

Polymer blend nanocomposites for polymer electrolyte membrane fuel cell (PEMFC) applications

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Abbreviations

AFC	alkaline fuel cell
BPP	bipolar plate
DEMFC	direct methanol fuel cell
DOE	Department of Environment
FC	fuel cell
FCEV	fuel cell electric vehicle
GDL	gas diffusion layer
GE	general electric
GHG	greenhouse gas
GO	graphene oxide
H ₂	hydrogen gas
ICE	internal combustion engine
MCFC	molten carbonate fuel cell
MEA	membrane electrode assembly
MGO	marine gas oil
mGT	micro gas turbine
NASA	National Aeronautics and Space Administration
PAFC	phosphoric acid fuel cell
PBI	polybenzimidazole
PEEK	polyaryletherketone
PEFC	polymer electrolyte fuel cell
PEM	polymer electrolyte membrane
PEMFC	polymer electrolyte membrane fuel cell
PES	polyether sulfone
Pt	platinum
PTFE	polytetrafluoroethylene
PVA	poly(vinyl alcohol)
PVB	poly(vinyl butyral)

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Composite Membranes for Advanced Applications in DMFC and PEMFC Vicente Moreno Compañ, Sergio Romana Mollá, Andrio Andreu Balado, 2025-10-30 This book reports on the preparation and characterization of solution cast composite membranes and nanofiber reinforced membranes obtained by electrospinning technique It describes cutting edge analysis techniques that suggest that the reinforced fibers enhance the mechanical properties and produce a remarkable reduction of the methanol permeability Coverage includes the performance of fuel cells containing different membrane electrode assemblies MEAs for PEMFC application as well as the analysis of the methanol permeability in composite materials for direct methanol fuel cell DMFC applications [Composite Membranes for Advanced Applications in DMFC and PEMFC](#)

Composite Membranes for Advanced Applications in DMFC and PEMFC Vicente Moreno Compañ, Sergio Romana Mollá, Andrio Andreu Balado, 2015-11-09 This book reports on the preparation and characterization of solution cast composite membranes and nanofiber reinforced membranes obtained by electrospinning technique It describes cutting edge analysis techniques that suggest that the reinforced fibers enhance the mechanical properties and produce a remarkable reduction of the methanol permeability Coverage includes the performance of fuel cells containing different membrane electrode assemblies MEAs for PEMFC application as well as the analysis of the methanol permeability in composite materials for direct methanol fuel cell DMFC applications [Membranes for Low Temperature Fuel Cells](#)

Membranes for Low Temperature Fuel Cells Surbhi Sharma, 2019-06-04 Membranes for Low Temperature Fuel Cells provides a comprehensive review of novel and state of the art polymer electrolyte membrane fuel cells PEMFC membranes The author highlights requirements and considerations for a membrane as an integral part of PEMFC and its interactions with other components It is an indispensable resource for anyone interested in new PEMFC membrane materials and concerned with the development optimisation and testing of such membranes Various composite membranes polymer and non polymer are discussed along with analyses of the latest filler materials like graphene ionic liquids polymeric ionic liquids nanostructured metal oxides and membrane concepts unfolding in the field of PEMFC This book provides the latest academic and technical developments in PEMFC membranes with thorough insights into various preparation characterisation and testing methods utilised Factors affecting proton conduction water adsorption and transportation behaviour of membranes are also deliberated upon Provides the latest academic and technical developments in PEMFC membranes Reviews recent literature on ex situ studies and in situ single cell and stack tests investigating the durability chemical thermomechanical and degradation of membranes Surbhi Sharma MSc PhD Working on graphene oxide and fuel cells since 2007 she has published about 50 research articles book chapters and holds a patent She has also been awarded various research grants [Synthetic Polymeric Membranes for Advanced Water Treatment, Gas Separation, and Energy Sustainability](#)

