Advanced Polymeric Materials Structure Property Relationships

Advanced Polymeric Materials - Gabriel O. Shonaike 2003-04-14
Featuring contributions from experts at some of the world's leading academic and industrial institutions, Advanced Polymeric Materials: Structure Property Relationships brings into book form a wealth of information previously available primarily only within computer programs. In a welcome narrative treatment, it provides comprehensive coverage of p

Bio-inspired Polymers - Nico Bruns 2016-10-14
Many key aspects of life are based on naturally occurring polymers, such as polysaccharides, proteins and DNA. Unsurprisingly, their molecular functionalities, macromolecular structures and material properties are providing inspiration for designing new polymeric materials with specific functions, for example, responsive, adaptive and self-healing materials. Bio-inspired Polymers covers all aspects of the subject, ranging from the synthesis of novel polymers, to structure-property relationships, materials with advanced properties and applications of bio-inspired polymers in such diverse fields as drug delivery, tissue engineering, optical materials and lightweight structural materials. Written and edited by leading experts on the topic, the book provides a comprehensive review and essential graduate level text on

bio-inspired polymers for biochemists, materials scientists and chemists working in both industry and academia.

Polypropylene - Fatih Dogan 2012-05-30

This book aims to bring together researchers and their papers on polypropylene, and to describe and illustrate the developmental stages polypropylene has gone through over the last 70 years. Besides, one can find papers not only on every application and practice of polypropylene but also on the latest polypropylene technologies. It is also intended in this compilation to present information on polypropylene in a medium readily accessible for any reader.

Modern Trends in Composite Laminates Mechanics - Holm Altenbach 2014-05-04

The aim of the book is to give a clear picture of some new modern trends in composite mechanics and to give a presentation of the current state-of-the-art of the theory and application of composite laminates. The book addresses the basics as well as recent developments in the theory of laminates and their effective properties, the problem of testing and identification of properties, strength, damage, and failure of composite laminates, lightweight construction principles, optimization techniques, the generation of smart structures, and a number of special technical aspects (e.g. stress localization), their modelling and analysis. The intention of the book is to provide deeper understanding, to give mathematical and algorithmic techniques for analysis, simulation and optimization and to link various aspects of composite mechanics as necessary to exploit the full potential that is possible for composite structures.

Polymeric Biomaterials - Severian Dumitriu 2013-01-17

Biomaterials have had a major impact on the practice of contemporary medicine and patient care. Growing into a major interdisciplinary effort

involving chemists, biologists, engineers, and physicians, biomaterials development has enabled the creation of high-quality devices, implants, and drug carriers with greater biocompatibility and biofunctiona

Degradation Rate of Bioresorbable Materials - F J Buchanan 2008-09-26

Bioresorbable materials are extensively used for a wide range of biomedical applications from drug delivery to fracture fixation, and may remain in the body for weeks, months or even years. Accurately predicting and evaluating the degradation rate of these materials is critical to their performance and the controlled release of bioactive agents. Degradation rate of bioresorbable materials provides a comprehensive review of the most important techniques in safely predicting and evaluating the degradation rate of polymer, ceramic and composite based biomaterials. Part one provides an introductory review of bioresorbable materials and the biological environment of the body. Chapters in Part two address degradation mechanisms of commonly used materials such as polymers and ceramics. This is followed by chapters on bioresorption test methods and modelling techniques in Part three. Part four discusses factors influencing bioresorbability such as sterilisation, porosity and host response. The final section reviews current clinical applications of bioresorbable materials. With its distinguished editor and multidisciplinary team of international contributors, Degradation rate of bioresorbable materials: prediction and evaluation provides a unique and valuable reference for biomaterials scientists, engineers and students as well as the medical community. Comprehensively reviews the most pertinent techniques in safely predicting and evaluating the degradation rate of bioresorbable materials Addresses degradation mechanisms of commonly used materials Discusses factors

influencing bioresorbability such as sterilisation and host response

Polymeric Biomaterials: Structure and function - Severian Dumitriu 2013

The third edition of a bestseller, this comprehensive reference presents the latest polymer developments and most up-to-date applications of polymeric biomaterials in medicine. Expanded into two volumes, the first volume covers the structure and properties of synthetic and natural polymers as well as bioresorbable hybrid membranes, drug delivery systems, cell bioassay systems, and electrospinning for regenerative medicine. This substantially larger resource includes state-of-the-art research and successful breakthroughs in applications that have occurred in the last ten years.

