Engineering Polymer Systems For Improved Drug Delivery

Undoubtedly the applications of polymers are rapidly evolving. Technology is continually changing and quickly advancing as polymers are needed to solve a variety of day-to-day challenges leading to improvements in quality of life. The Encyclopedia of Polymer Applications presents state-of-the-art research and development on the applications of polymers. This groundbreaking work provides important overviews to help stimulate further advancements in all areas of polymers. This comprehensive multi-volume reference includes articles contributed from a diverse and global team of renowned researchers. It offers a broad-based perspective on a multitude of topics in a variety of applications, as well as detailed research information, figures, tables, illustrations, and references. The encyclopedia provides introductions, classifications, properties, selection, types, technologies, shelf-life, recycling, testing and applications for each of the entries where applicable. It features critical content for both novices and experts including, engineers, scientists (polymer scientists, materials scientists, biomedical engineers, macromolecular chemists), researchers, and students, as well as interested readers in academia, industry, and research institutions.

This book focuses on the recent trends in micro- and nano-structured polymer systems, particularly natural polymers, biopolymers, biomaterials, and their composites, blends, and IPNs. This valuable volume covers the occurrence, synthesis, isolation, production, properties and applications, modification, as well as the relevant analysis techniques to reveal the structures and properties of polymer systems. Biobased polymer blends and composites occupy a unique position in the dynamic world of new biomaterials. The growing need for lubricious coatings and surfaces in medical devices—an outcome of the move from invasive to noninvasive medicines and procedures—is playing a major role in the advancement of biomaterials technology. Natural polymers have attained their cutting-edge technology through various platforms, and this book presents a multitude of information about them. Topics include biopolymer-synthetic systems, nanomaterial-polymer structures, multi-characterization techniques, polymer blends and composites, polymer gels and polyelectrolytes, and many other interesting aspects of interests to researchers. This book will be valuable to scientists, physicians, pharmacists, engineers, and other specialists in a variety of disciplines, both academic and industrial.

Stimuli Responsive Polymeric Nanocarriers for Drug Delivery Applications: Volume Two: Advanced Nanocarriers for Therapeutics discusses, in detail, the recent trends in designing dual and multi-responsive polymers and nanoparticles for safe drug delivery. Chapters cover dual-responsive polymeric nanocarriers for drug delivery and their different stimuli, multi-responsive polymeric nanocarriers, and the therapeutic applications of stimuli-responsive polymers. With an emphasis on advanced medical applications and synergistic operational and technological methodologies for the improvement of polymers systems for the production of stimuli-responsive polymers, this book is essential reading for materials scientists and researchers working in the drug delivery and pharmaceutical industries. As innovation and development in the area of stimuli responsive polymer-based nanomaterials for drug delivery is moving fast and there is an increased global demand for biodegradable and biocompatible responsive polymers and nanoparticles for safe drug delivery, users will find this to be a timely resource. Focusses on the most advanced technologies, recent evaluation methods, technical aspects, and advanced synthesis techniques stimuli-responsive polymers Examines advanced medical applications of stimuli responsive polymers Analyzes synergistic operational and technological methodologies for the improvement of polymer systems for the production of stimuli-responsive polymers in drug delivery

Macromolecular Engineering: Design, Synthesis and Application of Polymers explores the role of macromolecular engineering in the development of polymer systems with engineered structures that offer the desired combination of properties for advanced applications. This book is organized into sections covering theory and principles, science and technology, architectures and technologies, and applications, with an emphasis on the latest advances in techniques, materials, properties, and end uses - and including recently commercialized, or soon to be commercialized, designed polymer systems. The chapters are contributed by a group of leading figures who are actively researching in the field. This is an invaluable resource for researchers and scientists interested in polymer synthesis and design, across the fields of polymer chemistry, polymer science, plastics engineering, and materials science and engineering. In industry, this book supports engineers, R&D, and scientists working on polymer design for application areas such as biomedical and healthcare, automotive and aerospace, construction and consumer goods. Presents the theory, principles, architectures, technologies, and latest advances in macromolecular engineering for polymer design and synthesis Explains polymer design for cutting-edge applications areas, including coatings, automotive, industrial, household and medical uses Approaches several novel materials, such as polyisobutylene (PIB), polyamide-based polyurethanes, and aliphatic polyesters

