Rechargeable Batteries

Ji-Guang Zhang, Wu Xu, Wesley A. Henderson

Rechargeable Batteries Zhengcheng Zhang, Sheng Shui Zhang, 2015-06-24 This book updates the latest advancements in new chemistries, novel materials and system integration of rechargeable batteries, including lithium-ion batteries and batteries beyond lithium-ion and addresses where the research is advancing in the near future in a brief and concise manner. The book is intended for a wide range of readers from undergraduates, postgraduates to senior scientists and engineers. In order to update the latest status of rechargeable batteries and predict near research trend, we plan to invite the world leading researchers who are presently working in the field to write each chapter of the book. The book covers not only lithium-ion batteries but also other batteries beyond lithium-ion, such as lithium-air, lithium-sulfur, sodium-ion, sodium-sulfur, magnesium-ion and liquid flow batteries.

Functional Materials For Next-generation Rechargeable Batteries Jiangfeng Ni,Li Lu,2021-02-10 Over-consumption of fossil fuels has caused deficiency of limited resources and environmental pollution. Hence, deployment and utilization of renewable energy become an urgent need. The development of next-generation rechargeable batteries that store more energy and last longer has been significantly driven by the utilization of renewable energy. This book starts with principles and fundamentals of lithium rechargeable batteries, followed by their designs and assembly. The book then focuses on the recent progress in the development of advanced functional materials, as both cathode and anode, for next-generation rechargeable batteries such as lithium-sulfur, sodium-ion, and zinc-ion batteries. One of the special features of this book is that both inorganic electrode materials and organic materials are included to meet the requirement of high energy density and high safety of future rechargeable batteries. In addition to traditional non-aqueous rechargeable batteries, detailed information and discussion on aqueous batteries and solid-state batteries are also provided.

Rechargeable Lithium Batteries Alejandro Franco, 2015-04-07 Rechargeable Lithium Batteries: From Fundamentals to Application provides an overview of rechargeable lithium batteries, from fundamental materials, though characterization and modeling, to applications. The market share of lithium ion batteries is fast increasing due to their high energy density and low maintenance requirements. Lithium air batteries have the potential for even higher energy densities, a requirement for the development of electric vehicles, and other types of rechargeable lithium battery are also in development. After an introductory chapter providing an overview of the main scientific and technological challenges posed by rechargeable Li

batteries, Part One of this book reviews materials and characterization of rechargeable lithium batteries. Part Two covers performance and applications, discussing essential aspects such as battery management, battery safety and emerging rechargeable lithium battery technologies as well as medical and aerospace applications. - Expert overview of the main scientific and technological challenges posed by rechargeable lithium batteries - Address the important topics of analysis, characterization, and modeling in rechargeable lithium batteries - Key analysis of essential aspects such as battery management, battery safety, and emerging rechargeable lithium battery technologies

Batteries in a Portable World, 2016

Rechargeable Batteries Applications Handbook Gates Energy Gates Energy Products, 1998-01-30 Represents the first widely available compendium of the information needed by those design professionals responsible for using rechargeable batteries. This handbook introduces the most common forms of rechargeable batteries, including their history, the basic chemistry that governs their operation, and common design approaches. The introduction also exposes reader to common battery design terms and concepts. Two sections of the handbook provide performance information on two principal types of rechargeable batteries commonly found in consumer and industrial products: sealed nickel-cadmium and sealed-lead cells. For each type of cell, this book covers discharge performance, charging and charger design, storage, life, applications information, testing, and safety. - New paperback edition of a best-seller - First widely-available book on rechargeable cells - Operation, applications, and testing

<u>Lithium Ion Rechargeable Batteries</u> Kazunori Ozawa,2012-01-09 Starting out with an introduction to the fundamentals of lithium ion batteries, this book begins by describing in detail the new materials for all four major uses as cathodes, anodes, separators, and electrolytes. It then goes on to address such critical issues as self-discharge and passivation effects, highlighting lithium ion diffusion and its profound effect on a battery's power density, life cycle and safety issues. The monograph concludes with a detailed chapter on lithium ion battery use in hybrid electric vehicles. Invaluable reading for materials scientists, electrochemists, physicists, and those working in the automobile and electrotechnical industries, as well as those working in computer hardware and the semiconductor industry.

