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Discusses polymer

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nanocomposites composed of a family of polymeric materials whose properties are capable of being tailored to meet specific applications. This book describes the different methodologies for producing and synthesizing

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***silver nanoparticles (AgNPs)
of various shapes and sizes. It
also provides an in-depth
understanding of the new
methods for characterizing
and modifying the properties
of AgNPs as well as their
properties and applications in***

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various fields. This book is a useful resource for a wide range of readers, including scientists, engineers, doctoral and postdoctoral fellows, and scientific professionals working in specialized fields such as medicine,

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***nanotechnology,
spectroscopy, analytical
chemistry diagnostics, and
plasmonics.***

***This book is based on the 13
review articles written by
subject experts and published
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***of Adhesion and Adhesives.
The rationale for publication
of this book is that currently
the RAA has limited
circulation, so this book
provides broad exposure and
dissemination of the concise,
critical, illuminating, and***

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thought-provoking review articles. The subjects of the reviews fall into 4 general areas: 1. Polymer surface modification 2. Biomedical, pharmaceutical and dental fields 3. Adhesives and adhesive joints 4. General

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The topics covered include: Adhesion of condensed bodies at microscale; imparting adhesion property to silicone material; functionally graded adhesively bonded joints; synthetic adhesives for wood

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panels; adhesion theories in wood adhesive bonding; adhesion and surface issues in biocomposites and bionanocomposites; adhesion phenomena in pharmaceutical products and applications of AFM; cyanoacrylate adhesives

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in surgical applications; ways to generate monosort functionalized polyolefin surfaces; nano-enhanced adhesives; bonding dissimilar materials in dentistry; flame treatment of polymeric materials—relevance to

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***adhesion; and mucoadhesive
polymers for enhancing
retention of ocular drug
delivery.***

***The book focuses on clay-
based micro and
nanocomposites with
different synthetic polymers***

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and presents their synthesis, characterization and testing. The fields of application of these materials include food packaging, rheological control agents, wastewater treatment, biomedical applications and drug

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**delivery. Keywords: Synthetic
Polymer Composites,
Nanoclay-based Polymer
Nanocomposites, Hectorite,
Nontronite-Starch,
Reinforcement of
Thermoplastics, Polyethylene,
Polypropylene, Sonochemical**

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***Emerging innovations in the
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developments and
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***Polymer Nanocomposites
Fundamentals and
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***Fundamentals, Properties,
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Nanocomposites

Clay Nanoparticles

Polymer Nanoclay Composites

Sustainable Nanotechnology

This second edition of the successful reference work has been updated and revised with approximately 30% new content to reflect the numerous

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instrumental developments and improvements, as well as the significant expansion of this rapidly developing field. For example, the combination of IR imaging with AFM has enhanced the achievable lateral resolution by an order of magnitude down to a few hundred nanometers,

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thus launching a multiplicity of new applications in material science.

Furthermore, Raman and IR spectroscopic imaging have become key technologies for the life sciences and today contribute tremendously to a better and more detailed understanding of numerous biological

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and medical research topics. The topical structure of this new edition is now subdivided into four parts. The first treats the fundamentals of the instrumentation for infrared and Raman imaging and mapping and an overview on the chemometric tools for image analysis. The second part

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describes a wide variety of applications ranging from biomedical via food, agriculture and plants to polymers and pharmaceuticals. This is followed by a description of imaging techniques operating beyond the diffraction limit, while the final part covers special methodical

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developments and their utility in specific fields. With its many valuable practical tips, this is a must-have overview for researchers in academic and industrial laboratories wishing to obtain reliable results with this method. A polymer containing small amounts of ionic groups either along the polymer

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backbone chains or as pendant groups is defined as ionomer. As originally proposed by Eisenberg, the interaction between ionic groups leads to the formation of multiplets containing a small number of ion pairs, and also to ionic clusters, which constitute a second phase made of many

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multiplets as well as portions of the hydrocarbon chains. These ionic structures have been shown to act as strong electrostatic cross-links, which provide altered physical properties, such as enhanced mechanical properties and high melt viscosity, among others. Both aromatic

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polyesters as aliphatic are polymeric materials widely used today. Their most familiar applications are in clothing, food packaging and water and carbonated soft drinks bottles. Major part of biodegradable synthetic polymers are polyesters, and in particular, aliphatic polyesters.

