
Book Reviews

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1 Essentials of Inorganic Materials Synthesis

by: C.N.R. Rao and Kanishka Biswas

Published 2015

by John Wiley & Sons, Inc., Hoboken, New Jersey, 209pp

ISBN: 978-1-118-83254-7 (Hardback)

Chemical methods of synthesis play a crucial role in designing and discovering novel materials, especially metastable ones which cannot be prepared otherwise. They often provide better and less cumbersome methods for preparing known materials. There is a tendency nowadays to avoid brute-force methods and instead employ methods involving mild reaction conditions. Soft-chemistry routes are indeed becoming popular and will continue to be pursued greatly in the future. In view of the increasing importance of materials synthesis, we considered it appropriate to provide a proper account of the chemical methods of synthesis of inorganic materials in a book.

In this book, we briefly examine the different types of reactions and methods employed in the synthesis of inorganic solid materials. Besides the traditional ceramic procedures, we discuss precursor methods, combustion method, topochemical reactions, intercalation reactions, ion-exchange reactions, alkali-flux method, sol-gel method, mechanochemical synthesis, microwave synthesis, electrochemical methods, pyrosol process, arc and skull methods and high-pressure methods. Hydrothermal and solvothermal syntheses are discussed separately and also in sections dealing with specific materials. Superconducting cuprates and intergrowth structures are discussed in separate sections. Synthesis of nanomaterials is dealt with in some detail. Synthetic methods for metal borides, carbides, nitrides, fluorides, silicides, phosphides and chalcogenides are also outlined.

While this book is not expected to serve as a laboratory guide, it is our hope that it provides an up-to-date account of the varied aspects of chemical synthesis of inorganic materials and serves as a ready reckoner as well as a guide to students, teachers and practitioners. The key references cited in the monograph would help to obtain greater details of preparative procedures and related aspects.

2 Practical Guide to Water-Blown Cellular Polymers

by: C. Defonseka

Published 2016

**by A Smithers Group Company, Shawbury, Shrewsbury,
Shropshire, SY4 4NR, UK, 169pp**

ISBN: 978-1-91024-268-1 (Softback)

ISBN: 978-1-91024-269-8 (Ebook)

Cellular polymers are an important branch of plastics and have an essential role in daily life. They are also known as ‘foamed polymers’, ‘polymeric foams’ or ‘expanded plastics’. In a world changing constantly to reduce costs, researchers and scientists have been looking for lighter (yet strong) materials, especially for automobile, aircraft, building-construction and packaging industries. With regard to plastics applications, the shift from solid polymers to cellular polymers has been the answer.

Blowing agents have a major role in the manufacture of expanded or cellular polymers. Since the birth of the concept of the need for cellular polymers, the blowing agents used have been petroleum-based, which results in harmful gases being emitted into the atmosphere. For several years, environmental concerns have resulted in laws to prevent some of these harmful blowing agents being used.

Blowing agents having lesser impacts on environmental issues have been allowed, but researchers have created a novel ‘blowing’ or ‘expansion’ system for PS and PU – water-blown cellular polymers. This is a very exciting concept and very encouraging for overcoming environmental concerns because three of the largest industrial applications are based on these cellular polymers. Previously, this concept was confined to only petroleum-based polymers but, due to diligent and constant research, scientists have created water-blown systems, even for polymers based on natural oil-based polymers. Moreover, these blowing systems are also being used for specialty polymers to produce cellular polymers.

The polymerisation stages and processing methods may differ from those using conventional approaches. Moulding of these water-blown cellular polymers may also have some issues, with the consequent advantages and disadvantages. This book discusses these issues in detail and also offers recommendations for machinery, equipment and processing parameters to obtain optimal results.

The readers of this book will benefit from the in-depth knowledge and information provided by the author, who is active as a consultant in local and international arenas.

This book provides a thorough understanding of waterblown cellular polymers and how to process and mould them. As such, this book is ideally suited for students, entrepreneurs, teachers, professionals as well as for small and large moulders of water-blown cellular polymers.

