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Advanced Materials for Sodium Ion Storage Jun 17 2020 Globally, lithium ion batteries (LIBs) are leaders in the energy storage sector but there are concerns regarding load leveling of renewable energy sources as well as smart grids and limited availability of lithium resources resulting in cost increase. Therefore, sodium ion batteries (SIBs) are being researched as next-generation alternatives to LIBs due to their similar sustainability and electrochemistry. This book mainly focuses on the current research on electrode materials and proposes future directions for SIBs to meet the current challenges associated with the full cell aspect. Further, it provide insights into scientific and practical issues in the development of SIBs.

Lithium-ion Batteries Dec 24 2020 This compilation begins by discussing Sn, Sb and Ge-based anodes. Various approaches for alleviating volume changes corresponding to each kind of anode are presented in regards to the last 20 years. Sn, Sb and Ge-based alloy-type anodes have attracted considerable research interest as promising candidates for next-generation LIBs due to their high theoretical capacities, suitable operating voltages and natural abundances. Next, the authors discuss the synthesis and application of Titanium dioxide (TiO2) based lithium-ion battery anodes. TiO2 has attracted considerable attention as a promising alternative lithium-ion battery anode. The evolution of studies on synthetic methods, performance improvement, and the size tuning strategy are thoroughly addressed. Following this, the book focuses on clarifying the mechanisms of lithium dendrite growth, the issues related to lithium dendrites, and the recent advances for technical solutions. To power electric vehicles, a minimum energy density of 300 Wh/kg is required. State-of-the-art LIBs are dominating portable electronics, but can only enable an energy density of 100-220 Wh/kg in practice to date. In this regard, metallic lithium is highly regarded as promising next-generation anodes, ascribed to its extremely high theoretical capacity of 3860 mAh/g versus 372 mAh/g of the commercial graphite anodes. Recent progress in the development of Si/Gn nanocomposite anodes for lithium-ion batteries is also studied. The synthetic routes and electrochemical performance of these nanomaterials and the underlying reaction mechanisms are systematically described. The authors maintain that more research efforts are needed for the widespread applications of such composite anodes in the future of lithium-ion batteries. Afterwards, the advanced ab initio atomistic thermodynamics approach for electrode materials in LIBs is formulated, which enables the resolution of the interfacial structure of an LIB electrode material in an electrochemical environment under (constrained) reaction conditions. This universal approach is outlined, using state-of-the-art electrode materials in LIBs, such as LTO or lithium cobaltite (LCO, LiCoO2) as examples.

Potassium-ion Batteries Dec 16 2022 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. Potassium-ion batteries were first introduced to the world

for energy storage in 2004, over two decades after the invention of lithium-ion batteries. Potassium-ion (or “K-ion”) batteries have many advantages, including low cost, long cycle life, high energy density, safety, and reliability. Potassium-ion batteries are the potential alternative to lithium-ion batteries, fueling a new direction of energy storage research in many applications and across industries. Potassium-ion Batteries: Materials and Applications explores the concepts, mechanisms, and applications of the next-generation energy technology of potassium-ion batteries. Also included is an in-depth overview of energy storage materials and electrolytes. This is the first book on this technology and serves as a reference guide for electrochemists, chemical engineers, students, research scholars, faculty, and R&D professionals who are working in electrochemistry, solid-state science, material science, ionics, power sources, and renewable energy storage fields.
Hydrometallurgical Recycling of Lithium-Ion Battery Materials Nov 03 2021 The expanding market share of lithium-ion batteries (LIBs), driven by the secondary battery and electric vehicle markets, has consequently led to the accumulation of spent LIBs. This presents a unique business opportunity for recovering and recycling valuable metals from the spent lithium-ion cathode materials. Hydrometallurgical Recycling of Lithium-Ion Battery Materials provides a comprehensive review of the available hydrometallurgical technologies for recycling spent lithium-ion cathode active materials. The aim of this book is to raise awareness of LIB recycling, provide comprehensive knowledge of hydrometallurgical recycling of lithium cathode active materials, and promote an environmentally friendlier hydrometallurgical recycling process. Key Features • Summarizes current recycling processes, challenges, and perspectives • Offers a comprehensive review of current commercialized LIB recycling companies • Showcases an innovative closed-loop hydrometallurgical recycling process to recycle lithium cathode materials • Provides detailed modeling and economic analyses of several hydrometallurgical recycling processes • Features practical cases and data developed by the authors Offering the most up-to-date information on LIB material recycling, this book is aimed at researchers and professionals in materials, chemical, electrical, and mechanical engineering, as well as chemists working on battery technologies.
Lithium-Ion Batteries Sep 01 2021 Lithium-Ion Batteries features an in-depth description of different lithium-ion applications, including important features such as safety and reliability. This title acquaints readers with the numerous and often consumer-oriented applications of this widespread battery type. Lithium-Ion Batteries also explores the concepts of nanostructured materials, as well as the importance of battery management systems. This handbook is an invaluable resource for electrochemical engineers and battery and fuel cell experts everywhere, from research institutions and universities to a worldwide array of professional industries. Contains all applications of consumer and industrial lithium-ion batteries, including reviews, in a single volume Features contributions from the world's leading industry and research experts Presents executive summaries of specific case studies Covers information on basic research and application approaches
Rechargeable Lithium Batteries Jul 19 2020 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

