

# Ion Exchange Membranes For Electro Membrane Processes

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Membrane Processes in Separation and Purification J.G. Crespo 1994-06-30 The current vigour in separations research principally derives from the need for pioneering separations processes in an emerging technology (biotechnology), from new societal emphases (reduction of chemical emissions into the environment), as well as from opportunities for achieving dramatic improvements in the efficiency of a number of manufacturing technologies through the development of a new generation of membranes (novel membrane applications). 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 review of applied membrane processes. Even though other texts have appeared in recent years, a more documented, practical book is needed, with a strong interaction with the collateral disciplines of materials sciences, life sciences and environmental science. This book emphasizes the need for such an integrated approach to membrane processes.

Fundamental Modeling of Membrane Systems Patricia Luis 2018-06-29 Fundamental Modelling of Membrane Systems: Membrane and Process Performance summarizes the state-of-the-art modeling approaches for all significant membrane processes, from molecular transport, to process level, helping researchers and students who carry out experimental research save time and accurately interpret experimental data. The book provides an overview of the different membrane technologies, handling micro-, ultra-, and nanofiltration, reverse and forward osmosis, pervaporation, gas permeation, supported liquid membranes, membrane contactors, membrane bioreactors and ion-exchange membrane systems. Examples of hybrid membrane systems are also included. Presents an accessible reference on how to model membranes and membrane processes Provides a clear, mathematical description of mass transfer in membrane systems Written by well-known, prominent authors in the field of membrane science

Electrochemical Membrane Technology for Water and Wastewater Treatment Zhiwei Wang 2022-04-04 Electrochemical Membrane Technology for Water and Wastewater Treatment consolidates state-of-the-art research developments in electrochemical membrane technology in water reclamation and sustainability in terms of fundamental theories, membrane and electrode materials, reactor designs, and fouling control mechanisms and applications. Fundamental theories and applications of electrochemical membrane technology are detailed, with emerging applications of electrochemical membrane technology introduced. The knowledge gaps and future research perspectives in electrochemical membrane technology are also addressed. This book is an excellent resource for understanding fundamental theories, the latest developments, and future prospects in electrochemical membrane technology. The concepts presented in this book can benefit a broad audience of researchers and engineers working in water purification, membrane technology and electrochemical process. Consolidates scattered knowledge of electrochemical membrane technology into a more assessible resource Provides a comprehensive review of fundamental theories, membrane materials and module design as well as the latest developments in electrochemical membrane technology Provides a state-of-the-art review on the applications of electrochemical membrane

technology Includes detailed discussions on the challenges and prospects of electrochemical membrane technology in different applications Presents an excellent reference for the education and understanding of water treatment, wastewater treatment, membrane technology, electrochemical technology, environmental science and technology, and the latest research and developments

Membrane Technology Sundergopal Sridhar 2018-09-03 Contributed by multiple experts, the book covers the scientific and engineering aspects of membrane processes and systems. It aims to cover basic concepts of novel membrane processes including membrane bioreactors, microbial fuel cell, forward osmosis, electro-dialysis and membrane contactors. Maintains a pragmatic approach involving design, operation and cost analysis of pilot plants as well as scaled-up counterparts

Membrane Separations Technology R.D. Noble 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.

Electromembrane Processes Lubo š Nov á k 2021-12-20 The book is a comprehensive view of all electromembrane processes, including electromembrane processes for energy conversion - a currently very significant problem. The necessary theory and basic information needed for understanding the technology are explained in Part I. Materials used for ion-selective membranes and separation processes are described in Part II, and the applications for synthesis and energy conversion in Part III.

Membrane Technologies for Water Treatment Alberto Figoli 2016-02-18 Focuses on the application of membrane technologies in removing toxic metals/metalloids from water. Particular attention is devoted to the removal of arsenic, uranium, and fluoride. These compounds are all existing in the earth ' s crust at levels between two and five thousands micrograms per kg (parts per million) on average and these compounds can be considered highly toxic to humans, who are exposed to them primarily from air, food and water. In order to comply with the new maximum contaminant level, numerous studies have been undertaken to improve established treatments or to develop novel treatment technologies for removing toxic metals from contaminated surface and groundwater. Among the technologies available, applicable for water treatment, membrane technology has been identified as a promising technology to remove such toxic metals from water. The book describes both pressure driven (traditional processes, such as Nanofiltration, Reverse Osmosis, Ultrafiltration,etc) and more advanced membrane processes (such as forward osmosis, membrane distillation, and membrane bioreactors) employed in the application of interest. Key aspect of this book is to provide information on both the basics of membrane technologies and on the results depending on the type of technology employed.

