Natural Polymers Composites Vol 1

Polymer composites are materials in which the matrix polymer is reinforced with organic/inorganic fillers of a definite size and shape, leading to enhanced performance of the resultant composite. These materials find a wide number of applications in such diverse fields as geotextiles, building, electronics, medical, packaging, and automobiles. This first systematic reference on the topic emphasizes the characteristics and dimension of this reinforcement. The authors are leading researchers in the field from academia, government, industry, as well as private research institutions across the globe, and adopt a practical approach here, covering such aspects as the preparation, characterization, properties and theory of polymer composites. The book begins by discussing the state of the art, new challenges, and opportunities of various polymer composite systems. Interfacial characterization of the composites is discussed in detail, as is the macro- and micromechanics of the composites. Structure-property relationships in various composite systems are explained with the help of theoretical models, while processing techniques for various macro- to nanocomposite systems and the influence of processing parameters on the properties of the composite are reviewed in detail. The characterization of microstructure, elastic, viscoelastic, static and dynamic mechanical, thermal, tribological, rheological, optical, electrical and barrier properties are highlighted, as well as their myriad applications. Divided into three volumes: Vol. 1. Macro- and Microcomposites; Vol. 2. Nanocomposites; and Vol. 3. Biocomposites.

In the search for sustainable materials, natural polymers present an attractive alternative for many applications compared to their synthetic counterparts derived from petrochemicals. The two volume set, Natural Polymers, covers the synthesis, characterisation and applications of key natural polymeric systems including their morphology, structure, dynamics and properties. Volume one focuses on natural polymer composites, including both natural and protein fibres, and volume two on natural polymer nanocomposites. The first volume examines the characterization, life cycle assessment and new sources of natural fibres and their potential as a replacement for synthetic fibres in industrial applications. It then explores the important advancements in the field of wool, silk, spidersilk and mussel byssus fibres. The second volume looks at the properties and characterization of cellulose, chitosan, furanic, starch, wool and silk nanocomposites and the potential industrial applications of natural polymer nanocomposites. With contributions from leading researchers in natural polymers from around the globe, Natural Polymers provides a valuable reference for material scientists, polymer chemists and polymer engineers.

Presenting a comprehensive overview of the field, Biofiller-Reinforced Biodegradable Polymer Composites examines biodegradable composites derived from biofiller and biodegradable polymers while providing critical information for efficient use of biocomposites developed from natural resources. Discusses advanced techniques for the use of both biofiller and biodegradable polymers as the matrix for composites. Highlights application of both natural fiber and natural matrix for composites in the development of environmentally friendly and sustainable materials. Introduces the basics of biocomposites, the processing and characteristics of new composite materials, and new combinations of composites such as soy protein and nanocellulose. Elaborates on the introduction of new materials to develop biodegradable polymers. This book has been written for researchers, advanced students, and professional engineers and materials scientists working in the area of bio-based polymers, natural fiber composites, and biocomposites.

Environmental concerns are driving demand for bio-degradable materials such as plant-based natural fiber reinforced polymer composites. These composites are fast replacing conventional materials in many applications, especially in automobiles, where tribology (friction, lubrication and wear) is important. This book covers the availability and processing of natural fiber polymer composites and their structural, thermal, mechanical and, in particular, tribological properties. Chapter 1 discusses sources of natural fibers, their extraction and surface modification. It also reviews the thermal, structural, mechanical, spectroscopic and morphological properties of unmodified and chemically modified natural fibers such as sisal, jute, wood, bamboo and cotton together with their potential applications. Chapter 2 gives a brief introduction to the tribology of polymer composites and the role of fiber reinforcement and fillers in modifying their tribological properties. Further chapters discuss the chemical composition, physical structure, mechanical properties and tribological behaviour of polymer composites reinforced with sisal, jute, cotton and bamboo fibers. The tribological behaviour of wood polymer composites (WPCs) is also discussed. Tribology of natural fibre polymer composites is a useful reference guide for engineers, scientific and technical personnel involved in the development of natural fiber composites. In particular it will give an insight into mechanical properties and failure mechanisms in situations where wear, lubrication and friction are a problem. Examines the availability and processing of natural fiber composites and their structural, thermal, mechanical and tribological properties Explores sources of natural fibers, their extraction and surface modification as well as properties of chemically modified natural fibers Provides an overview of the tribology of polymer composites and the role of fiber reinforcement and filters in modifying tribological composites

The book consists of 21 chapters by subject matter experts and is divided into four parts: Soil Microenvironment and Biotransformation Mechanisms; Synergistic effects between substrates and Microbes; Polyhydroxyalakanoates: Resources, Demands and Sustainability; and Cellulose based biomaterials: Benefits and challenges. Included in the chapters are classical bioremediation approaches and advances in the use of nanoparticles for removal of radioactive waste. The book also discusses the production of applied emerging biopolymers using diverse microorganisms. All chapters are supplemented with comprehensive illustrative diagrams and comparative tables.