Sodium-Ion Batteries Jun 22 2023 Sodium-ion batteries are likely to be the next-generation power sources. They offer higher safety than lithium-ion batteries and, most important, sodium is available in unlimited abundance. The book covers the fundamental principles and applications of sodium-ion batteries and reports experimental work on the use of electrolytes and different electrode materials, such as silicon, carbon, conducting polymers, and Mn- and Sn-based materials. Also discussed are state-of-the-art, future prospects and challenges in sodium-ion battery technology. Keywords: Sodium-Ion Batteries, Lithium-Ion Batteries, Carbon Nanofibers, Conducting Polymers, Electrode Materials, Electrolytes, Graphene, Carbon Anodes, Magnetic Nanomaterials, Mn-based Materials, Sn-based Materials, Na-O2 Batteries, NASICON Electrodes, Organic Electrodes, Polyacetylene, Polyaniline, Polyphenylene, Redox Mediators, Reversible Capacity, Singlet Oxygen, Superoxide Stability.

Lithium Batteries Apr 27 2021 Explains the current state of the science and points the wayto technological advances First developed in the late 1980s, lithium-ion batteries nowpower everything from tablet computers to power tools to electriccars. Despite tremendous progress in the last two decades in theengineering and manufacturing of lithium-ion batteries, they arecurrently unable to meet the energy and power demands of many newand emerging devices. This book sets the stage for the developmentof a new generation of higher-energy density, rechargeablelithium-ion batteries by advancing battery chemistry andidentifying new electrode and electrolyte materials. The first chapter of Lithium Batteries sets thefoundation for the rest of the book with a brief account of thehistory of lithium-ion battery development. Next, the book coverssuch topics as: Advanced organic and ionic liquid electrolytes for batteryapplications Advanced cathode materials for lithium-ion batteries Metal fluorosulphates capable of doubling the energy density oflithium-ion batteries Efforts to develop lithium-air batteries Alternative anode rechargeable batteries such as magnesium andsodium anode systems Each of the sixteen chapters has been contributed by one or moreleading experts in electrochemistry and lithium battery technology.Their contributions are based on the latest published findings aswell as their own firsthand laboratory experience. Figuresthroughout the book help readers understand the concepts underlyingthe latest efforts to advance the science of batteries and developnew materials. Readers will also find a bibliography at the end ofeach chapter to facilitate further research into individualtopics. Lithium Batteries provides electrochemistry students andresearchers with a snapshot of current efforts to improve batteryperformance as well as the tools needed to advance their ownresearch efforts.

Lithium-Ion Batteries: Basics and Applications Apr 08 2022 The handbook focuses on a complete outline of lithium-ion batteries. Just before starting with an exposition of the fundamentals of this system, the book gives a short explanation of the newest cell generation. The most important elements are described as negative / positive electrode materials, electrolytes, seals and separators. The battery disconnect unit and the battery management system are important parts of modern lithium-ion batteries. An economical, faultless and efficient battery production is a must today and is represented with one chapter in the handbook. Cross-cutting issues like electrical, chemical, functional safety are further topics. Last but not least standards and transportation themes are the final chapters of the handbook. The different topics of the handbook provide a good knowledge base not only for those working daily on electrochemical energy storage, but also to scientists, engineers and students concerned in modern battery systems.