Biodegradable Systems in Tissue Engineering and Regenerative Medicine

Micro- to Nanostructural Evolution in Advanced Technologies

Alginates

Engineering Polymer Systems for Improved Drug Delivery

Engineering Polymer Systems for Improved Drug DeliveryJohn Wiley & Sons

Polymerie materials have been replacing other conventional materials like metals, glass and wood in a number of applications. The use of various types of fillers incorporated into the polymer has become quite common as a means of reducing cost and to impart

certain desirable mechanieal, thermal, electrieal and magnetic properties to the polymers. Oue to the energy crisis and high priees of petrochemieals, there has been a greater demand to use more and more fillers to cheapen the polymerie materials while maintaining and/or improving their properties. The advantages that filled polymer systems have to offer are normally offset to some extent by the increased complexity in the rheological behavior that is introduced by the inclusion of the fillers. Usually when the use of fillers is considered, a compromise has to be made between the improved mechanieal properties in the solid state, the increased difficulty in melt processing, the problem of achieving uniform dispersion of the filler in the polymer matrix and the economics of the process due to the added step of compounding. It has been recognized that addition of filler to the polymer brings a change in processing behavior. The presence of the filler increases the melt viscosity leading to increases in the pressure drop across the die but gives rise to less die swell due to decreased melt elasticity.

Here, front-line researchers in the booming field of nanobiotechnology describe the most promising approaches for bioinspired drug delivery, encompassing small molecule delivery, delivery of therapeutic proteins and gene delivery. The carriers surveyed include polymeric, proteinaceous and lipid systems on the nanoscale, with a focus on their adaptability for different cargoes and target tissues. Thanks to the broad coverage of carriers as well as cargoes discussed, every researcher in the field will find valuable information here.

Maintaining a balance between depth and breadth, the Sixth Edition of Principles of Polymer Systems continues to present an integrated approach to polymer science and engineering. A classic text in the field, the new edition offers a comprehensive exploration of polymers at a level geared toward upper-level undergraduates and beginning graduate students. Revisions to the sixth edition include: A more detailed discussion of crystallization kinetics, strain-induced crystallization, block copolymers, liquid crystal polymers, and gels New, powerful radical polymerization methods Additional polymerization process flow sheets and discussion of the polymerization of polystyrene and poly(vinyl chloride) New discussions on the elongational viscosity of polymers and coarse-grained bead-spring molecular and tube models Updated information on models and experimental results of rubber elasticity Expanded sections on fracture of glassy and semicrystalline polymers New sections on fracture of elastomers, diffusion in polymers, and membrane formation New coverage of polymers from renewable resources New section on X-ray methods and dielectric relaxation All chapters have been updated and out-of-date material removed. The text contains more theoretical background for some of the fundamental concepts pertaining to polymer structure and behavior, while also providing an up-to-date discussion of the latest developments in polymerization systems. Example problems in the text help students through step-by-step solutions and nearly 300 end-of-chapter problems, many new to this edition, reinforce the concepts presented.

Handbook of Polymer Crystallization

Single and Two-Phase Flows on Chemical and Biomedical Engineering

Multiphase Polymer Systems

Crystallization in Multiphase Polymer Systems

New Insights

"The only comprehensive reference on polymer crystallization, Handbook of Polymer Crystallization provides readers with a broad, in-depth guide on the subject, covering the numerous problems encountered during crystallization as well as solutions to resolve those problems to achieve the desired result."--Provided by publisher.

The selection and application of engineered materials is an integrated process that requires an understanding of the interaction between materials properties, manufacturing characteristics, design considerations, and the total life cycle of the product. This reference book on engineering plastics provides practical and comprehensive coverage on how the performance of plastics is characterized during design, property testing, and failure analysis. The fundamental structure and properties of plastics are reviewed for general reference, and detailed articles describe the important design factors, properties, and failure mechanisms of plastics. The effects of composition, processing, and structure are detailed in articles on the physical, chemical, thermal, and mechanical properties. Other articles cover failure mechanisms such as: crazing and fracture; impact loading; fatigue failure; wear failures, moisture related failure; organic chemical related failure; photolytic degradation; and microbial degradation. Characterization of plastics in failure analysis is described with additional articles on analysis of structure, surface analysis, and fractography.

