



燃料電池と水素製造

持続可能な科学技術百科事典・第2版

1. Fuel Cells and Hydrogen Production

Encyclopedia of Sustainability Science and Technology, Second Edition

Edited by **T. E. Lipman**, University of California Berkeley TSRC, Berkeley,

2018年10月出版予定 全2巻/1163ページ ハードカバー 定価 ¥136,880

- ◇ 代替エネルギーおよび持続可能性研究など重要分野のあらゆる問題を網羅する参考図書。
- ◇ 固体酸化物・解炭酸塩・リン酸・高分子電解質膜燃料電池をカバー。
- ◇ R&D、持続可能性、マーケティングなどについて論じています。
- ◇ エネルギー貯蔵、電気化学、エネルギー技術、触媒関係の研究者、技術者、院生レベルの学生に必備。

The expected end of the “oil age” will lead to increasing focus and reliance on alternative energy conversion devices, among which fuel cells have the potential to play an important role. Not only can phosphoric acid and solid oxide fuel cells already efficiently convert today’s fossil fuels, including methane, into electricity, but other types of fuel cells, such as polymer electrolyte membrane fuel cells, have the potential to become the cornerstones of a possible future hydrogen economy. This handbook offers concise yet comprehensive coverage of the current state of fuel cell research and identifies key areas for future investigation. Internationally renowned specialists provide authoritative introductions to a wide variety of fuel cell types and hydrogen production technologies, and discuss materials and components for these systems. Sustainability and marketing considerations are also covered, including comparisons of fuel cells with alternative technologies.

CONTENTS: Part 1: Fuel Cells.- Alkaline Membrane Fuel Cells.- Direct Hydrocarbon Solid Oxide Fuel Cells.- Fuel Cell Comparison to Alternate Technologies.- Fuel Cell Types and Their Electrochemistry.- Fuel Cells (SOFC): Alternative Approaches (Electrolytes, Electrodes, Fuels).- Fuel Cells, Introduction.- Membrane Electrolytes, from Perfluorosulfonic Acid (PFSA) to Hydrocarbon Ionomers.- Molten Carbonate Fuel Cells.- PEM Fuel Cell Materials: Costs, Performance and Durability.- PEM Fuel Cells and Platinum-Based Electrocatalysts.- PEM Fuel Cells, Materials and Design Development Challenges.- Phosphoric Acid Fuel Cells for Stationary Applications.- Polybenzimidazole Fuel Cell Technology.- Polymer Electrolyte (PE) Fuel Cell Systems.- Polymer Electrolyte Membrane (PEM) Fuel Cells, Automotive Applications.- Polymer Electrolyte Membrane Fuel Cells (PEM-FC) and Non-noble Metal Catalysts for Oxygen Reduction.- Proton Exchange Membrane Fuel Cells: High-Temperature, Low-Humidity Operation.- Solid Oxide Fuel Cell Materials: Durability, Reliability and Cost.- Solid Oxide Fuel Cells.- Solid Oxide Fuel Cells, Marketing Issues.- Solid Oxide Fuel Cells, Sustainability Aspects.- **Part 2: Hydrogen Production Science and Technology.**- Advances on Inorganic Membrane Reactors for Production of Hydrogen.- Biohydrogen Production.- Biohydrogen Production from Agricultural Residues.- Electrochemical Hydrogen Production.- Genetic Optimization of Microalgae for Hydrogen Production.- Hydrogen Production from Biological Sources.- Hydrogen Production from High-Temperature Fuel Cells.- Hydrogen Production Science and Technology.- Hydrogen Production through Pyrolysis.- Hydrogen via Direct Solar Production.- Hydrogen Production through Electrolysis.- Photo-catalytic Hydrogen Production.

(Springer) ISBN 9781493977888

2. Advanced Battery Materials

(Advanced Material Series)

by Ashutosh Tiwari

Nov 2018, 400 pages, Hardcover (Wiley)

ISBN 9781119407553 ¥40,820

This book covers the recent advances in battery materials and their novel applications at the cross-section of advanced materials both current and next-generation, that are shaping the future of energy storage.