Handbook of Battery Materials Jun 10 2022 Jurgen O. Besenhard (Ed.) Handbook of Battery Materials Batteries are finding applications in an increasing range of every-day products: walkmen, mobile phones and electric cars need very different battery types. Each of these battery systems consists of very different types of materials. Improvement of these materials is an important issue in modern materials science and electrochemistry. This handbook gives a concise survey of the materials used in modern battery technology. The physico-chemical fundamentals are treated as are the environmental and recycling aspects. It is a profound reference source for anyone working in the research and development of new battery systems, regardless whether chemist, physicist, or engineer.

Electrode Materials for Energy Storage and Conversion Jan 25 2021 This book provides a comprehensive overview of the latest developments and materials used in electrochemical energy storage and conversion devices, including lithium-ion batteries, sodium-ion batteries, zinc-ion batteries, supercapacitors and conversion materials for solar and fuel cells. Chapters introduce the technologies behind each material, in addition to the fundamental principles of the devices, and their wider impact and contribution to the field. This book will be an ideal reference for researchers and individuals working in industries based on energy storage and conversion technologies across physics, chemistry and engineering. FEATURES Edited by established authorities, with chapter contributions from subject area specialists Provides a comprehensive review of the field Up to date with the latest developments and research Editors Dr. Mesfin A. Kebede obtained his PhD in Metallurgical Engineering from Inha University, South Korea. He is now a principal research scientist at Energy Centre of Council for Scientific and Industrial Research (CSIR), South Africa. He previously was an assistant professor in the Department of Applied Physics and Materials Science at Hawassa University, Ethiopia. His extensive research experience covers the use of electrode materials for energy storage and energy conversion. Prof. Fabian I. Ezema is a professor at the University of Nigeria, Nsukka. He obtained his PhD in Physics and Astronomy from University of Nigeria, Nsukka. His research focuses on several areas of materials science with emphasis on energy applications, specifically electrode materials for energy conversion and storage.
Printed Batteries Feb 23 2021 Offers the first comprehensive account of this interesting and growing research field Printed Batteries: Materials, Technologies and Applications reviews the current state of the art for printed batteries, discussing the different types and materials, and describing the printing techniques. It addresses the main applications that are being developed for printed batteries as well as the major advantages and remaining challenges that exist in this rapidly evolving area of research. It is the first book on printed batteries that seeks to promote a deeper understanding of this increasingly relevant research and application area. It is written in a way so as to interest and motivate readers to tackle the many challenges that lie ahead so that the entire research community can provide the world with a bright, innovative future in the area of printed batteries. Topics covered in Printed Batteries include, Printed Batteries: Definition, Types and Advantages; Printing Techniques for Batteries, Including 3D Printing; Inks Formulation and Properties for Printing Techniques; Rheological Properties for Electrode Slurry; Solid Polymer Electrolytes for Printed Batteries; Printed Battery Design; and Printed Battery Applications. Covers everything readers need to know about the materials and techniques required for printed batteries Informs on the applications for printed batteries and what the benefits are Discusses the challenges that lie ahead as innovators continue with their research Printed Batteries: Materials, Technologies and Applications is a unique and informative book that will appeal to academic researchers, industrial scientists, and engineers working in the areas of sensors, actuators, energy storage, and printed electronics.
Batteries for Electric Vehicles Jan 05 2022 The first practical guide to optimizing battery usage in electric vehicles, covering materials, electrochemistry, implementation and control.
Advanced Batteries Oct 22 2020 Storage and conversion are critical components of important energy-related technologies. "Advanced Batteries: Materials Science Aspects" employs materials science concepts and tools to describe the critical features that control the behavior of advanced electrochemical storage systems. This volume focuses on the basic phenomena that determine the properties of the components, i.e. electrodes and electrolytes, of advanced systems, as well as experimental methods used to study their critical parameters. This unique materials science approach utilizes concepts and methodologies different from those typical in electrochemical texts, offering a fresh, fundamental and tutorial perspective of advanced battery systems. Graduate students, scientists and engineers interested in electrochemical energy storage and conversion will find "Advanced Batteries: Materials Science Aspects" a valuable reference.
High Accuracy Computational Methods for Lithium Ion Battery Materials Aug 20 2020 The ongoing research to improve the performance of Lithium-ion batteries has required the study of