Synthetic Polymeric Membranes for Advanced Water Treatment Gas Separation and Energy Sustainability Ahmad Fauzi Ismail, Wan Norharyati Wan Salleh, Norhaniza Yusof, 2020-05-14 Synthetic Polymeric Membranes for Advanced Water Treatment Gas Separation and Energy Sustainability is a cutting edge guide that focuses on advanced water treatment applications covering oily

wastewater treatment desalination removal of dyes and pigments photodegradation of organic hazardous materials heavy metal removal removal and recovery of nutrients and volatile organic compounds Other sections examine the area of gas separation including acidic gas removal oxygen enrichment gas and vapor separation hydrogen separation and gas sensing Final sections cover applications for sustainable energy usage including the use of synthetic polymer membranes in proton exchange membrane fuel cells PEMFCs and more This is a highly valuable guide for researchers scientists and advanced students working with polymer membranes and films and across polymer science polymer chemistry materials science chemical e Explains the design preparation and characterization of synthetic polymer based membranes for advanced applications Provides a clear picture of the state of the art in the field including novel fabrication approaches and the latest advances in physico chemical characterizations Supports the development and implementation of innovative sustainable solutions to water treatment gas separation and energy devices

Comprehensive Membrane Science and Engineering Enrico Drioli, Lidietta Giorno, 2010-07-09 Comprehensive Membrane Science and Engineering Four Volume Set 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

Advanced Materials for Membrane Fabrication and Modification Stephen Gray, Toshinori Tsuru, Yoram Cohen, Woei-Jye Lau, 2018-08-30 Membranes are an energy efficient separation technology that are now the basis for many water treatment and food processing applications However there is the potential to improve the operating performance of these separations and to extend the application of membranes to energy production gas separations organic solvent based separations and biomedical applications through novel membrane materials This book contains 20 chapters written by leading academic researchers on membrane fabrication and modification techniques and provides a comprehensive overview on the recent developments of membrane technology Membranes can be manufactured from a range of materials including polymeric compounds and ceramic materials and both these materials are considered in the book There are 5 chapters on water and wastewater membranes that cover the fabrication of thin film TFC composite membranes for nanofiltration NF reverse osmosis RO forward osmosis FO applications stimuli responsive membranes electrospun membranes porous ceramic membranes and polymeric ultrafiltration UF manufacture and modification There are another 6 chapters on gas separation that consider carbon membranes zeolite membranes silica template and metal

oxide silica membranes TFC membranes silica membranes and metal organic framework MOF membranes Zeolite membranes are also considered for organic solvent applications as are solvent resistant membranes manufactured by phase inversion ceramic supported composite membranes and ceramic NF membranes The emerging areas of membranes for energy and biomedical applications have 3 and 2 chapters respectively Energy applications consider ion exchange membranes for use in fuel cells membranes for electrodialysis and membranes for use in microbial fuel cells For biomedical applications the chapters focus on hemodialysis membranes and redox responsive membranes

Advanced Functional Membranes Inamuddin,Tariq Altalhi,Mohd Imran Ahamed,Mohammad Luqman,2022-03-15 Functional membranes are used in food processing sensor technology medical and biomedical devices desalination waste water treatment CO2 capture energy production and energy storage optoelectronics etc The book reviews recent advances in the field and discusses challenges and perspectives Keywords Membrane Fabrication Polymer Membranes Self Assembled Membranes Molecular Probes Membrane Fouling Membrane Cleaning Microfiltration Ultrafiltration Food Processing Sensors Medical Devices Biomedical Applications Desalination Wastewater Treatment Ion Exchange Processes Polymeric Ceramic Membranes Nano Holes Fuel Cells Lithium Ion Batteries Optoelectronics

Polyamide Thin Film Composite Membranes for Water Applications Ying Siew Khoo,Jia Zheng Oor,Woei Jye Lau,Jia Wei Chew,2024-04-26 The global market for polymeric membranes used in water and wastewater treatment is experiencing robust growth with polyamide PA thin film composite TFC membranes dominating reverse osmosis RO and nanofiltration NF processes This monograph presents the latest trends in characterization techniques for PA TFC membranes and provides the most current and relevant information on these techniques tailored specifically for TFC NF and RO membranes Features Focuses solely on the characterization of PA TFC membranes used in water and wastewater treatment Provides the latest insights into employing advanced and emerging characterization tools to analyze the intrinsic properties of the PA selective layer and evaluate the overall performance of PA TFC membranes during filtration processes Extensively examines the strengths and limitations of each membrane characterization tool offering in depth analyses for readers This book is an indispensable reference and practical guide for advanced students researchers and scientists involved in NF and RO membrane fabrication and characterization including those in the fields of chemical materials and environmental engineering

