

Micro- and Nanostructured **POLYMER SYSTEMS**

From Synthesis to Applications



Editors

Sabu Thomas, PhD, Robert A. Shanks, PhD, Jithin Joy

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Micro Nanostructured Polymer Systems Applications

Mike Jess



Micro Nanostructured Polymer Systems Applications:

Micro- and Nanostructured Polymer Systems Sabu Thomas, Robert Shanks, Jithin Joy, 2016-01-05 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 t Pharmaceutical Polymer Formulations and its Applications Raj K. Keservani, Eknath D. Ahire, Rajesh Kumar Kesharwani, 2025-07-22 The book is an essential resource for anyone in the pharmaceutical field as it provides in depth insights into the versatile roles of polymers in controlled drug delivery highlighting their critical applications in product innovation development and manufacturing Pharmaceutical Polymer Formulations and Its Applications provides an overview of the applications of pharmaceutical polymers in the vast field of controlled drug delivery Polymers have the potential for a range of uses in the design of pharmaceutical dosage forms They can be used as suspending emulsifying binding or flocculant agents as well as adhesives and packaging and coating materials They can be used to make gels nanoparticles microparticles and various capsules Polymers have played an indispensable role in the manufacture of pharmaceutical products This volume includes various polymers used in pharmacy based on their applications The overviews focus on the use of pharmaceutical polymers for controlled drug delivery applications Examples of pharmaceutical polymers and the principles of controlled drug delivery are outlined and applications of polymers for controlled drug delivery are also discussed Readers will find the book Explores the latest tactics utilized for the application of polymers in the healthcare industry Showcases the numerous innovations of polymers in manufacturing of pharmaceuticals Provides essential elements for the conceptualization and comprehension of polymer products by highlighting their aspects and overcoming manufacturing regulatory and quality control obstacles Audience The book will interest chemists and healthcare professionals interested in pharmaceutical innovation using polymers Design and Applications of Nanostructured Polymer Blends and Nanocomposite Systems Sabu Thomas, Robert Shanks, Sarath Chandran, 2015-09-22 Design and Applications of Nanostructured Polymer Blend and Nanocomposite Systems offers readers an intelligent thorough introduction to the design and applications of this new generation of designer polymers with customized properties The book assembles and covers in a unified way the state of the art developments of this less explored type of material With a focus on nanostructured polymer blends the book discusses the science of nanostructure formation and the potential performance benefits of nanostructured polymer blends and composites for applications across many sectors electronics coatings adhesives energy photovoltaics aerospace automotive and medical devices biocompatible polymers The book also describes the design morphology and structure of nanostructured polymer composites and blends to achieve specific properties Covers all important information for designing and selecting the right nanostructured polymer system Provides specialized knowledge on self repairing nanofibre and nanostructured multiphase materials as well as

evaluation and testing of nanostructured polymer systems Serves as a reference guide for development of new products in industries ranging from electronics coatings and energy to transport and medical applications Describes the design morphology and structure of nanostructured polymer composites and blends to achieve specific properties

Polymer Nanocomposites in Biomedical Engineering Kishor Kumar Sadasivuni, Deepalekshmi Ponnammam, Mariappan Rajan, Basheer Ahmed, Mariam Ali S A Al-Maadeed, 2019-01-29 This book presents a thorough discussion of the physics biology chemistry and medicinal science behind a new and important area of materials science and engineering polymer nanocomposites The tremendous opportunities of polymer nanocomposites in the biomedical field arise from their multitude of applications and their ability to satisfy the vastly different functional requirements for each of these applications In the biomedical field a polymer nanocomposite system must meet certain design and functional criteria including biocompatibility biodegradability mechanical properties and in some cases aesthetic demands The content of this book builds on what has been learnt in elementary courses about synthesising polymers different nanoparticles polymer composites biomedical requirements uses of polymer nanocomposites in medicine as well as medical devices and the major mechanisms involved during each application The impact of hybrid nanofillers and synergistic composite mixtures which are used extensively or show promising outcomes in the biomedical field are also discussed These novel materials vary from inorganic ceramic reinforced nanocomposites for mechanical property improvement to peptide based nanomaterials with the chemistry designed to render the entire material biocompatible

