible membranes contains an exclusive chapter on functionalized membranes and incorporation of stimuli responsive membranes in each type and includes exercise problems after each chapter It also discusses new membrane operations as membrane reactors and membrane contactors *Membrane Process Design Using Residue Curve Maps* Mark Peters, David Glasser, Diane Hildebrandt, Shehzaad Kauchali, 2011-04-20 Design and Synthesis of Membrane Separation Processes provides a novel method of design and synthesis for membrane separation While the main focus of the book is given to gas separation and pervaporation membranes the theory has been developed in such a way that it is general and valid for any type of membrane The method which uses a graphical technique allows one to calculate and visualize the change in composition of

the retentate non permeate phase This graphical approach is based on Membrane Residue Curve Maps One of the strengths of this approach is that it is exactly analogous to the method of Residue Curve Maps that has proved so successful in distillation system synthesis and design *Science and Technology of Separation Membranes* Tadashi Uragami,2017-02-10 Offers a comprehensive overview of membrane science and technology from a single source Written by a renowned author with more than 40 years experience in membrane science and technology and polymer science Covers all major current applications of membrane technology in two definitive volumes Includes academic analyses applications and practical problems for each existing membrane technology Includes novel applications such as membrane reactors hybrid systems and optical resolution as well as membrane fuel cells **Ceramic Membranes Applied in Separation Processes** Dionisio da Silva Biron,Venina dos Santos,Mara Zeni,2017-05-18 This book covers diverse types of ceramic membranes applied in separation processes The authors present the preparation methods and well as the main application of ceramic membranes Modules microfiltration and ultrafiltration are topics described within the text The final chapter focuses on water and wastewater treatment by membranes separation processes **Transport Mechanisms in Membrane Separation Processes** J.G.A. Bitter,2012-12-06 The present book contains a comparison of existing theoretical models developed in order to describe membrane separation processes In general the permeation equations resulting from these models give inaccurate predictions of the mutual effects of the permeants involved due to the simplifications adopted in their derivation It is concluded that an optimum description of transport phenomena in tight diffusion type membranes is achieved with the solution diffusion model According to this model each component of a fluid mixture to be separated dissolves in the membrane and passes through by diffusion in response to its gradient in the chemical potential A modified Flory Huggins equation has been derived to calculate the solubility of the permeants in the membrane material Contrary to the original Flory Huggins equation the modified equation accounts for the large effect on solubility of crystallinity and elastic strain of the polymer chains by swelling The equilibrium sorption of liquids computed with this equation was found to be in good agreement with experimental results Also the sorption of gases in both rubbery and glassy polymers could be described quantitatively with the modified Flory Huggins equation without any need of the arbitrary Langmuir term as required in the conventional dual mode sorption model Furthermore fewer parameters are required than with the at least identical accuracy

Membrane Technologies and Applications Kaustubha Mohanty,Mihir K. Purkait,2011-12-19 Compiling recent advances in membrane separations technology this highly relevant book introduces cost effective solutions for separation problems in a wide range of industries It discusses membrane use in water and wastewater treatment food and dairy industry and fuel cell applications It describes the role of membrane technologies in resource recovery pollution prevention and energy production as well as environmental monitoring and quality control A concise resource for emerging technologies this book provides the tools to implement effective production processes improve environmental protection and public health and explore new

opportunities for the industry *Liquid Separations with Membranes* Karl W. Böddeker, 2007-12-14 The plan of this book is to present the relevant thermodynamic features of fluid mixtures in contact with semipermeable barriers then to apply this information in deriving the design requirements of individual membrane separation processes The membranes by this approach are introduced by way of the mass transport and selectivity demands which they are to meet This book gives a survey in systematic order of the terms and concepts by which barrier separations operate **Fundamentals of Membrane Separation Technology** Zhan Wang, 2024-01-23 Fundamentals of Membrane Separation Technology provides a comprehensive and systematic introduction to this environmentally friendly separation process Using a structured format that promotes comprehension and implementation each chapter provides overviews principles materials and preparation and industrial applications Each chapter then concludes with future prospects references and end of chapter exercises Written for students and professionals this book is an ideal reference for those who wish to better understand the fundamentals and applications of membrane technology Evaluates present and future applications of more recently developed membranes in energy conversion biomedical components controlled release devices and environmental engineering Provides a comprehensive overview of all aspects of membranes and their applications Includes numerous industrial case studies practical examples and questions Membrane Separation Processes Patrick Meares, 1976 **Ion-Exchange Membrane Separation Processes** H Strathmann, 2004-02-12 Today membranes and membrane processes are used as efficient tools for the separation of liquid mixtures or gases in the chemical and biomedical industry in water desalination and wastewater purification Despite the fact that various membrane processes like reverse osmosis are described in great detail in a number of books processes involving ion exchange membranes are only described in a fragmented way in scientific journals and patents even though large industrial applications like electrodialysis have been around for over half a century Therefore this book is emphasizing on the most relevant aspects of ion exchange membranes This book provides a comprehensive overview of ion exchange membrane separation processes covering the fundamentals as well as recent developments of the different products and processes and their applications The audience for this book is heterogeneous as it includes plant managers and process engineers as well as research scientists and graduate students The separate chapters are based on different topics The first chapter describes the relevant Electromembrane processes in a general overview The second chapter explains thermodynamic and physicochemical fundamentals The third chapter gives information about ion exchange membrane preparation techniques while the fourth and fifth chapter discusses the processes as unit operations giving examples for the design of specific plants First work on the principles and applications of electrodialysis and related separation processes Presently no other comprehensive work that can serve as both reference work and text book is available Book is suited for teaching students and as source for detailed information **Basic Principles of Membrane Technology** Marcel Mulder, 1996-09-30 The field of synthetic membrane science and technology is an active growing field involving an

interdisciplinary mixture of polymer chemistry physical chemistry and chemical engineering Some membrane processes are reasonably well understood and have been commercialised for some period of time Other membrane processes have only recently been employed in commercial applications and still other processes are only in formative research stages This volume gives a comprehensive compendium of the basic principles in the field of synthetic membranes The following topics are covered basic aspects of membrane processes materials and material properties membrane preparation and characterisation membrane transport concentration polarisation and fouling process and module design The second edition of this well established text has been considerably expanded and updated and many chapters now contain sections giving solved and unsolved problems Audience This book is recommended as a textbook for undergraduate and graduate students as well as a comprehensive reference for engineers scientists and technical management Polymeric Gas Separation Membranes D.R. Paul, 2018-05-04 Polymeric Gas Separation Membranes is an outstanding reference devoted to discussing the separation of gases by membranes An international team of contributors examines the latest findings of membrane science and practical applications and explores the complete spectrum of relevant topics from fundamentals of gas sorption and diffusion in polymers to vapor separation from air They also compare membrane processes with other separation technologies This essential book will be valuable to all practitioners and students in membrane science and technology

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