Lithium Ion Batteries Advances And Applications

Electrolytes for Lithium and Lithium-ion Batteries provides a comprehensive overview of the scientific understanding and technological development of electrolyte materials in the last several years. This book covers key electrolytes such as LiPF6 salt in mixed-carbonate solvents with additives for the state-of-the-art Li-ion batteries as well as new electrolyte materials developed recently that lay the foundation for future advances. This book also reviews the characterization of electrolyte materials for their transport properties, structures, phase relationships, stabilities, and impurities. The book discusses in-depth the electrode-electrolyte interactions and interphasial chemistries that are key for the successful use of the electrolyte in practical devices. The Quantum Mechanical and Molecular Dynamical calculations that has proved to be so powerful in understanding and predicating behavior and properties of materials is also reviewed in this book. Electrolytes for Lithium and Lithium-ion Batteries is ideal for electrochemists, engineers, researchers interested in energy science and technology, material scientists, and physicists working on energy.

Solid-state batteries hold the promise of providing energy storage with high volumetric and gravimetric energy densities at high power densities, yet with far less safety issues relative to those associated with conventional liquid or gel-based lithium-ion batteries. Solid-state batteries are envisioned to be useful for a broad spectrum of energy storage applications, including powering automobiles and portable electronic devices, as well as stationary storage and load-leveling of renewably generated energy. This comprehensive handbook covers a wide range of topics related to solid-state batteries, including advanced enabling characterization techniques, fundamentals of solid-state systems, novel solid electrolyte systems, interfaces, cell-level studies, and three-dimensional architectures. It is directed at physicists, chemists, materials scientists, electrochemists, electrical engineers, battery technologists, and evaluators of present and future generations of power sources. This handbook serves as a reference text providing state-of-the-art reviews on solid-state battery technologies, as well as providing insights into likely future developments in the field. It is extensively annotated with comprehensive references useful to the student and practitioners in the field.

Written by a group of top scientists and engineers in academic and industrial R&D, Lithium-Ion Batteries: Advanced Materials and Technologies gives a clear picture of the current status of these highly efficient batteries. Leading international specialists from universities, government laboratories, and the lithium-ion battery industry share th

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.

Lithium-ion batteries (LIBs), as a key part of the 2019 Nobel Prize in Chemistry, have become increasingly important in recent years, owing to their potential impact on building a more sustainable future. Compared with other batteries developed, LIBs offer high energy density, high discharge power, and a long service life. These characteristics have facilitated a remarkable advance of LIBs in many frontiers, including electric vehicles, portable and flexible electronics, and stationary applications. Since the field of LIBs is advancing rapidly and attracting an increasing number of researchers, it is necessary to often provide the community with the latest updates. Therefore, this book was designed to focus on updating the electrochemical community with the latest advances and prospects on various aspects of LIBs. The materials presented in this book cover advances in several fronts of the technology, ranging from detailed fundamental studies of the electrochemical cell to investigations to better improve parameters related to battery packs.

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 was previously 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 an emphasis on energy applications, specifically electrode materials for energy conversion and storage.

Polymer-Based Separators for Lithium-Ion Batteries: Production, Processing, and Properties takes a detailed, systematic approach to the development of polymer separators for lithium-ion batteries, supporting the reader in selecting materials and processes for high-performance polymer separators with enhanced properties. The book begins by introducing the polymeric materials that may be used for separators, as well as characterization techniques, before presenting the available technologies used to produce separators for use in lithium-ion batteries. Each technology is discussed in terms of the advantages and
disadvantages of the chosen approach, with the properties of the separators made via each technology also summarized and 
compared in detail. In addition, areas for further development are addressed, and the limitations of current materials and 
separators in achieving those goals are highlighted. This is a valuable resource for scientists and engineers in the industry who 
work on polymer-based battery separators, polymers for electronic/energy applications, and new materials and processes for 
lithium-ion batteries. In academia, this book will be of interest to researchers and advanced students across the fields of polymer 
science, materials science, electronics, energy, and chemical engineering. Covers all current and new technologies used in the 
production of polymer battery separators for lithium-ion batteries Analyzes the connections between the various materials and 
processes, advantages and disadvantages, and resulting properties of different polymer-based separators Enables the reader to 
develop polymer separators that meet industry standards and property and performance requirements

This book presents a state-of-the-art review of recent advances in the recycling of spent lithium-ion batteries. The topics covered 
include: introduction to the structure of lithium-ion batteries; development of battery-powered electric vehicles; potential 
environmental impact of spent lithium-ion batteries; pretreatment of spent lithium-ion batteries for recycling processing; 
pyrometallurgical processing for recycling spent lithium-ion batteries; hydrometallurgical processing for recycling spent lithium-ion 
batteries; direct processing for recycling spent lithium-ion batteries; high value-added products from recycling of spent lithium-ion 
batteries; and effects of recycling of spent lithium-ion batteries on environmental burdens. The book provides an essential 
reference resource for professors, researchers, and policymakers in academia, industry, and government around the globe. 
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.