Rechargeable Batteries Rajender Boddula, Inamuddin, Ramyakrishna Pothu, Abdullah M. Asiri, 2020-05-27 Battery technology is constantly changing, and the concepts and applications of these changes are rapidly becoming increasingly more important as more and more industries and individuals continue to make "greener" choices in their energy sources. As global dependence on fossil fuels slowly wanes, there is a heavier and heavier importance placed on cleaner power sources and methods for storing and transporting that power. Battery technology is a huge part of this global energy revolution. Rechargeable battery technologies have been a milestone for moving toward a fossil-fuel-free society. They include groundbreaking changes in energy storage, transportation, and electronics. Improvements in battery electrodes and

electrolytes have been a remarkable development, and, in the last few years, rechargeable batteries have attracted significant interest from scientists as they are a boon for electric vehicles, laptops and computers, mobile phones, portable electronics, and grid-level electricity storage devices. Rechargeable Batteries: History, Progress, and Applicationsoutlines the history, development, future, and applications for rechargeable batteries for energy storage applications. It also provides an in-depth description of various energy storage materials and is an invaluable reference guide for electrochemists, chemical engineers, students, faculty, and R&D professionals in energy storage science, material science, and renewable energy. This is a must-have for any engineer's library who works with batteries and energy storage.

Advanced Technologies for Rechargeable Batteries Prasanth Raghavan, Akhila Das, Jabeen Fatima M. J., 2024-08-22 This volume covers recent advanced battery systems such as metal-ion, hybrid, and metal-air batteries. It includes an introduction to fluoride, potassium, zinc, chloride, aluminium, and iron-ion batteries; special or hybrid batteries are included, with calcium, nuclear, thermal, and lithium-magnesium hybrid batteries also explained. It summarizes the recent progress and chemistry behind the popular metal-air batteries, including a systematic overview of the components, design, and integration of these new battery technologies. Features: Covers recent battery technologies in detail, from the chemistry to advances in post-lithium-ion batteries. Various post-lithium-ion batteries are discussed in detail. Includes a section on ion batteries, exploring new types of metal-ion batteries. Focuses in each chapter on a particular battery type, including different metal-ion batteries such as zinc, potassium, aluminium, and their air version batteries. Provides authoritative coverage of scientific content via global contributing experts. This book is aimed at graduate students, researchers, and professionals in materials science, chemical and electrical engineering, and electrochemistry.

Lithium Metal Anodes and Rechargeable Lithium Metal Batteries Ji-Guang Zhang, Wu Xu, Wesley A. Henderson, 2016-10-06 This book provides comprehensive coverage of Lithium (Li) metal anodes for rechargeable batteries. Li is an ideal anode material for rechargeable batteries due to its extremely high theoretical specific capacity (3860 mAh g-1), low density (0.59 g cm-3), and the lowest negative electrochemical potential (-3.040 V vs. standard hydrogenelectrodes). Unfortunately, uncontrollable dendritic Li growth and limited Coulombic efficiency during Li deposition/stripping inherent in these batteries have prevented their practical applications over the past 40 years. With the emergence of post Liion batteries, safe and efficient operation of Li metal anodes has become an enabling technology which may determine the fate of several promising candidates for the next generation energy storage systems, including rechargeable Li-air batteries, Li-S batteries, and Li metal batteries which utilize intercalation compounds as cathodes. In this work, various factors that affect the morphology and Coulombic efficiency of Li anodes are analyzed. The authors also present the technologies utilized to characterize the morphology of Li deposition and the results obtained by modeling of Li dendrite growth. Finally, recent developments, especially the new approaches that enable safe and efficient operation of Li

metal anodes at high current densities are reviewed. The urgent need and perspectives in this field are also discussed. The fundamental understanding and approaches presented in this work will be critical for the application of Li metal anodes. The general principles and approaches can also be used in other metal electrodes and general electrochemical deposition of metal films.

