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Electrochemical Technologies for Energy Storage and Conversion - Jinli Qiao 2016-06-20 For Researchers, Students, Industrial Professionals, and Manufacturers Electrochemical Reduction of Carbon Dioxide (CO2). Written by electrochemical energy scientists actively involved in environmental research and development, this book addresses the largest challenge to CO2 electrocatalysis: how to make the cost-effective tools for converting CO2 into useful products. The book provides insight and practical solutions to aid the design of efficient, economical, and highly efficient electrocatalysts for CO2 reduction.

Energy Storage Options and Their Environmental Impact

Mesfin A. Kebede 2019-12-11 This book explores a wide range of energy storage devices, such as advanced batteries, electrochemical capacitors (EDLCs), and supercapacitors. It provides a comprehensive overview of the fundamental aspects of the electrochemical processes and how they impact the design of advanced energy storage devices.

Electrochemical Devices for Energy Storage Applications - J-M. Kibue 2018-12-11 In this book, the authors provide an overview of the fundamental concepts and principles underlying the design and operation of electrochemical energy storage devices. The book covers a wide range of topics, including battery chemistry, device design, and system integration.


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Carbon Based Nanomaterials for Advanced Thermal and Electrochemical Energy Storage and Conversion—Cheng-Te Lin 2019-07-20 Carbon Nanomaterials and their Applications in Energy Storage and Conversion explores the latest research developments on the fundamental and practical prospects of carbon-based nanomaterials for thermal, solar, and electrochemical energy conversion, along with their applications in both laboratory and industrial perspectives. Large growth in human populations has led to societal growth in global energy consumption, hence fossil fuel usage has increased, which raises challenges in terms of energy security and sustainability. Therefore, aligning carbon nanomaterials as a solution because of their structural diversity and electrical, thermal, and mechanical properties. Provides an overview on state-of-the-art carbonaceous nanomaterials and their applications in the field of energy conversion and storage. This book covers both fundamental and practical aspects of the research, setting the stage for future work.

High-Temperature Electrochemical Energy Conversion and Storage—Xiaoguang Shi 2017-11-08 As global demand for energy and lower carbon emissions rise, developing systems of energy conversion and storage becomes necessary. This book explores how Electrochemical Energy Storage and Conversion (EESC) devices are being used to convert energy to usable forms, and then store it for later use. The book also covers the latest research and developments in the field of high-temperature electrochemistry. Written in a clear and detailed manner, it is suitable for developers, researchers, or students of any level.

Energy Storage for Power Systems—A.G. Te-Guarian 1994-06-30 Based on the study of energy storage this book comprehensively covers the various types of secondary storage systems (storing energy until it is needed, and discusses the multidisciplinary problem of choice of their types and parameters.

Redox Flow Batteries—Huamin Zhang 2017-02-26 Flow batteries have received attention in large-scale energy storage due to their flexible design, high safety, high energy efficiency, and environmental friendliness. In recent years, they have been rapidly developed and tested in a variety of scales that prove their feasibility and promise. Redox Flow Batteries: Energy Storage for Power Systems presents the basic principles and newest advances. Explains the energy storage mechanism based on the fundamental concept of physics and electrochemistry.

Redox Polymers for Energy and Nanomedicine—Nevra Cansu 2020-10-20 Polymers with redox properties are electroactive macromolecules containing localized sites or groups that can be oxidized and reduced. Redox Polymers for Energy and Nanomedicine highlights trends in the chemistry, characterization and application of polymers with redox properties. Chapter cover batteries, supercapacitors, solar cells, biofuel cells, thiol-ene click, drug delivery, biosensors, actuators and smart surfaces. The book will be of interest to graduate students and researchers working in polymer science, electrochemistry, energy research and nanomedicine.

Solar Energy Conversion and Storage—Sunil C. Amba 2015-11-05 Solar Energy Conversion and Storage: Photophysical Modes shows the latest advances in solar energy conversion and solar energy storage. The book is based on the latest developments of methods of converting solar energy into useful forms of energy, and focuses on the nature of solar energy. Highlights existing and developing photophysical methods of solar energy conversion and storage. Explores emerging trends such as the use of nanomaterials Solar Energy Conversion and Storage: Photophysical Modes provides a comprehensive, state-of-the-art reference for graduate students, researchers, and engineers alike.

Electric Batteries and Supercapacitors for Distributed Energy Storage—Robert Huggins 2010-08-12 Introduction Energy is necessary for a number of reasons, the most basic and obvious involve the preparation of food and the provision of heat to make life comfortable, or at least, bearable. Subsequently, a range of technologies or the use of technologies can be employed to provide a consistent supply of energy. The book provides an essential tool for engineers. It covers the basic principles and newest advances. Explains the energy storage mechanism based on the fundamental concept of physics and electrochemistry.

Grid-Size Energy Storage Systems and Applications—Fu-Biao Wu 2010-06-11 Grid-Size Energy Storage Systems and Applications provides a timely introduction to state-of-the-art technologies and important demonstration projects in this rapidly developing field. Written with a view to real-world applications, the authors describe storage technologies and their applications in the context of the demonstration projects. The book is directed at researchers and professionals in developing countries with reference to the practical use of storage systems. The rapidly-developing area of electrochemical energy storage technology and its implementation in the power grid is covered in particular detail. Examples of Chinese pilot projects in new energy grids and micro grids are also included. Whether you are interested in storage technology, or want to learn more about Grid-Size Energy Storage Systems and Applications, this book is for you.