In the decade since the introduction of the first commercial lithium-ion battery research and development on virtually every aspect 
of the chemistry and engineering of these systems has proceeded at unprecedented levels. This book is a snapshot of the state-of-
the-art and where the work is going in the near future. The book is intended not only for researchers, but also for engineers and 
users of lithium-ion batteries which are found in virtually every type of portable electronic product. 
Since the first development of lithium-ion batteries in the early 1990’s, there have been tremendous advances in the science and 
technology of these electrochemical energy sources. At present, lithium batteries dominate the field of advanced power sources 
and have almost entirely replaced their bulkier and less energetic counterparts such as nickel-cadmium and nickel-metalhydride 
batteries; especially in portable electronic devices. But lithium batteries are still the object of continuing intense research aimed at 
making further improvements in performance and safety, at lower cost, so as to make them suitable for higher-power and more
demanding applications such as electric vehicles. The research and development of new electrode materials, particularly for cathodes, having an improved electrochemical performance has always been a matter of changing focus. Thus, olivine, lithium iron phosphate, has attracted considerable attention in recent years as a safe, environmentally friendly, extremely stable and very promising cathode material.

Silicon Anode Systems for Lithium-Ion Batteries is an introduction to silicon anodes as an alternative to traditional graphite-based anodes. The book provides a comprehensive overview including abundance, system voltage, and capacity. It provides key insights into the basic challenges faced by the materials system such as new configurations and concepts for overcoming the expansion and contraction related problems. This book has been written for the practitioner, researcher or developer of commercial technologies. Provides a thorough explanation of the advantages, challenge, materials science, and commercial prospects of silicon and related anode materials for lithium-ion batteries. Provides insights into practical issues including processing and performance of advanced Si-based materials in battery-relevant materials systems. Discusses suppressants in electrolytes to minimize adverse effects of solid electrolyte interphase (SEI) formation and safety limitations associated with this technology. This book surveys state-of-the-art research on and developments in lithium-ion batteries for hybrid and electric vehicles. It summarizes their features in terms of performance, cost, service life, management, charging facilities, and safety. Vehicle electrification is now commonly accepted as a means of reducing fossil-fuels consumption and air pollution. At present, every electric vehicle on the road is powered by a lithium-ion battery. Currently, batteries based on lithium-ion technology are ranked first in terms of performance, reliability and safety. Though other systems, e.g., metal-air, lithium-sulphur, solid state, and aluminium-ion, are now being investigated, the lithium-ion system is likely to dominate for at least the next decade – which is why several manufacturers, e.g., Toyota, Nissan and Tesla, are chiefly focusing on this technology. Providing comprehensive information on lithium-ion batteries, the book includes contributions by the world's leading experts on Li-ion batteries and vehicles.

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.

This book covers the most recent advances in the science and technology of nanostructured materials for lithium-ion application. With contributions from renowned scientists and technologists, the chapters discuss state-of-the-art research on nanostructured anode and cathode materials, some already used in commercial batteries and others still in development. They include nanostructured anode materials based on Si, Ge, Sn, and other metals and metal oxides together with cathode materials of olivine, the hexagonal and spinel crystal structures.
Nanostructured Materials for Next-Generation Energy Storage and Conversion: Photovoltaic and Solar Energy, is volume 4 of a 4-volume series on sustainable energy. Photovoltaic and Solar Energy while being a comprehensive reference work, is written with minimal jargon related to various aspects of solar energy and energy policies. It is authored by leading experts in the field, and lays out theory, practice, and simulation studies related to solar energy and allied applications including policy, economic and technological challenges. Topics covered include: introduction to solar energy, fundamentals of solar radiation, heat transfer, thermal collection and conversion, solar economy, heating, cooling, dehumidification systems, power and process heat, solar power conversion, policy and applications pertinent to solar energy as viable alternatives to fossil fuels. The aim of the book is to present all the information necessary for the design and analysis of solar energy systems for engineers, material scientists, economics, policy analysts, graduate students, senior undergraduates, solar energy practitioner, as well as policy or lawmakers in the field of energy policy, international energy trade, and libraries which house technical handbooks related to energy, energy policy and applications.