Recent Developments in Polymer Macro, Micro and Nano Blends P.M. Visakh, Gordana Markovic, Daniel Pasquini, 2016-08-24 Recent Developments in Polymer Macro Micro and Nano Blends Preparation and Characterisation discusses the various types of techniques that are currently used for the characterization of polymer based macro micro and nano blends It summarizes recent technical research accomplishments emphasizing a broad range of characterization methods In addition the book discusses preparation methods and applications for various types of polymer based macro micro and nano blends Chapters include thermoplastic based polymer nano blends applications of rubber based and thermoplastic blends micro nanostructures polymer blends containing block copolymers advances in polymer inorganic hybrids as membrane materials synthesis of polymer inorganic hybrids through heterophase polymerizations nanoporous polymer foams from nanostructured polymer blends and natural polymeric biodegradable nano blends for protein delivery Describes the techniques pertaining to a kind or small number of blends showing specific examples of their applications Covers micro macro and nano polymer blends Contains contributions from leading experts in the field

Handbook of Multiphase Polymer Systems Abderrahim Boudenne, Laurent Ibos, Yves Candau, Sabu Thomas, 2011-06-09 Multiphase polymeric systems include a wide range of materials such as composites blends alloys gels and interpenetrating polymer networks IPNs A one stop reference on multiphase polymer systems this book fully covers the preparation properties and applications of advanced multiphase systems from macro to nano scales Edited by well respected

academics in the field of multiphase polymer systems the book includes contributions from leading international experts An essential resource for plastic and rubber technologists filler specialists and researchers in fields studying thermal and electrical properties

Biodegradable Polymers in Clinical Use and Clinical Development Abraham J. Domb, Neeraj Kumar, 2011-05-12 This book focuses on biodegradable polymers that are already in clinical use or under clinical development Synthetic and natural polymers will be included This excludes polymers that have been investigated and did not reach clinical development The purpose of this book is to provide updated status of the polymers that are clinical use and those that are now being developed for clinical use and hopefully will reach the clinic during the next 5 years The book provides information that of interest to academics and practicing researchers including chemists biologists and bioengineers and users physicians pharmacists

Nanostructured Polymer Blends Sabu Thomas, Robert Shanks, Sarath Chandran, 2013-11-28 Over 30% of commercial polymers are blends or alloys or one kind or another Nanostructured blends offer the scientist or plastics engineer a new range of possibilities with characteristics including thermodynamic stability the potential to improve material transparency creep and solvent resistance the potential to simultaneously increase tensile strength and ductility superior rheological properties and relatively low cost Nanostructured Polymer Blends opens up immense structural possibilities via chemical and mechanical modifications that generate novel properties and functions and high performance characteristics at a low cost The emerging applications of these new materials cover a wide range of industry sectors encompassing the coatings and adhesives industry electronics energy photovoltaics aerospace and medical devices where polymer blends provide innovations in biocompatible materials This book explains the science of nanostructure formation and the nature of interphase formations demystifies the design of nanostructured blends to achieve specific properties and introduces the applications for this important new class of nanomaterial All the key topics related to recent advances in blends are covered IPNs phase morphologies composites and nanocomposites nanostructure formation the chemistry and structure of additives etc Introduces the science and technology of nanostructured polymer blends and the procedures involved in melt blending and chemical blending to produce new materials with specific performance characteristics Unlocks the potential of nanostructured polymer blends for applications across sectors including electronics energy photovoltaics aerospace automotive and medical devices biocompatible polymers Explains the performance benefits in areas including rheological properties thermodynamic stability material transparency solvent resistance etc

Micro and Nanostructured Epoxy / Rubber Blends Sabu Thomas, Christophe Sinturel, Raju Thomas, 2014-09-04 Epoxy resins are polymers which are extensively used as coating materials due to their outstanding mechanical properties and good handling characteristics A disadvantage results from their high cross link density they are brittle and have very low resistance to crack growth and propagation This necessitates the toughening of the epoxy matrix without impairing its good thermomechanical properties The final properties of the polymer depend on their structure The book focuses on the microstructural aspects in

the modification of epoxy resins with low molecular weight liquid rubbers one of the prime toughening agents commonly employed The book follows thoroughly the reactions of elastomer modified epoxy resins from their liquid stage to the network formation It gives an in depth view into the cure reaction phase separation and the simultaneous development of the morphology Chapters on ageing failure analysis and life cycle analysis round out the book