increasingly complex physical and chemical phenomena. In this context, the use of computational tools to quantitatively assess these phenomena has proven crucial for advancing the Lithium-ion battery technology. However, recent areas of research, ranging from studying the di↵diffusion of Lithium ions across solid polymer or ionic salt electrolytes, to the calculation of the voltage curve and discharge rate for complex transition metal oxide electrodes, has pushed Lithium-ion battery research beyond the framework of common computational methods, compromising the accuracy of these tools. Thus, there is an increasing need to use more accurate computational tools, or develop new ones, that could still be used in practice to design battery materials. This project presents how more accurate methods can be used to compute voltage curves for Lithium-ion cathode materials, determine the voltage stability of organic electrolyte, or predict the conductivity of di↵different electrolyte materials. The motivation for the use of higher accuracy methods is emphasized for each application by showing the limitations of commonly used methods. In particular, the achieved accuracy enables an enhanced understanding of the specific, complex physical and chemical phenomena at the heart of Lithium-ion battery limitations, which is crucial to the design of better battery materials.

Lithium-Ion Batteries and Solar Cells Dec 04 2021 Lithium-Ion Batteries and Solar Cells: Physical, Chemical, and Materials Properties presents a thorough investigation of diverse physical, chemical, and material properties and special functionalities of lithium-ion batteries and solar cells. It covers theoretical simulations and high-resolution experimental measurements that promote a full understanding of the basic science to develop excellent device performance. Employs first-principles and the machine learning method to fully explore the rich and unique phenomena of cathode, anode, and electrolyte (solid and liquid states) in lithium-ion batteries Develops distinct experimental methods and techniques to enhance the performance of lithium-ion batteries and solar cells Treats syntheses, fabrication, and measurements Discusses open issues, challenges, and potential commercial applications This book is aimed at materials scientists, chemical engineers, and electrical engineers developing enhanced batteries and solar cells for peak performance.

All Solid State Thin-Film Lithium-Ion Batteries Feb 18 2023 A comprehensive, accessible introduction to modern all-solid-state lithium-ion batteries. All-solid-state thin-film lithium-ion batteries present a special and especially important version of lithium-ion ones. They are intended for battery-powered integrated circuit cards (smart-cards), radio-frequency identifier (RFID) tags, smart watches, implantable medical devices, remote microsensors and transmitters, Internet of Things systems, and various other wireless devices including smart building control and so on. Comprising four chapters the monograph explores and provides: The fundamentals of rechargeable batteries, comparison of lithium-ion batteries with other kinds, features of thin-film batteries. A description of functional materials for all-solid-state thin-film batteries. Various methods for applying functional layers of an all-solid-state thin-film lithium-ion battery. Diagnostics of functional layers of all-solid-state thin-film lithium-ion batteries. The monograph is intended for teachers, researchers, advanced undergraduate students, and post-graduate students of profile faculties of universities, as well as for developers and manufacturers of thin-film lithium-ion batteries.

Recycling of Power Lithium-Ion Batteries Oct 02 2021 Recycling of Power Lithium-Ion Batteries Explore the past, present, and future of power lithium-ion battery recycling, from the governing regulatory framework to predictions of the future of the industry In Recycling of Power Lithium-Ion Batteries: Technology, Equipment, and Policies, a team of distinguished researchers and engineers delivers an authoritative and illuminating exploration of the industrial status and development trends in the global power lithium-ion battery sector. The book examines the development of advanced battery materials and new recycling technologies, as well as typical case studies in enterprise battery recycling. The authors provide a roadmap to the development of spent power battery recycling enterprises that can provide support to the sustainable development industry. Recycling of Power Lithium-Ion Batteries discusses a wide variety of topics with immediate applications to modern industry, including new application scenarios for power lithium-ion batteries, as well as an examination of the laws, regulations, and standards governing battery recycling.