Energy Storage for Power Systems—A.G. Te-Guarian 1994-06-30 Based on the study of energy storage this book comprehensively covers the various types of secondary storage systems (storing energy until it is needed, and discusses the multidisciplinary problem of choice of their types and parameters.

Advanced Battery Materials—Chunwen Sun 2019-03-26 Electrochemical energy storage has played major roles in energy storage technologies for portable electronics and electric vehicle applications. During the past thirty years, great progress has been made in research and development of various batteries, in term of energy density, power density, stability, charge/discharge rate, cycle life, safety, and cost. This book explains the energy storage mechanism based on the fundamental concept of physics and electrochemistry. Provides an overview on state-of-the-art technologies as well as the challenges that must still be resolved in the field of electrochemical storage, taking into account sustainable development and the limited time available to us.

dynamic modeling examples, making each chapter a standalone module on storage technology. Each chapter includes a detailed mathematical model of the given energy storage system along with solved and unsolved examples, case studies, and prospects among emerging technologies and solutions for future energy systems. Giving a detailed understanding of why mechanical energy storage systems are useful, this book is a beneficial reference for anyone researching and working in mechanical energy storage systems. Covers advances in mechanical energy storage systems, both electricity and heat, in one reference includes solved and unsolved examples for each storage technology. Offers end-of-chapter summaries for each application includes detailed mathematical models of each energy storage system examined.

Electrochemical Energy Storage - Reinhart Job 2020-09-21 Starting from physical and electrochemical foundations, this textbook explains working principles of energy storage devices. After a history of galvanic cells, different types of primary, secondary and flow cells as well as fuel cells and supercapacitors are covered. An emphasis lies on the general setup and mechanisms behind those devices to enable easy understanding for students from all technical and natural science disciplines.

Advances in Batteries for Medium and Large-Scale Energy Storage - C. Menenias 2014-12-09 As energy produced from renewable sources is increasingly integrated into the electricity grid, interest in energy storage technologies for grid stabilization is growing. This book reviews advances in battery technologies and applications for medium and large-scale energy storage. Chapters address advances in nickel, sodium and lithium-based batteries. Other chapters review other emerging battery technologies such as metal-air batteries and flow batteries. The final section of the book discusses design considerations and applications of batteries in remote locations and for grid-scale storage. Reviews advances in battery technologies and applications for medium and large-scale energy storage. Examine battery types, including zinc-based, lithium-air and vanadium redox flow batteries. Analyze design issues and applications of these technologies.

Nanocarbon Electrochemistry - Nianjun Yang 2019-12-11 Provides a comprehensive introduction to the field of nanocarbon electrochemistry. The discoveries of new carbon materials such as fullerene, graphene, carbon nanotubes, graphene nanoribbons, carbon dots, and graphdiyne have triggered numerous research advances in the field of electrochemistry. This book brings together up-to-date accounts of the recent progress, developments, and achievements in the electrochemistry of different carbon materials, focusing on their unique properties and various applications. Nanocarbon Electrochemistry begins by looking at the studies of heterogeneous electron transfer at various carbon electrodes when redox-active molecules are reversibly and specifically adsorbed on the carbon electrode surface. It then covers electrochemical energy storage applications of various carbon materials, particularly the construction and performance of supercapacitors and batteries by use of graphene and related materials. Next, it concentrates on electrochemical energy conversion applications where electrocatalysis at 0D, 1D, 2D, and 3D carbon materials nanocarbon materials is highlighted. The book finishes with an examination of the contents of electrogenerated chemiluminescence and photovoltaic-electrochemical pollutant degradation by use of diamond and related carbon materials. Covers the fundamental properties of different carbon materials and their applications across a wide range of areas. Provides sufficient background regarding different applications, which contributes to the understanding of specialists and non-specialists.

Energy Storage - Robert Higgins 2015-11-13 Energy Storage explains the underlying scientific and engineering fundamentals of all major energy storage methods. These include the storage of energy as heat, in phase transitions and reversible chemical reactions, and in organic fuels and hydrogen, as well as in mechanical, electrostatic and magnetic systems. Updated coverage of electrochemical storage systems considers exciting developments in materials and methods for applications such as rapid short-term storage in hybrid and intermittent energy generation systems, and battery optimization for increasingly prevalent EV and stop-start automotive technologies. This nuanced coverage of cutting-edge advances is unique in that it does not require prior knowledge of electrochemistry. Traditional and emerging battery systems are explained, including lithium, flow and liquid batteries. Energy Storage provides a comprehensive overview of the concepts, principles and practice of energy storage that is useful to both students and professionals.

Emerging Nanotechnologies in Rechargeable Energy Storage Systems - Lida M Rodriguez-Martinez 2017-02-06 Emerging Nanotechnologies in Rechargeable Energy Storage Systems addresses the technical state-of-the-art of nanotechnology for rechargeable energy storage systems. Materials characterization and device-modeling aspects are covered in detail, with additional sections devoted to the application of nanotechnologies in batteries for electrical vehicles. In the later part of the book, safety and regulatory issues are thoroughly discussed. Users will find a valuable source of information on the latest developments in nanotechnology in rechargeable energy storage systems. This book will be of great use to researchers and graduate students in the fields of nanotechnology, electrical energy storage, and those interested in materials and electrochemical cell development. Gives readers working in the rechargeable energy storage sector a greater awareness on how novel nanotechnology oriented methods can help them develop higher-performance batteries and supercapacitor systems. Provides focused coverage of the development, process, characterization techniques, modeling, safety and applications of nanomaterials for rechargeable energy storage systems. Presents readers with an informed choice in materials selection for rechargeable energy storage devices.