Well-known researchers deliberate subjects including:

- Design and development of lithium ion batteries: Technology innovation and challenges for electric vehicles;
- Transition metal oxide based electrocatalyst for metal-air battery;
- Comprehensively account of lithium-sulfur batteries;
- Production of graphene and graphene composites from biomass starting material, formation mechanism and end application;
- Three-dimensionally porous Li-ion and Li-S secondary battery cathodes;
- Rational structure design and performance optimization of transition metal oxide-based lithium ion battery anodes;
- Carbon-based anode materials for sodium-ion batteries;
- Lithium titanate-based lithium-ion batteries;
- Doped graphene for electrochemical energy storage systems;
- Promising nanoscale materials as high-performance anodes in sodium-ion batteries;
- Copper-metal-sulfides for advanced batteries.

3. Advanced Electrocatalysts for Low-Temperature Fuel Cells

Edited by Francisco Javier Rodríguez-Varela & Teko Napporn

Nov 2018, 302 pages, Hardcover (Springer)

ISBN 9783319990187 ¥27,370

This book introduces the reader to the state of the art in nanostructured anode and cathode electrocatalysts for low-temperature acid and alkaline fuel cells. It explores the electrocatalysis of anode (oxidation of organic molecules) and cathode (oxygen reduction) reactions. It also offers insights into metal-carbon interactions, correlating them with the catalytic activity of the electrochemical reactions.

The book explores the electrocatalytic behaviour of materials based on noble metals and their alloys, as well as metal-metal oxides and metal-free nanostructures. It also discusses the surface and structural modification of carbon supports to enhance the catalytic activity of electrocatalysts for fuel-cell reactions.

4. Advanced Nanomaterials for Catalysis and Energy

Synthesis, Characterization and Applications

Edited by Vladislav A. Sadykov

(Series: Advanced Nanomaterials)

Sept 2018, 587 pages, Paperback (Elsevier)

ISBN 9780128148075 ¥39,910

Advanced Nanomaterials for Catalysis and Energy: Synthesis, Characterization and Applications outlines new approaches to the synthesis of nanomaterials (synthesis in flow conditions, laser electrodispersion of single metals or alloys on carbon or oxide supports, mechanochemistry, sol-gel routes, etc.) to provide systems with a narrow particle size distribution, controlled metal-support interaction and nanocomposites with uniform spatial distribution of domains of different phases,

even in dense sintered materials. Methods for characterization of real structure and surface properties of nanomaterials are discussed, including synchrotron radiation diffraction and X-ray photoelectron spectroscopy studies, neutronography, transmission/scanning electron microscopy with elemental analysis, and more.

The book covers the effect of nanosystems' composition, bulk and surface properties, metal-support interaction, particle size and morphology, deposition density, etc. on their functional properties (transport features, catalytic activity and reaction mechanism). Finally, it includes examples of various developed nanostructured solid electrolytes and mixed ionic-electronic conductors as materials in solid oxide fuel cells and asymmetric supported membranes for oxygen and hydrogen separation.

5. Anion Exchange Membrane Fuel Cells

Principles, Materials and Systems

(Lecture Notes in Energy, Vol 63)

Edited by Liang An & T.S. Zhao

May 2018, 346 pages, Hardcover (Springer)

ISBN 9783319713700 ¥31,580

This book provides a review of the latest advances in anion exchange membrane fuel cells. Starting with an introduction to the field, it then examines the chemistry and catalysis involved in this energy technology. It also includes an introduction to the mathematical modelling of these fuel cells before discussing the system design and performance of real-world systems.

Anion exchange membrane fuel cells are an emerging energy technology that has the potential to overcome many of the obstacles of proton exchange membrane fuel cells in terms of the cost, stability, and durability of materials. The book is an essential reference resource for professionals, researchers, and policymakers around the globe working in academia, industry, and government.

6. Artificial Intelligence in Renewable Energetic Systems

Smart Sustainable Energy Systems

(Lecture Notes in Networks and Systems, Vol 35)

Edited by Mustapha Hatti

Mar 2018, 531 pages, Paperback (Springer)

ISBN 9783319731919 ¥48,220

This book includes the latest research presented at the International Conference on Artificial Intelligence in Renewable Energetic Systems held in Tipaza, Algeria on October 22–24, 2017. The development of renewable energy at low cost must necessarily involve the intelligent optimization of energy flows and the intelligent balancing of production, consumption and energy storage. Intelligence is distributed at all levels and allows information to be processed to optimize energy flows according to constraints. This thematic is shaping the outlines of future economies of and offers the possibility of transforming society. Taking advantage of the growing power of the microprocessor makes the complexity of renewable energy systems accessible, especially since the algorithms of artificial intelligence make it possible to take relevant decisions or even reveal unsuspected trends in the management and optimization of renewable energy flows. The book enables those working on energy systems and those dealing with models of artificial intelligence to combine their knowledge and their intellectual potential for the benefit of the scientific community and humanity.