Nanomaterials for Clinical Applications Costas Demetzos, Natassa Pippa, 2020-02-14 Nanomaterials in Clinical Medicine Case Studies in Nanomedicines focuses on the nanomaterials that can be formulated as drug delivery vehicles such as liposomes micelles nanoemulsions and nanogels Their physicochemical morphological thermo dynamical and nanotoxicological properties are analyzed with respect to the design and development of drug delivery nanosystems for the encapsulation of an active pharmaceutical ingredient and its controlled release Each chapter covers basic properties the nanosystem e g liposomes the added value in drug delivery and targeting and future perspectives Case studies and examples of how nanomaterials are being used in clinical medicine including marketed liposomal medicines and medical utility and regimens are also included Particular attention is given to new nanocarriers such as elastic liposomes lipid polymeric hybrid nanoparticles organogel nanofibers carbon nanomaterials quantum dots and inorganic nanoparticles This book is an important information source for those wanting to increase their understanding of what major nanomaterials are being used to create more effective drug delivery systems Summarizes the major nanomaterials used in clinical medicine explaining how their properties make them suitable for this purpose Explains how nanomaterials are used to create increasingly efficient drug delivery vehicles Includes real life examples demonstrating how nanomaterials are being used in medical practice

Nanostructured Polymer Blends Yuan Meng, Xinghong Zhang, 2013-11-28 The engineering of nanostructured thermosets with different modifiers has generated significant interest since improved overall properties are promised by good control over monodispersed microdomains Incorporation of block copolymers and hyperbranched polymers are acknowledged as two efficient strategies to build up such nano microcomposites bearing distinct phase segregating behaviors owing to respective unique architectures In this chapter we aim to illustrate the interplay between matrix and modifier from a perspective of thermodynamics The two most common mechanisms of thermoset block copolymer demixing are interpreted most obtained morphologies of thermoset hyperbranched polymers are broadly correlated to the width of the phase separation conversion window General preparation methods as well as time temperature transition diagrams are given to guide practice Thermal mechanical and dynamic properties are covered with an emphasis on how the formation of various nanostructures actually influences these properties

Synthetic Polymeric Materials-Based Drug Delivery Systems for Inflammatory Diseases Harish Dureja, Vimal Arora, Paul A. McCarron, Vandana B. Patravale, Kamal Dua, 2025-09-22 This book provides a comprehensive overview of synthetic polymers and their applications in designing delivery systems for the management of inflammatory diseases It presents introductory insights into inflammatory conditions delves into the role of synthetic polymers and examines diverse

delivery approaches Synthetic Polymeric Materials Based Drug Delivery Systems for Inflammatory Diseases explores the potential of synthetic polymers in designing drug delivery systems for managing inflammatory diseases including inflammatory lung diseases inflammatory bowel diseases and inflammatory skin diseases as well as other conditions like cancer neurodegenerative disorders rheumatoid arthritis and eye related inflammatory conditions It also discusses the role of synthetic polymers in modulating immune system responses in different disease conditions Furthermore it analyzes the 3D printing technologies employed for the preparation of drug delivery systems based on synthetic polymers Toward the end the book highlights the challenges and prospects of synthetic polymers in designing delivery systems for the effective management of inflammatory diseases and their clinical usage This book is intended for researchers and professionals in the fields of pharmaceutical sciences nanotechnology and drug delivery systems

Key Features Highlights the role of a synthetic polymer based drug delivery system against inflammatory responses Explores the cutting edge technology of 3D printing and its application in preparing drug delivery systems based on synthetic polymers Provides valuable insights into how synthetic polymers can be used to modulate immune system responses Presents regulatory compliance using synthetic polymers in drug delivery systems for inflammatory diseases Examines challenges associated with synthetic polymers in drug delivery systems for inflammatory diseases

