A Guide to Canada's Export Controls

This book is a printed edition of the Special Issue "Advances in Polyhydroxyalkanoate (PHA) Production" that was published in Bioengineering

Shock Waves @ Marseille II

The series Topics in Current Chemistry presents critical reviews of the present and future trends in modern chemical research. The scope of coverage is all areas of chemical science including the interfaces with related disciplines such as biology, medicine and materials science. The goal of each thematic volume is to give the non-specialist reader, whether in academia or industry, a comprehensive insight into an area where new research is emerging which is of interest to a larger scientific audience. Each review within the volume critically surveys one aspect of that topic and
places it within the context of the volume as a whole. The most significant developments of the last 5 to 10 years are presented using selected examples to illustrate the principles discussed. The coverage is not intended to be an exhaustive summary of the field or include large quantities of data, but should rather be conceptual, concentrating on the methodological thinking that will allow the non-specialist reader to understand the information presented. Contributions also offer an outlook on potential future developments in the field.

**Ceramic Conductors**

PEM Water Electrolysis, a volume in the Hydrogen Energy and Fuel Cell Primers series presents the most recent advances in the field. It brings together information that has thus far been scattered in many different sources under one single title, making it a useful reference for industry professionals, researchers and graduate students. Volumes One and Two allow readers to identify technology gaps for commercially viable PEM electrolysis systems for energy applications and examine the fundamentals of PEM electrolysis and selected research topics that are top of mind for the academic and industry community, such as gas cross-over and AST protocols. The book lays the foundation for the exploration of the current industrial trends for PEM electrolysis, such as power to gas application and a strong focus on the current trends in the application of PEM electrolysis associated with energy storage. Presents the fundamentals and most current knowledge in proton exchange membrane water electrolyzers Explores the technology gaps and challenges for commercial deployment of PEM water electrolysis technologies Includes unconventional systems, such as ozone generators Brings together information from many different sources under one single title, making it a useful reference for industry professionals, researchers and graduate students alike

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

**Fuel Cell Handbook**

This book covers major technological advancements in, and evolving applications of, thermal and photovoltaic solar energy systems. Advances in technologies for harnessing solar energy are extensively discussed, with topics including the fabrication, compaction and optimization of energy grids, solar cells and panels. Leading international experts discuss the applications, challenges and future prospects of research in this increasingly vital field, providing a valuable resource for all researchers working in this field.
This work provides a collection of current research papers including valuable insights on materials-related aspects of solid-oxide fuel cells current status, processing and fabrication, various electrolytes, anodes, and cathodes, ceramic/metal interconnects, seal materials, mechanical properties, characterization, modeling, fuel reforming, component materials, materials processing, performance, stability, and more.

**Advanced Electro catalysts for Low-Temperature Fuel Cells**

In this book well-known experts highlight cutting-edge research priorities and discuss the state of the art in the field of solid oxide fuel cells giving an update on specific subjects such as protonic conductors, interconnects, electrocatalytic and catalytic processes and modelling approaches. Fundamentals and advances in this field are illustrated to help young researchers address issues in the characterization of materials and in the analysis of processes, not often tackled in scholarly books.