Ion Exchange Membranes in Aqueous, Methanolic and Ethanolic Electrolyte Solutions Frank Sarfert 2005 Ion exchange membranes serve as the selective barrier in (electro-)dialytic separation processes. To date they are applied almost exclusively to aqueous electrolyte systems. In principal, however, ion exchange membranes also should be applicable to non aqueous solutions. In order to clarify how and why the membrane behavior in non aqueous electrolyte systems deviates from aqueous systems, equilibrium and transport properties of commercial monopolar and bipolar membranes are determined experimentally for aqueous, methanolic and ethanolic sodium perchlorate solutions in this study. Based on these results the dependence of the membrane performance on solution characteristics such as the relative permittivity, the solute concentration and the ionic

mobility and on membrane specifics such as the type of functional groups and the membrane morphology is discussed. Thus, evidence is found for the importance of ion pair formation in the solution as well as in the membrane phase. Both effects lead to a more or less pronounced degradation of the membrane performance. Further insights into the stationary and dynamic behavior of ion exchange membranes is obtained from a detailed, physically meaningful and dynamic bipolar membrane model. It is characterized by the consideration of four ionic species as well as solvent and electric potential, the existence of a space charge region at the cation/anion exchange layer interface, the description of non-idealities by means of solution and membrane phase activity coefficients and the solvent dissociation according to the chemical reaction model. Thus, a model is developed which is able to reproduce all observed experimental trends for both aqueous and non aqueous solutions.

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

Focus on Solid State Chemistry Arte M. Newman 2007 This book on solid state chemistry presents studies of chemical, structural, thermodynamic, electronic, magnetic, and optical properties and processes in solids. Research areas include: bonding in solids, crystal chemistry, crystal growth mechanisms, diffusion epitaxy, high-pressure processes, magnetic properties of materials, optical characterisation of materials, order-disorder, phase equilibria and transformation mechanisms, reactions at surfaces, statistical mechanics of defect interactions, structural studies and transport phenomena.

Ion Exchange: Science and Technology A.E. Rodrigues 2012-12-06 Proceedings of the NATO Advanced Study Institute on Ion Exchange: Science and Technology, Tro í a, Portugal, July 14-26, 1985

Comprehensive Membrane Science and Engineering Enrico Drioli 2010-07-09 This multivolume work covers all aspects of membrane science and technology - from basic phenomena to the most advanced applications and future perspectives. Modern membrane engineering is critical to the development of process-intensification strategies and to the stimulation of industrial growth. The work presents researchers and industrial managers with an indispensable tool toward achieving these aims. Covers membrane science theory and economics, as well as applications ranging from chemical purification and natural gas enrichment to potable water Includes contributions and case studies from internationally recognized experts and from up-and-coming researchers working in this multi-billion dollar field Takes a unique, multidisciplinary approach that stimulates research in hybrid technologies for current (and future) life-saving applications (artificial organs, drug delivery)

Ion Exchange Membranes Yoshinobu Tanaka 2015-01-19 Fundamental study and industrial application of ion exchange membranes started over half a century ago. Through ongoing research and development, ion exchange membrane technology is now applied to many fields and contributes to the improvement of our standard of living. Ion Exchange Membranes, 2nd edition states the ion exchange membrane technology from the standpoint of fundamentals and applications. It discusses not only various phenomena exhibited by membranes but also their applications in many fields with economical

evaluations. This second edition is updated and revised, featuring ten expanded chapters. New to this edition is a computer simulation program of ion-exchange membrane electrodialysis for water desalination that provides a guideline for designing, manufacturing and operating a practical-scale electrodialyzer. Meant to replace experiments, this program will be an important asset to those with time and monetary budgets. New edition features ten revised and expanded chapters, providing the latest developments in ion exchange membrane technology Computer simulation program, accessible through a companion website, provides a guideline for designing, manufacturing and operating practical-scale electrodialyzers Attractive visual presentation, including many figures and diagrams