Readers will also find: A thorough introduction to the status and development of the lithium-ion battery and its key materials Fulsome discussions of battery recycling technologies and equipment, including pre-treatment technology for battery recycling Comprehensive explorations of the life cycle of power lithium-ion batteries and the impact of battery recycling Expansive treatments of the technology outlook in the lithium-ion battery space, including green battery design and recovery systems Perfect for materials scientists, environmental chemists, and power technology engineers, Recycling of Power Lithium-Ion Batteries: Technology, Equipment, and Policies will also earn a place in the libraries of chemical and process engineers, electrochemists, and professionals working at waste disposal sites.

Nanotechnology for Lithium-Ion Batteries Nov 22 2020 This unique combined analysis of two scientific success stories—lithium-ion batteries and nanotechnology—has contributions from leading international experts who analyze the positive interplay between them, as well as future developments in energy storage.

Lithium-Ion Batteries Jul 31 2021 Here in a single source is an up-to-date description of the technology associated with the Li-Ion battery industry. It will be useful as a text for researchers interested in energy conversion for the direct conversion of chemical energy into electrical energy.

Materials for Lithium-Ion Batteries Aug 24 2023 A lithium-ion battery comprises essentially three components: two intercalation compounds as positive and negative electrodes, separated by an ionic-electronic electrolyte. Each component is discussed in sufficient detail to give the practising engineer an understanding of the subject, providing guidance on the selection of suitable materials in actual applications. Each topic covered is written by an expert, reflecting many years of experience in research and applications. Each topic is provided with an extensive list of references, allowing easy access to further information. Readership: Research students and engineers seeking an expert review. Graduate courses in electrical drives can also be designed around the book by selecting sections for discussion. The coverage and treatment make the book indispensable for the lithium battery community.

High Energy Density Lithium Batteries Nov 15 2022 Materials Engineering for High Density Energy Storage provides first-hand knowledge about the design of safe and powerful batteries and the methods and approaches for enhancing the performance of next-generation batteries. The book explores how the innovative approaches currently employed, including thin films, nanoparticles and nanocomposites, are paving new ways to performance improvement. The topic's tremendous application potential will appeal to a broad audience, including materials scientists, physicists, electrochemists, libraries, and graduate students.

Lithium-ion Batteries May 21 2023 There is a great need to develop lithium-ion batteries with high power density. Much research is, therefore, devoted to designing high-performance electrode materials and electrolytes. The book reviews the fundamental concepts and recent advances in the areas of anodes, cathodes, electrolytes, separators, binders, fabrication of device assemblies and electrochemical performance. Keywords: Lithium-ion Batteries (LIBs), Fabrication of TiO2 for LIBs, Nanomaterials, Conducting Polymers, 2D Transition Metal Dichalcogenides, Metal Sulphides, Magnetic Nanomaterials, Silicon Materials, Anodes, Cathodes, Electrolytes, Separators, Binders, Fabrication of Device Assemblies, and Electrochemical Performance of LIBs.

Lithium Batteries Jan 17 2023 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.

Lithium-ion Batteries Mar 27 2021 "This is the first machine-generated scientific book in chemistry published by Springer Nature. Serving as an innovative prototype defining the current status of the technology, it also provides an overview about the latest trends of lithium-ion batteries research. This book explores future ways of informing researchers and professionals. State-of-the-art computer algorithms were applied to: select relevant sources from Springer Nature publications, arrange these in a topical order, and provide succinct summaries of these articles. The result is a cross-corpora auto-summarization of current texts, organized by means of a similarity-based clustering routine in coherent chapters and sections. This book summarizes more than 150 research articles published from 2016 to 2018 and provides an informative and concise overview of recent research into anode and cathode materials as well as further aspects such as separators, polymer electrolytes, thermal behavior and modelling. With this prototype, Springer Nature has begun an innovative journey to explore the field of machine-generated content and to find answers to the manifold questions on this fascinating topic. Therefore it was intentionally decided not to manually polish or copy-edit any of the texts so as to highlight the current status and remaining boundaries of machine-generated content. Our goal is to initiate a broad discussion, together with the research community and domain experts, about the future opportunities, challenges and limitations of this technology."--Publisher's website.