Electrospun Polymers and Composites: Ultrafine Materials, High Performance Fibres and Wearables reviews the latest technological developments and innovations in

electrospun polymers and composites, highlighting the multifunctionality of these ultrafine materials as high performance fibers. The book's chapters investigate a wide range of different electrospinning applications, including drug delivery, tissue scaffolding, fiber reinforcement and nanofiltration, with a particular focus on shape memory effect and the wearable characteristics of electrospun polymers and composites. This will be a valuable reference resource for research and for industrial communities working in the field of electrospinning. Covers two important material systems in electrospun materials, including electrospun polymers and composites Emphasizes areas in shape memory effect and wearable features of electrospun polymers and composites Presents a multidisciplinary work that will attract a wide spectrum of readers in chemical engineering, biomedical engineering, chemistry, pharmacy, environmental science, materials science and engineering, as well as mechanical and electrical engineering

An up-to-date and comprehensive overview summarizing recent achievements, the state of the art, and trends in research into nanocellulose and cellulose nanocomposites. Following an introduction, this ready references discusses the characterization as well surface modification of cellulose nanocomposites before going into details of the manufacturing and the self-assembly of such compounds. After a description of various alternatives, including thermoplastic, thermosetting, rubber, and fully green cellulose nanocomposites, the book continues with their mechanic and thermal properties, as well as crystallization and rheology behavior. A summary of spectroscopic and water sorption properties precedes a look at environmental health and safety of these nanocomposites. With its coverage of a wide variety of materials, important characterization tools and resulting applications, this is an essential reference for beginners as well as experienced researchers.

Fiber Technology for Fiber-Reinforced Composites provides a detailed introduction to fiber reinforced composites, explaining the mechanics of fiber reinforced composites, along with information on the various fiber types, including manufacturing of fibers (starting from monomers and precursors), fiber spinning techniques, testing of fibers, and surface modification of fibers. As material technologies develop, composite materials are becoming more and more important in transportation, construction, electronics, sporting goods, the defense industry, and other areas of research. Many engineers working in industry and academics at universities are trying to manufacture composite materials using a limited number of fiber types with almost no information on fiber technology, fiber morphology, fiber properties, and fiber sizing agents. This book fills that gap in knowledge. Unique in that it focuses on a broad range of different fiber types used in composites manufacturing Contains contributions from leading experts working in both industry and academia Provides comprehensive coverage on both natural and nanofibers

Natural Fiber-Reinforced Biodegradable and Bioresorbable Polymer Composites focuses on key areas of fundamental research and applications of biocomposites. Several key elements that affect the usage of these composites in real-life applications are discussed. There will be a comprehensive review on the different kinds of biocomposites at the beginning of the book, then the different types of natural fibers, bio-polymers, and green nanoparticle biocomposites are discussed as well as their potential for future development and use in engineering biomedical and domestic products. Recently mankind has realized that unless the environment is protected, he himself will be threatened by the over consumption of natural resources as well as a substantial reduction in the amount of fresh air produced in the world. Conservation of forests and the optimal utilization of agricultural and other renewable resources like solar, wind, and tidal energy, have become important topics worldwide. With such concern, the use of renewable resources—such as plant and animal-based, fiber-reinforced polymeric composites—are now becoming an important design criterion for designing and manufacturing components for a broad range of different industrial products. Research on biodegradable polymeric composites can contribute, to some extent, to a much greener and safer environment. For example, in the biomedical and bioengineering fields, the use of natural fiber mixed with biodegradable and bioresorbable polymers can produce joint and bone fixtures to alleviate pain in patients. Includes comprehensive information about the sources, properties, and biodegradability of natural fibers Discusses failure mechanisms and modeling of natural fibers composites Analyzes the effectiveness of using natural materials for enhancing mechanical, thermal, and biodegradable properties

This book contains recent research on phenolic resin and its composite materials. The book covers all types of wood composites, natural fibres and synthetic fibres reinforced composites. It discusses various properties of phenolic composites and presents comparative study with other polymer composites for prospective applications. The chapters in the book present an up-to-date information on the subject area of polymer and composite-based information by prominent researchers in academia and industry as well as government/private research laboratories across the world. The book serves as a holistic reference source for university and college faculties, professionals, postdoctoral research fellows, undergraduate/graduate students, and research and science officers working in the area of polymer science, non-forest products utilization, natural fibres and biomass materials.