7. Basic Equations of Mass Transport through a Membrane Layer, 2nd Ed.

by Endre Nagy

Nov 2018, 510 pages, Paperback (Elsevier)

ISBN 9780128137222 ¥36,280

Basic Equations of Mass Transport through a Membrane Layer, Second Edition, offers the important knowledge essential for compound separation, product removing, concentration and production in the chemical, biochemical, pharmaceutical and food industries. The book outlines various membrane processes and their applications, offering a detailed mathematical description of mass transport and defining basic mass transport and concentration distribution expressions. In addition, the book discusses the process parameters and the application of the expressions developed for a variety of industrial applications.

Readers will find detailed explanations of convective-diffusive mass transport, both with and without polarization layers, that help predict and process performance and facilitate improvements to operation conditions and efficiency.

8. Chalcogenide Materials for Energy Conversion

Pathways to Oxygen and Hydrogen Reactions

(Series: Nanostructure Science and Technology)

by Nicolas Alonso-Vante

Apr 2018, 226 pages, Hardcover (Springer)

ISBN 9783319896106 ¥25,260

This book addresses electrocatalysis based on chalcogenides, particularly in the nanoscale domain. Special attention is paid to the hydrogen evolution reaction (HER) and the oxygen reduction reaction (ORR). The book provides an introduction to materials synthesis; the basic principles of electrocatalysis; related precious metal versus non-precious metal catalytic center chalcogenides as well as supports; and the role of such supports in stabilizing the catalytic centers. In short: pursuing a bottom-up approach, it covers the properties of this class of electrocatalysts and examines their applications in low-temperature fuel systems such as microfluidic fuel cells for portable devices. Accordingly, it is ideally suited for all professionals and researchers interested in electrochemistry, renewable energy and electrocatalysis, and non-precious metal centers for chemical energy conversion.

9. The Chemistry of Membranes Used in Fuel Cells

Degradation and Stabilization

Edited by Shulamith Schlick

Feb 2018, 304 pages, Hardcover (Wiley)

ISBN 9781119196051 ¥27,210

This book describes the mechanism of membrane degradation and stabilization, as well as the search for stable membranes that can be used in alkaline fuel cells. Arranged in ten chapters, the book presents detailed studies that can help readers understand the attack and degradation mechanisms of polymer membranes and mitigation strategies. Coverage starts from fundamentals and moves to different fuel cell membrane types and methods to profile and analyze them.

The Chemistry of Membranes Used in Fuel Cells: Degradation and Stabilization features chapters on: Fuel Cell Fundamentals: The Evolution of Fuel Cells and their Components; Degradation Mechanism of Perfluorinated Membranes; Ranking the Stability of Perfluorinated Membranes Used in Fuel Cells to Attack by Hydroxyl Radicals; Stabilization Mechanism of Perfluorinated Membranes by Ce(III) and Mn(II); Hydrocarbon Proton Exchange Membranes;

Stabilization of Perfluorinated Membranes Using Nanoparticle Additives; Degradation Mechanism in Aquivion Perfluorinated Membranes and Stabilization Strategies; Anion Exchange Membrane Fuel Cells: Synthesis and Stability; In-depth Profiling of Degradation Processes in Nafion Due to Pt Dissolution and Migration into the Membrane; and Quantum Mechanical Calculations of the Degradation Mechanism in Perfluorinated Membranes.

10. Current Trends and Future Developments on (Bio-) Membranes Renewable Energy Integrated with Membrane Operations

Edited by Angelo Basile, Alfredo Cassano & Alberto Figoli

Oct 2018, 438 pages, Paperback (Elsevier)

ISBN 9780128135457 ¥47,170

Current Trends and Future Developments in (Bio-) Membranes: Renewable Energy Integrated with Membrane Operations offers an overview of advanced technologies in the field of water desalination, wastewater treatment and hydrogen production that is coupled with renewable energy sources. Membrane processes are well-recognized technologies in the field of water and wastewater treatment. This book reviews their potential and lists new technologies which allow for the use of solar, hydroelectric, wind, hydrothermal and other forms of renewable energy with the same effect. In addition, it highlights what has already been achieved in the integration of membrane reactors and energy produced by biomass.

11. Direct Alcohol Fuel Cells for Portable Applications

Fundamentals, Engineering and Advances

by Alexandra M. F. R. Pinto, Vania Sofia Oliveira & Daniela Sofia Castro Falcao

Sept 2018, 353 pages, Paperback (Academic Pr.)