**Encouraging Pro-Environmental Behaviour**

High temperature solid oxide fuel cell (SOFC) technology is a promising power generation option that features high electrical efficiency and low emissions of environmentally polluting gases such as CO₂, NOx and SOx. It is ideal for distributed stationary power generation applications where both high-efficiency electricity and high-quality heat are in strong demand. For the past few decades, SOFC technology has attracted intense worldwide R&D effort and, along with polymer electrolyte membrane fuel cell (PEM FC) technology, has undergone extensive commercialization development. This book presents a systematic and in-depth narrative of the technology from the perspective of fundamentals, providing comprehensive theoretical analysis and innovative characterization techniques for SOFC technology. The book initially deals with the basics and development of SOFC technology from cell materials to fundamental thermodynamics, electronic properties of solids and charged particle transport. This coverage is extended with a thorough analysis of such operational features as current flow and energy balance, and on to voltage losses and electrical efficiency. Furthermore, the book also covers the important issues of fuel cell
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stability and durability with chapters on performance characterization, fuel processing, and electrode poisoning. Finally, the book provides a comprehensive review for SOFC materials and fabrication techniques. A series of useful scientific appendices rounds off the book. Solid oxide fuel cell technology is a standard reference for all those researching this important field as well as those working in the power industry. Provides a comprehensive review of solid oxide fuel cells from history and design to chemistry and materials development. Presents analysis of operational features including current flow, energy balance, voltage losses and electrical efficiency. Explores fuel cell stability and durability with specific chapters examining performance characterization, fuel processing and electrode poisoning.

Selective Catalysis for Renewable Feedstocks and Chemicals

The storage of electroenergy is an essential feature of modern energy technologies. Unfortunately, no economical and technically feasible method for the solution of this severe problem is presently available. But electrochemistry is a favourite candidate from an engineering point of view. It promises the highest energy densities of all possible alternatives. If this is true, there will be a proportionality between the amount of electricity to be stored and the possible voltage, together with the mass of materials which make this storage possible. Insofar it is a matter of material science to develop adequate systems. Electricity is by far the most important secondary energy source. The present production rate, mainly in the thermal electric power stations, is in the order of 1.3 TW. Rechargeable batteries (RB) are of widespread use in practice for electroenergy storage and supply. The total capacity of primary and rechargeable batteries being exploited is the same as that of the world electric power stations. However, the important goal in the light of modern energy technology, namely the economical storage of large amounts of electricity for electric vehicles, electric route transport, load levelling, solar energy utilization, civil video & audio devices, earth and spatial communications, etc. will not be met by the presently available systems. Unless some of the new emerging electrochemical systems are established up to date, RB’s based on aqueous acidic or alkali accumulators are mainly produced today.

Zeolites for Cleaner Technologies

The WHO Guidelines on Hand Hygiene in Health Care provide healthcare workers (HCWs), hospital administrators and health authorities with a thorough review of evidence on hand hygiene in health care and specific recommendations to improve practices and reduce transmission of pathogenic microorganisms to patients and HCWs. The present Guidelines are intended to be implemented in any situation.
in which health care is delivered either to a patient or to a specific group in a population. Therefore, this concept applies to all settings where health care is permanently or occasionally performed, such as home care by birth attendants. Definitions of health-care settings are proposed in Appendix 1. These Guidelines and the associated WHO Multimodal Hand Hygiene Improvement Strategy and an Implementation Toolkit (http://www.who.int/gpsc/en/) are designed to offer health-care facilities in Member States a conceptual framework and practical tools for the application of recommendations in practice at the bedside. While ensuring consistency with the Guidelines recommendations, individual adaptation according to local regulations, settings, needs, and resources is desirable. This extensive review includes in one document sufficient technical information to support training materials and help plan implementation strategies. The document comprises six parts.

Characterization and Properties of Petroleum Fractions

Encouraging Pro-Environmental Behavior: What Works, What Doesn’t, and Why examines the main drivers of human behavior related to environmental sustainability and how we can encourage environmental behavior change in humans. The book explores the underlying barriers and enablers of environmental behavior and outlines key theoretical advances from psychology to improve understanding. It then uses theory-based research in the development of behavior change interventions to critically evaluate empirical evidence on the effectiveness of those interventions. This book will help inform and improve the success of behavior change initiatives to mitigate climate change. Explores what influences behavior: who conserves and why includes both theory and practice Focuses on water and energy use, food choice and travel behavior Identifies impacts of incentives and interventions