Since the earliest dosage forms to modern drug delivery systems, came a great development and growth of knowledge with respect to drug delivery. Strategies to Modify the Drug Release from Pharmaceutical Systems will address principles, systems, applications and advances in the field.It will be principally a textbook and a reference source of strategies to

modify the drug release. Moreover, the characterization, mathematical and physicochemical models, applications and the systems will be discussed. Addresses the principles, systems, applications and advances in the field of drug delivery Highlights the mathematical and physicochemical principles related to strategies Discusses drug release and its possible modifications

Crystallization in Multiphase Polymer Systems is the first book that explains in depth the crystallization behavior of multiphase polymer systems. Polymeric structures are more complex in nature than other material structures due to their significant structural disorder. Most of the polymers used today are semicrystalline, and the subject of crystallization is still one of the major issues relating to the performance of semicrystalline polymers in the modern polymer industry. The study of the crystallization processes, crystalline morphologies and other phase transitions is of great significance for the understanding the structure-property relationships of these systems. Crystallization in block copolymers, miscible blends, immiscible blends, and polymer composites and nanocomposites is thoroughly discussed and represents the core coverage of this book. The book critically analyzes the kinetics of nucleation and growth process of the crystalline phases in multi-component polymer systems in different length scales, from macro to nanoscale. Various experimental techniques used for the characterization of polymer crystallization process are discussed. Written by experts in the field of polymer crystallization, this book is a unique source and enables professionals and students to understand crystallization behavior in multiphase polymer systems such as block copolymers, polymer blends, composites and nanocomposites. Covers crystallization of multiphase polymer systems, including copolymers, blends and nanocomposites Features comprehensive, detailed information about the basic research, practical applications and new developments for these polymeric materials Analyzes the kinetics of nucleation and growth process of the crystalline phases in multi-component polymer systems in different length scales, from macro to nanoscale

Processing and Characterization of Multicomponent Polymer Systems

Volume 2: Advanced Nanocarriers for Therapeutics

The Fabrication of Self-Healing Cellulose Triacetate Polymer Composites and Dicyclopentadine Polymeric Foam

Encyclopedia of Polymer Applications, 3 Volume Set

Polymer Science and Engineering

This new volume explores the latest research on the use of alginate as a biopolymer in various biomedical applications and therapeutics. The uses of alginates and modified alginates discussed in this book include tissue regeneration, encapsulation and delivery of drugs, nucleic acid materials, proteins and peptides, genes, herbal therapeutic agents, nutraceuticals, and more. This book also describes the synthesis and characterizations of various alginate and modified alginate systems, such as hydrogels, gels, composites, nanoparticles, scaffolds, etc., used for the biomedical applications and therapeutics. Alginate, a biopolymer of natural origin, is of immense interest for its variety of applications in pharmaceuticals (as medical diagnostic aids) and in materials science. It is the one of the most abundant natural biopolymers and is considered an excellent excipient because of its non-toxic, stable, and biodegradable properties. Several research innovations have been made on applications of alginate in drug delivery and biomedicines. There needs to be a thorough understanding of the synthesis, purification, and characterization of alginates and its derivatives for their utility in healthcare fields, and this volume offers an abundance of information toward that end.

This volume gives an analysis of recent achievements in the field of synthesis, structural investigations, and properties of polybutilene therephthalate (PBT). Furthermore, the mechanism of PBT synthesis by equilibrium polycondensation reaction is described together with the used reagents, catalysts, and stabilizers.

Recent years have witnessed the sheer growth of macromolecular concepts and nanotechnology-based innovations in polymer science. Processing and Characterization of Multicomponent Polymer Systems is a collection of contributions from materials science experts across the globe. The fabrication and characterization of polymeric systems are still important in the study of materials science, and the quality measurements of newly designed polymeric stuffs demand systematic and new characterization protocols. The volume highlights some of the latest innovations and principles of nanostructured polymeric materials and polymer nanocomposites. It is devoted to novel architectures at the nano-level with an emphasis on new synthesis and characterization methods. Organized into several sections, the chapters cover a selection of topics on: Biocomposites and nanocomposites Interpenetrating polymeric networks and nanostructured materials Theoretical protocols for polymers and clusters Special topics in polymer processing and polymer coating. This survey will be an important resource for those involved in the field of polymer materials design for advanced technologies, including scientists, engineers, and budding researchers working in the area of polymer science and nanotechnology.