ISBN 9780128118498 ¥34,470

Direct Alcohol Fuel Cells for Portable Applications: Fundamentals, Engineering and Advances presents the fundamental concepts, technological advances and challenges in developing, modeling and deploying fuel cells and fuel cell systems for portable devices, including micro and mini fuel cells. The authors review the fundamental science of direct alcohol fuel cells, covering, in detail, thermodynamics, electrode kinetics and electrocatalysis of charge-transfer reactions, mass and heat transfer phenomena, and basic modeling aspects. In addition, the book examines other fuels in DAFCs, such as formic acid, ethylene glycol and glycerol, along with technological aspects and applications, including case studies and cost analysis.

Researchers, engineering professionals, fuel cell developers, policymakers and senior graduate students will find this a valuable resource. The book's comprehensive coverage of fundamentals is especially useful for graduate students, advanced undergraduate students and those new to the field.

12. Energy Optimization in Process Systems and Fuel Cells, 3rd Edition

By Stanislaw Sieniutycz & Jacek Jezowski

May 2018, 812 pages, Paperback (Elsevier) ISBN

9780081025574 ¥54,430

Energy Optimization in Process Systems and Fuel Cells, Third Edition covers the optimization and integration of energy systems, with a particular focus on fuel cell technology. With rising energy prices, imminent energy shortages, and the

increasing environmental impacts of energy production, energy optimization and systems integration is critically important. The book applies thermodynamics, kinetics and economics to study the effect of equipment size, environmental parameters, and economic factors on optimal power production and heat integration. Author Stanislaw Sieniutycz, highly recognized for his expertise and teaching, shows how costs can be substantially reduced, particularly in utilities common in the chemical industry.

This third edition contains substantial revisions and modifications, with new material on catalytic reactors, sorption systems, sorbent or catalyst regenerators, dryers, and more.

13. Flexible Energy Conversion and Storage Devices

Edited by Chunyi Zhi & Liming Dai

Oct 2018, 512 pages, Hardcover (Wiley-VCH)

ISBN 9783527342532 **¥39,000**

Provides in-depth knowledge of flexible energy conversion and storage devices-covering aspects from materials to technologies. Written by leading experts on various critical issues in this emerging field, this book reviews the recent progresses on flexible energy conversion and storage devices, such as batteries, supercapacitors, solar cells, and fuel cells. It introduces not only the basic principles and strategies to make a device flexible, but also the applicable materials and technologies, such as polymers, carbon materials, nanotechnologies and textile technologies. It also discusses the perspectives for different devices. Flexible Energy Conversion and Storage Devices contains chapters, which are all written by top researchers who have been actively working in the field to deliver recent advances in areas from materials syntheses, through fundamental principles, to device applications. It covers flexible all-solid state supercapacitors; fiber/yarn based flexible supercapacitors; flexible lithium and sodium ion batteries; flexible diversified and zinc ion batteries; flexible Mg, alkaline, silver-zinc, and lithium sulfur batteries; flexible fuel cells; flexible nanodielectric materials with high permittivity for power energy storage; flexible dye sensitized solar cells; flexible perovskite solar cells; flexible organic solar cells; flexible quantum dot-sensitized solar cells; flexible triboelectric nanogenerators; flexible thermoelectric devices; and flexible electrodes for water-splitting.

14. Fuel Cells and Hydrogen From Fundamentals to Applied Research

Edited by Viktor Hacker & Shigenori Mitsuhashi

Aug 2018, 296 pages, Paperback (Elsevier)

ISBN 9780128114599 **¥41,730**

Fuel Cells and Hydrogen: From Fundamentals to Applied Research provides an overview of the basic principles of fuel cell and hydrogen technology, which subsequently allows the reader to delve more deeply into applied research. In addition to covering the basic principles of fuel cells and hydrogen technologies, the book examines the principles and methods to develop and test fuel cells, the evaluation of the performance and lifetime of fuel cells and the concepts of hydrogen production.

Fuel Cells and Hydrogen: From Fundamentals to Applied Research acts as an invaluable reference book for fuel cell developers and students, researchers in industry entering the area of fuel cells and lecturers teaching fuel cells and hydrogen technology.