Ammonia Synthesis Catalysts

This book provides a review of worldwide developments in ammonia synthesis catalysts over the last 30 years. It focuses on the new generation of Fe1-xO based catalysts and ruthenium catalysts — both are major breakthroughs for fused iron catalysts. The basic theory for ammonia synthesis is systematically explained, covering topics such as the chemical components, crystal structure, preparation, reduction, performance evaluation, characterization of the catalysts, the mechanism and kinetics of ammonia synthesis reaction. Both theory and practice are combined in this presentation, with emphasis on the research methods, application and exploitation of catalysts. The comprehensive volume includes an assessment of the economic and engineering aspects of ammonia plants based on the performance of catalysts. Recent developments in photo-catalysis, electro-catalysis, biocatalysis and new uses of ammonia are also
introduced in this book. The author, Professor Huazhang Liu, has been engaged in research and practice for more than 50 years in this field and was the inventor of the first Fe1-xO based catalysts in the world. He has done a lot of research on Fe3O4 based- and ruthenium based-catalysts, and has published more than 300 papers and obtained 21 patents during his career. Contents: Historical Evolution of Catalysts for Ammonia Synthesis Catalytic Reaction Mechanisms of Ammonia Synthesis Chemical Composition and Structure of Fused Iron Catalysts Preparation of Fused Iron Catalysts Reduction of Fused Iron Catalysts Ruthenium Based Ammonia Synthesis Catalysts Performance Evaluation and Characterization of Catalysts Performance and Application of Catalysts Effect of Catalyst Performance on the Economic Benefits of Catalytic Process Innovation and Speculation Readership: Researchers in academia and industry working on catalysts for ammonia synthesis. Keywords: Ammonia Synthesis; Catalysts; Catalytic; Iron Catalyst; Fused Iron Catalyst; Ruthenium Catalyst Key Features: Provides a review of worldwide developments in ammonia synthesis catalysts over the last 30 years. Focuses on the new generation of Fe1-xO based catalysts and ruthenium catalysts. Combines theory and practice, with emphasis on research methods and industrial exploitation.

**Lithium Batteries**

Workshop Processes, Practices and Materials is an ideal introduction to workshop processes, practices and materials for entry-level engineers and workshop technicians. With detailed illustrations throughout and simple, clear language, this is a practical introduction to what can be a very complex subject. It has been significantly updated and revised to include new material on adhesives, protective coatings, plastics and current Health and Safety legislation. It covers all the standard topics, including safe practices, measuring equipment, hand and machine tools, materials and joining methods, making it an indispensable handbook for use both in class and the workshop. Its broad coverage makes it a useful reference book for many different courses worldwide.

**Methods for Electrocatalysis**

Celebrating the founding of the Flavor Subdivision of the Agriculture and Food Chemistry Division of the American Chemical Society, this book provides an overview of progress made during the past 30-40 years in various aspects of flavor chemistry as seen by internationally renowned scientists in the forefront of their respective fields. In addition, it presents up-to-date findings in the areas of flavor chemistry, analytical methods, thermally produced flavors and precursors, enzymatically produced flavors and precursors, and sensory methods and results.

**WHO Guidelines on Hand Hygiene in Health Care**
This book has been a long time in the making. Since its beginning the concept has been refined many times. This is a first attempt at a technical book for me and fortunately the goals I have set have been achieved. I have been involved in water based ink evaluation since its unclear beginnings in the early 1970s. This book is fashioned much like a loose-leaf binder I had put together for early reference and guidance. The format has worked for me over the years; I trust it will work for you. I would like to thank the many people who made this book possible, particularly Blackie Academic & Professional for their saint-like patience. Thanks again to W.B. Thiele (Thiele-Engdahl), to Lucille, my wife, and to James and Frank, my two boys. A final and special thank you to Richard Bach who taught me there are no limits.

LASL Explosive Property Data

This book is a special collection of articles dedicated to the preparation and characterization of nanoporous materials, such as zeolitic-type materials, mesoporous silica (SBA-15, MCM-41, and KIT-6), mesoporous metallic oxides, metal–organic framework structures (MOFs), and pillared clays, and their applications in adsorption, catalysis, and separation processes. This book presents a global vision of researchers from international universities, research centers, and industries working with nanoporous materials and shares the latest results on the synthesis and characterization of such materials, which have given rise to the special interest in their applications in basic and industrial processes.