3 Classical Electrodynamics from Image Charges to the Photon Mass and Magnetic Monopoles

by: F. Lacava

Published 2016

by Springer International Publishing Switzerland,

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AG Switzerland, 195pp

Library of Congress Control Number: 2016943959

ISSN: 2192-4791, ISSN: 2192-4805

ISBN: 978-3-319-39473-2

ISBN: 978-3-319-39474-9 (eBook)

DOI: 10.1007/978-3-319-39474-9

This book proposes intriguing arguments that will enable students to achieve a deeper understanding of electromagnetism, while also presenting a number of classical methods for solving difficult problems. Two chapters are devoted to relativistic electrodynamics, covering all aspects needed for a full comprehension of the nature of electric and magnetic fields and, subsequently, electrostatics. Each of the two final chapters examines a selected experimental issue, introducing students to the work involved in actually proving a law or theory. Classical books on electricity and magnetism are mentioned in many references, helping to familiarise students with books that they will encounter in their further studies. Various problems are presented, together with their worked-out solutions. The book is based on notes from special lectures delivered by the author to students during the second year of a BSc course in Physics, but the subject matter may also be of interest to senior physicists, as many of the themes covered are completely ignored or touched only briefly in standard textbooks.

The book contains the following chapters:

- Classical Electrodynamics: A Short Review
- Multipole Expansion of the Electrostatic Potential
- The Method of Image Charges
- Image Charges in Dielectrics
- Functions of Complex Variables and Electrostatics
- Relativistic Transformation of E and B Fields
- Relativistic Covariance of Electrodynamics
- The Resonant Cavity
- Energy and Momentum of the Electromagnetic Field
- The Feynman Paradox
- Test of the Coulomb's Law and Limits on the Mass of the Photon
- Magnetic Monopoles
- Appendix A: Orthogonal Curvilinear Coordinates.

4 Computational Thermodynamics of Materials**by: Zi-Kui Liu and Yi Wang****Published 2016****by Cambridge University Press, Materials research Society, University
Printing House, Cambridge CB2 8BS, UK, 248pp****ISBN: 978-0-521-19896-7 (Hardback)**

This unique and comprehensive introduction offers an unrivalled and in-depth understanding of the computational-based thermodynamic approach and how it can be used to guide the design of materials for robust performances, integrating basic fundamental concepts with experimental techniques and practical industrial applications, to provide readers with a thorough grounding in the subject. Topics covered range from the underlying thermodynamic principles, to the theory and methodology of thermodynamic data collecting, analysis, modelling, and verification, with details on free energy, phase equilibrium, phase diagrams, chemical reactions, and electrochemistry. In thermodynamic modelling, the authors focus on the CALPHAD method and first-principles calculations. They also provide guidance for use of YPHON, a mixed-space phonon code developed by the authors for polar materials based on the supercell approach. Including worked examples, case studies, and end-of-chapter problems, this is an essential resource for students, researchers, and practitioners in materials science.

The book contains the following chapters:

- Laws of thermodynamics
- Gibbs energy function
- Phase equilibria in heterogeneous systems
- Experimental data for thermodynamic modelling
- First-principles calculations and theory
- CALPHAD modelling of thermodynamics
- Applications to chemical reactions
- Applications to electrochemical systems
- Critical phenomena, thermal expansion, and Materials Genome®.

**5 Corrosion Engineering and Cathodic Protection Handbook:
With an Extensive Question and Answer Section
by: Volkan Cicek
Published 2017
by John Wiley & Sons, Inc.,
111 River Street, Hoboken, NJ 07030, USA
and Scrivener Publishing LLC, 100 Cummings Center, Suite 541J,
Beverly, MA 01915, USA, 748pp
ISBN: 978-1-119-28375-1**

The most comprehensive and up-to-date book on corrosion, this valuable volume is the one and only go-to reference work and textbook for corrosion engineering and cathodic protection for industrial applications complete with an exhaustive selection of questions and answers.

The Corrosion Engineering and Cathodic Protection Handbook combines the author's previous three works, Corrosion Chemistry, Cathodic Protection, and Corrosion Engineering to offer, in one place, the most comprehensive and thorough work available to the engineer or student. The author has also added a tremendous and exhaustive list of questions and answers based on the text, which can be used in university courses or industry courses, something that has never been offered before in this format.

The Corrosion Engineering and Cathodic Protection Handbook is a must-have reference book for the engineer in the field, covering the process of corrosion from a scientific and engineering aspect, along with the prevention of corrosion in industrial applications. It is also a valuable textbook, with the addition of the questions and answers section creating a unique book that is nothing short of groundbreaking. Useful in solving day-to-day problems for the engineer, and serving as a valuable learning tool for the student, this is sure to be an instant contemporary classic and belongs in any engineer's library.