15. Fuel Cell Systems Explained, 3rd Edition

by Andrew L. Dicks & David A. J. Rand

Hardcover: 488 pages

July 2018, 488 pages, Hardcover (Wiley)

ISBN 9781118613528 **¥21,770**

Since publication of the first edition of Fuel Cell Systems Explained, three compelling drivers have supported the continuing development of fuel cell technology. These are: the need to maintain energy security in an energy-hungry world, the desire to move towards zero-emission vehicles and power plants, and the mitigation of climate change by lowering of CO₂ emissions.

New fuel cell materials, enhanced stack performance and increased lifetimes are leading to the emergence of the first truly commercial systems in applications that range from fork-lift trucks to power sources for mobile phone towers. Leading vehicle manufacturers have embraced the use of electric drive-trains and now see hydrogen fuel cells complementing advanced battery technology in zero-emission vehicles. After many decades of laboratory development, a global but fragile fuel cell industry is bringing the first commercial products to market.

This thoroughly revised edition includes several new sections devoted to, for example, fuel cell characterisation, improved materials for low-temperature hydrogen and liquid-fuelled systems, and real-world technology implementation.

Assuming no prior knowledge of fuel cell technology, the third edition comprehensively brings together all of the key topics encompassed in this diverse field. Practitioners, researchers and students in electrical, power, chemical and automotive engineering will continue to benefit from this essential guide to the principles, design and implementation of fuel cell systems.

16. Fuel Cells, Solar Panels, and Storage Devices

Materials and Methods

by Johannes Karl Fink

Jan 2018, 312 pages, Hardcover (Wiley)

ISBN 9781119480105 **¥35,380**

This book focuses on the materials used for fuel cells, solar panels, and storage devices, such as rechargeable batteries.

Fuel cell devices, such as direct methanol fuel cells, direct ethanol fuel cells, direct urea fuel cells, as well as biological fuel cells and the electrolytes, membranes, and catalysts used there are detailed. Separate chapters are devoted to polymer electrode materials and membranes.

With regard to solar cells, the types of solar cells are detailed, such as inorganic-organic hybrid solar cells, solar powered biological fuel cells, heterojunction cells, multi-junction cells, and others. Also, the fabrication methods are described. Further, the electrolytes, membranes, and catalysts used there are detailed. The section that is dealing with rechargeable batteries explains the types of rechargeable devices, such as aluminum-based batteries, zinc batteries, magnesium batteries, and lithium batteries. Materials that are used for cathodes, anodes and electrolytes are detailed.

The text focuses on the basic issues and also the literature of the past decade. Beyond education, this book may serve the needs of polymer specialists as well as other specialists, e.g., materials scientists, electrochemical engineers, etc., who have only a passing knowledge of these issues, but need to know more.

17. Hybridization, Diagnostic and Prognostic of PEM Fuel Cells Durability and Reliability

by Samir Jemei

Nov 2018, 236 pages, Hardcover (Wiley)

ISBN 9781786301673 **¥24,490**

Energy transition and global warming are now terms that are

part of our everyday vocabulary. No more energy scientists ignore the objectives of the Horizon 2020 program. Long-term solutions must be proposed in the short and medium term. Thus, we propose in this book to demonstrate that there is a way for hydrogen in the energy mix of the future and more particularly around fuel cells.

Nevertheless, large-scale deployment of the fuel cell will only take place if it is robust enough to ensure continuity of service to the customer. Indeed, the lifetime of the PACs is a central point to be studied upstream, coupled with the development of reliable indicators of their failures. In this context, research on the subject of hybridization, diagnosis and prognosis has been carried out for many years.

The improvement in the lifespan of the PACs is currently a sensitive point, as we only reach about 3 000 hours of operation (with a PEMFC under transport-type transport constraints) whereas it would have to be closer to 5 000 h for a transport application. A PEMFC does not tolerate very fast load variations as the electric motor of a vehicle might require as they lead to premature aging. A first solution to overcome this problem resides in the hybridization of the PAC generator with other sources of energy.

A second solution will ensure the maintenance of the good performances of the PAC throughout its lifetime and the detection of any failing components and the development of diagnostic methods / tools. Indeed, the diagnosis can take place at different levels: Identify, once produced, the origin of a failure to inform the user of its nature and / or detect in real time a drift of normal operating conditions in order to inform the control system to correct drift by acting on its causes in order to predict its duration and its impact on the performance and life of the PAC and / or the system.

Finally, a third solution to drastically increase the lifetime of PACs is the prognosis of PACs. This new scientific and technological axis has emerged in recent years to estimate the duration of operation before a system fails and the risk of the existence or subsequent appearance of one or several modes of failures. Different methods based on data, models or hybridization of the two allow to develop such solutions which display very convincing results for the future of fuel cells in the landscape of the future energy mix.