Advances in Polyhydroxyalkanoate (PHA) Production

The Essential Reference for the Field, Featuring Protocols, Analysis, Fundamentals, and the Latest Advances Impedance Spectroscopy: Theory, Experiment, and Applications provides a comprehensive reference for graduate students, researchers, and engineers working in electrochemistry, physical chemistry, and physics. Covering both fundamentals concepts and practical applications, this unique reference provides a level of understanding that allows immediate use of impedance spectroscopy methods. Step-by-step experiment protocols with analysis guidance lend immediate relevance to general principles, while extensive figures and equations aid in the understanding of complex concepts. Detailed discussion includes the best measurement methods and identifying sources of error, and theoretical considerations for modeling, equivalent circuits, and equations in the complex domain are provided for most subjects under investigation. Written by a team of expert contributors, this book provides a clear understanding of impedance spectroscopy in general as well as the essential skills needed to use it in specific applications. Extensively updated to reflect the field’s latest advances, this new Third Edition: Incorporates the latest research, and provides
coverage of new areas in which impedance spectroscopy is gaining
importance Discusses the application of impedance spectroscopy to
viscoelastic rubbery materials and biological systems Explores
impedance spectroscopy applications in electrochemistry,
semiconductors, solid electrolytes, corrosion, solid state devices,
and electrochemical power sources Examines both the theoretical and
practical aspects, and discusses when impedance spectroscopy is and
is not the appropriate solution to an analysis problem Researchers
and engineers will find value in the immediate practicality, while
students will appreciate the hands-on approach to impedance
spectroscopy methods. Retaining the reputation it has gained over
years as a primary reference, Impedance Spectroscopy: Theory,
Experiment, and Applications once again present a comprehensive
reference reflecting the current state of the field.

Workshop Processes, Practices and Materials

Chemical Process Design

Nanotechnology for the Energy Challenge

'C ideal for getting an overview of applied organic chemistry' This
bestselling standard, now in its 3rd completely revised English
dition, is an excellent source of technological and economic
formation on the most important precursors and intermediates used
in the chemical industry. Right and left columns containing synopsis
of the main text and statistical data, and numerous fold-out flow
diagrams ensure optimal didactic presentation of complex chemical
processes. The translation into eight languages, the four German and
three English editions clearly evidence the popularity of this book.
'it is where I look first to get a quick overview of the
manufacturing process of a product Weissermel/A rpe has been serving
me for years as an indispensable reference work.' (Berichte der
Bunsengesellschaft für Physikalische Chemie) 'Whether student or
scientist, theorist or practician - everybody interested in
industrial organic chemistry will appreciate this work.' (farbe +
lack) 'it should be ready to hand to every chemist or process
engineer involved directly or indirectly with industrial organic
chemistry. It should be in the hand of every higher-graduate
student, especially if chemical technology is not part of the study,
like in many college universities' (Tenside-Surfactants-Detergents)

Catalysis for Renewables

This book, written and edited by leading authorities from academia
and industrial groups, covers both preventive- and curative-zeolite-
based technologies in the field of chemical processing. The opening
chapter presents the state of the art in zeolite science. The two
subsequent chapters summarize the chemistries involved in the processes and the constraints imposed on the catalyst/adsorbent. Three major areas are covered: oil refining, petrochemicals and fine chemicals. A chapter on the (curative) use of zeolites in pollution abatement completes this overview. In the area of oil refining, a general lecture sets the scene for present and future challenges. It is followed by in-depth case studies involving FCC, hydrocracking and light naphtha isomerization. Also, an entire chapter is devoted to the often-overlooked subject of base oils. In the area of petrochemicals, the processing of aromatics and olefins is described and special attention is paid to the synergy between catalysis and separation on molecular sieves.