Mass Transfer and Kinetics of Ion Exchange L. Liberti 2012-12-06 While ion-exchange processes were originally used for the treatment of very dilute solutions, many applications for the treatment of concentrated solutions have been developed in recent years. In these situations, the mass transfer bottlenecks are located in the membrane, rather than the liquid phase. Therefore, the development of quantitative models for ion-exchange kinetics requires knowledge about the conductance characteristics of ions and solvent in the solid phase. A useful approach towards this aim is the study of transport characteristics of these species, and of their interactions in solid ion exchange membranes. Many different transport processes and related phenomena can be observed in membrane-solution systems, e.g., ion migration, electroosmosis, diffusion and self-diffusion, osmosis, hydraulic flow, hyperfiltration (reverse osmosis) or ultrafiltration, streaming potential and streaming current, and membrane potentials (also called "membrane concentration potentials"). It is important to correlate all these phenomena so as to avoid a very large number of unnecessary measurements. Such correlation is often possible [Meares, 1976] since all these phenomena are determined by the ease of migration of the different species across the membrane. Important correlations have been made and summarized even before high-capacity ion-exchange membranes became commercially available [Sollner, 1950, 1971].

Water Resources Research Catalog 1966

Membrane Technology and Applications Richard Baker 2004-05-31 Table of Contents Preface Acknowledgments for the first edition Acknowledgments for the second edition 1 Overview of Membrane Science and Technology 1 2 Membrane Transport Theory 15 3 Membranes and Modules 89 4 Concentration Polarization 161 5 Reverse Osmosis 191 6 Ultrafiltration 237 7 Microfiltration 275 8 Gas Separation 301 9 Pervaporation 355 10 Ion Exchange Membrane Processes - Electrodialysis 393 11 Carrier Facilitated Transport 425 12 Medical Applications of Membranes 465 13 Other Membrane Processes 491 Appendix 523 Index 535.

Water Treatment Membrane Processes Lyonnaise des eaux-Dumez (Firm) 1996 Best water filtration strategies for the '90s. Get the engineering savvy you need to capitalize on membrane technology for effective water filtration. Water Treatment Membrane Processes, by the American Water Works Association Research Foundation, enables you to use membrane filtration methods for purifying drinking water--and utilize new research for wastewater treatment. This richly illustrated guide shows you how to apply membrane processes in numerous water treatment applications. . .model membrane performance. . .and take charge of field evaluation and piloting. You'll see how to implement nanofiltration, ultrafiltration, microfiltration, and electrodialysis techniques--and make the most of membrane reactors, bioreactors and ion exchange membrane reactors.

Electromembrane Processes Luigi Gurreri 2021-09-08 Electromembrane processes offer a multitude of applications, allowing for the recovery of water, other products, and energy. This book is a collection of contributions on recent advancements in electromembrane processes attained via experiments and/or models. The first paper is a comprehensive review article on the applications of electrodialysis for wastewater treatment, highlighting current status, technical challenges, and key points for future perspectives. The second paper focuses on ZSM-5 zeolite/PVA mixed matrix CEMs with high monovalent permselectivity for recovering either acid or  $\text{Li}^+$ . The third paper regards direct numerical simulations of electroconvection in an electrodialysis dilute channel with forced flow under potentiodynamic and galvanodynamic regimes. The fourth paper investigates the reasons for the formation and properties of soliton-like charge waves in overlimiting conditions. The fifth paper focuses on the characterization of AEMs functionalized by surface modification via poly(acrylic) acid yielding monovalent permselectivity for reverse electrodialysis. In the sixth paper, CFD simulations of reverse electrodialysis systems are performed. The seventh paper proposes an integrated membrane process, including electrochemical intercalation – deintercalation, for the preparation of  $\text{Li}_2\text{CO}_3$  from

brine with a high  $Mg^{2+}/Li^{+}$  mass ratio. Finally, the eighth paper is a perspective article devoted to the acid–base flow battery with monopolar and bipolar membranes.

Proceedings of the Symposia on Fundamentals of Electrochemical Process Design 1995

Membrane Technology Enhancement for Environmental Protection and Sustainable Industrial Growth Zhen Zhang 2020-12-14 This book presents a detailed discussion of the fundamentals and practical applications of membrane technology enhancement in a range of industrial processes, energy recovery, and resource recycling. To date, most books on the applications of membrane technology have mainly focused on gas pollution removal or industrial wastewater treatment. In contrast, the enhancement of various membrane processes in the areas of energy and the environment has remained largely overlooked. This book highlights recent works and industrial products using membrane technology, while also discussing experiments and modeling studies on the membrane enhancement process.