Inorganic Battery Materials Oct 14 2022 A guide to the fundamental chemistry and recent advances of battery materials In one comprehensive volume, Inorganic Battery Materials explores the basic chemistry principles, recent advances, and the challenges and opportunities of the current and emerging technologies of battery materials. With contributions from an international panel of experts, this authoritative resource contains information on the fundamental features of battery materials, discussions on material synthesis, structural characterizations and electrochemical reactions. The book explores a wide range of topics including the state-of-the-art lithium ion battery chemistry to more energy-aggressive chemistries involving lithium metal. The authors also include a review of sulfur and oxygen, aqueous battery chemistry, redox flow battery chemistry, solid state battery chemistry and environmentally beneficial carbon dioxide battery chemistry. In the context of renewable energy utilization and transportation electrification, battery technologies have been under more extensive and intensive development than ever. This important book: Provides an understanding of the chemistry of a battery technology Explores battery technology's potential as well as the obstacles that hamper the potential from being realized Highlights new applications and points out the potential growth areas that can serve as inspirations for future research Includes an understanding of the chemistry of battery materials and how they store and convert energy Written for students and academics in the fields of energy materials, electrochemistry, solid state chemistry, inorganic materials chemistry and materials science, Inorganic Battery Materials focuses on the inorganic chemistry of battery materials associated with both current and future battery technologies to provide a unique reference in the field. About EIBC Books The Encyclopedia of Inorganic and Bioinorganic Chemistry (EIBC) was created as an online reference in 2012 by merging the Encyclopedia of Inorganic Chemistry and the Handbook of Metalloproteins. The resulting combination proves to be the defining reference work in the field of inorganic and bioinorganic chemistry, and a lot of chemistry libraries around the world have access to the online version. Many readers, however, prefer to have more concise thematic volumes in print, targeted to their specific area of interest. This feedback from EIBC readers has encouraged the Editors to plan a series of EIBC Books [formerly called EIC Books], focusing on topics of current interest. EIBC Books will appear on a regular basis, will be edited by the EIBC Editors and specialist Guest Editors, and will feature articles from leading scholars in their fields. EIBC Books aim to provide both the starting research student and the confirmed research worker with a critical distillation of the leading concepts in inorganic and bioinorganic chemistry, and provide a structured entry into the fields covered.

Battery Technologies Jul 11 2022 Battery Technologies A state-of-the-art exploration of modern battery technology In Battery Technologies: Materials and Components, distinguished researchers

Dr. Jianmin Ma delivers a comprehensive and robust overview of battery technology and new and emerging technologies related to lithium, aluminum, dual-ion, flexible, and biodegradable batteries. The book offers practical information on electrode materials, electrolytes, and the construction of battery systems. It also considers potential approaches to some of the primary challenges facing battery designers and manufacturers today. Battery Technologies: Materials and Components provides readers with: A thorough introduction to the lithium-ion battery, including cathode and anode materials, electrolytes, and binders Comprehensive explorations of lithium-oxygen batteries, including battery systems, catalysts, and anodes Practical discussions of redox flow batteries, aqueous batteries, biodegradable batteries, and flexible batteries In-depth examinations of dual-ion batteries, aluminum ion batteries, and zinc-oxygen batteries Perfect for inorganic chemists, materials scientists, and electrochemists, Battery Technologies: Materials and Components will also earn a place in the libraries of catalytic and polymer chemists seeking a one-stop resource on battery technology.

Lithium-ion Battery Materials and Engineering Apr 20 2023 Gaining public attention due, in part, to their potential application as energy storage devices in cars, Lithium-ion batteries have encountered widespread demand, however, the understanding of lithium-ion technology has often lagged behind production. This book defines the most commonly encountered challenges from the perspective of a high-end lithium-ion manufacturer with two decades of experience with lithium-ion batteries and over six decades of experience with batteries of other chemistries. Authors with years of experience in the applied science and engineering of lithium-ion batteries gather to share their view on where lithium-ion technology stands now, what are the main challenges, and their possible solutions. The book contains real-life examples of how a subtle change in cell components can have a considerable effect on cell's performance. Examples are supported with approachable basic science commentaries. Providing a unique combination of practical know-how with an in-depth perspective, this book will appeal to graduate students, young faculty members, or others interested in the current research and development trends in lithium-ion technology.