Contents:
- Introduction to Zeolite Science and Technology (M Guisnet & J-P Gilson)
- The Chemistry of Catalytic Processes (A Corma & A Martínez)
- Preparation of Zeolite Catalysts (T G Roberie et al.)
- Refining Processes: Setting the Scene (R H Jensen)
- Advances in Fluid Catalytic Cracking (E T Habib et al.)
- Hydrocracking (J A R Van Veen)
- C4-C6 Alkane Isomerisation (F Schmidt & E Köhler)
- Base Oil Production and Processing (M Daage)
- Para-Xylene Manufacturing
- Catalytic Reactions and Processes (F Alario & M Guisnet)
- Separation of Paraxylene by Adsorption (A Méthivier)
- Alkylolation: Towards Cleaner Processes (J S Beck et al.)
- Methanol to Olefins (MTO) and Beyond (P Barger)
- Zeolite Effects on Catalytic Transformations of Fine Chemicals (D E De Vos & P A Jacobs)
- Functionalization of Aromatics over Zeolite Catalysts (P Marion et al.)
- Zeolites and ‘Non-Zeolite’ Molecular Sieves in the Synthesis of Fragrances and Flavors (W F Hoelderich & M C Laufer)
- Pollution Abatement Using Zeolites: State of the Art and Further Needs (G Delahay & B Coq)

Readership: Undergraduates, graduate students, academics and researchers in catalyst chemistry. Reviews: "Chapter authors have provided a teaching text that gives excellent introductory chapters to zeolites, and to the nature and significance of the processes that they can catalyse ... This excellent book should be required reading for all scientists who have an interest in improving the environment." Chemistry & Industry

Handbook of Petrochemicals and Processes

There has been much polemic about affluence, consumption, and the global environment. For some observers, "consumption" is at the root of global environmental threats: wealthy individuals and societies use far too much of the earth's resource base and should scale back their appetites to preserve the environment for future generations and allow a decent life for the rest of the world. Other observers see affluence as the way to escape environmental threats: economic development increases public pressure for environmental protection and makes capital available for environmentally benign technologies. The arguments are fed by conflicting beliefs, values, hopes, and fears—but surprisingly little scientific analysis. This book demonstrates that the relationship of consumption to the environment needs careful analysis by environmental and social scientists and
conveys some of the excitement of treating the issue scientifically. It poses the key empirical questions: Which kinds of consumption are environmentally significant? Which actors are responsible for that consumption? What forces cause or explain environmentally significant consumption? How can it be changed? The book presents studies that open up important issues for empirical study: Are there any signs of saturation in the demand for travel in wealthy countries? What is the relationship between environmental consumption and human well-being? To what extent do people in developing countries emulate American consumption styles? The book also suggests broad strategies that scientists and research sponsors can use to better inform future debates about the environment, development, and consumption.

**Production of Platform Chemicals from Sustainable Resources**

Solving problems in chemical reaction engineering and kinetics is now easier than ever! As students read through this text, they’ll find a comprehensive, introductory treatment of reactors for single-phase and multiphase systems that exposes them to a broad range of reactors and key design features. They’ll gain valuable insight on reaction kinetics in relation to chemical reactor design. They will also utilize a special software package that helps them quickly solve systems of algebraic and differential equations, and perform parameter estimation, which gives them more time for analysis. Key Features Thorough coverage is provided on the relevant principles of kinetics in order to develop better designs of chemical reactors. E-Z Solve software, on CD-ROM, is included with the text. By utilizing this software, students can have more time to focus on the development of design models and on the interpretation of calculated results. The software also facilitates exploration and discussion of realistic, industrial design problems. More than 500 worked examples and end-of-chapter problems are included to help students learn how to apply the theory to solve design problems. A web site, www.wiley.com/college/missen, provides additional resources including sample files, demonstrations, and a description of the E-Z Solve software.

**Solid Oxide Fuel Cell Technology**

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.