Advances in Sustainable Polymer Composites reviews recent scientific findings on the production and use of sustainable polymers and composites as innovative new materials. The book discusses the importance of sustainable polymers in terms of current practices and how to address environmental and economic issues. Attention is focused on the physical, chemical and electrical properties of these composites. The book also looks at the lifecycle of both single and hybrid polymers and nanocomposites, with chapters covering the latest research findings on sustainable polymer composites with various filler loadings and their improvement on compatibility. From the viewpoint of polymer composites, this book covers not only well-known sustainable future trends in sustainable polymers and composites, but also advanced materials produced from micro, nano and pico-scale fillers that achieve better physical and mechanical results. Features advanced materials produced from micro, nano and pico-scale fillers Emphasizes the modeling and prediction of thermal, rheological and mechanical behavior Covers various types of fillers and different reinforcement agents Focuses on all aspects of fabrication,

characterization and applications Addresses sustainability approaches and solutions

Natural fibers and their composites have a long and important place in the history of human creativity and industry. Increasing consumer interest in "green" products made with sustainable materials, along with the rising cost of petroleum - the basic ingredient of synthetic fibers - have once again brought natural fibers and their composites to the fore. The renewed interest in natural fibers is only a few decades old. Thus, the pioneering work of current researchers in this new era of natural fiber composites will help to illuminate the path for future researchers as they explore new potentialities for natural fibers. Sabu Thomas and Laly Pothen, themselves leaders in the field, bring together cutting edge research by eminent scientists in Natural Fiber Reinforced Composites. Covering the latest research trends such as nano technology, the book will be a valuable resource for the natural fiber composite researcher.

Analytical pyrolysis is one of the many tools utilized for the study of natural organic polymers. This books describes in three parts the methodology of analytical pyrolysis, the results of pyrolysis for a variety of biopolymers, and several practical applications of analytical pyrolysis on natural organic polymers and their composite materials. Analytical pyrolysis methodology covers two distinct subjects, the instrumentation used for pyrolysis and the analytical methods that are applied for the analysis of the pyrolysis products. A variety of pyrolytic techniques and of analytical instruments commonly coupled with pyrolysis devices are given. The description of the results of pyrolysis for biopolymers and some chemically modified natural organic polymers is the core of the book. The main pyrolysis products of numerous compounds as well as the proposed mechanisms for their pyrolysis are described. In this part an attempt is made to present as much as possible the chemistry of the pyrolytic process of natural organic polymers. The applications of analytical pyrolysis include topics such as polymer detection used for example in forensic science, structure elucidation of specific polymers, and identification of small molecules present in polymers (anti-oxidants, plasticizers, etc.). Also, the degradation during heating is a subject of major interest in many practical applications regarding the physical properties of polymers. The applications to composite polymeric materials are in the fields of classification of microorganisms, study of a variety of biological samples, study of fossil materials, etc. Analytical pyrolysis can also be used for obtaining information on the burning area generate pyrolysates that have complex compositions. Their analysis is important in connection with health issues, environmental problems, and taste of food and cigarettes. Features of this book: • Presents analytical pyrolysis as a uniform subject and not as a conglomerate of scientific papers. • Puts together in an organized manner a large volume of available information in this specific field. • Provides original results which address subjects with relatively scarce information in literature. • Gives original views on subjects such as the parallel between the pyrolytic process and the ion fragmentation in mass spectrometry. • Includes the role of pyrolysis in the burning process. The three parts of the book are covered in 18 chapters, each divided into sections. Some sections are further divided by particular subjects. References are given for each chapter, and an effort has been made to include as much as possible from the available representative information. A few unpublished personal results are also included.

This book introduces the most recent innovations in natural polymer applications in the food, construction, electronics, biomedical, pharmaceutical, and engineering industries. The authors provide perspectives from their respective range of industries covering classification, extraction, modification, and application of natural polymers from various sources in nature. They discuss the techniques used in analysis of natural polymers in various systems incorporating natural polymers as well as their intrinsic properties.