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Monomers for the latter can be synthesized from renewable resources. Biodegradable polyesters play a key role in medical applications due to their biodegradability and versatile synthesis able to afford tailored properties; they are currently employed as biomaterials for medical

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purposes such as surgical sutures, scaffolds, screws and reinforcing plates as well as controlled release drug carriers, since they are biocompatible and nontoxic. This thesis is focused to the chemical modification of aromatic and aliphatic polyesters through the incorporation of

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various concentration and different ionic groups. We synthesized poly(hexamethylene terephthalate) and poly(butylene succinate)-based ionomers and investigated the effects of the ionic substitution on physical properties, crystallization rates and hydrodegradability of these polyester

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ionomers. In addition, we also studied the influence of the ionic interaction with nanoclays in the formation of ionomers-based nanocomposites. This thesis embodies a multidisciplinary task work that includes synthesis, spectroscopy characterization, evaluation of thermal and mechanical

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properties, hydrolytic degradation and nanocomposites preparation: the synthesis procedure of copolyesters was made in all cases by polycondensation in melt-phase. Different conditions of temperature, catalyst and time required were used for each family of copolyesters

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depending on both the stability and the reactivity of the comonomers involved in the synthesis. The copolyesters synthesized incorporated sulfonated, ammonium, trimethylammonium and tributylphosphonium ionic groups into their chains. The hydrolytic degradation results suggest that the

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insertion of sulfonated groups in the copolyesters make them more hydrophilic allowing better solvation and an easier attack of water on the ester groups. Nanocomposites with nanoclays were obtained by using different approaches for mixing and in some cases by making use of

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compatibilizers.

*Octadecyltrimethylammonium,
1,12-dodecylenediammonium salts
and a terpolyester ionomer were used
for compatibilization. The clay was
used either unmodified or modified
with alkylammonium soaps. Results
obtained by the different procedures*

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were compared and the effect of the compatibilizers on the mixing efficiency and composite properties were evaluated. Characterization was carried out by ^1H and ^{13}C nuclear magnetic resonance (NMR) spectroscopy, FTIR spectroscopy, gel permeation chromatography (GPC),

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differential scanning calorimetry (DSC), and thermogravimetry analysis (TGA). The changes in crystal structure upon copolymerization were followed by X-ray diffraction (XRD). Original monograph discusses graphene within the carbon chemistry alternatives available to materials

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engineers and explains how it is incorporated into polymer-matrix, as well as ceramic- and metal-matrix composite materials. The book shows how different forms of graphene can be synthesized and then added to polymer composites as main or hybrid nanofillers, with a focus on how

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graphene affects electrical and mechanical properties. Offers the theory and data necessary to design novel graphene-based composites with unique load-bearing, flammability and wear properties. Throughout, the book lists many newly discovered mechanical, thermal and electrical

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properties of graphene. Emerging uses of graphene in films, coatings and colloidal suspensions (i.e., graphene with liquid matrices) are also investigated. -----

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Heterostructured nanoparticles have the capability for a broad range of novel and enhanced properties, which leads to appealing biomedical and environmental applications. This timely

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new book addresses the design and preparation of multiphase nanomaterials with desired size, shape, phase composition, and crystallinity, as well as their current applications. It emphasizes key examples to motivate deeper studies, including nanomaterial-based

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hyperthermia treatment of cancer, nanohybrids for water purification, nanostructures used in the removal or detection of bioagents from waste water, and so on. Features Presents state of the art research on heterostructured nanomaterials, from their synthesis and physiochemical

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properties to current environmental and biological applications. Includes details on toxicity and risk assessment of multifunctional nanomaterials.

Discusses recent developments and utilization in healthcare by leading experts. Introduces the main features of functionalization of nanomaterials in

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terms of desired size, shape, phase composition, surface functionalization/coating, toxicity, and geometry. Emphasizes practical applications in the environmental and biomedical sectors.