The Corrosion Engineering and Cathodic Protection Handbook:

- Combines the author's three books, Corrosion Chemistry, Cathodic Protection and Corrosion Engineering into one exhaustive reference work that covers every subject relating to corrosion.
- Includes a massive selection of questions and answers based on the text that can be used in a university setting, for undergraduates and graduate students, or in industrial courses.
- Explains major corrosion prevention methods which are very valuable in industrial application
- Is the most comprehensive and up-to-date reference work on the subject of corrosion, a must-have for any engineer's library.

6 Interface/Interphase in Polymer Nanocomposites

by: Anil N. Netravali and K.L. Mittal

Published 2017

by John Wiley & Sons, Inc., Hoboken, New Jersey

and Scrivener Publishing LLC, Beverly, MA 01915-6106, USA, 421pp

ISBN: 978-1-119-18491-1

This book brings together experts and leading researchers in the field to present their cutting-edge research in understanding, modifying and controlling interface between various nanofillers and a host of polymer matrices.

Polymer composites are made of two components: polymer or matrix (continuous phase) and filler or reinforcement (discontinuous phase) to obtain properties that cannot be achieved by a single component alone. The specific tensile properties of fibre reinforced composites are excellent because of their low density and high mechanical properties. Over the past few decades, such composites have replaced metals in many applications from aerospace to sports gears, from automobiles to wind turbines, and from circuit boards to civil structures such as bridges and buildings.

Significant research has been done in polymeric nanocomposites and progress has been made in understanding nanofiller-polymer interface and interphase and their relation to nanocomposite properties. However, the information is scattered in many different publication media. This is the first book that consolidates the current knowledge on understanding, characterisation and tailoring interfacial interactions between nanofillers and polymers.

The book is divided into two parts: Part 1: Nanocomposite Interfaces/Interphases with six chapters and Part 2: Techniques to Characterize/Control Nano-adhesion with five chapters. All are authored by senior subject specialists covering topics including:

- Thermodynamic mechanisms governing nanofiller dispersion, engineering of interphase with nanofillers
- Role of interphase in governing the mechanical, electrical, thermal and other functional properties of nanocomposites, characterisation and modelling of the interphase
- Effects of crystallisation on the interface, chemical and physical techniques for surface modification of nanocellulose reinforcements
- Electro-micromechanical and nanoindentation techniques for interface evaluation, molecular dynamics (MD) simulations to quantify filler-matrix adhesion and nanocomposite mechanical properties.

The book should be of interest to researchers in academia, in government research labs and R&D personnel in a host of industries who are interested in designing and improving the properties of polymers and composites by the addition of nanoparticles.

7 Ceramic Matrix Composites: Materials, Modeling and Technology
by: N.P. Bansal and J. Lamon
Published 2015
by The American Ceramic Society, John Wiley & Sons, Inc.,
Hoboken, New Jersey, 694pp
ISBN: 978-1-118-23116-6 (Hardback)

Ceramic composites are considered an enabling for advanced aer propulsion, space propulsion, space power, aerospace vehicle, space structures, ground transport, as well as nuclear and chemical industries. In the last 30 years, tremendous progress has been made in the development and advancement of ceramic matrix composites (CMC). *Ceramic Matrix Composites: Materials, Modelling and Technology* provides a coherent overview of this progression and guides readers through the most recent developments on various aspects of CMCs including:

- Behaviour and properties of constituents: fibres, fibre/matrix interfaces, and interphases, and performs
- Processing, properties and technology of continuous fibre-reinforced C/C, C/SiC, C/C-SiC, SiC/SiC, oxide/oxide, and ultra-high temperature ceramic composites, as well as application of CMCs in key sectors including aeronautics, space, and nuclear industries
- Environment effects, including the effects of steam on oxide/oxide composites; stress*oxidation degradation in SiC-based composites; thermomechanical ablation; radiation effects on SiC-based and carbon fibre composites; and foreign object damage
- Proactive coatings against oxidation and surface recession of CMCs
- Multiscale modelling of material behaviour and computational simulation of lift-of-engineering structures
- Integration and joining of CMCs and mechanical testing of joined structures
- Acoustic emission-based detection and quantification of damage with a view to life-prediction.

With chapter contributed by internationally recognised experts in the field of C; MCs and its coverage of state-of-the-art information, this book is recommended for scientists, engineers, technologists, and researchers in industry, research laboratories, and academia. Students in materials science, ceramics, structural materials, mechanical, civil and biomedical engineering will find in an invaluable supplement to their studies.