We propose here to develop these three scientific axes on the basis of recent research coming mainly from the FCLAB federation of research but also from international laboratories.

18. Hydrogen-Air PEM Fuel Cell Integration, Modeling and Control

by Shiwen Tong, Dianwei Qian & Chunlei Huo
Dec 2018, 250 pages, Hardcover (De Gruyter)
ISBN 9783110601138 **¥22,670**

The book presents the modeling and control of hydrogen-air PEM fuel cells, including simultaneous estimation of the parameters and states, fuzzy cluster modeling, SPM-based predictive control and advanced fuzzy control. MATLAB/Simulink-based modeling and control programs are discussed in detail. With simulations and experiments, it is an essential reference for both scientists and industrial engineers.

19. Hydrogen Energy Challenges and Solutions for a Cleaner Future

by Bahman Zohuri
Aug 2018, 283 pages, Hardcover (Springer)
ISBN 9783319934600 **¥25,260**

This book describes the challenges and solutions the energy sector faces by shifting towards a hydrogen based fuel economy. The most current and up-to-date efforts of countries and leaders in the automotive sector are reviewed as they strive to develop technology and find solutions to production, storage, and distribution challenges. Hydrogen fuel is a zero-emission fuel when burned with oxygen and is often used

with electrochemical cells, or combustion in internal engines, to power vehicles and electric devices. This book offers unique solutions to integrating renewable sources of energy like wind or solar power into the production of hydrogen fuel, making it a cost effective, efficient and truly renewable alternative fuel.

20. Hydrogen Storage Technologies

(Series: Advances in Hydrogen Production and Storage)

Edited by Mehmet Sankir & Nurdan Demirci Sankir
July 2018, 344 pages, Hardcover (Wiley)
ISBN 9781119459880 **¥40,820**

Hydrogen storage is considered a key technology for stationary and portable power generation especially for transportation. This volume covers the novel technologies to efficiently store and distribute hydrogen and discusses the underlying basics as well as the advanced details in hydrogen storage technologies.

The book has two major parts: Chemical and electrochemical hydrogen storage and Carbon-based materials for hydrogen storage. The following subjects are detailed in Part I:

Multi stage compression system based on metal hydrides
Metal-N-H systems and their physico-chemical properties
Mg-based nano materials with enhanced sorption kinetics
Gaseous and electrochemical hydrogen storage in the Ti-Z-Ni
Electrochemical methods for hydrogenation/dehydrogenation of metal hydrides

In Part II the following subjects are addressed:

Activated carbon for hydrogen storage obtained from agro-industrial waste

Hydrogen storage using carbonaceous materials

Hydrogen storage performance of composite material consisting of single walled carbon nanotubes and metal oxide nanoparticles

Hydrogen storage characteristics of graphene addition of hydrogen storage materials

Discussion of the crucial features of hydrogen adsorption of nanotextured carbon-based materials

21. Introduction to Transfer Phenomena in PEM Fuel Cells

by Bilal Abderezzak
Oct 2018, 220 pages, Hardcover (Wiley)
ISBN 9781785482915 **¥23,580**

Introduction to Transfer Phenomena in PEM Fuel Cells presents the fruit of several years of research in the area of fuel cells. The book illustrates the transfer phenomena occurring inside a single cell and describes the technology field of hydrogen, explicitly the production, storage and risk management of hydrogen as an energy carrier. Several applications of hydrogen are also cited, and special interest is dedicated to the PEM Fuel Cell. Mass, charge and heat transfer phenomena are also discussed in this great resource that includes explanations, illustrations and governing equations for each section.

22. Metal Oxides in Energy Technologies

(Series: Metal Oxides)

Edited by Yuping Wu
Oct 2018, 452 pages, Paperback (Elsevier)
ISBN 9780128111673 **¥36,280**

Metal Oxides in Energy Technologies provides, for the first time, a look at the wide range of energy applications of metal oxides. Topics covered include metal oxides materials and their applications in batteries, supercapacitors, fuel cells, solar cells, supercapacitors, and much more. The book is written by an experienced author of over 240 papers in peer-reviewed

journals who was also been recognized as one of Thomson Reuter's "World's Most Influential Scientific Minds" in 2015. This book presents a unique work that is ideal for academic researchers and engineers.