Lithium Ion Batteries May 17 2020 The eight chapters in this book cover topics on advanced anode and cathode materials, materials design, materials screening, electrode architectures, diagnostics and materials characterization, and electrode/electrolyte interface characterization for lithium batteries. All these topics were carefully chosen to reflect the most recent advances in the science and technology of rechargeable Li-ion batteries, to provide wide readership with a platform of subjects that will help in the understanding of current technologies, and to shed light on areas of deficiency and to energize prospects for future advances.

Handbook of Battery Materials Jul 23 2023 A one-stop resource for both researchers and development engineers, this comprehensive handbook serves as a daily reference, replacing heaps of individual papers. This second edition features twenty percent more content with new chapters on battery characterization, process technology, failure mechanisms and method development, plus updated information on classic batteries as well as entirely new results on advanced approaches. The authors, from such leading institutions as the US National Labs and from companies such as Panasonic and Sanyo, present a balanced view on battery research and large-scale applications. They follow a distinctly materials-oriented route through the entire field of battery research, thus allowing readers to quickly find the information on the particular materials system relevant to their research.

Advanced Battery Materials May 09 2022 Electrochemical energy storage has played important 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 increase and cost reduction. However, the energy density has to be further increased to achieve long endurance time. In this book, recent research and development in advanced electrode materials for electrochemical energy storage devices are presented, including lithium ion batteries, lithium-sulfur batteries and metal-air batteries, sodium ion batteries and supercapacitors. The materials involve transition metal oxides, sulfides, Si-based material as well as

graphene and graphene composites.
Rechargeable Lithium-Ion Batteries Apr 15 2020 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.
Electrodes for Li-ion Batteries Feb 06 2022 The electrochemical energy storage is a means to conserveelectrical energy in chemical form. This form of storage benefitsfrom the fact that these two energies share the same vector, theelectron. This advantage allows us to limit the losses related tothe conversion of energy from one form to another. The RS2Efocuses its research on rechargeable electrochemical devices (orelectrochemical storage) batteries and supercapacitors. The materials used in the electrodes are key components oflithium-ion batteries. Their nature depend battery performance interms of mass and volume capacity, energy density, power,durability, safety, etc. This book deals with current and futurepositive and negative electrode materials covering aspects relatedto research new and better materials for future applications(related to renewable energy storage and transportation inparticular), bringing light on the mechanisms of operation, agingand failure.
Water in Lithium-Ion Batteries Sep 13 2022 This book reviews the impact of water content in lithium-ion batteries (LIBs) as well as the reactivity of anodes, cathodes and electrolytes with water and processes that provide water-resistance to materials in LIBs. Water in LIBs which were constructed with anode, cathode and organic electrolyte containing lithium salts can degrade the cell performance and seriously damage the materials present. However, because a small amount of water in cells contributes to the formation of the solid electrolyte interphase, complete removal of water from cells lowers the battery performance and increases costs due to removal of water from the battery materials. This book presents the optimal concentration of water for each battery material along with appropriate removal methods and water-scavengers which were developed recently to establish both high performance and lower costs. Moreover this book describes the development of anodes and cathodes prepared by aqueous process and aqueous LIBs in which aqueous electrolytes containing lithium salts are used as an electrolyte. This book will be useful not only for academic researchers but also for company researchers who deal with LIBs.
Rechargeable Ion Batteries Mar 19 2023 Rechargeable Ion Batteries Highly informative and comprehensive resource providing knowledge on underlying concepts, materials, ongoing developments and the many applications of ion-based batteries Rechargeable Ion Batteries explores the concepts and the design of rechargeable ion batteries, including their materials chemistries, applications, stability, and novel developments. Focus is given on state-of-the-art Li-based batteries used for portable electronics and electric vehicles, while other emerging ion-battery technologies