Phase morphology in multicomponent polymer-based systems represents the main physical characteristic that allows for control of the material design and implicitly the development of new plastics. Emphasizing properties of these promising new materials in both solution and solid phase, this book describes the preparation, processing, properties, and practical implications of advanced multiphase systems from macro to

nanoscales. It covers a wide range of systems including copolymers, polymer blends, polymer composites, gels, interpenetrating polymers, and layered polymer/metal structures, describing aspects of polymer science, engineering, and technology. The book analyzes experimental and theoretical aspects regarding the thermal and electrical transport phenomena and magnetic properties of crucial importance in advanced technologies. It reviews the most recent advances concerning morphological, rheological, interfacial, physical, fire-resistant, thermophysical, and biomedical properties of multiphase polymer systems. Concomitantly the book deals with basic investigation techniques that are sensitive in elucidating the features of each phase. It also discusses the latest research trends that offer new solutions for advanced bio- and nanotechnologies. Introduces an overview of recent studies in the area of multiphase polymer systems, their micro- and nanostructural evolutions in advanced technologies, and provides future outlooks, new challenges and opportunities. Discusses multicomponent structures that offer enhanced physical, mechanical, thermal, electrical, magnetic, and optical properties adapted to current requirements of modern technologies. Covers a wide range of materials, such as composites, blends, alloys, gels and interpenetrating polymer networks. Presents new strategies for controlling the micro- and nanomorphology and the mechanical properties of multiphase polymeric materials. Describes different applications of multiphase polymeric materials in various fields, including automotive, aeronautics and space industry, displays, and medicine.

Macromolecular Engineering

The Shifting Research Frontiers

Topological Effects on Properties of Multicomponent Polymer Systems

Characterization and Failure Analysis of Plastics

From Synthesis to Applications

Both technically and economically, additives form a large and increasingly significant part of the polymer industry, both plastics and elastomers. Since the first edition of this book was published, there have been wide-ranging developments, covering chemistry and formulation of new and more efficient additive systems and the safer use of additives, both by processors in the factory and, in the wider field, as they affect the general public. This new edition follows the successful formula of its predecessor, it provides a comprehensive view of all types of additives, concentrating mainly on their technical aspects (chemistry/formulation, structure, function, main applications) with notes on the commercial background of each. The field has been expanded to include any substance that is added to a polymer to improve its use, so including reinforcing materials (such as glass fibre), carbon black and titanium dioxide. This is a book which has been planned for ease of use and the information is presented in a way which is appropriate to the users' needs.

The two principal objectives of this book were (1) to identify promising materials technologies, design issues (both overall and for individual components), and fire performance parameters (both full scale and for individual components) that, if properly optimized, would lead to improved fire and smoke resistance of materials and components used in aircraft interiors; and (2) to identify long-range research directions that hold the most promise for producing predictive modeling capability, new advanced materials, and the required product development to achieve totally fire-resistant interiors in future aircrafts. The emphasis of the study is on long-term innovation leading to impacts on fire worthiness of aircraft interiors ten to twenty years hence.

Polymers are used in everything from nylon stockings to commercial aircraft to artificial heart valves, and they have a key role in addressing international competitiveness and other national issues. Polymer Science and Engineering explores the universe of polymers, describing their properties and wide-ranging potential, and presents the state of the science, with a hard look at downward trends in research support. Leading experts offer findings, recommendations, and research directions. Lively vignettes provide snapshots of polymers in everyday applications. The volume includes an overview of the use of polymers in such fields as medicine and biotechnology, information and communication, housing and construction, energy and transportation, national defense, and environmental protection. The committee looks at the various classes of polymers--plastics, fibers, composites, and other materials, as well as polymers used as membranes and coatings--and how their composition and specific methods of processing result in unparalleled usefulness. The reader can also learn the science behind the technology, including efforts to model polymer synthesis after nature's methods, and breakthroughs in characterizing polymer properties needed for twenty-first-century applications. This informative volume will be important to chemists, engineers, materials scientists, researchers, industrialists, and policymakers interested in the role of polymers, as well as to science and engineering educators and students.