Carbon Nanotube-Polymer Composites - Dimitrios Tasis 2015-11-09

Chemically-modified carbon nanotubes (CNTs) exhibit a wide range of physical and chemical properties which makes them an attractive starting material for the preparation of super-strong and highly-conductive fibres and films. Much information is available across the primary literature, making it difficult to obtain an overall picture of the state-of-the-art. This volume brings together some of the leading researchers in the field from across the globe to present the potential these materials have, not only in developing and characterising novel materials but also the devices which can be fabricated from them. Topics featured in the book include Raman characterisation, industrial polymer materials, actuators and sensors and polymer reinforcement, with chapters prepared by highly-cited authors from across the globe. A valuable handbook for any academic or industrial laboratory, this book will appeal to newcomers to the field and established researchers alike.

Automotive Engineering - Brian Cantor 2008-02-19

The current automotive industry faces numerous challenges, including increased global competition, more stringent environmental and safety requirements, the need for higher performance vehicles, and reducing costs. The materials used in automotive engineering play key roles in overcoming these issues. Automotive Engineering: Lightweight, Functional, and Novel Materials focuses on both existing materials and future developments in automotive science and technology. Divided into four sections, the book first describes the development of future vehicles, aluminum alloys for manufacturing lighter body panels, and various polymer composites for stronger module carriers. It then reviews state-of-the-art functional materials and smart technologies and projects in which application areas they will most impact future automotive designs and manufacturing. The next section considers the difficulties that must be overcome for light alloys to displace ferrous-based materials and the increasing competition from lightweight polymeric-based composites. The final section explores newer processing and manufacturing technologies, including welding and joining, titanium alloys, and durable, high-performance composites. With contributions from internationally recognized experts, this volume provides a comprehensive overview of cutting-edge automotive materials and technologies. It will help you understand the key materials and engineering concerns currently confronting this industry.

Engineering of Thermoplastic Elastomer with Graphene and Other Anisotropic Nanofillers - Abhijit Bandyopadhyay 2020-10-14

This book is an effort to tether all the exuberant observations on adding nanomaterial in the TPE matrix. With an enhanced processing property along with amplified recyclability and

reprocessing feature, thermoplastic elastomers (TPE) proves to be one of the most significant polymeric materials till date. As the scientific world evolves, these advanced materials have attuned themselves with various anisotropic nanomaterials to induce an enhanced property effect on the final product. On an additional note, authors have done extensive research on graphene, the most multifaceted element in the filler family keeping TPE and its derivate as the matrix martial. Cogitating the idea of a multidimensional readership, authors have analyzed the synthesis, derivatization, and properties of graphene and its derivatives separately. Apart from reviewing the future prospects and the potential application of these nano-filled advanced materials, they have kept the structure–property relationship of graphene-based composites at the cynosure to provide firm understanding on the blossoming of these elastomeric composites. The authors believe this book is a potential content for both professionals and academicians.

Natural and Synthetic Biomedical Polymers - Sangamesh Kumbar 2014-01-21

Polymers are important and attractive biomaterials for researchers and clinical applications due to the ease of tailoring their chemical, physical and biological properties for target devices. Due to this versatility they are rapidly replacing other classes of biomaterials such as ceramics or metals. As a result, the demand for biomedical polymers has grown exponentially and supports a diverse and highly monetized research community. Currently worth $1.2bn in 2009 (up from $650m in 2000), biomedical polymers are expected to achieve a CAGR of 9.8% until 2015, supporting a current research community of approximately 28,000+. Summarizing the main advances in biopolymer development of the last decades, this work

systematically covers both the physical science and biomedical engineering of the multidisciplinary field. Coverage extends across synthesis, characterization, design consideration and biomedical applications. The work supports scientists researching the formulation of novel polymers with desirable physical, chemical, biological, biomechanical and degradation properties for specific targeted biomedical applications. Combines chemistry, biology and engineering for expert and appropriate integration of design and engineering of polymeric biomaterials Physical, chemical, biological, biomechanical and degradation properties alongside currently deployed clinical applications of specific biomaterials aids use as single source reference on field. 15+ case studies provides in-depth analysis of currently used polymeric biomaterials, aiding design considerations for the future

Structure-property Relationships of Hierarchical Polymer Materials - Minchao Zhang 2017