The progressive dwindling of fossil resources, coupled with the drastic increase in oil prices, have sparked a feverish activity in search of alternatives based on renewable resources for the production of energy. Given the predominance of petroleum- and carbon-based chemistry for the manufacture of organic chemical commodities, a similar preoccupation has recently generated numerous initiatives aimed at replacing these fossil sources with renewable counterparts. In particular, major efforts are being conducted in the field of polymer science and technology to prepare macromolecular materials based on renewable resources. The concept of the bio-refinery, viz. the rational exploitation of the vegetable biomass in terms of the separation of its components and their utilisation as such, or after suitable chemical modifications, is thus gaining momentum and considerable financial backing from both the public and private sectors. This collection of chapters, each one written by internationally recognised experts in the corresponding field, covers in a comprehensive fashion all the major aspects related to the synthesis, characterization and properties of macromolecular materials prepared using renewable resources as such, or after appropriate modifications. Thus, monomers such as terpenes and furans, oligomers like rosin and tannins, and polymers ranging from cellulose to proteins and including macromolecules synthesized by microbes, are discussed with the purpose of showing the extraordinary variety of materials that can be prepared from their intelligent exploitation. Particular emphasis has been placed on recent advances and imminent perspectives, given the incessantly growing interest that this area is experiencing in both the scientific and technological realms. Discusses bio-refining with explicit application to materials Replete with examples of applications of the concept of sustainable development Presents an impressive variety of novel macromolecular materials

Alginate is a hydrophilic, biocompatible, biodegradable, and relatively economical polymer generally found in marine brown algae. The modification in the alginate molecule after polymerization has shown strong potential in biomedical, pharmaceutical and biotechnology applications such as wound dressing, drug delivery, dental treatment, in cell culture and tissue engineering. Besides this, alginates have industrial applications too in the paper and food industries as plasticizers and additives. The few books that have been published on alginates focus more on their biology. This current book focuses on the exploration of alginates and their modification, characterization, derivatives, composites, hydrogels as well as the new and emerging applications.

The Handbook of Composites From Renewable Materials comprises a set of 8 individual volumes that brings an interdisciplinary perspective to accomplish a more detailed understanding of the interplay between the synthesis, structure, characterization, processing, applications and performance of these advanced materials. The handbook covers a multitude of natural polymers/ reinforcement/ fillers and biodegradable materials. Together, the 8 volumes total at least 5000 pages and offers a unique publication. Volume 1 is solely focused on the Structure and Chemistry of renewable materials. Some of the important topics include but not limited to: carbon fibers from sustainable resources; polylactic acid composites and composite foams based on natural fibres; composites materials from other than cellulosic resources; microcrystalline cellulose and related polymer composites; tannin-based foam; renewable feedstock vanillin derived polymer and composites; silk biocomposites; bio-derived adhesives and matrix polymers; biomass based formaldehyde-free bio-resin ; isolation and characterization of water soluble polysaccharide; bio-based fillers; keratin based materials in biotechnology; structure of proteins adsorbed onto bioactive glasses for sustainable composite; effect of filler properties on the antioxidant response of starch composites; composite of chitosan and its derivate; magnetic biochar from discarded agricultural biomass; biodegradable polymers for protein and peptide conjugation; polyurethanes and polyurethane composites from bio-based / recycled components.

Biopolymers are becoming an increasingly important area of research as traditional chemical feedstocks run low and concerns about environmental impacts increase. One area of particular interest is their use for more sustainable development of metal nanoparticles. Biopolymer-based Metal Nanoparticle Chemistry for Sustainability Applications, Volume 1 reviews key polymers found in nature, their characterization and modification, and processes for using them in the development of metal nanoparticles. Beginning with an introduction to both green chemistry and biopolymers in Part 1, the book goes on to outline the classification of biopolymers in Part 2, with specific details on polysaccharides, proteins and polypeptides, lignin, and polylactic acid. Properties of biopolymers, including biodegradability and toxicity, are the focus of Part 3, before Part 4 goes on to discuss synthesis and characterization. Reviews novel sources of polymers with high potential as green media for synthesizing nanostructures Provides technological details on the synthesis of natural polymer-based metal nanoparticles Highlights the use of natural polymer supports and the impact of their properties on stability, morphology and scale of nanostructures