Conventional materials technology has yielded clear improvements in regenerative medicine. Ideally, however, a replacement material should mimic the living tissue mechanically, chemically, biologically and functionally. The use of tissue-engineered products based on novel biodegradable polymeric systems will lead to dramatic improvements in health

Additives for Plastics Handbook

Polybutilene Therephthalate (PBT), Synthesis and Properties

Multicomponent Polymer Systems

A Symposium Co-sponsored by the Division of Industrial and Engineering Chemistry, the Division of Polymer Chemistry, and the Division of Cellulose, Wood, and Fiber Chemistry at the 159th Meeting of the American Chemical Society, Houston, Tex., Feb. 23-26, 1970

Self-Healing Polymer-Based Systems

Rubber Toughened Engineering Plastics covers the main physical principles involved in optimum toughening in high temperature engineering plastics and speciality plastics and describes the synthetic strategies used to obtain satisfactorily toughened grades in these materials by control of microstructure. This book will act as a focus for current thought on the principles of rubber toughening and the

methods employed for the rubber toughening of major engineering and speciality plastics.

This book examines the current state of the art, new challenges, opportunities, and applications in the area of polymer nanocomposites. Special attention has been paid to the processing-morphology-structure-property relationship of the system. Various unresolved issues and new challenges in the field of polymer nanocompostes are discussed. The influence of preparation techniques (processing) on the generation of morphologies and the dependence of these morphologies on the properties of the system are treated in detail. This book also illustrates different techniques used for the characterization of polymer nanocomposites. The handpicked selection of topics and expert contributors across the globe make this survey an outstanding resource reference for anyone involved in the field of polymer nanocompostes for advanced technologies.

Multicomponent polymer systems comprised of two or more chemically different polymer moieties provide an effective way to attain the desired properties from a limited palette of commodity polymers. Variations in macromolecular topologies often result in unique and unusual properties leading to novel applications. This dissertation addresses the effect of topology on properties of two multicomponent polymers systems: blends and polyrotaxanes. Blends of cyclic and linear polymers were compared to their topological counterparts, polyrotaxanes, in which cyclic components are threaded onto the linear polymer chains. The first part of the dissertation focuses on the synthesis and purification of cyclic polymers derived from linear (polyoxyethylene) (POE). Cyclic POEs of different cycle sizes were synthesized and then purified from their linear byproducts by inclusion complexation with alpha-cyclodextrin. Polystyrene was threaded through the resulting cycles by in situ free radical polymerization of styrene monomer in the presence of an excess of POE cycles. A bulky free radical initiator was utilized to endcap the polystyrene molecule at the two ends to prevent dethreading of cyclic moieties. In the second part of the dissertation, phase behavior, morphology and dynamics of cyclic POE and polystyrene blends were compared to linear POE and polystyrene blends. Advanced solid-state NMR techniques and differential scanning calorimetry were employed for this purpose. Cyclic POE was found to be much more miscible with polystyrene when compared to linear POE, resulting in nanometer-sized domains and significantly reduced mobilities of the cyclic POE components in the blends. The unusual behavior of cyclic POE in the blends was attributed to topological as well as end-group effects with the topological effects being predominant. Polyrotaxanes composed of polystyrene and cyclic POE components exhibited cyclic POE domain sizes similar to that of physical blends. Cyclic POE dynamics in polyrotaxanes were considerably hindered, however, due to the threaded architecture. Surface segregation studies of cyclic POE/polystyrene blends and polyrotaxanes did not show segregation of POE to the surface because of the improved miscibility and the topological constraints present in these systems.

Polymers have played a critical role in the rational design and application of drug delivery systems that increase the efficacy and reduce the toxicity of new and conventional therapeutics. Beginning with an introduction to the fundamentals of drug delivery, Engineering Polymer Systems for Improved Drug Delivery explores traditional drug delivery techniques as well as emerging advanced drug delivery techniques. By reviewing many types of polymeric drug delivery systems, and including key points, worked examples and homework problems, this book will serve as a guide to for specialists and non-specialists as well as a graduate level text for drug delivery courses.