New Promising Electrochemical Systems for Rechargeable Batteries

This book explores key parameters, properties and fundamental concepts of electrocatalysis. It also discusses the engineering strategies, current applications in fuel-cells, water-splitting, metal-ion batteries, and fuel generation. This book elucidates entire category viewpoints together with industrial applications. Therefore, all the sections of this book emphasize the recent advances of different types of electrocatalysts, current challenges, and state-of-the-art studies through detailed reviews. This book is the result of commitments by numerous experts in the field from various backgrounds and expertise and appeals to industrialists, researchers, scientists and in addition understudies from various teaches.

Fuel Cells

This Special Issue of Crystals contains papers focusing on various properties of conducting ceramics. Multiple aspects of both the research and application of this group of materials have been addressed. Conducting ceramics are the wide group of mostly oxide materials which play crucial roles in various technical applications, especially in the context of the harvesting and storage of energy. Without ion-conducting oxides, such as yttria-stabilized zirconia, doped ceria devices such as solid oxide fuel cells would not exist, not to mention the wide group of other ion conductors which can be applied in batteries or even electrolyzers, besides fuel cells. The works published in this Special Issue tackle experimental results as well as general theoretical trends in the field of ceramic conductors, or electroceramics, as it is often referred to.

Advances in Medium and High Temperature Solid Oxide Fuel Cell Technology

The importance of food packaging hardly needs emphasizing since only a handful of foods are sold in an unpackaged state. With an increasing focus on sustainability and cost-effectiveness, responsible companies no longer want to over-package their food products, yet many remain unsure just where reductions can
This book provides state-of-the-art reviews, the latest research, prospects and challenges of the production of platform chemicals such as C6 sugars, 5-hydroxymethylfurfural, furfural, gamma-valerolactone, xylitol, 2,5-furandicarboxylic acid, levulinic acid, ethanol and others from sustainable biomass resources using processes that include heterogeneous catalysis, ionic liquids, hydrothermal/solvothermal, electrochemical and fermentation methods. It also discusses the application of these chemicals and their derivatives for synthesizing commodity chemicals via various routes. Intended as a reference resource for researchers, academicians and industrialists in the area of energy, chemical engineering and biomass conversion, it provides a wealth of information essential for assessing the production and application of various biomass-derived platform chemicals using biological, chemical and electrochemical techniques.

This practical how-to-do book deals with the design of sustainable chemical processes by means of systematic methods aided by computer simulation. A mple case studies illustrate generic creative issues, as well as the efficient use of simulation techniques, with each one standing for an important issue taken from practice. The didactic approach guides readers from basic knowledge to mastering complex flow-sheets, starting with chemistry and thermodynamics, via process synthesis, efficient use of energy and waste minimization, right up to plant-wide control and process dynamics. The simulation results are compared with flow-sheets and performance indices of actual industrial licensed processes, while the complete input data for all the case studies is also provided, allowing readers to reproduce the results with their own simulators. For everyone interested in the design of innovative chemical processes.

First published in 1991, this volume responds to the major changes in the petrochemical industry over the previous decade due to increases in raw material costs, improvements in process efficiency and the increasing importance now being placed on environmental issues. The Handbook of Petrochemicals and Processes provides comprehensive, up to date information on 76 petrochemicals and their processes, giving details of the chemical reactions involved in transforming raw materials, such as olefins and aromatics, into chemicals, plastics and synthetic fibres. The competing processes for each product including the latest technical developments are
described, with their feedstock requirements, catalysts and conversion rates compared. Many of the processes are illustrated with clear flow diagrams. The book is easy to use with the products arranged in alphabetical order. Within each chapter on the individual products there are details of the physical characteristics and properties; grades available; handling; transportation; health and safety aspects and lists of the major manufacturers and licensors. The Handbook of Petrochemicals and Processes gathers together in one volume, all the commonly sought chemical information. It will prove an invaluable source of reference for industrial chemists, chemical engineers, and industry professionals, as well as librarians and information centres concerned with the petrochemical industry.