New Composite Membranes Based on Modified Nafion Or Flemion for PEM Fuel Cell Application Huimin Tian,2004

Nanotechnology in Fuel Cells Huaihe Song,Tuan Anh Nguyen,Ghulam Yasin,2022-02-23 Nanotechnology in Fuel Cells focuses on the use of nanotechnology in macroscopic and nanosized fuel cells to enhance their performance and lifespan The book covers the fundamental design concepts and promising applications of nanotechnology enhanced fuel cells and their advantages over traditional fuel cells in portable devices including longer shelf life and lower cost In the case of proton exchange membrane fuel cells PEMFCs nano membranes could provide 100 times higher conductivity of hydrogen ions in low humidity conditions than traditional

membranes For hydrogen fuel cell nanocatalysts Pt hybrid nanoparticles could provide 12 times higher catalytic activity This is an important reference source for materials scientists and engineers who are looking to understand how nanotechnology is being used to create more efficient macro and nanosized fuel cells Outlines how fuel cells can be nanoengineered to enhance their performance and lifespan Covers a variety of fuel cell types including proton exchange membrane fuel cells and hydrogen based fuel cells Assesses the major challenges of nanoengineering fuel cells at an industrial scale

Membranes with Functionalized Nanomaterials Suman Dutta, Chaudhery Mustansar Hussain, 2022-04-09

Membranes with Functionalized Nanomaterials Current and Emerging Research Trends in Membrane Technology provides researchers and practitioners with basic and advanced knowledge of sustainable membrane technology The book summarizes recent progress made in novel functionalized nanomaterials FNMs used in modern membrane technology It gives a comprehensive overview of state of the art technologies in the field of nanomaterial based membranes and provides in an in depth and step by step way the foundational scientific knowledge on various sustainable membranes with FNMs technologies and their impact on society and in various industries In addition readers get a handbook in a compact form with various aspects of FNMs based sustainable membranes Explores innovative strategies to fabricate functionalized nanomaterials based membranes Evaluates the advanced functionalized nanomaterials based membranes and other transformational options Offers a detailed spectrum of applications of sustainable functionalized nanomaterials based membranes

Membranes for Energy Conversion

Klaus-Viktor Peinemann, Suzana Pereira Nunes, 2008-09-08

Focusing on recent developments in innovative energy conversion this second volume features emerging applications with the capacity to transform the entire energy economy Specific examples include the development of sulfonated polyarylether type polymers as proton exchange membranes for high and medium temperature polymer electrode fuel cells PEFC with an entire section devoted to the rapidly expanding field of materials development for solid oxide fuel cells SOFC The result is a detailed and invaluable source of information for those involved in the chemical material science and engineering fields of power generation

Preparation and

Characterization of Composite Proton Exchange Membranes for Fuel Cell Applications Jung-Chou Lin, 2000

Organic-inorganic Composite Membranes For Molecular Separation Wanqin Jin, Gongping Liu, Nanping Xu, 2017-09-27

This book gives comprehensive information on the design preparation and application of organic inorganic composite membranes that are used for molecular separation Various membrane types with different materials are highlighted including polymer ceramic composite membranes mixed matrix membranes metal organic frameworks membranes and graphene based membranes Physical and chemical properties morphologies interfacial behaviors transport characteristics and separation performance of the organic inorganic composite membranes are thoroughly discussed based on advanced characterization techniques Meanwhile the book contains several typical applications of the membranes in fields such as bio fuels production organic compounds recovery solvent dehydration carbon dioxide capture and others In addition large scale

production and industrial implementation of the organic inorganic composite membranes are briefly introduced