Sustainable Nanotechnology A robust examination of the use of

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nanotechnology in the manufacture of sustainable products In Sustainable Nanotechnology: Strategies, Products, and Applications, a team of distinguished researchers delivers a comprehensive and up-to-date exploration of nanotechnology applications in environmental,

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pharmaceutical, and engineering products in the context of global sustainability. The book offers balanced coverage of the benefits and risks of nanotechnology. Divided into three parts, the editors have included contributions from leading scholars discussing sustainability, toxicological

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impacts, and nanomaterial-based adsorbents. This edited volume helps readers understand how nanotechnology and nanomaterials apply in different global sustainability challenges. It also discusses models for understanding the lifecycle and risk assessments of manufactured

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nanomaterials. Case studies are included to explore such topics as design, remediation, and technology assessment. The book also provides: Thorough introductions to nanotechnology-based research priorities for global sustainability and the challenges and opportunities of

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modern, sustainable nanotechnology
Comprehensive explorations of
improving the sustainability of bio-
based products with nanotechnology
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environmental sustainability of
biopolymers using nanotechnology
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nanotechnology-based polymers for drug delivery applications In-depth examinations of green nanotechnology-driven drug delivery systems Perfect for nanotechnology-focused professionals, sustainability experts, biomedical experts, and pharmaceutical industry practitioners,

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*Sustainable Nanotechnology:
Strategies, Products, and Applications
will also earn a place in the libraries of
neuroscientists, bioengineering
professionals, and those involved in
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*Synthetic Polymer Composites
Infrared and Raman Spectroscopic*

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Imaging

*Manufacturing of Nanocomposites with
Engineering Plastics*

*Polyhedral Oligomeric Silsesquioxane
(POSS) Polymer Nanocomposites*

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*Handbook of Nanomaterials for
Industrial Applications*

Clay–Polymer Nanocomposites is a complete summary of the existing knowledge on this topic, from the basic concepts of synthesis and design to their applications in timely topics such as high-performance composites, environment,

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and energy issues. This book covers many aspects of synthesis such as in- situ polymerization within the interlamellar spacing of the clays or by reaction of pristine or pre-modified clays with reactive polymers and prepolymers. Indeed, nanocomposites can be prepared at industrial scale by melt mixing.

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Regardless the synthesis method, much is said in this book about the importance of the clay pre-modification step, which is demonstrated to be effective, on many occasions, in obtaining exfoliated nanocomposites. Clay–Polymer Nanocomposites reports the background to numerous characterization methods

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including solid state NMR, neutron scattering, diffraction and vibrational techniques as well as surface analytical methods, namely XPS, inverse gas chromatography and nitrogen adsorption to probe surface composition, wetting and textural/structural properties. Although not described in dedicated chapters, numerous

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X-ray diffraction patterns of clay–polymer nanocomposites and reference materials are displayed to account for the effects of intercalation and exfoliations of layered aluminosilicates. Finally, multiscale molecular simulation protocols are presenting for predicting morphologies and properties of nanostructured polymer

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systems with industrial relevance. As far as applications are concerned, Clay-Polymer Nanocomposites examines structural composites such as clay-epoxy and clay-biopolymers, the use of clay-polymer nanocomposites as reactive nanocomposite fillers, catalytic clay-(conductive) polymers and similar

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nanocomposites for the uptake of hazardous compounds or for controlled drug release, antibacterial applications, energy storage, and more. The most comprehensive coverage of the state of the art in clay–polymer nanocomposites, from synthesis and design to opportunities and applications Covers the various methods

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of characterization of clay-polymer nanocomposites - including spectroscopy, thermal analyses, and X-ray diffraction
Includes a discussion of a range of application areas, including biomedicine, energy storage, biofouling resistance, and more

A state-of-the-art reference, Metal

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Nanoparticles offers the latest research on the synthesis, characterization, and applications of nanoparticles. Following an introduction of structural, optical, electronic, and electrochemical properties of nanoparticles, the book elaborates on nanoclusters, hyper-Raleigh scattering, nanoarrays, and several applications

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properties, and biomolecule sensors.