Electrodialysis Technology United States. Office of Water Research and Technology 1979

Electrochemically Enabled Sustainability Kwong-Yu Chan 2014-06-13 Electrochemically Enabled Sustainability: Devices, Materials and Mechanisms for Energy Conversion covers topics related to current research in electrochemical power sources, highlighting some of the latest concepts in electrochemical conversion for sustainability. The book examines the most recent and innovative technologies employed in battery and fuel cell technology. It introduces the fundamental concepts applied to these electrochemical power sources and provides in-depth discussion on the materials, design, and performance of these devices. Written by internationally acclaimed experts, the chapters illustrate how key technologies for sustainability are enabled by electrochemical conversion. Topics include the reduction of carbon dioxide to resolve issues of carbon capture, energy storage, and generation of portable fuel; turning waste into energy using microbial fuel cells; the promise of vanadium redox flow batteries for massive energy storage; and improved performance of hybrid devices. The book addresses numerous aspects of lithium-type batteries for vehicle propulsion and energy storage, presenting a broad range of lithium batteries, and considering nano-structuring issues, layered-structure materials, and hierarchical structure. This book provides timely coverage of critical issues in emerging and conventional technologies, presenting a wide range of electrochemical devices, related materials, and operation mechanisms. It stimulates an appreciation for the novelty of these electrochemical power sources and offers a projection of future integration of these devices in practice.

Principles of Desalination K Spiegler 2012-12-02 Principles of Desalination focuses on the principles of the developing technology of large-scale desalting. This book presents the principal desalting methods and explores the process of hyperfiltration or reverse osmosis. Comprised of 11 chapters, this book starts with an overview of the water use and the problem of a potential water shortage. This text then discusses the fundamentals of the major desalting methods in use and explores the basic scientific and design principles that underlie the methods. Other chapters consider the method of vapor reheat distillation, which incorporates the liquid–liquid heat exchange principle. This book discusses as well the various aspects of ion exchange and explores the mechanisms in dual-purpose plants producing both distilled water and steam-turbine raised power. The final chapter considers the cost of conventional water supplies. This book is a valuable resource for technologists and scientists. Students in the graduate courses of engineering will also find this book useful.

Nanotechnology in Membrane Processes Kailash Chandra Khulbe 2021-01-09 Nanotechnology has been established in membrane technology for decades. In this book, comprehensive coverage is given to nanotechnology applications in synthetic membrane processes, which are used in different fields such as water treatment, separation of gases, the food industry, military use, drug delivery, air filtration, and green chemistry. Nanomaterials such as carbon nanotubes, nanoparticles, and dendrimers are contributing to the development of more efficient and cost-effective water filtration processes. Gas separation and carbon capture can be significantly improved in flue gas applications. Nanoporous membrane systems engineered to mimic natural filtration systems are being actively developed for use in smart implantable drug delivery systems, bio artificial organs, and other novel nano-enabled medical devices. The microscopic structure of nanoporous ceramic membranes, mainly focusing on zeolite materials, as well as the energy-saving effect of membrane separation, contribute to various chemical synthesis processes. In the food industry, nanotechnology has the potential to create new tools for pathogen detection and packaging. For each application, nanotechnology is mostly

used to make composite membranes, and the book provides a detailed look at the mechanisms by which the composite membrane works in each application area.

Ion-Exchange Membrane Separation Processes H Strathmann 2004-01-29 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

Sustainable Water for the Future Isabel C. Escobar 2009-10-05 This book is part of a series on sustainability. Specifically, it deals with the issue of sustainable water use. Fresh sources of potable water are being depleted across the world. Pure water is the goal of water utilities as well as several industries. Well past the experimental stage, membrane processes are now a proven and reliable method of providing high-quality, cost-effective water. Membrane technologies have immediate applications to treatment of fresh, brackish and sea waters, as well as wastewater reclamation. With innovative module design and engineering, micro- and ultra-filtrations have become effective and economical for drinking water production, particularly for removal of microorganisms. Membrane bioreactors are being developed for municipal and industrial water recycling. Various membrane processes are also used to remove contaminants from industrial wastewaters. This book covers the fundamental and practical concepts and issues regarding the application of membrane technologies for sustainable water treatment. It describes and compares the effectiveness of desalination versus water recycling for long-term sustainable water use. - Describes the global water situation with respect to sustainability - Emphasizes the role of membrane technologies - Compares the strategies of water recycling and desalination

