Book Reviews

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1 Lithium-Ion Batteries, Advanced Materials and Technologies

by: X. Yuan, H. Liu and J. Zhang
Series Editor: S. Lee, Green Chemistry and Chemical Engineering
Published 2012
by CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742, USA, 406pp
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Energy conversion and energy storage are becoming more and more important in today's society due to the increased demand for stationary and mobile power. In particular, electrochemical energy conversion and storage devices using battery technologies have recently attracted attention worldwide in terms of technology development and commercialisation. For example, lithium-ion batteries have been considered one of the most promising energy conversion and storage devices due to their intrinsic advantages such as high energy density, high efficiency, superior rate capability, and long cycling life compared with other batteries.

This book is designed to draw a clear picture of the current status of lithium-ion batteries, with a focus on the technical progress, challenges, and perspectives in the field of cathode materials, anode materials, electrolytes, separators, numerical modelling and theoretical calculation, and state-of-the-art manufacturing processes. Design of safe and powerful lithium-ion batteries and the methods/approaches for enhancing the performance of next-generation lithium-ion battery technology are also presented and discussed in this book. A group of top scientists and engineers working on lithium-ion batteries with not only excellent academic records but also strong industrial expertise were invited to contribute chapters. In this book, these leading experts from universities, government laboratories, and lithium-ion battery industries in North America, Europe, and Asia share their knowledge, information, and insights on recent advances in the fundamental theories, experimental methodologies, and research achievements in lithium-ion battery technology.

The book contains the following chapters:

Material challenges and respective, cathode materials for lithium-ion batteries, anode materials for lithium-ion batteries, electrolytes for lithium-ion batteries, separators for lithium-ion batteries, first-principles methods in the modelling of Li-ion battery materials, a multidimensional, electrochemical-thermal coupled lithium-ion battery model, state-of-the-art production technology of cathode and anode materials for lithium-ion batteries.

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This book will be a good resource for electrochemists, material scientists, students, industrial professionals, manufacturers, and the public, providing comprehensive and up-to-date information on lithium-ion battery principles, current status, and future prospects. The information in this book will be very helpful for readers in selecting existing materials/technologies and developing new materials/technologies to improve lithium-ion battery performance.

2 Ceramics Science and Technology, Vol. 3, Synthesis and Processing

by: R. Riedel and I.W. Chen
Published 2012
by Wiley-VCH Verlag GmbH & Co. KgaA
Boschstrasse 12, 69469 Weinheim, Germany, 530pp
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Volume 3 of this series is devoted to ceramic processing -a critical field in ceramic science and technology. The importance of this field is witnessed by the continuing activities in the areas of basic and applied research, and also in the development of new processing equipment for both production and experimentation. Steps in processing – from start to finish – have immediate impacts on the performance of the final ceramics. Notably, the more stringent the requirements for ceramic performance are, the stronger the connection between processing and performance. In other words – ceramics are 'unforgiving' to processing mistakes.

Ceramic processing usually starts from powders that neither melt nor plastically deform, but must be densified by diffusion during firing. As finished ceramics do not plastically deform either, any remaining defects in the fired ceramic as well as any new defects introduced during finishing may become the fatal flaws that lead to mechanical and electrical failures. During firing, the diffusion distance is intimately related to the way in which the processing is conducted prior to firing. The powder's characteristics and the packing mechanics determine the size and population of structural inhomogeneities in the green body. It is not only the size of the powder also the largest inhomogeneity that determines the diffusion distance. Justifiably, great emphasis has been placed on the powder characteristics that can promote a uniform packing while minimising the diffusion distance. The production and use of such powders are, without question, critical stages in ensuring successful ceramic processing. Nonetheless, the detection of processing defects that remain after sintering and their removal by machining and finishing are necessary, albeit expensive, steps to ensure a good performance of the ceramic components in many applications.

The book contains the following chapters:

Part I – Powders:

- Powder compaction by dry pressing
- Tape casting

- Hydrothermal routes to advanced ceramic powders and materials
- Liquid feed-flame spray pyrolysis (LF_FSP) in the synthesis of single- and mixed-metal oxide nanopowders
- Sol-gel processing of ceramics.