Lithium-Ion Batteries: Fundamentals and Applications offers a comprehensive treatment of the principles, background, design, production, and use of lithium-ion batteries. Based on a solid foundation of long-term research work, this authoritative monograph: Introduces the underlying theory and history of lithium-ion batteries Describes the key components of lithium-ion batteries, including negative and positive electrode materials, electrolytes, and separators Discusses electronic conductive agents, binders, solvents for slurry preparation, positive thermal coefficient (PTC) materials, current collectors, and cases Examines the assembly processes and electrochemical performance of lithium-ion batteries Explores applications in power tools, electric vehicles, aerospace, and more Lithium-Ion Batteries: Fundamentals and Applications delivers a systematic overview of lithium-ion batteries, from physical properties to manufacturing technologies. The book also supplies valuable insight into potential growth opportunities in this exciting market.

Advances in Battery Technologies for Electric Vehicles provides an in-depth look into the research being conducted on the development of more efficient batteries capable of long distance travel. The text contains an introductory section on the market for battery and hybrid electric vehicles, then thoroughly presents the latest on lithium-ion battery technology. Readers will find sections on battery pack design and management, a discussion of the infrastructure required for the creation of a battery powered transport network, and coverage of the issues involved with end-of-life management for these types of batteries. Provides an in-depth look into new research on the development of more efficient, long distance travel batteries Contains an introductory section on the market for battery and hybrid electric vehicles Discusses battery pack design and management and the issues involved with end-of-life management for these types of batteries.
Written by a group of top scientists and engineers in academic and industrial R&D, Lithium-Ion Batteries: Advanced Materials and Technologies gives a clear picture of the current status of these highly efficient batteries. Leading international specialists from universities, government laboratories, and the lithium-ion battery industry share their knowledge and insights on recent advances in the fundamental theories, experimental methods, and research achievements of lithium-ion battery technology. Along with coverage of state-of-the-art manufacturing processes, the book focuses on the technical progress and challenges of cathode materials, anode materials, electrolytes, and separators. It also presents numerical modeling and theoretical calculations, discusses the design of safe and powerful lithium-ion batteries, and describes approaches for enhancing the performance of next-generation lithium-ion battery technology. Due to their high energy density, high efficiency, superior rate capability, and long cycling life, lithium-ion batteries provide a solution to the increasing demands for both stationary and mobile power. With comprehensive and up-to-date information on lithium-ion battery principles, experimental research, numerical modeling, industrial manufacturing, and future prospects, this volume will help you not only select existing materials and technologies but also develop new ones to improve battery performance.

The papers included in this issue of ECS Transactions were originally presented in the symposium “Rechargeable Lithium and Lithium Ion Batteries”, held during the 212th meeting of The Electrochemical Society, in Washington, DC, from October 7 to 12, 2007.

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.

This book addresses recycling technologies for many of the valuable and scarce materials from spent lithium-ion batteries. A successful transition to electric mobility will result in large volumes of these. The book discusses engineering issues in the entire process chain from disassembly over mechanical conditioning to chemical treatment. A framework for environmental and economic evaluation is presented and recommendations for researchers as well as for potential operators are derived.

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.

The book “Lithium-ion Batteries - Thin Film for Energy Materials and Devices” provides recent research and trends for thin film materials relevant to energy utilization. The book has seven chapters with high quality content covering general aspects of the fabrication method for cathode, anode, and solid electrolyte materials and their thin films. All the chapters have been written by experts from different backgrounds, and the book is the result of collaborations between all contributing authors who agreed to share their research expertise and technological visions for the future. We hope this book will significantly stimulate readers to develop new devices.

Lithium-Ion 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 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.

Lithium ion batteries (LIBs) are efficient storage systems for portable electronic devices, electrical power grids, and electrified transportation due to their high-energy density and low maintenance requirements. After their launch into the market in 1990s, they immediately became the dominant technology for portable systems. The development of LiBs for electric drive vehicles has been, in contrast, rather incremental. There are several critical issues, such as an energy density, system safety, cost, and
environmental impact of the battery production processes, that remain challenges in the automotive field. In order to strengthen the LiB's competitiveness and affordability in vehicle technology, the necessity of game-changer batteries is urgent. Recently, a novel approach going beyond Li batteries has become rapidly established. Several new chemistries have been proposed, leading to better performances in terms of energy density, long-life storage capability, safety, and sustainability. However, several challenges, such as a thorough understanding of mechanisms, cell design, long-term durability, and safety issues, have not yet been fully addressed. This book collects some recent developments and emerging trends in the field of "post-lithium" batteries, covering both fundamental and applied aspects of next-generation batteries.

Rechargeable Lithium Batteries: From Fundamentals to Application provides an overview of rechargeable lithium batteries, from fundamental materials, through 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.