23. Microbial Fuel Cell Technology for Bioelectricity

Edited by Venkataraman Sivasankar, Prabhakaran Mylsamy & Kiyoshi Omine

Aug 2018, 311 pages, Hardcover (Springer)

ISBN 9783319929033 **¥31,580**

In view of the increased consumption of energy due to the proliferation of electronic devices, this book addresses the trends, similarities, differences and advances in fuel cells of both chemical and biological composition. Fundamentals of microbial fuel cells are described, accompanied by details surrounding their uses and limitations. Chapters on electricigens, microbial group investigations and performance, Rumen Fluid microbes and state-of-the-art advances in microbial fuel cell technology are discussed. The book elaborates upon analytical techniques used for biofilm characterization. It also includes chapters on MFC models that include plant-based MFCs, Algal/Fungi MFCs, MDCs and MFCs using animal waste. A critical review on the performance of MFC technology in field trials is offered in an exclusively dedicated section. By addressing one of the most promising sources for clean and renewable energy, this book fills a pressing need to understand a possible solution for meeting the energy demands in our highly advanced technical world.

24. Modeling, Design, Construction, and Operation of Power Generators with Solid Oxide Fuel Cells

From Single Cell to Complete Power System

(Series: Green Energy and Technology)

Edited by Jakub Kupecki

Apr 2018, 261 pages, Hardcover (Springer)

ISBN 9783319756011 **¥25,260**

The book summarizes the current state of the solid oxide fuel cell (SOFC) technology in power generation applications. It describes the single cells, SOFC stacks, micro-combined heat and power systems, large-scale stationary power generators and polygeneration units. The principles of modeling, simulation and controls of power systems with solid oxide fuel cells are presented and discussed. Authors provide theoretical background of the technology followed by the essential insights into the integrated power systems. Selected aspects of the design, construction and operation of power units in range from single kilowatts to hundreds of kilowatts are presented. Finally, the book reports the selected studies on prototype systems which have been constructed in Europe.

The book discusses the theoretical and practical aspects of operation of power generators with solid oxide fuel cells including fabrication of cells, design of stacks, system modeling, simulation of stationary and non-stationary operation of systems, fuel preparation and controls.

25. Nanocarbons for Energy Conversion

Supramolecular Approaches

(Series: Nanostructure Science and Technology)

Edited by Naotoshi Nakashima

Aug 2018, 564 pages, Hardcover (Springer)

ISBN 9783319929156 **¥31,580**

This book focuses on nanocarbons (carbon nanotubes, graphene, nanoporous carbon, and carbon black) and related materials for energy conversion, including fuel cells (predominately proton exchange membrane fuel cells [PEMFC]), Li-ion batteries, and supercapacitors. Written by a group of internationally recognized researchers, it offers an in-depth review of the structure, properties, and functions of nanocarbons, and summarizes recent advances in the design, fabrication and characterization of nanocarbon-based catalysts for energy applications. As such, it is an invaluable resource for graduate students, academics and industrial scientists interested in the areas of nanocarbons, energy materials for fuel cells, batteries and supercapacitors as well as materials design, and supramolecular science.

26. Nanomaterials for Green Energy

(Series: Micro and Nano Technologies)

by Bharat A Bhanvase, Vijay B Pawade, & Sanjay J. Dhoble

May 2018, 500 pages, Paperback (Elsevier)

ISBN 9780128137314 **¥32,650**

Nanomaterials for Green Energy focuses on the synthesis, characterization and application of novel nanomaterials in the fields of green science and technology. This book contains fundamental information about the properties of novel nanomaterials and their application in green energy. In particular, synthesis and characterization of novel nanomaterials, their application in solar and fuel cells and batteries, and nanomaterials for a low-toxicity environment are discussed. It will provide an important reference resource for researchers in materials science and renewable energy who wish to learn more about how nanomaterials are used to create cheaper, more efficient green energy products.

27. Nanostructured Materials for Next-Generation Energy Storage and Conversion: Fuel Cells

Edited by Fan Li, Sajid Bashir & Jingbo Louise Liu

Apr 2018, 556 pages, Hardcover (Springer)

ISBN 9783662563632 **¥55,590**

The energy crisis and pollution have posed significant risks to the environment, transportation, and economy over the last century. Thus, green energy becomes one of the critical global technologies and the use of nanomaterials in these technologies is an important and active research area. This book series presents the progress and opportunities in green energy sustainability. Developments in nanoscaled electrocatalysts, solid oxide and proton exchange membrane fuel cells, lithium ion batteries, and photovoltaic techniques comprise the area of energy storage and conversion. Developments in carbon dioxide (CO₂) capture and hydrogen (H₂) storage using tunable structured materials are discussed. Design and characterization of new nanoscaled materials with controllable particle size, structure, shape, porosity and band gap to enhance next generation energy systems are also included. The technical topics covered in this series are metal organic frameworks, nanoparticles, nanocomposites, proton exchange membrane fuel cell catalysts, solid oxide fuel cell electrode design, trapping of carbon dioxide, and hydrogen gas storage.