In-Depth on the Fouling and Antifouling of Ion-Exchange Membranes Las^aad Dammak 2021-12-31 The use of ion-exchange membranes (IEMs) has accelerated over the past two decades in a wide variety of industrial processes (electrodialysis, electro-electrodialysis, electrolysis, dialysis, etc.) for applications related to chemical, pharmaceutical and food industries, energy production, water treatments, etc. Organic and mineral fouling (or scaling) phenomena are two major factors limiting the efficiencies of IEMs processes and performances (reduction of the IEMs selectivity and stability, increase of their electrical resistance, deduction of the energy efficiency of the process, etc.) leading to significant economic losses. The current washing, cleaning and sterilization processes (anti-fouling treatments) make it possible to recover some of the IEMs performances, but frequently induce degradation on the membrane material. Another essential point in the fouling studies is the choice of the best and appropriate analysis and diagnostic technique to evaluate this or that magnitude, or observe this or that object on the surface or in the mass of the membrane. This book is focused on recent advancements in techniques for diagnosing and characterizing the fouling effects on membranes, in mechanisms governing this complex phenomenon, and in the various innovative and economically viable solutions for reducing fouling.

Ion Exchange Membranes Toshikatsu Sata 2004 Various separation membranes have been developed since their discovery over half a century ago, providing numerous benefits and fulfilling many applications in our everyday lives. They lend themselves to techniques ranging from microfiltration and gas separation, to what can be considered as the most advanced technique - ion

exchange. This book, aimed at academic researchers, engineers and industrialists, contains a brief history of ion exchange and goes on to explain the preparation, characterization, modification and applications of these important membranes. Discussions include the use of ion exchange in analytical and medical techniques, as well as the development of future applications.

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Electromembrane Desalination Processes for Production of Low Conductivity Water Andrej Grabowski 2010 Water of very low mineral content, i.e. low ionic conductivity, is required in many industrial processes and laboratory applications. The demand for total output volume and purity of such water has been significantly increasing during the last decades. Electromembrane processes provide a more sustainable and cost effective water purification compared to alternative processes like distillation and ion-exchange deionization. In the first part of the publication a review of processes used for deionization of water is presented and main physicochemical phenomena occurring in electromembrane processes will be discussed. The subsequent parts are devoted to the experimental verification of novel improvements for two electromembrane processes: electrodialysis and continuous electrodeionization. Considering electrodialysis, an investigation on ion-exchange membranes with profiled surfaces will be presented. It includes a section of appropriate membrane manufacturing procedures and desalination tests with profiled membranes. It turns out that electrodialysis with profiled ion-exchange membranes is superior to conventional electrodialysis with flat membranes and spacers, in particular with respect to desalination degree and reduced energy consumption. Considering continuous electrodeionization, experimental studies concerning improvements of continuous electrodeionization with bipolar membranes will be presented and discussed. Influence of ion-exchange membrane permselectivity on the product water quality is demonstrated and proposed improvements are aimed to reduce this influence. Concepts with a so-called protection compartment will be discussed and compared experimentally with a concept where the concentrate compartments are filled with ion exchange resin beads. It will be shown that improved continuous electrodeionization with bipolar membranes is able to produce ultrapure water in a quality comparable to conventional mixed-bed ion-exchangers but in a more cost effective and sustainable way.

60 Years of the Loeb-Sourirajan Membrane Hui-Hsin Tseng 2022-04-02 60 Years of the Loeb-Sourirajan Membrane: Principles, New Materials, Modelling, Characterization and Applications bring forth theoretical advances, novel characterization techniques, materials development, advanced treatment processes, and emerging applications of membrane-based technologies. The trigger for writing this book is the 2020, 60th anniversary of the first asymmetric polymeric membrane invented by Dr. Sidney Loeb and Dr. Srinivasa Sourirajan (University of California, Los Angeles, USA) on the breakthrough discovery of the semipermeable membrane for seawater desalination. The book places emphasis on the advances of organic and inorganic membranes in different fields, covering not only the primary application of membranes for water and wastewater treatment but also other applications dealing with energy conversion and storage, organic solvent purification, gas separation, and biomedical processes. Provides a comprehensive overview on membrane technologies from the fundamental knowledge of fabrication principle and separation mechanisms to a wide range of applications, including new/emerging processes Covers the use of new/advanced materials (both organic and inorganic), novel membrane fabrication techniques, and cutting-edge characterization methods for the development of advanced membranes Includes advances in computational modeling and simulation of membrane processes