Development of Percolated Network PEMFC Composite Membranes with HFPO/SO₂ Coated Particles Via Plasma Polymerization Jeshwanth Rameshwaram,2010 **Nanocomposite Membranes for Water and Gas Separation** Mohtada Sadrzadeh,Toraj Mohammadi,2019-11-13 Nanocomposite Membranes for Water and Gas Separation presents an introduction to the application of nanocomposite membranes in both water and gas separation processes This in depth literature review and discussion focuses on state of the art nanocomposite membranes current challenges and future progress including helpful guidelines for the further improvement of these materials for water and gas separation processes Chapters address material development synthesis protocols and the numerical simulation of nanocomposite membranes along with current challenges and future trends in the areas of water and gas separation Explains the development of nanocomposite membranes through bio mimicking nanomaterials Discusses the surface modification of nanomaterials to fabricate robust nanocomposite membranes Outlines the environmental and operational challenges for the application of nanocomposite membranes *Nano-Enhanced and Nanostructured Polymer-Based Membranes for Energy Applications* Maria Giovanna Buonomenna,2022-01-22 There is a growing need for better membranes in several emerging application fields especially those related to energy conversion and storage as well as to water treatment and recycling Processability is an important functional property often ignored especially in the early discovery phase for new materials but it should be one of the most important properties that needs to be considered in the development of better membrane materials Useful membrane materials have to be capable of being formed into thin membranes in particular for membrane gas separation water treatment and desalination and then packaged into large area membrane modules All gas separation membranes that are in current commercial use are based on polymers which are solution processable This book intends to deal with composite in most cases hybrid polymer based membranes for three separate application fields energy conversion energy storage and water treatment and recovery Each chapter will explain clearly the various membrane processes then go on to discuss in detail the corresponding advanced membranes used The logic that lies behind this is that you have to understand the process in order to develop new high performance membranes By taking this approach the author aims to overcome the disconnection that currently exists between membrane materials scientists and industrial process engineers Discusses interdisciplinary content by a single author approaching synthesis and development of materials from the perspective of their processability Describes the novel aspects of membrane science that is related to energy storage conversion and wastewater treatment Presents an emphasis on scientific results which have an impact on real applications in terms of renewable and clean energy challenges *Inorganic Polymeric and Composite Membranes* S. Ted Oyama,Susan M Stagg-Williams,2011-05-04 Inorganic Polymeric and Composite Membranes Structure Function and Other Correlations covers the latest technical advances in topics such as structure function relationships for polymeric inorganic and composite

membranes Leading scientists provide in depth reviews and disseminate cutting edge research results on correlations but also discuss new materials characterization modelling computational simulation process concepts and spectroscopy Unified by fundamental general correlations theme Many graphical examples Covers all major membrane types *Fluoropolymeric Membranes* Zhaoliang Cui, Enrico Drioli, Francesca Macedonio, Young Moo Lee, 2025-07-01 Enables readers to gain a comprehensive understanding of fluoropolymeric membrane science and technology from a single resource Fluoropolymeric Membranes Fundamentals Fabrication and Applications comprehensively and systematically covers the basic science and technology of fluoropolymeric membranes which have high mechanical strength and excellent chemical stability and thus have been employed for the last several decades as materials for membrane separation processes in a variety of applications Written by four highly qualified authors Fluoropolymeric Membranes includes information on Typical fluoropolymers like poly vinylidene fluoride poly tetrafluoroethylene and poly ethylene chlorotrifluoroethylene Structure and properties of fluoropolymeric membranes and fabrication strategies of advanced fluoropolymeric membranes Fluoropolymeric membranes novel applications in chemical and bio separations hybrid systems energy fuel cells batteries gas and air treatments and more How fluoropolymeric membranes support common water treatment processes such as ultrafiltration microfiltration MBR membrane processes and more New membrane operations such as membrane distillation membrane crystallization membrane emulsification and membrane contactors Providing complete coverage on the subject Fluoropolymeric Membranes is an essential resource for polymer chemists membrane scientists process engineers materials scientists water chemists environmental chemists and chemists in industry **Novel Composite Membranes for Fuel Cells** Sossina M. Haile, Hal Clark, 2003

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