are also introduced. The text addresses innovative approaches by reviewing nanostructured anodes and cathodes that pave new ways for enhancing the electrochemical performance. The first three chapters are dedicated to the general concepts of electrochemical cells, enabling readers to understand all necessary concepts for batteries from a single book. The following chapter covers the exciting applications of lithium-ion and sodium-ion batteries, while the subsequent chapters on Li-battery components include new types of anodes, cathodes, and electrolytes that have been developed recently, complemented by an overview of designing mechanically stable ion-battery systems. The last three chapters summarize recent progress in lithium-sulfur, sodium-ion, magnesium-ion and zinc and emerging ion-battery technologies. In Rechargeable Ion Batteries, readers can expect to find specific information on: Electrochemical cells, primary batteries, secondary batteries, recycling of batteries, applications of lithium and sodium batteries Next-generation cathodes, anodes and electrolytes for secondary lithium-ion batteries, which allow for improved performance and safety Multiphysics modeling for predicting design criteria for next generation ion-insertion electrodes Developments in lithium-sulfur batteries, sodium-ion batteries, and future ion-battery technologies Rechargeable Ion Batteries provides informative and comprehensive coverage of the subject to interested researchers, academics, and professionals in various fields, including materials science, electrochemistry, physical chemistry, mechanics, engineering, recycling and industry including the battery manufacturers and supply chain ancillaries, automotive, aerospace, and marine sectors, energy storage installers and environmental stakeholders. Readers can easily acquire a base of knowledge on the subject while understanding future developments in the field.

Lithium Ion Rechargeable Batteries Aug 12 2022 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.

Lithium-ion Batteries Mar 07 2022

Iron Phosphate Materials as Cathodes for Lithium Batteries May 29 2021 Iron Phosphate Materials as Cathodes for Lithium Batteries describes the synthesis and the chemical–physical characteristics of iron phosphates, and presents methods of making LiFePO4 a suitable cathode material for lithium-ion batteries. The author studies carbon’s ability to increase conductivity and to decrease material grain size, as well as investigating the electrochemical behaviour of the materials obtained. Iron Phosphate Materials as Cathodes for Lithium Batteries also proposes a model to explain lithium insertion/extraction in LiFePO4 and to predict voltage profiles at various discharge rates. Iron Phosphate Materials as Cathodes for Lithium Batteries is written for postgraduate students and researchers in electrochemistry, R&D professionals and experts in electrochemical storage.

Handbook of Sodium-Ion Batteries Sep 20 2020 The need for batteries has grown exponentially in response to the increase in global energy demand and to the ambitious goals that governments have set up for sustainable energy development worldwide, especially in developed countries. While lithium-ion batteries currently dominate the energy storage market, the limited and unevenly distributed lithium resources have caused huge concerns over the sustainability of the lithium-ion battery technology. Sodium-ion batteries have significant benefits over lithium-ion batteries, including sodium's abundance in the Earth's crust. These batteries have therefore gained research interest, and efforts are being made to use them in place of lithium-ion batteries. While the past decade has witnessed significant research advances and breakthroughs in developing the sodium-ion battery technology, there still remain fundamental challenges that must be overcome to push the

technology forward. This book comprises 13 chapters that discuss the fundamental challenges, electrode materials, electrolytes, separators, advanced instrumental analysis techniques, and computational methods for sodium-ion batteries from renowned scientists. The book is a unique combination of all aspects associated with sodium-ion batteries and can therefore be used as a handbook.

Lithium-Related Batteries Jun 29 2021 This book serves as a comprehensive treatment of the advanced microscopic properties of lithium- and sodium-based batteries. It focuses on the development of the quasiparticle framework and the successful syntheses of cathode/electrolyte/anode materials in these batteries. FEATURES Highlights lithium-ion and sodium-ion batteries as well as lithium sulfur-, aluminum-, and iron-related batteries Describes advanced battery materials and their fundamental properties Addresses challenges to improving battery performance Develops theoretical predictions and experimental observations under a unified quasiparticle framework Targets core issues such as stability and efficiencies Lithium-Related Batteries: Advances and Challenges will appeal to researchers and advanced students working in battery development, including those in the fields of materials, chemical, and energy engineering.