Principles of Polymer Systems, Sixth Edition

Biodegradable and Biocompatible Polymer Composites

Healable Polymer Systems

Stimuli Responsive Polymeric Nanocarriers for Drug Delivery Applications

New Applications of Mineral Fillers

Self-Healing Polymer-Based Systems presents all aspects of self-healing polymeric materials, offering detailed information on fundamentals, preparation methods, technology, and applications, and drawing on the latest state-of-the-art research. The book begins by introducing self-healing polymeric systems, with a thorough explanation of underlying concepts, challenges, mechanisms, kinetic and thermodynamics, and types of chemistry involved. The second part of the book studies the main categories of self-healing polymeric material, examining elastomer-based, thermoplastic-based, and thermoset-based materials in turn. This is followed by a series of chapters that examine the very latest advances, including nanoparticles, coatings, shape memory, self-healing biomaterials, ionomers, supramolecular polymers, photoinduced and thermally induced self-healing, healing efficiency, life cycle analysis, and characterization. Finally, novel applications are presented and explained. This book serves as an essential resource for academic researchers, scientists, and graduate students in the areas of polymer properties, self-healing materials, polymer science, polymer chemistry, and materials science. In industry, this book contains highly valuable information for R&D professionals, designers, and engineers, who are looking to incorporate self-healing properties in their materials, products, or components. Provides comprehensive coverage of self-healing polymeric materials, covering principles, techniques, and applications Includes the very latest developments in the field, such as the role of nanofillers in healing, life cycle analysis of materials, and shape memory assisted healing Enables the reader to unlock the potential of self-healing polymeric materials for a range of advanced applications

This proceedings book presents the main findings of the 13th International Seminar on Polymer Science and Technology (ISPST 2018), which was held at Amirkabir University of Technology, Tehran, on November 10–22, 2018. This forum was the culmination of more than three decades of academic and industrial activities of Iranian scholars and professionals, and the participation of many notable international scientists, in covering various important polymer-related subjects of concern to Iran and the world at large, including polymer synthesis, processing and properties, as well as issues concerning polymer degradation, stability, and environmental aspects. For the past half a century, the growing concern for advancing human health, quality of life, and – especially in the last few decades – avoiding and combating environmental pollution have shaped and driven scientific activities geared toward the creation of smart materials that are compatible with the human body, and have prompted scientists and technologists to pursue research using natural and sustainable sources. This book highlights efforts to responsibly address the problems caused by, and which can potentially be solved by, polymers and plastics.

The use of polymers is restricted by their flammability - they may indeed initiate or propagate fire. Fire Retardancy of Polymers focuses on mineral additives from

either micro- or nano-composites for application in fire retardants. With the use of fire retardant additives containing halogen or phosphorus compounds in decline, the need for other systems is evident. The major materials that are used are alumina trihydrate or magnesium hydroxide which account for more than 50% by weight of the world-wide sales of fire retardants. Recent works have shown that such halogen-free compounds may give enhanced fire retardancy to polymeric materials when used in low levels, alone, or in synergistic mixtures. The corresponding fire performance depends on the dispersion of the mineral filler, with micrometer-scale dispersion leading to the best performances. Specialists discuss these new applications of mineral fillers with particular emphasis on action mechanisms, new materials including textiles, toxicology and hazards. With extensive references, this book provides a comprehensive and up-to-date view of these applications. This book will appeal to professionals, materials scientists and engineers looking for novel ways to eliminate fire hazards and improve flame retardancy of materials, with a special interest in sustainable development.

Biocompatibility refers to the ability of a biomaterial to perform its desired function with respect to a medical therapy, without eliciting any undesirable local or systemic effects in the recipient or beneficiary of that therapy, but generating the most appropriate beneficial cellular or tissue response in that specific situation, and optimizing the clinically relevant performance of that therapy, which reflects current developments in the area of intrinsically biocompatible polymer systems. Polymeric biomaterials are presently used as, for example, long-term implantable medical devices, degradable implantable systems, transient invasive intravascular devices, and, recently, as tissue engineering scaffolds. This Special Issue welcomes full papers and short communications highlighting the aspects of the current trends in the area of intrinsically biocompatible polymer systems.