Next Generation Batteries Kiyoshi Kanamura,2021-03-23 In this book, the development of next-generation batteries is introduced. Included are reports of investigations to realize high energy density batteries: Li-air, Li-sulfur, and all solid-state and metal anode (Mg, Al, Zn) batteries. Sulfide and oxide solid electrolytes are also reviewed. A number of relevant aspects of all solid-state batteries with a carbon anode or Li-metal anode are discussed and described: The formation of the cathode; the interface between the cathode (anode) and electrolyte; the discharge and charge mechanisms of the Li-air battery; the electrolyte system for the Li-air battery; and cell construction. The Li-sulfur battery involves a critical problem, namely, the dissolution of intermediates of sulfur during the discharge process. Here, new electrolyte systems for the suppression of intermediate dissolution are discussed. Li-metal batteries with liquid electrolytes also present a significant problem: the dendrite formation of lithium. New separators and electrolytes are introduced to improve the safety and rechargeability of the Li-metal anode. Mg, Al, and Zn metal anodes have been also applied to rechargeable batteries, and in this book, new metal anode batteries are introduced as the generation-after-next batteries. This volume is a summary of ALCA-SPRING projects, which constitute the most extensive research for next-generation batteries in Japan. The work presented in this book is highly informative and useful not only for battery researchers but also for researchers in the fields of electric vehicles and energy storage.

Advanced Technologies for Rechargeable Batteries Prasanth Raghavan, Akhila Das, Jabeen Fatima M J, 2024-08-27 This volume focusses on Alkaline Metal Ion, Redox Flow and Metal Sulfur Batteries and details about the various kinds of advanced rechargeable batteries. This book is aimed at graduate students, researchers and professionals in materials science, chemical and electrical engineering, and electrochemistry.

Rechargeable Lithium-Ion Batteries Thandavarayan Maiyalagan, Perumal Elumalai, 2020-12-17 Lithium-ion batteries are the most promising among the secondary battery technologies, for providing high energy and high power required for hybrid electric vehicles (HEV) and electric vehicles (EV). Lithium-ion batteries consist of conventional graphite or lithium titanate as anode and lithium transition metal-oxides as cathode. A lithium salt dissolved in an aprotic solvent such as ethylene carbonate and diethylene carbonate is used as electrolyte. This rechargeable battery operates based on the principle of electrochemical lithium insertion/re-insertion or intercalation/de-intercalation during charging/discharging of the battery. It is essential that both electrodes have layered structure which should accept and release the lithium-ion. In advanced lithium-ion battery technologies, other than layered anodes are also considered. High cell voltage, high capacity as well as energy

density, high Columbic efficiency, long cycle life, and convenient to fabricate any size or shape of the battery, are the vital features of this battery technology. Lithium-ion batteries are already being used widely in most of the consumer electronics such as mobile phones, laptops, PDAs etc. and are in early stages of application in HEV and EV, which will have far and wide implications and benefits to society. The book contains ten chapters, each focusing on a specific topic pertaining to the application of lithium-ion batteries in Electric Vehicles. Basic principles, electrode materials, electrolytes, high voltage cathodes, recycling spent Li-ion batteries and battery charge controller are addressed. This book is unique among the countable books focusing on the lithium-ion battery technologies for vehicular applications. It provides fundamentals and practical knowledge on the lithium-ion battery for vehicular application. Students, scholars, academicians, and battery and automobile industries will find this volume useful.

Advanced Technologies for Rechargeable Batteries Prasanth Raghavan, Akhila Das, Jabeen Fatima M. J., 2024-08-22 This volume focuses on alkaline metal-ion, redox flow, and metal sulfur batteries and provides details about the various kinds of advanced rechargeable batteries. It explains magnesium-ion batteries, sodium-ion batteries, metal sulfur batteries, and redox flow batteries with an introduction to rechargeable batteries and major upcoming batteries (magnesium-/sodium-ion batteries). Various kinds of redox flow batteries from introduction extending to the recent progress in redox flow batteries have been extensively discussed. Features: Covers recent battery technologies in detail, from chemistry to advances in post-lithium-ion batteries. Reviews magnesium-ion batteries, sodium-ion batteries, metal sulfur batteries, and redox flow batteries. Explains various metal sulfur batteries. Explores different types of redox flow batteries for large-scale energy storage application. Provides authoritative coverage of scientific contents via global contributing experts. This book is aimed at graduate students, researchers, and professionals in materials science, chemical and electrical engineering, and electrochemistry.