Ion Exchange Membrane Electrodialysis Yoshinobu Tanaka 2010 Industrial application of ion exchange membranes started from saline water desalination. However, now it extends widely in many fields such as drinking water or wastewater treatment, demineralisation of amino acid, whey, sugar liquor, recovery of useful components, treatment of organic substances and contributes to the improvement of our standard of living. The application of ion exchange membranes must expand

further if we pay attention to unique functions of the membranes for separating ionic species from non-ionic substances or other kinds of ionic species. This book discusses the performance of an electrolysers from the stand point of fundamental and practical views.

Advancement in Polymer-Based Membranes for Water Remediation Sanjay K. Nayak 2022-02-23 Advancements in Polymer-Based Membranes for Water Remediation describes the advanced membrane science and engineering behind the separation processes within the domain of polymer-based membrane systems in water remediation. Emphasis has been put on several aspects, ranging from fundamental concepts to the commercialization of pressure and potential driven membranes, updated with the latest technological progresses, and relevant polymer materials and application potential towards water treatment systems. Also included in this book are advances in polymers for membrane application in reverse osmosis, nanofiltration, ultrafiltration, microfiltration, forward osmosis, and polymeric ion-exchange membranes for electrodialysis and capacitive deionization. With its critical analyzes and opinions from experts around the world, this book will garner considerable interest among actual users, i.e., scientists, engineers, industrialists, entrepreneurs and students. Evaluates water remediation using pressure driven and potential driven membrane processes Reviews emerging polymer systems for membranes preparation Offers a comprehensive analysis in the development of polymer-based membranes and their applications in water remediation Analyzes membrane performance parameters to evaluate separation efficiency for various water pollutants Covers concept-to-commercialization aspects of polymer-based membranes in terms of water purification, pollutant removal, stability and scalability

Electrospun and Nanofibrous Membranes Ali Kargari 2022-09-30 Electrospun and Nanofibrous Membranes: Principles and Applications covers the fundamental basic science and many engineering aspects of electrospun membrane technology and nanofibers, membrane design and membrane processes. The book comprehensively reviews a wide range of applications including pressure-driven processes, MD process, batteries, oil-water separation, air filtration, drug delivery, fuel-cells, and ion-exchange membranes, as well as antimicrobial membranes. Electrospun and Nanofibrous Membranes will be useful for a range of audiences: chemical, polymer, and materials engineers; professors and graduate students working on membrane-based separation technology and electrospun nanofibers; as well as R&D engineers in industry working with applications including water and wastewater treatment, desalination, drug delivery and tissue engineering, new generation of batteries, fuel cells, and air filtration. Introduces comprehensively the principles of electrospinning and electrospun membranes Reviews and evaluates the different configurations of electrospinning Discusses scale-up strategies for nanofiber production

Ion Exchange Technology I Inamuddin Dr. 2012-06-02 Ion-exchange Technology I: Theory and Materials describes the theoretical principles of ion-exchange processes. More specifically, this volume focuses on the synthesis, characterization, and modelling of ion-exchange materials and their associated kinetics and equilibria. This title is a highly valuable source not only to postgraduate students and researchers but also to industrial R&D specialists in chemistry, chemical, and biochemical technology as well as to engineers and industrialists.