Part II – Densification and beyond:

- Sintering
- Hot isostatic pressing and gas-pressure sintering
- Hot pressing and spark plasma sintering
- Fundamentals and methods of ceramic joining
- Machining and finishing of ceramics.

Part III – Films and coatings:

- Vapour-phase deposition of oxides
- Metal-organic chemical vapour deposition of metal oxide films and nanostructures.

Part IV – Manufacturing technology:

- Powder characterisation
- Process defects
- Nonconventional polymers in ceramic processing: thermoplastics and monomers
- Manufacturing technology: rapid prototyping.

Part V – Alternative strategies to ceramics:

- Sintering of nanograin ceramics
- Polymer-derived ceramics
- High-pressure routes to ceramics.

Materials scientists, engineers, chemists, biochemists, physicists and medical researchers alike will find this work a treasure trove for a wide range of ceramics knowledge from theory and fundamentals to practical approaches and problem solutions.

Volume 3 of this series is devoted to ceramic processing – a critical field in ceramic science and technology. The importance of this field is witnessed by the continuing activities in the areas of basic and applied research, and also in the development of new processing equipment for both production and experimentation. Steps in processing – from start to finish – have immediate impacts on the performance of the final ceramics. Notably, the more stringent the requirements for ceramic performance are, the stronger the connection between processing and performance.

3 In-Situ Synthesis of Polymer Nanocomposites

by: V. Mittal
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by Wiley-VCH Verlag GmbH & Co. KgaA
Boschstrasse 12, 69469 Weinheim, Germany, 400pp
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In-situ intercalation method was reported by Toyota researchers for the synthesis of polyamide nanocomposites in the early nineties which led to the exponential growth in the nanocomposites research. For generation of polymer nanocomposites by method, the layered silicate mineral was swollen in the liquid monomer. After swelling, the polymerisation of monomer was initiated in the presence of filler. As monomer is present in and out of the filler interlayers, the generated structure is exfoliated or significantly intercalated. Since then, a large number of polymers like polyethylene, polypropylene (both cases have monomers as gases), PET, epoxy, polyurethane and polystyrene have been synthesised in situ in the presence of filler to generate nanocomposites. In-situ intercalative polymerisation in the presence of filler does provide distinct advantages as compared with other nanocomposite synthesis techniques like possibility to polymerise a large range of thermoplastic and thermosetting polymers, handling of gaseous or liquid monomers, handling of high-pressure polymerisation, and easy control of heat of heat of polymerisation owing to dispersion medium present in the system. This book also aims to highlight these advantages of in-situ polymerisation in the light of generation of polymer nanocomposites with a large spectrum of polymer matrices.

The book series 'Polymer Nano-, Micro- and Macrocomposites' provides complete and comprehensive information on all important aspects of polymer composite research and development, including, but not limited to synthesis, filler modification, modelling, characterisation as well as application and commercialisation issues. Each book focuses on a particular topic and gives a balanced in-depth overview of the respective subfield of polymer composite science and its relation to industrial applications. With the books the readers obtain dedicated resources with information relevant: to their research, thereby helping to save time and money.

The book contains the following chapters:

- In-situ synthesis of polymer nanocomposites
- Polyamide nanocomposites by in-situ polymerisation
- Polyolefin-clay nanocomposites by in-situ polymerisation
- Gas-phase-assisted surface polymerisation and thereby preparation of polymer nanocomposites
- PET clay nanocomposites by in-situ polymerisation
- Control of filler phase dispersion in bio-based nanocomposites by in-situ reactive polymerisation

- Polyurethane nanocomposites by in-situ polymerisation approach and their properties
- In-situ synthesis and properties of epoxy nanocomposites
- Unsaturated polyester-montmorillonite nanocomposites by in-situ polymerisation
- Polymer clay nanocomposites by in-situ atom transfer radical polymerisation
- Polybutadiene clay nanocomposites by in-situ polymerisation
- P3HT-MWNT nanocomposites by in-situ polymerisation and their properties
- Polystyrene-montmorillonite nanocomposites by in-situ polymerisation and their properties
- Aliphatic polyester and poly(ester amide) clay nanocomposites by in-situ polymerisation.