This book covers remarkable contemporary nanomaterials such as carbon nanomaterials, nanoclays, quantum dots, MXene, and metal-organic frameworks. Each chapter discusses the synthesis techniques, characterization methods, properties, and the

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nanomaterials' use in different aspects of biomedical, energy, polymers, material construction, biosensors, coatings, and catalysis. Moreover, commercialization challenges and environmental risks of nanomaterials are also covered in depth. The book provides an understanding of the fundamental properties, limitations and

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challenges in nanomaterials synthesis, serving as a valuable resource for researchers, graduate students, academicians, and consultants working with nanomaterials for engineering applications.

This classic reference examines the mechanisms driving adhesion, categories

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of adhesives, techniques for bond formation and evaluation, and major industrial applications. Integrating recent innovation and improved instrumentation, the work offers broad and comprehensive coverage. This edition incorporates several new adhesive classes, new application topics, and recent developments with

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nanoadhesives and bio-based adhesives. Existing chapters are thoroughly updated, revised, or replaced and authored by top specialists in the field. Abundant figures, tables, and equations appear throughout the work.

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This book is part of a two-volume book series that exhaustively reviews the key recent research into nanoclay reinforced polymer composites.

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This second volume focuses on nanoclay based nanocomposites and bionanocomposites fabrication, characterization and applications. This includes classification of nanoclay, chemical modification and

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and mineralogical research on
clays suitability; bio-
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properties of halloysite nanocomposites; the effect of Nanoclays on gas barrier properties of polymers and modified nanocomposites. This book is a valuable reference guide for academics and

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The application of nanotechnology within the medical sphere has had a significant influence on how diseases and conditions are treated and diagnosed. While

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many strides have been made,
there is still continuous
research on nanotechnology
being performed in the field.
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nanocomposites, including their synthesis, characterization, interfacial interactions and advanced applications. Sections introduce essentials, information on their preparation and discussions on polymeric

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industrial setting, this book will be of great interest to scientists, R&D professionals, and engineers across industries and disciplines. Covers all aspects of polyhedral oligomeric silsesquioxanes (POSS) and

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their nanocomposites, including synthesis and characterization techniques, properties, analysis, applications and trends Targets POSS nanocomposites, describing synthesis, characterization and the

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selection of POSS filler types according to polymeric material Explains the preparation and utilization of POSS polymer nanocomposites for cutting-edge applications, including biological, energy, and defense

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applications, and limitations of a
cutting-edge material Based on
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and physical properties

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date overview on cutting-edge advancements in the field of nanocomposites derived from conjugated polymeric matrices. Design of conducting polymers and resultant nanocomposites has instigated

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significant addition in the field of modern nanoscience and technology. Recently, conducting polymer-based nanocomposites have attracted considerable academic and industrial research interest.

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The conductivity and physical properties of conjugated polymers have shown dramatic improvement with nanofiller addition. Appropriate fabrication strategies and the choice of a nanoreinforcement,

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along with a conducting matrix, may lead to enhanced physicochemical features and material performance.

Substantial electrical conductivity, optical features, thermal stability, thermal

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conductivity, mechanical strength, and other physical properties of the conducting polymer-based nanocomposites have led to high-performance materials and high-tech devices and

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applications. This book begins with a widespread impression of state-of-the-art knowledge in indispensable features and processing of conducting polymer-based nanocomposites. It then

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discusses essential categories of conducting polymer-based nanocomposites such as polyaniline, polypyrrole, polythiophene, and derived nanomaterials. Subsequent sections of this book are

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related to the potential impact of conducting polymer-based nanocomposites in various technical fields. Significant application areas have been identified for anti-corrosion, EMI shielding, sensing, and

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energy device relevance.