This new volume, Natural Polymers for Pharmaceutical Applications, Volume 1: Plant-Derived Polymers, presents some of the latest research on the applications of natural polymers in drug delivery and therapeutics for healthcare benefits. Polymers and their applications from several plants are discussed in depth, including tamarind gum, gum Arabic, natural carbohydrate polymer gum tragacanth, pectin, guar gum and its derivatives, locust bean gum, sterculia gum, okra gum, and others. The use of the polymers derived from plants as potential pharmaceutical excipients is expanding day by day because of their stability in the biological system, drug-releasing capability, drug-targeting abilities, as well as their bioavailability.

Because we are living in an era of Green Science and Technology, developments in the field of bio- and nano- polymer composite materials for advanced structural and medical applications is a rapidly emerging area and the subject of scientific attention. In light of the continuously deteriorating environmental conditions, researchers all over the world have focused an enormous amount of scientific research towards bio-based materials because of their cost effectiveness, eco-friendliness and renewability. This handbook deals with cellulose fibers and nano-fibers and covers the latest advances in bio- and nano- polymer composite materials. This rapidly expanding field is generating many exciting new materials with novel properties and promises to yield advanced applications in diverse fields. This book reviews vital issues and topics and will be of interest to academicians, research scholars, polymer engineers and researchers in industries working in the subject area. It will also be a valuable resource for undergraduate and postgraduate students at institutes of plastic engineering and other technical institutes.

This two volume set provides a valuable reference on natural polymer composites, including both natural and protein fibres, and natural polymer nanocomposites.

The book Natural Polymers: Derivatives, Blends and Composites Volume II is an edited volume comprised of fifteen chapters from different experts working in the area of natural polymers. Natural polymers are finding applications in fields of packaging, medicine, pharmaceutics, biomedicine, textiles and many others. This book gives detailed insight into all aspects of natural polymers to the latest trends in the development of new products. This book will hopefully be supportive to scientists, researchers, academicians and students in different disciplines. Key features: 1. Describes various derivatives of natural polymers (ie: composites, nanoparticles, hydrogels, etc.); 2. Self-contained chapters on starch, chitosan, alginate, bovine serum albumin, among others; 3. Covers a broad range of natural polymer applications, from packaging to biomedicine.

Advanced High Strength Natural Fibre Composites in Construction provides the basic framework and knowledge required for the efficient and sustainable use of natural fiber composites as a structural and building material, along with information on the ongoing efforts to improve the efficiency of use and competitiveness of these composites. Areas of particular interest include understanding the nature and behavior of raw materials and their functional contributions to the advanced architectures of high strength composites (Part 1), discussing both traditional and novel manufacturing technologies for various advanced natural fiber construction materials (Part 2), examining the parameters and performance of the composites (Part 3), and finally commenting on the associated codes, standards, and sustainable development of advanced high strength natural fiber composites for construction. This exposition will be based on well understood environmental science as it applies to construction (Part 4). The book is aimed at academics, research scholars, and engineers, and will serve as a most valuable text or reference book that challenges undergraduate and postgraduate students to think beyond standard practices when designing and creating novel construction materials. Presents the first comprehensive review on the efficient and sustainable use of natural fiber composites in construction and building materials Contains detailed information on the structure, chemical composition, and physical and mechanical properties of natural fibers Covers both traditional and novel manufacturing technologies for high strength natural fiber composites Includes material parameters and performance in use, as well as associated codes, standards, and applied case studies Presents contributions from leading international experts in the field

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

The first systematic reference on the topic with an emphasis on the characteristics and dimension of the reinforcement. This first of three volumes, authored by leading researchers in the field from academia, government, industry, as well as private research institutions around the globe, focuses on macro and micro composites. Clearly divided

into three sections, the first offers an introduction to polymer composites, discussing the state of the art, new challenges, and opportunities of various polymer composite systems, as well as preparation and manufacturing techniques. The second part looks at macro systems, with an emphasis on fiber reinforced polymer composites, textile composites, and polymer hybrid composites. Likewise, the final section deals with micro systems, including micro particle reinforced polymer composites, the synthesis, surface modification and characterization of micro particulate fillers and flakes as well as filled polymer micro composites, plus applications and the recovery, recycling and life cycle analysis of synthetic polymeric composites.