4 Applied Polymer Rheology, Polymeric Fluids with Industrial Applications

by: M. Kontopoulou
Published 2012
by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey
111 River Street, Hoboken, NJ 07030-5774, USA, 354pp
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ISBN: 978-1-118-14059-8 (eMobi)

The topic of the rheology of polymeric fluids has been the subject of intense research and has attracted some of the brightest minds in fluid mechanics, polymer physics, and chemistry. There are two main venues through which this ~ifsearch has been disseminated: The first is through numerous state-of-the-art ~extbooks, written by the top scientists in the field. These cover extensively

'-~he science and fundamental principles of rheology; constitutive equations; principles of rheometry, measurement methods, and techniques. The other dissemination method is through papers published in peer-reviewed journals. These cover a vast array of topics, from purely theoretical concepts to the applied rheology of specific polymeric fluids and melts. Many review papers on various topics of applied rheology are also available. Although very comprehensive, these publications are often not readily accessible to professionals, consultants and industrial practitioners, who because of time constraints are not necessarily in a position to follow the advanced rheological concepts presented in many of the scientific papers published in top peer-reviewed journals.

The purpose of this book is to present the state-of-the-art for specific polymeric systems of current industrial interest, as studied by well-recognised researchers who are experts in their fields. It targets professionals, industrial practitioners, as well as researchers and graduate students in the fields of polymer engineering, materials science, and chemical engineering who need to know the most recent developments pertaining to the rheology of various polymeric systems. This target audience would benefit from the

existence of a book that explains the distinct rheological characteristics of various industrial systems and their impact on their processing characteristics and ultimate engineering properties. This textbook provides them with a comprehensive overview of the rheological characteristics of the polymeric fluids of interest to their application, so they can interpret their findings or plan their experiments. It is also intended as a useful tool for processors and equipment designers, who need to plan carefully the processing conditions of their materials based on their rheological characteristics.

5 Green Corrosion Chemistry and Engineering, Opportunities and Challenges

by: S.K. Sharma
Published 2012
by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey
111 River Street, Hoboken, NJ 07030-5774, USA, 400pp
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The fast growing industrialisation and development activities cause many problems such as water pollution, noise pollution, soil pollution, air pollution, and so on. At the same time, these pollutions cause damage, deformation, destruction, and decay of materials and metals, which is commonly known as Corrosion. It is one of the most dangerous industrial problems World Wide that must be confronted for safety, environmental, and economic reasons. It also incurs heavy maintenance costs and environmental impacts of billions of dollars.

Green chemistry provides many environmentally friendly corrosion inhibitors, called ‘green inhibitors’. Several efforts have been made using corrosion preventive practices. Use of corrosion inhibitors and anti-corrosion coatings are some of them. The theme *Green Corrosion Chemistry and Engineering* – involves all such genuine efforts which may reduce the maintenance costs and save the environment.

This book is a sincere effort to address the problem of corrosion and to discuss preventive measures with the help of eco-friendly (green) alternates including protective coatings, use of green inhibitors, application of micro-electrochemical techniques, use of nanocomposites and pre-treatments, and much more.

The book contains the following chapters:

- Basics of corrosion chemistry
- Corrosion and electrochemistry
- Application of microelectrochemical techniques in corrosion research
- Protective coatings: an overview
- New era of eco-friendly corrosion inhibitors
- Green corrosion inhibitors: status in developing countries

- Innovative silanes-based pretreatment to improve the adhesion of organic coatings
- Corrosion of austenitic stainless steels and nickel-base alloys in supercritical water and novel control methods
- Metal-phosphonate anticorrosion coatings
- Metal-matrix nanocomposite coatings produced by electrode position
- Adsorption studies, modelling, and use of green inhibitors in corrosion inhibition: an overview of recent research
- Indian initiatives for corrosion protection
- Protective coatings: novel nanohybrid coatings for corrosion and fouling prevention.

With its unique focus on specifically addressing the problems for societies and economies associated with corrosion and their solution, this book provides an up-to-date overview of the progress in corrosion chemistry and engineering.