Advanced Polymeric Systems Didier Rouxel, K.M. Praveen, Indu Raj, Sandhya Gopalakrishnan, Nandakumar Kalarikkal, Sabu Thomas, 2022-09-01 Over recent years a considerable amount of effort has been devoted both in industry and academia towards the incorporation of various macro micro and nano sized fillers into polymers There is also much interest in the evaluation of various polymer properties with respect to a wide set of applications The advances in nanotechnology together with the development in material sciences has improved the shortcomings of these materials over the decade This book covers the latest advances in the field of polymer nanocomposites and polymer composites for varied applications The major topics discussed in the book include Nanostructured materials for energy applications Nanostructured polymer composites Bio polymers Nanostructured polymers for biomedical applications The book contains extended and updated research papers that were initially selected for the ICAMP 2017 conference which focused on advances in polymer materials The book is ideal for researchers and practitioners in polymer science and materials science as well as for graduate students in polymer chemistry materials science nanotechnology and biomedical engineering

Multiphase Polymer Systems Andreea Irina Barzic, Silvia Ioan, 2016-09-19 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

Nanostructured Polymer Blends Sérgio Roberto Montoro, Simone de Fátima Medeiros, Gizelda Maria Alves, 2013-11-28 Polymer systems can be developed into a variety of functional forms to meet industrial and scientific applications In general they are presented in four common physical forms 1 linear free chains in solution 2 covalently or physically cross linked reversible gels 3 micro and nanoparticles and 4 chains adsorbed or in surface grafted form Hydrogels are polymeric particles consisting of water soluble polymer chains chemically or physically connected using in general a cross linking agent These materials do not dissolve in water but may swell considerably in aqueous medium demonstrating an extraordinary ability 20% to absorb water into the reticulated structure Such features make these materials promising tools in the biomedical field especially as controlled drug release systems This chapter describes recent progress in the development and applications of polymeric nanostructured hydrogels mainly in the context of biomedical devices Additionally it reports the significant advances in synthesis and characterization strategies of these materials Special attention is devoted to smart or stimuli responsive bionanogels which mimic the property of living systems responding to environmental changes such as pH temperature light pressure electric field chemicals or ionic strength or a combination of different stimuli Consequently these bionanogels offer an efficient solution to various biomedical limitations in the field of drug administration

Chitosan-Based Systems for Biopharmaceuticals Bruno Sarmento, Jose das Neves, 2012-02-16 Chitosan is a linear polysaccharide commercially produced by the deacetylation of chitin It is non toxic biodegradable biocompatible and acts as a bioadhesive with otherwise unstable biomolecules making it a valuable component in the formulation of biopharmaceutical drugs Chitosan Based Systems for Biopharmaceuticals provides an extensive overview of the application of chitosan and its derivatives in the development and optimisation of biopharmaceuticals The book is divided in four different parts Part I discusses general

aspects of chitosan and its derivatives with particular emphasis on issues related to the development of biopharmaceutical chitosan based systems Part II deals with the use of chitosan and derivatives in the formulation and delivery of biopharmaceuticals and focuses on the synergistic effects between chitosan and this particular subset of pharmaceuticals Part III discusses specific applications of chitosan and its derivatives for biopharmaceutical use Finally Part IV presents diverse viewpoints on different issues such as regulatory manufacturing and toxicological requirements of chitosan and its derivatives related to the development of biopharmaceutical products as well as their patent status and clinical application and potential Topics covered include chemical and technological advances in chitins and chitosans useful for the formulation of biopharmaceuticals physical properties of chitosan and derivatives in sol and gel states absorption promotion properties of chitosan and derivatives biocompatibility and biodegradation of chitosan and derivatives biological and pharmacological activity of chitosan and derivatives biological chemical and physical compatibility of chitosan and biopharmaceuticals approaches for functional modification or crosslinking of chitosan use of chitosan and derivatives in conventional biopharmaceutical dosage forms manufacture techniques of chitosan based microparticles and nanoparticles for biopharmaceuticals chitosan and derivatives for biopharmaceutical use mucoadhesive properties chitosan based systems for mucosal delivery of biopharmaceuticals chitosan based delivery systems for mucosal vaccination chitosan based nanoparticulates for oral delivery of biopharmaceuticals chitosan based systems for ocular delivery of biopharmaceuticals chemical modification of chitosan for delivery of DNA and siRNA target specific chitosan based nanoparticle systems for nucleic acid delivery functional PEGylated chitosan systems for biopharmaceuticals stimuli sensitive chitosan based systems for biopharmaceuticals chitosan copolymers for biopharmaceuticals application of chitosan for anti cancer biopharmaceutical delivery chitosan based biopharmaceuticals scaffolds in tissue engineering and regenerative medicine wound healing properties of chitosan and its use in wound dressing biopharmaceuticals toxicological properties of chitosan and derivatives for biopharmaceutical applications regulatory status of chitosan and derivatives patentability and intellectual property issues quality control and good manufacturing practice preclinical and clinical use of chitosan and derivatives for biopharmaceuticals Chitosan Based Systems for Biopharmaceuticals is an important compendium of fundamental concepts practical tools and applications of chitosan based biopharmaceuticals for researchers in academia and industry working in drug formulation and delivery biopharmaceuticals medicinal chemistry pharmacy bioengineering and new materials development