Finally, the book covers predictable challenges and future opportunities in the field of conjugated nanocomposites. Integrates the fundamentals of

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conducting polymers and a range of multifunctional applications Describes categories of essential conducting polymer-based nanocomposites for polyaniline, polypyrrole,

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polythiophene, and derivative materials Assimilates the significance of multifunctional nanostructured materials of nanocomposite nanofibers Portrays current and future demanding technological

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applications of conjugated
polymer-based
nanocomposites, including anti-
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shielding, sensors, and energy
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technology research. In fact,

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the concept of organic-inorganic hybrid materials is applied to a wide variety of approaches that include materials with inorganic and/or organic nature with respect to their

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matrices and/or dispersed phase. The present book compiles one editorial and eleven approaches to the topic, and intends to provide a transversal idea about what the field of the so-called

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organic-inorganic hybrid materials means in actual scientific scenarios. In any case, the role is pointed out of the interphase between the components as the critical aspect to consider, as a way to

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enhance and understand these components in order to design materials with "tailor-made" organized structures considering the increasing nano-, meso-, micro- and macro-scales.

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Environmental Sustainability and Industries identifies and discusses critical areas related to environmentally conscious industrial development of products and services that may support more sustainable and

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equitable societies. This book addresses pollution prevention by referring to the use of processes, practices, and materials that reduce or eliminate the generation of pollutants at the source of

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production, more efficient use of raw materials, energy, water or other resources, or by conserving natural resources by maintaining clean production. It explains industrial energy efficiency as

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the most cost-effective use of energy in manufacturing processes, reducing its wastage as well as the total consumption of primary energy resources. Life cycle assessment is used as an

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analytical method to quantify environmental impacts, focusing on environmental considerations concerning process design and optimization, and including various sustainable

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manufacturing parameters in the context of industrial processes and proposes a classification of identified parameters to evaluate and optimize the manufacturing performances. The book also

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dives into industrial ecology, investigating how, where, and why environmental improvements can be made to develop a sustainable industry, meeting the needs of current generations without sacrificing

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the needs of the future ones.
This book analyzes a
company's environmental,
social, and economic
performance and their
interrelationships,
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identifying and understanding causal relationships between alternative approaches to action and their impact on financial and nonfinancial performance. It concludes with a view on the future of

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sustainable industrial systems
stressing change as a joint
effort of scientists,
governments, people in
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sustainability for industry
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and processes for sustainable
approaches for industry
Presents the development in
the use of the assessment
models as a tool to support the
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different sustainable

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technologies and processes
The use of nanotechnologies
continues to grow, as
nanomaterials have proven
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profession. Using nanotechnology, materials can be made lighter, more durable, more reactive, and more efficient leading nanoscale materials to enhance many everyday products and

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processes. With many different sizes, shapes, and internal structures, the applications are endless. These uses range from pharmaceuticals to materials such as cement or cloth, electronics,

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environmental sustainability, and more. Therefore, there has been a recent surge of research focused on the synthesis and characterizations of these nanomaterials to better

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understand how they can be used, their applications, and the many different types. The Research Anthology on Synthesis, Characterization, and Applications of Nanomaterials seeks to

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address not only how nanomaterials are created, used, or characterized, but also to apply this knowledge to the multidimensional industries, fields, and applications of nanomaterials

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and nanoscience. This includes topics such as both natural and manmade nanomaterials; the size, shape, reactivity, and other essential characteristics of nanomaterials; challenges and potential effects of using

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nanomaterials; and the advantages of nanomaterials with multidisciplinary uses. This book is ideally designed for researchers, engineers, practitioners, industrialists, educators, strategists,

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nanomaterials are rapidly emerging as one of the most fascinating materials for multifunctional applications. Among biorenewable polymers, cellulose based nanomaterials are of great importance due to their inherent

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advantages such as environmental friendliness, biodegradability, biocompatibility, easy processing and cost effectiveness, to name a few. They may be produced from biological systems such as plants or be chemically synthesised from

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biological materials. This book summarizes the recent remarkable achievements witnessed in green technology of cellulose based nanomaterials in different fields ranging from biomedical to automotive. This book also discusses

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the extensive research developments for next generation nanocellulose-based polymer nanocomposites. The book contains seventeen chapters and each chapter addresses some specific issues related to nanocellulose and also