Explains the current state of the science and points the way to technological advances First developed in the late 1980s, lithium-ion batteries nowpower everything from tablet computers to power tools to electric cars. Despite tremendous progress in the last two decades in the engineering and manufacturing of lithium-ion batteries, they are currently unable to meet the energy and power demands of many new and emerging devices. This book sets the stage for the development of a new generation of higher-energy density, rechargeable lithium-ion batteries by advancing battery chemistry and identifying new electrode and electrolyte materials.
The first chapter of Lithium Batteries sets the foundation for the rest of the book with a brief account of the history of lithium-ion battery development. Next, the book covers such topics as: Advanced organic and ionic liquid electrolytes for battery applications. Advanced cathode materials for lithium-ion batteries. Metal fluorosulphates capable of doubling the energy density of lithium-ion batteries. Efforts to develop lithium-air batteries. Alternative anode rechargeable batteries such as magnesium and sodium anode systems. Each of the sixteen chapters has been contributed by one or more leading experts in electrochemistry and lithium battery technology. Their contributions are based on the latest published findings as well as their own firsthand laboratory experience. Figures throughout the book help readers understand the concepts underlying the latest efforts to advance the science of batteries and develop new materials. Readers will also find a bibliography at the end of each chapter to facilitate further research into individual topics. Lithium Batteries provides electrochemistry students and researchers with a snapshot of current efforts to improve battery performance as well as the tools needed to advance their own research efforts.

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.
as well as economic and risk analyses. The second part focuses on information technology's impact on service systems, such as data-driven reliability modeling, failure prognosis, and service decision making methodologies for battery services. The third part addresses battery management systems (BMS) for control and optimization of battery cells, operations, and hybrid storage systems to ensure overall performance and safety, as well as EV management. The contributors consist of experts from universities, industry research centers, and government agency. In addition, this book: Provides comprehensive overviews of lithium-ion battery and battery electrical vehicle manufacturing, as well as economic returns and government support Introduces integrated models for quality propagation and productivity improvement, as well as indicators for bottleneck identification and mitigation in battery manufacturing Covers models and diagnosis algorithms for battery SOC and SOH estimation, data-driven prognosis algorithms for predicting the remaining useful life (RUL) of battery SOC and SOH Presents mathematical models and novel structure of battery equalizers in battery management systems (BMS) Reviews the state of the art of battery, supercapacitor, and battery-supercapacitor hybrid energy storage systems (HESSs) for advanced electric vehicle applications Advances in Battery Manufacturing, Services, and Management Systems is written for researchers and engineers working on battery manufacturing, service, operations, logistics, and management. It can also serve as a reference for senior undergraduate and graduate students interested in BM2S2.

As energy produced from renewable sources is increasingly integrated into the electricity grid, interest in energy storage technologies for grid stabilisation 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 Examines battery types, including zing-based, lithium-air and vanadium redox flow batteries Analyses design issues and applications of these technologies

Summary: Reviews the applications of Lithium-ion batteries in both the portable and industrial world, with a focus on safety, cost, reliability, and recycling. Pistoia's Lithium-ion Batteries features an in-depth description of different Lithium-ion applications, including important features such as safety and reliability. This title allows readers to get acquainted 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 working anywhere
from research institutions and universities, to a worldwide array of diverse professional industries.--Provided by publisher.

"Lithium-Ion Batteries: Properties, Advantages and Limitations summarizes research progress in anode and cathode binders of lithium ion batteries in the past 20 years. So far, the binders reported in the literature involve polymers, natural extracts, conductive binders and self-healing binders. Additionally, the authors provide a comprehensive review of state-of-the-art progress in graphite-silicon anodes, from novel structure design to electrode fabrication, from half-coin-cell testing to pouch-full-cell evaluation, and from fundamental mechanistic studies to applied research. High-performance polymeric separators, which serve as an important component in lithium-ion batteries, are also attracting increased attention. The requirements for the separators, their types, preparation methods and latest developments are summarized. Following this, recent advancements in ab initio screening of electrode materials for lithium-ion batteries by the construction of activity-stability Volcano plots are summarized. The underlying approach may also be applied in the investigation of catalytic reactions. In closing, the authors examine the diffusion equation in curvilinear coordinates by using the method of characteristics. This method is commonly applied to solve first order partial differential equations"

This invaluable book focuses on the mechanisms of formation of a solid-electrolyte interphase (SEI) on the electrode surfaces of lithium-ion batteries. The SEI film is due to electromechanical reduction of species present in the electrolyte. It is widely recognized that the presence of the film plays an essential role in the battery performance, and its very nature can determine an extended (or shorter) life for the battery. In spite of the numerous related research efforts, details on the stability of the SEI composition and its influence on the battery capacity are still controversial. This book carefully analyzes and discusses the most recent findings and advances on this topic.

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