Micro- and Nano-Structured Interpenetrating Polymer Networks Sabu Thomas, Daniel Grande, Uros Cvelbar, K. V. S. N. Raju, Ramanuj Narayan, Selvin P. Thomas, Akhina H., 2016-03-08 This book examines the current state of the art new challenges opportunities and applications of IPNs With contributions from experts across the globe this survey is an outstanding resource reference for anyone involved in the field of polymer materials design for advanced technologies Comprehensively summarizes many of the recent technical research accomplishments in the area of micro and

nanostructured Interpenetrating Polymer Networks Discusses various aspects of synthesis characterization structure morphology modelling properties and applications of IPNs Describes how nano structured IPNs correlate their multiscale structure to their properties and morphologies Serves as a one stop reference resource for important research accomplishments in the area of IPNs and nano structured polymer systems Includes chapters from leading researchers in the IPN field from industry academy government and private research institutions *Plastic Footprint* Pankaj Pathak, Sadia Ilyas, Rajiv R. Srivastava, 2025-07-26 This book gives a broader framework of plastic pollution which is a significant issue worldwide The book emphasizes the primary plastic waste discharged from the direct source and secondary pollutants plastic trash which is disposed of on land and converted to micro and nano plastics in ocean In addition to this the volume also addresses the issues of plastic pollution by managing plastic waste in a circular closed loop The book is divided into three parts 1 generation and assessment of plastic waste 2 impact assessment of plastics due to improper management and disposal 3 sustainable management of plastic waste and converting them into resource **Nanostructured Conductive Polymers** Ali Eftekhari, 2011-07-07 Providing a vital link between nanotechnology and conductive polymers this book covers advances in topics of this interdisciplinary area In each chapter there is a discussion of current research issues while reviewing the background of the topic The selection of topics and contributors from around the globe make this text an outstanding resource for researchers involved in the field of nanomaterials or polymer materials design The book is divided into three sections From Conductive Polymers to Nanotechnology Synthesis and Characterization and Applications

Micro- and Nanotechnology Enabled Applications for Portable Miniaturized Analytical Systems Sabu Thomas, Mazaher Ahmadi, Abbas Afkhami, Tayyeb Madrakian, Tuan Anh Nguyen, 2021-10-12 Micro and Nanotechnology Enabled Applications for Portable Miniaturized Analytical Systems outlines the basic principles of miniaturized analytical devices such as spectrometric separation imaging and electrochemical miniaturized instruments Concepts such as smartphone enabled miniaturized detection systems and micro nanomachines are also reviewed Subsequent chapters explore the emerging application of these mobile devices for miniaturized analysis in various fields including medicine and biomedicine environmental chemistry food chemistry and forensic chemistry This is an important reference source for materials scientists and engineers wanting to understand how miniaturization techniques are being used to create a range of efficient sustainable electronic and optical devices Miniaturization describes the concept of manufacturing increasingly smaller mechanical optical and electronic products and devices These smaller instruments can be used to produce micro and nanoscale components required for analytical procedures A variety of micro nanoscale materials have been synthesized and used in analytical procedures such as sensing materials sorbents adsorbents catalysts and reactors The miniaturization of analytical instruments can be applied to the different steps of analytical procedures such as sample preparation analytical separation and detection reducing the total cost of manufacturing the instruments and the needed reagents and organic

solvents Outlines how miniaturization techniques can be used to create new optical and electronic micro and nanodevices
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