Reactive Modifiers for Polymers

Handbook of Engineering Polymeric Materials

Copia eines Churf. Brandenburgischen Rescripti an dero Residenten an französischen Hofe Hr. von Spannheim

Rubber Toughened Engineering Plastics

Intrinsically Biocompatible Polymer Systems

Polymers are used in many everyday technologies and their degradation due to environmental exposure has lead to great interest in materials which can heal and repair themselves. In order to design new self healing polymers it's important to understand the fundamental healing mechanisms behind the material. Healable Polymer Systems will outline the key concepts and mechanisms underpinning the design and processing of healable polymers, and indicate potential directions for progress in the future development and applications of these fascinating and potentially valuable materials. The book covers the different techniques developed successfully to date for both autonomous healable materials (those which do not require an external stimulus to promote healing) and rehealable or remendable materials (those which only recover their original physical properties if a specific stimulus is applied). These include the encapsulated-monomer approach, reversible covalent bond formation, irreversible covalent bond formation and supramolecular self-assembly providing detailed insights into their chemistry. Written by leading experts, the book provides polymer scientists with a compact and readily accessible source of reference for healable polymer systems.

There is considerable interest within the polymer industry in developing methods to modify existing polymer systems to achieve improvements in their functional or engineering properties. The chemical treatment of polymers, either prior to or during processing, represents an inexpensive and rapid way of achieving these modifications, and a great deal of research is underway, directed at improving both the understanding of the processes involved and the development of the practical techniques employed. The improvements obtained by chemical treatment range from subtle alteration of the chemical properties of a polymer to wholesale changes in the physical, mechanical and chemical properties, with the current favourable economics ensuring that industry will continue to exploit the technique in the search for improved polymer materials. Written by an international team of authors, drawn from both basic and applied research programmes in industry and academia, and with a strong emphasis on the underlying chemistry, this book forms a timely, concise and accessible evaluation of the most promising technologies developed to date. Chemists, technologists, materials' scientists and engineers working in all areas of the polymer industry, along with academic researchers in those fields, will find this book an essential source of reference in the course of their work.

Single and two-phase flows are ubiquitous in most natural process and engineering systems. Examples of systems or process include, packed bed reactors, either single phase or multiphase, absorber and adsorber separation columns, filter beds, plate heat exchangers, flow of viscoelastic fluids in polymer systems, or the enhanced recovery of oil, among others. In each case the flow plays a central role in determining the system or process behavior and performance. A better understanding of the underlying physical phenomena and the ability to describe the phenomena properly are both crucial to improving design, operation and control processes involving the flow of fluids, ensuring that they will be more efficient and cost effective. Expanding disciplines such as microfluidics and the simulation of complex flow physical systems, such as blood flow in physiological networks, also rely heavily on accurate predictions of fluid flow. Recent advances either in computational and experimental techniques are improving the existing knowledge of single and multiphase flows in engineering and physical systems of interest. This ebook is a review on the state-of-the-art and recent advances in critical areas of fluid mechanics and transport phenomena with respect to chemical and biomedical engineering applications.

The volume includes presentations of technological and research accomplishments along with novel approaches in nanomedicine and nanotechnology. It explores the different types of nanomedicinal drugs with their production and commercial significance. Other topics discussed are the use of natural and synthetic nanoparticles for the production of drugs, different types of nanoparticles systems, drug carriers, wound-healing antimicrobial activity, effects of natural materials in nanomedicine, and toxicity of nanoparticles. The valuable information presented in this volume will help to keep those in this field up to date on the key findings, observations, and fabrication of drugs related to nanomedicine and nanotechnology. With chapters written by prominent researchers from academia, industry, and government and private research laboratories across the world, the book will prove to be a rich resource.