Structure-property relationships are central to the analysis and understanding of material systems. The exploration of such relationships for the known material systems and further creating new material systems are essential to solve the existing problems and guide the development of advanced technologies. In this thesis, structure-property relationships at different length scales and material systems are studied. We first study the structure-property relationships of fluid/air interfaces. Capillary interactions occurring at the water/air interface are experimentally quantified with a model containing a superhydrophobic floating object, a liquid marble, and a wall (Chapter 2). The overlapping of interfacial deformations is realized to be crucial for the capillary interactions. We further propose a new explanation of capillary interaction-driven motion of floating objects from

the perspective of pressure-induced hydraulic motion of water. Then the structure-property relationships of assembled silica nanoparticles (NPs)/polyimide (PI) composites are explored (Chapter 3). A new fabrication route for integrating assembled silica NP micro-structures into PI is demonstrated. Thermal-mechanical properties of the composite films show the advantageous enhancements of the continuous silica NPs micro-structures for PI. Additionally, the composite films, which provide exposed silica NPs on one surface, were found to be able to be modified post-production to introduce new surface properties. In Chapter 4, we describe the structure-property relationships of a MDA3-NaCl complex, formed from methylenedianiline (MDA) and sodium chloride (NaCl), in polyurethane curing. It can dissociate to release MDA to achieve controllable formation of urea links from amine and isocyanate groups. The curing behavior was found to be heterogeneous and localized, and the size and dispersity of the complex particles are essential for the efficiency and thermo-mechanical properties of the resultant polyurethane elastomers. Finally, structure-property relationships are considered for a silicone coating system. The fracture mechanics of silicone coatings are studied (Chapter 5). Mismatches between thermal expansion coefficients of silicone coatings and silicon substrates were used to introduce thermal strains. The release of the residual elastic strain energy supports the propagation of an initiated crack to form various crack patterns which is influenced by the modulus and thickness of the silicone coating, and the surface property of the coating/substrate interfaces.

Polymeric Materials - Gottfried Wilhelm Ehrenstein 2001

This book is intended to fill the knowledge gap between the chemical structure and the related physical characteristics of plastics necessary for appropriate material selection,

design, and processing. The entire spectrum of plastics is addressed, including thermoplastics, thermosets, elastomers, and blends. It also contains an in-depth presentation of the structure-property relationships of a wide range of plastics. One of the special features is the extensive discussion and explanation of the impact of relationships on processing and, vice-versa, the effect of processing on structure and properties. The book contains several application-oriented examples and is presented at an intermediate level for both practicing plastic engineers and advanced engineering students.

Polymer Nanocomposites Handbook - Rakesh K. Gupta 2009-07-20

Reflecting the exceptional growth in the use of nanostructured materials for an increasing range of industrial applications, Polymer Nanocomposites Handbook comprehensively covers the synthesis of nanomaterials that act as the building blocks of polymer nanocomposites and polymers that act as matrix materials. From early history to new technologies

Additive Manufacturing of Bio and Synthetic Polymers - Emin Bayraktar 2022-03-31

Additive manufacturing technology offers the ability to produce personalized products with lower development costs, shorter lead times, less energy consumed during manufacturing and less material waste. It can be used to manufacture complex parts and enables manufacturers to reduce their inventory, make products on-demand, create smaller and localized manufacturing environments, and even reduce supply chains. Additive manufacturing (AM), also known as fabricating three-dimensional (3D) and four-dimensional (4D) components, refers to processes that allow for the direct fabrication of physical products from computer-aided design (CAD) models through the repetitious deposition of material layers. Compared with traditional manufacturing

processes, AM allows the production of customized parts from bio- and synthetic polymers without the need for molds or machining typical for conventional formative and subtractive fabrication. In this Special Issue, we aimed to capture the cutting-edge state-of-the-art research pertaining to advancing the additive manufacturing of polymeric materials. The topic themes include advanced polymeric material development, processing parameter optimization, characterization techniques, structure-property relationships, process modelling, etc., specifically for AM.

Advanced Polymeric Materials for Sustainability and Innovations - Sajith Thottathil 2018-10-01

This informative volume discusses recent advancements in the research and development in synthesis, characterization, processing, morphology, structure, and properties of advanced polymeric materials. With contributions from leading international researchers and professors in academic, government and industrial institutions, Advanced Polymeric Materials for Sustainability and Innovations has a special focus on eco-friendly polymers, polymer composites, nanocomposites, and blends and materials for traditional and renewable energy. In this book the relationship between processing-morphology-property applications of polymeric materials is well established. Recent advances in the synthesis of new functional monomers has shown strong potential in generating better property polymers from renewable resources. Fundamental advances in the field of nanocomposite blends and nanostructured polymeric materials in automotive, civil, biomedical and packaging/coating applications are the highlights of this book.