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demonstrates the real potentialities of these nanomaterials in different domains. The key features of the book are: Synthesis and chemistry of nanocellulose from different biorenewable resources Different characterization of nanocellulosic

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Clay Nanoparticles: Properties and Applications sets out the major properties of clay nanoparticles and their technological applications. The first part of the book focuses on the characterization of nanoclays,

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bionanocomposites based on sustainable polymers filled with ecocompatible nanoclay. The potential use of nanoclays as flame retardants is also discussed, along with the correlation between the properties and potential

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applications of several nanoclay types. In particular, the applications explored include nanoclays as drug delivery systems and for environmental protection. The book provides a complete and multidisciplinary exploration of

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Handbook of Nanomaterials for Industrial Applications explores the use of novel nanomaterials in the industrial arena. The book covers nanomaterials and the techniques that can play vital roles in many

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industrial procedures, such as increasing sensitivity, magnifying precision and improving production limits. In addition, the book stresses that these approaches tend to provide green, sustainable solutions for industrial developments. Finally,

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studied. In the final chapter, a brief overview of opportunities, trends, and challenges of polymer nanocomposites are included. Throughout the book, the theme is developed that polymer nanocomposites are a

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the field of polymer-based nanocomposites for energy and environmental applications. It covers properties and applications, including the synthesis of polymer based nanocomposites from different

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sources and tactics on the efficacy and major challenges associated with successful scale-up fabrication. The chapters provide cutting-edge, up-to-date research findings on the use of polymer based nanocomposites

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in energy and environmental applications, while also detailing how to achieve material's characteristics and significant enhancements in physical, chemical, mechanical and thermal properties. It is an

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essential reference for future research in polymer based nanocomposites as topics such as sustainable, recyclable and eco-friendly methods for highly innovative and applied materials are current topics of importance.

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of radiation, and so achieve the desired composite properties. In recent times, polymer nanocomposites have attracted a great deal of scientific interest due to their unique advantages over conventional plastic

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materials, such as superior strength, modulus, thermal stability, thermal and electrical conductivity, and gas barrier. They are finding real and fast-growing applications in wide-ranging fields such as

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automotive, aerospace, electronics, packaging, and sports. This book focuses on the development of polymer nanocomposites as an advanced material for textile applications, such as fibers, coatings, and

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nanofibers. It compiles and details cutting-edge research in the science and nanotechnology of textiles with special reference to polymer nanocomposites in the form of invited chapters from scientists and subject experts

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from various institutes from all over the world. They include authors who are actively involved in the research and development of polymer nanocomposites with a wide range of functions—including

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antimicrobial, flame-retardant, gas barrier, shape memory, sensor, and energy-scavenging—as well as medical applications, such as tissue engineering and wound dressings, to create a new range

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using this technique are developed. The third chapter illustrates the synthesis of nanoclays by ion exchange reaction of montmorillonite and various quaternary ammonium or phosphonium

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salts. In the fourth chapter, the detailed studies on the reinforcement effect of nanoclays in polypropylene for the synthesis of polypropylene/nanoclay nanocomposites are

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elaborated. The fifth chapter consists of the application of the nanoclays as supporting materials for metal nanoparticles. The palladium, rhodium, gold and silver metal

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are studied in the sixth chapter. The final chapter summarizes the major findings and future direction for nanoclays. There is a major lack of fundamental knowledge and

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understanding on the interaction between a filler and the polymer matrix. When it comes to nanoscale fillers, such as layered silicates, carbon nanotubes, graphene or cellulose

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nanofibers it is even more important to know accurate structure-property relationships as well as identifying the parameters influencing material behavior. The reason for

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the lack of knowledge on how to process nanocomposites and why there are so few applications is that several scientific fields are affected and a joint effort of those

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**scientific communities
involved is necessary -
starting from the filler
manufacturing or pre-
processing over polymer
chemistry to the polymer
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Nanoclay Composites, all involved scientific areas are viewed together for the first time, providing an all-embracing coverage of all stages of polymer clay nanocomposites processing

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