Mineral-filled polymer composites are widely used in industries across the globe and applications are increasing continuously in sectors such as shipping, manufacturing, and renewable energy. One of two volumes comprising the Mineral-Filled Polymer Composites Handbook, this volume provides an overview of the latest research and future directions of advanced mineral fiber- reinforced polymer composites, focused specifically on materials properties. It covers fundamentals, recent progress, and new materials involved in mineral-filled polymer composites and includes a wide-ranging listing of chapters authored by an international team of experts. Examines the properties of a wide range of materials, from macro- to nano-sized Highlights resources for biobased minerals production and compares biobased minerals with commercial mineral fillers Covers novel synthesis methods Discusses effects of aging on properties Describes using halloysite and montmorillonite to improve composite properties and the potential of using mineral fillers to enhance the properties of biopolymer and synthetic polymers This book serves as an excellent reference guide for researchers, advanced students, academics, and industry professionals interested in the synthesis of mineral-filled polymer and biopolymer composites, as well as those pursuing research in the broad fields of composite materials, polymers, organic/inorganic hybrid materials, and nano-assembly.

There is a growing demand for strategies to address the impact of polymers and plastics in ecosystems. The principles of green chemistry offer a good source of such strategies. Ecofriendly Functional Polymers: An Approach from Application-Targeted Green Chemistry provides a holistic overview of polymer chemistry, development, and applications in the context of these sustainability-driven principles. It encourages researchers to consider the principles of green chemistry, environmental impacts, and end-user needs as integral aspects for consideration at the earliest stages of any design process, and draws together key aspects of polymer chemistry, organic synthesis, experimental design, and applications in a single volume. Beginning with an authoritative guide to fundamental polymer chemistry and its impact in the current environmental context, the book then discusses a range of key theoretical and experimental aspects of designing eco-friendly functional polymers. Applications of ecofriendly functional polymers across an entire range of fields are discussed, and a selection of case studies highlights the implementation of theoretical and experimental information to address a broad selection of issues. Highlights the physicochemical principles of green chemistry and the development of biodegradable and recyclable polymers in this context Compiles key information connecting structural features with properties, experimental strategies, and appropriate applications into a single volume Discusses requirements and applications across a broad range of fields, supported by practical examples

The book presents emerging economic and environmentally friendly lignocellulosic polymer composites materials that are free from side effects studied in the traditional synthetic materials. This book brings together panels of highly-accomplished leading experts in the field of lignocellulosic polymers & composites from academia, government, as well as research institutions across the globe and encompasses basic studies including preparation, characterization, properties and theory of polymers along with applications addressing new emerging topics of novel issues. Provide basic information and clear understanding of the present state and the growing utility of lignocellulosic materials from different natural resources Includes contributions from world-renowned experts on lignocellulosic polymer composites and discusses the combination of different kinds of lignocellulosic materials from natural resources Discusses the fundamental properties and applications of lignocellulosic polymers in comparison to traditional synthetic materials Explores various processing/ mechanical/ physic-chemical aspects of lignocellulosic polymer composites

The book summarizes in a comprehensive manner many of the recent technical research accomplishments in the area of natural polymers. It discusses the various attempts reporting on solving this problem from the point of view of the chemistry and the structure of natural polymers, highlighting the drawbacks and advantages of each method and proposal. Based on considerations of structure - property relations, it is possible to obtain fibers with improved strength by making use of their nanostructures and/or mesophase properties of natural polymers. The book is a unique book with contributions from the experts of the biomaterial area research. it covers all topics related to natural biomaterials such as natural rubber, cellulose, chitin, starch, hemicellulose, lignin, alginates, soy protein, casein and their bionanocomposites and applications. This book is a useful reference for scientists, academicians, research scholars and biotechnologists.

Automotive manufacturers are required to decrease CO2 emissions and increase fuel economy while assuring driver comfort and safety. In recent years, there has been rapid development in the application of lightweight and sustainable materials in the automotive industry to help meet these criteria. This book provides critical reviews and the latest research results of various lightweight and sustainable materials in automotive applications. It discusses current applications and future trends of lightweight materials in the automotive area. While there are a few books published mainly focusing on automotive applications of metallic lightweight materials, to date there is no available book focusing on a broad spectrum of lightweight materials, including metal, plastic, composites, bio-fiber, bio-polymer, carbon fiber, glass fiber, nanomaterials, rubber materials, and foaming materials, as this work does. The book also includes case studies of commercial lightweight automotive parts from sustainable lightweight materials, providing an invaluable