Introduction to Physical Polymer Science - Leslie H. Sperling 2005-11-25

An Updated Edition of the

Classic Text Polymers constitute the basis for the plastics, rubber, adhesives,fiber, and coating industries. The Fourth Edition of Introductionto Physical Polymer Science acknowledges the industrial success ofpolymers and the advancements made in the field while continuing todeliver the comprehensive introduction to polymer science that madeits predecessors classic texts. The Fourth Edition continues its coverage of amorphous andcrystalline materials, glass transitions, rubber elasticity, andmechanical behavior, and offers updated discussions of polymerblends, composites, and interfaces, as well as such basics asmolecular weight determination. Thus, interrelationships amongmolecular structure, morphology, and mechanical behavior ofpolymers continue to provide much of the value of the book. Newly introduced topics include: * Nanocomposites, including carbon nanotubes and exfoliatedmontmorillonite clays * The structure, motions, and functions of DNA and proteins, aswell as the interfaces of polymeric biomaterials with livingorganisms * The glass transition behavior of nano-thin plastic films In addition, new sections have been included on fire retardancy,friction and wear, optical tweezers, and more. Introduction to Physical Polymer Science, Fourth Edition providesboth an essential introduction to the field as well as an entrypoint to the latest research and developments in polymer scienceand engineering, making it an indispensable text for chemistry,chemical engineering, materials science and engineering, andpolymer science and engineering students and professionals.

Polymer Morphology - Qipeng Guo 2016-05-16

With a focus on structure-property relationships, this book describes how polymer morphology affects properties and how scientists can modify them. The book covers structure development, theory, simulation, and processing; and

discusses a broad range of techniques and methods. • Provides an up-to-date, comprehensive introduction to the principles and practices of polymer morphology • Illustrates major structure types, such as semicrystalline morphology, surface-induced polymer crystallization, phase separation, self-assembly, deformation, and surface topography • Covers a variety of polymers, such as homopolymers, block copolymers, polymer thin films, polymer blends, and polymer nanocomposites • Discusses a broad range of advanced and novel techniques and methods, like x-ray diffraction, thermal analysis, and electron microscopy and their applications in the morphology of polymer materials

Processing-structure-property Relationships in Co-continuous Polymer Blends and Composites - Molin Guo 2020

As society evolves and technology develops further, the need for more advanced products is increasing, so polymeric materials are gaining ever more attraction because of their excellent properties such as lightweight, low cost and good resistance to corrosion. Polymer processing is one of the keys to achieve these unique materials. Various kinds of morphologies can be produced during polymer melt compounding including droplet-matrix, fibrillar, lamellar, or co-continuous structures. Co-continuous morphology, which has the coexistence of two continuous structures within the same volume, has been drawing more attention currently because of its specific superior properties including a combination of the features of both components in a favorable way, as well as additional characteristics by selectively localizing fillers in the co-continuous structures. Since processing-structure-property relationships are guiding principles in materials design, development, and tailoring, it is important to study them in co-continuous polymer blends and composites. In chapter 1 of

this dissertation, the formation and properties of co-continuous blends and double-percolated co-continuous composites are introduced. In chapter 2, the formation of co-continuous poly(ethylene) oxide/ethylene-vinyl acetate blends as well as the effects of structure and processing on their surface roughness are explored. Moreover, two thermally conductive co-continuous ternary composites systems are reported in chapter 3. The role of viscosity ratio on filler distribution and electrical/thermal properties of the carbon nanofiber reinforced co-continuous polymer composites is discussed, along with the discussion of the effects of filler sizes on morphology and thermal conductivity of double-percolated polypropylene/poly(methyl methacrylate)/boron nitride polymer composites. Furthermore, two additional projects are demonstrated in chapter 4 and chapter 5. Chapter 4 compares the fiber length distribution in shear and extensional mixing in twin-screw extrusion of fiber-reinforced polymer composites, while chapter 5 proves the feasibility of using one-step extrusion to produce nanostructured lipid carriers. Finally, chapter 6 briefly concludes the research work in this dissertation, and contributions as well as future work are also covered.

Processing Techniques and Tribological Behavior of Composite Materials - Tyagi, Rajnesh 2015-01-31

An understanding of friction and wear behavior of materials is crucial in order to improve their performance and durability. New research is providing the opportunity to solve common problems relating to the development of materials, surface modification, coatings, and processing methods across industries. Processing Techniques and Tribological Behavior of Composite Materials provides relevant theoretical frameworks and the latest empirical research findings on the strategic role of composite

tribology in a variety of settings. This book is intended for students, researchers, academicians, and professionals working in industries where wear reduction and performance enhancement of machines and machine elements is essential to success.

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