ISEC '88

Unique in providing an overview of the subject on the scientific level, this book presents the current state of the art with regard to different aspects of sustainable energy production and its efficient storage. The broad scope ranges from nanomaterials for energy production, via fuel cells and nanostructured materials for fuel production, right up to supercapacitors and climate change. Edited by a rising star within the community, this is an invaluable work on a hot topic for materials scientists, solid state, surface and physical chemists, as well as those chemists working in industry and chemical engineers.

Novel Production Methods for Ethylene, Light Hydrocarbons, and Aromatics

Recently, there have been significant advances in the fields of high-enthalpy hypersonic flows, high-temperature gas physics, and chemistry shock propagation in various media, industrial and medical applications of shock waves, and shock-tube technology. This series contains all the papers and lectures of the 19th International Symposium on Shock Waves held in Marseille in 1993. They will be published in four topical volumes, each containing papers on related topics, and preceded by an overview written by a leading international expert. The volumes may be purchased independently.

Introduction to Chemical Reaction Engineering and Kinetics

Lithium Batteries: Science and Technology is an up-to-date and comprehensive compendium on advanced power sources and energy related topics. Each chapter is a detailed and thorough treatment of its subject. The volume includes several tutorials and contributes to an understanding of the many fields that impact the development of lithium batteries. Recent advances on various components are
included and numerous examples of innovation are presented. Extensive references are given at the end of each chapter. All contributors are internationally recognized experts in their respective specialty. The fundamental knowledge necessary for designing new battery materials with desired physical and chemical properties including structural, electronic and reactivity are discussed. The molecular engineering of battery materials is treated by the most advanced theoretical and experimental methods.

**Industrial Organic Chemistry**

The last three chapters of this book deal with application of methods presented in previous chapters to estimate various thermodynamic, physical, and transport properties of petroleum fractions. In this chapter, various methods for prediction of physical and thermodynamic properties of pure hydrocarbons and their mixtures, petroleum fractions, crude oils, natural gases, and reservoir fluids are presented. As it was discussed in Chapters 5 and 6, properties of gases may be estimated more accurately than properties of liquids. Theoretical methods of Chapters 5 and 6 for estimation of thermophysical properties generally can be applied to both liquids and gases; however, more accurate properties can be predicted through empirical correlations particularly developed for liquids. When these correlations are developed with some theoretical basis, they are more accurate and have wider range of applications. In this chapter some of these semitheoretical correlations are presented. Methods presented in Chapters 5 and 6 can be used to estimate properties such as density, enthalpy, heat capacity, heat of vaporization, and vapor pressure. Characterization methods of Chapters 2-4 are used to determine the input parameters needed for various predictive methods. One important part of this chapter is prediction of vapor pressure that is needed for vapor-liquid equilibrium calculations of Chapter 9.

**Nanoporous Materials and Their Applications**

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. Featuring 21 peer-reviewed entries from the Encyclopedia of Sustainability Science and Technology, Fuel Cells offers concise yet comprehensive coverage of the current state of research and identifies key areas for future investigation. Internationally renowned specialists provide authoritative introductions to a wide variety of fuel cell types, and discuss materials, components, and systems for these technologies. The
entries also cover sustainability and marketing considerations, including comparisons of fuel cells with alternative technologies.

**Food Packaging and Shelf Life**

With its focus on catalysis and addressing two very hot and timely topics with significant implications for our future lives, this will be a white book in the field. The authority behind this practical work is the IDECAT Network of Excellence, and the authors here outline how the use of catalysis will promote the more extensive use of renewable feedstocks in chemical and energy production. They present the latest applications, their applicability and results, making this a ready reference for researchers and engineers working in catalysis, chemistry, and industrial processes wishing to analyze options, outlooks and opportunities in the field.

**Environmentally Significant Consumption**

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.

**Advances in Solar Energy Research**

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