28. Palladium Membrane Technology for Hydrogen Production, Carbon Capture and Other Applications

Principles, Energy Production and Other Applications

(Woodhead Publishing Series in Energy)
Edited by A Doukelis, K Panopoulos, A Koumanakos
& E Kakaras

Nov 2018, 402 pages, Paperback (Woodhead)
ISBN 9780081015223 ¥50,800

Thanks to their outstanding hydrogen selectivity, palladium membranes have attracted extensive R&D interest. They are a potential breakthrough technology for hydrogen production and also have promising applications in the areas of thermochemical biorefining. This book summarises key research in palladium membrane technologies, with particular focus on the scale-up challenges. After an introductory chapter, Part one reviews the fabrication of palladium membranes. Part two then focuses on palladium membrane module and reactor design. The final part of the book reviews the operation of palladium membranes for synthesis gas/hydrogen production, carbon capture and other applications.

29. Portable Hydrogen Energy Systems Fuel Cells and Storage Fundamentals and Applications

Edited by Paloma Ferreira-Aparicio & Antonio M.
Chaparro

Aug 2018, 237 pages, Paperback (Academic Pr.)
ISBN 9780128131282 ¥30,840

Portable Hydrogen Energy Systems: Fuel Cells and Storage Fundamentals and Applications covers the basics of portable fuel cells, their types, possibilities for fuel storage, in particular for hydrogen as fuel, and their potential application. The book explores electrochemistry, types, and materials and components, but also includes a chapter on the particularities of their use in portable devices, with a focus on proton exchange membrane (PEM) type. Topics cover fuel storage for these cells, in particular hydrogen storage and an analysis of current possibilities. In addition, portable fuel cell systems are examined, covering auxiliary elements required for operation and possibilities for their miniaturization.

Engineers and developers of portable applications and electricity will find this book to provide fundamental information on the possibilities of portable hydrogen fuel cells, including costs and market information, for their planning, modeling, development and deployment. Graduate students and lecturers will find this to be a complementary resource in general hydrogen and fuel cell courses or in specialized courses covering portable systems.

30. Progress and Recent Trends in Microbial Fuel Cells

by Patit Paban Kundu & Kingshuk Dutta

June 2018, 464 pages, Paperback (Elsevier)

ISBN 9780444640178 ¥36,280

Progress and Recent Trends in Microbial Fuel Cells provides an in-depth analysis of the fundamentals, working principles, applications and advancements (including commercialization aspects) made in the field of Microbial Fuel Cells research, with critical analyses and opinions from experts around the world. Microbial Fuel cell, as a potential alternative energy harnessing device, has been progressing steadily towards fruitful commercialization. Involvements of electrolyte membranes and catalysts have been two of the most critical factors toward achieving this progress. Added applications of MFCs in areas of bio-hydrogen production and wastewater treatment have made this technology extremely attractive and important.

31. Science and Engineering of Hydrogen-Based Energy Technologies

Hydrogen Production and Practical
Applications in Energy Generation

Edited by Paulo Emilio Miranda

Oct 2018, 326 pages, Paperback (Academic Pr.)

ISBN 9780128142516 ¥25,400

Science and Engineering of Hydrogen-Based Energy Technologies explores the generation of energy using hydrogen and hydrogen-rich fuels in fuel cells from the perspective of its integration into renewable energy systems using the most sound and current scientific knowledge.

The book first examines the evolution of energy utilization and the role expected to be played by hydrogen energy technologies in the world's energy mix, not just for energy generation, but also for carbon capture, storage and utilization. It provides a general overview of the most common and promising types of fuel cells, such as PEMFCs, SOFCs and direct alcohol fuel cells. The co-production of chemical and electrolysis cells, as well as the available and future materials for fuel cells production are discussed. It then delves into the production of hydrogen from biomass, including waste materials, and from excess electricity produced by other renewable energy sources, such as solar, wind, hydro and geothermal. The main technological approaches to hydrogen storage are presented, along with several possible hydrogen energy engineering applications.

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