resource to those involved in this in-demand research and commercialization area.
Natural Fiber Reinforced Vinyl Ester and Vinyl Polymer Composites: Characterization, Properties and Applications discusses recent advances on the development, characterization and application of natural fiber vinyl ester and vinyl polymers composites. Various types of vinyl ester and vinyl based polymers, such as poly(vinyl chloride) (PVC), low and high density polyethylene (LDPE and HDPE), polypropylene (PP), polyvinyl alcohol (PVA) and polyvinyl acetate (PVAc) are discussed. Chapters focus on different composite fabrication processes, such as compression moulding, hand lay-up, and pultrusion processes. Key themes covered include the properties and characterization of vinyl ester and vinyl polymers composites reinforced by natural fibers. The effect of fiber treatment and coupling agents on mechanical and physical properties of these materials is also evaluated. In addition to a determination of physical and mechanical properties, studies on thermal, degradation, swelling behavior, and the morphological properties of natural fiber reinforced vinyl ester and vinyl polymer composites is also presented. Presents the importance of vinyl ester and vinyl-based polymers as matrices in natural fiber composites Provides a detailed and comprehensive review on the development, characterization and applications of natural fiber vinyl ester and vinyl polymers composites Looks at recent fabrication techniques and the mechanical properties of materials Contains contributions from leading experts in the field
Tribology of Natural Fiber Polymer Composites, Second Edition, covers the availability and processing of natural fiber polymer composites and their structural, thermal, mechanical and tribological properties and performance. Environmental concerns are driving demand for biodegradable materials such as plant-based, natural fiber-reinforced polymer composites. These composites are fast replacing conventional materials in many industrial applications, especially in automobiles, where tribology (friction, lubrication and wear) is an important aspect. Provides enhanced coverage on industrially relevant fiber types, such as flax, hemp, kenaf, rice, grain husk and pyrolyzed fibers Includes an emphasis on modeling and the simulation of the wear resistance of fibers Discusses the effect of aging in various environments and different results in wear and friction performance
Natural Polymers, Biopolymers, Biomaterials, and Their Composites, Blends, and IPNs focuses on the recent advances in natural polymers, biopolymers, biomaterials, and their composites, blends, and IPNs. 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/procedures—is playing a major role in the advancement of biomaterials technology. Natural polymers have attained their cutting-edge technology through various platforms, yet there is a lot of novel information about them that is discussed in the book. This important work covers topics such as chitosan composites for biomedical applications and wastewater treatment, coal biotechnology, biomedical and related applications of second generation polyamidoamines, silk fibers, PEG hydrogels, bamboo fiber reinforced PE composites, jute/polyester composites, magnetic biofoams, and many other interesting aspects of importance to polymer research today.
Explore the world of biocomposites with this one-stop resource edited by four international leaders in the field Bio-based Composites: Characterization, Properties, and Applications delivers a comprehensive treatment of all known characterization methods, properties, and industry applications of bio-based composites materials. This unique, one-stop resource covers all major developments in the field from the last decade of research into this environmentally beneficial area. The internationally recognized editors have selected resources that represent advances in the mechanical, thermal, tribological, and water sorption properties of bio-based composites, and cover new areas of research in physico-chemical analysis, flame retardancy, failure mechanisms, lifecycle assessment, and modeling of bio-based composites. The low weight, low cost, excellent thermal recyclability, and biodegradability of bio-based composites make them ideal candidates to replace engineered plastic products derived from fossil fuel. This book provides its readers with the knowledge they'll require to understand a new class of materials increasingly being used in the automotive and packaging industries, aerospace, the military, and construction. It also includes: An extended discussion of the environmental impact of bio-based composites using a lice cycle methodology A review of forecasts of natural fiber reinforced polymeric composites and its degradability concerns An analysis of the physical and mechanical properties of a bio-based composite with sisal powder A comprehensive treatment of the mechanical, thermal, tribological, and dielectric properties of bio-based composites A review of processing methods for the manufacture of bio-based composites Perfect for materials scientists in private industry, government laboratories, or engaged in academic research, Bio-Based Composites will also earn a place in the libraries of industrial and manufacturing engineers who seek a better understanding of the beneficial industrial applications of biocomposites in industries ranging from automobiles to packaging.
Nonconventional and Vernacular Construction Materials: Characterisation, Properties and Applications, Second Edition covers the topic by taking into account sustainability, the conservation movement, and current interests in cultural identity and its preservation. This updated edition presents case studies, information on relevant codes and regulations, and how they apply (or do not apply) to nocmats. Leading international experts contribute chapters on current applications and the engineering of these construction materials. Sections review vernacular construction, provide future directions for nonconventional and vernacular materials research, focus on natural fibers, and cover the use of industrial byproducts and natural ashes in cement mortar and concrete. Takes a scientifically rigorous approach to vernacular and non-conventional building materials and their applications Includes a series of case studies and new material on codes and regulations, thus providing an invaluable compendium of practical knowhow Presents the wider context of materials science and its applications in the sustainability agenda