Processing, Properties and Applications

Rheology of Filled Polymer Systems
Micro- and Nanostructured Polymer Systems
Materials Science and Engineering Laboratory
Eco-friendly and Smart Polymer Systems

Biodegradable and Biocompatible Polymer Composites: Processing, Properties and Applications begins by discussing the current state-of-the-art, new challenges and opportunities for various biodegradable and biocompatible polymer composite systems. Interfacial characterization of composites and the structure-property relationships in various composite systems are explained in detail via a theoretical model. Processing techniques for various macro and nanocomposite systems and the influence of processing parameters on properties of the composite are also reviewed in detail. The characterization of microstructure, elastic, visco-elastic, static and dynamic mechanical, thermal, rheological, optical, and electrical properties are highlighted, as are a broad range of applications. The book is a useful reference resource for both researchers and engineers working in composites materials science, biotechnology and nanotechnology, and is also useful for students attending chemistry, physics, and materials science and engineering courses. Presents recent outcomes and highlights the going importance of biodegradable and biocompatible polymer composites and their impact on the environment Analyzes all the main processing techniques, characterization and applications of biodegradable composites Written by leading international experts working in the field of biodegradable and biocompatible polymer composites Covers a broad range of application fields, including medical and pharmaceutical, agricultural, packaging and transport

ABSTRACT: Damage continues to plague the structural integrity of polymer composites. Continued stress leads to cracking and weakening of a composite system. Engineering polymer composites with carbon nanotube reinforcements and self-healing capabilities can potentially enhance the composites properties and extend the service lifetime. Carbon nanotubes (CNTs) promise to improve the electrical and mechanical properties of composite materials into which they are incorporated. These hollow tubes comprised completely of carbon, which have nanometer scale diameters, as well as low density, possess unique paradigm-shifting mechanical and electrical properties. The major problem prohibiting the widespread use of enhanced polymer composites has been the difficulty fabricating these composites. Research in developing methods capable of fully integrating the components is essential. This study sought to develop fabrication strategies to overcome the problem of integration and create polymer composites with advanced behavior useful in multiple applications. Engineering polymer composites with CNT and self-healing capabilities could enhance the composites' properties and extend the lifetime. Polymer composites are prone to degradation and damage. The damage leads to major system failure. The strategy developed here was inspired by living systems that evolved to mend damage and regain function. Engineering "smart" synthetic composites with infrastructures which can respond to damage is necessary for improving polymer usefulness. The molecular processes that alleviates damage aids in avoiding total mechanical failure. Such self-healing materials repair damage and continue function post repair. There several methods for creating composites with self-healing capability. The one studied here involves embedded microcapsules whose envelopes burst open releasing their contents in response to the material cracking. Microcapsules containing a reactive liquid "healing" core are embedded in the polymer during fabrication. A mechanical defect in the polymer breaks the shells of the microcapsules releasing the "healing" core. The core material polymerizes, thus healing the crack. As defects are repaired, functionality should be restored and the serviceable lifetime extended. The results obtained in this study indicate microcapsules can be modified to incorporate CNT. Also self-healing capabilities can be extended to new polymer systems in a cost-effective manner. In addition to enhancing polymers for sustainability, CNT reinforced structural foams could also prove to be beneficial in numerous industrial applications, where mechanically strong foams are needed. CNTs are already being investigated as structural enhancements for other foams, such as polyurethane - the most common and widely used polymer. High internal phase emulsion foams, highly porous emulsion template foams, are emerging as new and important forms of microcellular foams with numerous advantages, such as high impact strength and high stiffness-to-weight ratio. This research developed a novel method for creating carbon nanotube reinforced microcellular foam.

Presenting practical information on new and conventional polymers and products as alternative materials and end-use applications, this work details technological advancements in high-structure plastics and elastomers, functionalized materials, and their product applications. The book also provides a comparison of manufacturing and processing techni

This book describes advances in synthesis, processing, and technology of environmentally friendly polymers generated from renewable resources. With contents based on a wide range of functional monomers and contributions from eminent researchers, this volume demonstrates the design, synthesis, properties and applications of plant oil based polymers, presenting an elaborate review of acid mediated polymerization techniques for the generation of green polymers. Chemical engineers are provided with state-of-the-art information that acts to further progress research in this direction.

Fire Retardancy of Polymers
Nanoparticles in Polymer Systems for Biomedical Applications
Versatile Polymers in Biomedical Applications and Therapeutics
Bioinspired and Biomimetic Polymer Systems for Drug and Gene Delivery
Design, Synthesis and Application of Polymers