Energy Storage Devices for Electronic Systems Nihal Kularatna,2014-11-27 Energy storage devices are a crucial area of research and development across many engineering disciplines and industries. While batteries provide the significant advantage of high energy density, their limited life cycles, disposal challenges and charge and discharge management constraints undercut their effectiveness in certain applications. Compared to electrochemical cells, supercapacitors are charge-storage devices with much longer life cycles, yet they have traditionally been hobbled by limited DC voltage capabilities and energy density. However, recent advances are improving these issues. This book provides the opportunity to expand your knowledge of innovative supercapacitor applications, comparing them to other commonly used energy storage devices. It will strengthen your understanding of energy storage from a practical, applications-based point-of-view, without requiring detailed examination of underlying electrochemical equations. No matter what your field, you will find inspiration and guidance in the cutting-edge advances in energy storage devices in this book. - Provides explanations of the latest energy

storage devices in a practical applications-based context - Includes examples of circuit designs that optimize the use of supercapacitors, and pathways to improve existing designs by effectively managing energy storage devices crucial to both low and high power applications. - Covers batteries, BMS (battery management systems) and cutting-edge advances in supercapacitors, providing a unique compare and contrast examination demonstrating applications where each technology can offer unique benefits

Rechargeable Battery Act United States. Congress. House. Committee on Commerce. Subcommittee on Commerce, Trade, and Hazardous Materials, 1996

New Promising Electrochemical Systems for Rechargeable Batteries V. Barsukov, F. Beck, 2013-11-09 The storage of electroenergy is an essential feature of modem 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 modem 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.

Rechargeable Batteries Zhengcheng Zhang, Sheng Shui Zhang, 2015 This book updates the latest advancements in new chemistries, novel materials and system integration of rechargeable batteries, including lithium-ion batteries and batteries beyond lithium-ion, and addresses where the research is advancing in the near future in a brief and concise manner. The book is intended for a wide range of readers from undergraduates, postgraduates to senior scientists and engineers. In order to update the latest status of rechargeable batteries and predict near research trend, we plan to invite the world leading researchers who are presently working in the field to write each chapter of the book. The book covers not only lithium-ion batteries but also other batteries beyond lithium-ion, such as lithium-air, lithium-sulfur, sodium-ion, sodium-sulfur, magnesium-ion, and liquid flow batteries.

Rechargeable Battery Electrolytes Jianmin Ma, Zhouguang Lu, Yurong Ren, 2024-02-26 This book will cover all the major

ion-battery groups and their electrolytes. It is suitable for all levels of students and researchers who want to understand the fundamentals and future challenges of developing electrolytes.

Batteries for Sustainability Ralph J. Brodd, 2012-12-12 Batteries that can store electricity from solar and wind generation farms are a key component of a sustainable energy strategy. Featuring 15 peer-reviewed entries from the Encyclopedia of Sustainability Science and Technology, this book presents a wide range of battery types and components, from nanocarbons for supercapacitors to lead acid battery systems and technology. Worldwide experts provides a snapshot-in-time of the state-of-the art in battery-related R&D, with a particular focus on rechargeable batteries. Such batteries can store electrical energy generated by renewable energy sources such as solar, wind, and hydropower installations with high efficiency and release it on demand. They are efficient, non-polluting, self-contained devices, and their components can be recovered and used to recreate battery systems. Coverage also highlights the significant efforts currently underway to adapt battery technology to power cars, trucks and buses in order to eliminate pollution from petroleum combustion. Written for an audience of undergraduate and graduate students, researchers, and industry experts, Batteries for Sustainability is an invaluable one-stop reference to this essential area of energy technology.

Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications A.R. Jha, 2016-04-19 Distilling complex theoretical physical concepts into an understandable technical framework, Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications describes primary and secondary (rechargeable) batteries for various commercial, military, spacecraft, and satellite applications for covert communications, surveillan

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