Green Composites for Automotive Applications presents cutting-edge, comprehensive reviews on the industrial applications of green composites. The book provides an elaborative assessment of both academic and industrial research on eco-design, durability issues, environmental performance, and future trends. Particular emphasis is placed on the processing and characterization of green composites, specific types of materials, such as thermoset and thermoplastic, nanocomposites, sandwich, and polymer biofoams. Additional sections cover lifecycle and risk analysis. As such, this book is an essential reference resource for R&D specialists working in materials science, automotive, chemical, and environmental engineering, as well as R&D managers in industry. Contains contributions from leading experts in the field Covers experimental, analytical and numerical analysis Deals with most important automotive aspects Provides a special section dedicated to lifecycle assessment

Environmental devices help in monitoring the collection of one or more measurements that are used to access the status of an environment. Today, environmental monitoring and analytical methods are among the most rapidly developing branches of analysis. The functionalization of nanomaterials in the field of environmental science has increasing importance with regards to the fabrication of devices. Functionalized nanomaterials reformulate new materials and advanced characteristics for improved application in comparison to old fashion materials and open an opportunity for the development of devices for introducing new technology and techniques for monitoring environmental challenges. The monitoring of these environmental challenges in advances have direct impact on health and sustainability. Functionalized nanomaterials have different mechanical, absorption, optical or electrical properties than original nanomaterials. In fact, major utilization of nanomaterials occurs in their functionalized forms, which are very different from the parent material. This handbook provides an overview of the different state-of-the-art materials, devices and environmental applications of functionalized nanomaterials. In addition, the information offers a platform for ongoing research in the field of environmental science and device fabrication. The main objective of this book is to cover the major areas focusing on the functionalization of nanomaterials, device fabrication along with different techniques and environmental applications of functionalized nanomaterials-based devices. This is an important reference source for materials scientists, engineers and environmental scientsts who are looking to increase their understanding of how functionalized nanomaterial-based devices are being used for environmental monitoring applications. Helps the reader to understand the basic principles of functionalization of nanomaterials Highlights fabrication and characterization methods for functionalized nanomaterials-based environmental monitoring devices Assesses the major challenges of creating devices using functionalized nanomaterials on a mass scale

This unique handbook provides a vivid multidisciplinary dimension through technological perspectives to present cutting-edge research in the field of natural coloration and finishing. The 20 chapters are divided in to four parts: Substrates for coloration and finishing; renewable colorants and their applications; advanced materials and technologies for coloration and finishing; sustainability. Among the topics included in the Handbook of Renewable Materials for Coloration and Finishing are: The systematic discussion on the suitability, physical, chemical and processing aspects of substrates for coloration and finishing Bio-colorant’s application as photosensitizers for dye sensitized solar cells Animal based natural dyes Natural dyes extraction and dyeing methodology Application of natural dyes to cotton and jute textiles Sol-gel flame retardant and/or antimicrobial finishings for cellulosic textiles Rot resistance and antimicrobial finish of cotton khadi fabrics Advanced materials and technologies for antimicrobial finishing of cellulosic textiles

Kenaf fiber is gaining attention as an alternative reinforcement for composite products due to low cost, reduced environmental impact, and attractive mechanical properties. Kenaf Fibers and Composites covers the breadth of these exciting materials, from raw material preparation to application in a variety of products. It discusses fiber characterization and properties, how to prepare kenaf-based composites, and design, manufacturing, and applications. It also covers hybrid fiber composites, kenaf fiber thermosetting composites, kenaf fiber thermoplastic composites, kenaf fibers in various lengths, and forms and arrangements such as particulates, continuous roving, and woven fabrics. Cellulose-based kenaf composites and kenaf fiber-filled biopolymer composites are presented.