Sustainable Energy from Salinity Gradients Andrea Cipollina 2016-03-01 Salinity gradient energy, also known as blue energy and osmotic energy, is the energy obtainable from the difference in salt concentration between two feed solutions, typically sea water and river water. It is a large-scale renewable resource that can be harvested and converted to electricity. Efficient extraction of this energy is not straightforward, however. Sustainable Energy from Salinity Gradients provides a comprehensive review of resources, technologies and applications in this area of fast-growing interest. Key technologies covered include pressure retarded osmosis, reverse electrodialysis and accumulator mixing. Environmental and economic aspects are also considered, together with the possible synergies between desalination and salinity gradient energy technologies. Sustainable Energy from Salinity Gradients is an essential text for R&D professionals in the energy & water industry interested in salinity gradient power and researchers in academia from post-graduate level upwards. For more than ten years the Editors have been sharing substantial research activities in the fields of renewable energy and desalination, successfully participating to a number of European Union research projects and contributing to the relevant scientific literature with more than 100 papers and 2 books on Desalination technologies and their coupling with Renewable Energy. They are intensely working in the field of Salinity Gradient Power, carrying out research with specific focus on open-loop and closed-

loop reverse electrodialysis and pressure retarded osmosis. Covers applications of pressure retarded osmosis, reverse electrodialysis, and capacitive mixing for salinity gradient power in one convenient volume Presents the environmental aspects and economics of salinity gradient energy Explores possible synergies between desalination and salinity gradient energy

[Ion and Molecule Transport in Membrane Systems](#) Victor Nikonenko 2021-08-10 Membranes play an enormous role in our life. Biological cell membranes control the fluxes of substances in and out of cells. Artificial membranes are widely used in numerous applications including “ green ” separation processes in chemistry, agroindustry, biology, medicine; they are used as well in energy generation from renewable sources. They largely mimic the structure and functions of biological membranes. The similarity in the structure leads to the similarity in the properties and the approaches to study the laws governing the behavior of both biological and artificial membranes. In this book, some physico-chemical and chemico-physical aspects of the structure and behavior of biological and artificial membranes are investigated.

[Ionic Transport Processes](#) Ky ö sti Kontturi 2008-07-10 Modelling of heterogeneous processes, such as electrochemical reactions, extraction or ion-exchange, usually requires solving the transport problem associated to the process. Since the processes at the phase boundary are described by scalar quantities and transport quantities are vectors or tensors, coupling of them can take place only via conservation of mass, charge or momentum. In this book, transport of ionic species is addressed in a versatile manner, emphasizing the mutual coupling of fluxes in particular. Treatment is based on the formalism of irreversible thermodynamics, i.e. on linear (ionic) phenomenological equations, from which the most frequently used Nernst-Planck equation is derived. Limitations and assumptions made are thoroughly discussed. The Nernst-Planck equation is applied to selected problems at the electrodes and in membranes. Mathematical derivations are presented in detail so that the reader can learn the methodology of solving transport problems. Each chapter contains a large number of exercises, some of them more demanding than others.

[Boron Separation Processes](#) Nalan Kabay 2015-01-19 The impending crisis posed by water stress and poor sanitation represents one of greatest human challenges for the 21st century, and membrane technology has emerged as a serious contender to confront the crisis. Yet, whilst there are countless texts on wastewater treatment and on membrane technologies, none address the boron problem and separation processes for boron elimination. Boron Separation Processes fills this gap and provides a unique and single source that highlights the growing and competitive importance of these processes. For the first time, the reader is able to see in one reference work the state-of-the-art research in this rapidly growing field. The book focuses on four main areas: Effect of boron on humans and plants Separation of boron by ion exchange and adsorption processes Separation of boron by membrane processes Simulation and optimization studies for boron separation Provides in one source a state-of-the-art overview of this compelling area Reviews the environmental impact of boron before introducing emerging boron separation processes Includes simulation and optimization studies for boron separation processes Describes boron separation processes applicable to specific sources, such as seawater, geothermal water and wastewater

[Introduction to Membrane Science and Technology](#) Heinrich Strathmann 2011-10-17 Written by a dedicated lecturer and leading membrane scientist, who has worked both in academia and industry, this advanced textbook provides an impressive overview of all aspects of membranes and their applications. Together with numerous industrial case studies, practical examples and questions, the book provides an excellent and comprehensive introduction to the topic. Advanced students as well as process and chemical engineers working in industry will profit from this resource. A significant feature of the book is the treatment of more recently developed membranes and their applications in energy conversion, biomedical components, controlled release devices and environmental engineering with an indication of the present and future commercial impact. The solutions to the questions in the book can be found under <http://www.wiley-vch.de/publish/en/books/ISBN3-537-32451-8/> From the Contents: \* Introduction \* Fundamentals \* Membrane Preparation and Characterization \* Principles of Membrane Separation Processes \* Membrane Modules and Concentration Polarization \* Membrane Process Design and Operation

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