

Nanotechnology In Concrete Materials

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Nanoconcretes and Cement-Based MaterialsAdvanced
Polymer Concretes and CompoundsNano-Engineered
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Nanotechnology Safety

As a paradigm for the future, micro-scale technology seeks to fuse revolutionary concepts in science and engineering and then translate it into reality.

Nanotechnology is an interdisciplinary field that aims to connect what is seen with the naked eye and what is unseen on the molecular level. The Handbook of Research on Diverse Applications of Nanotechnology in Biomedicine, Chemistry, and Engineering examines the strengths and future potential of micro-scale technologies in a variety of industries. Highlighting the benefits, shortcomings, and emerging perspectives in the application of nano-scale technologies, this book is a comprehensive reference source for synthetic chemists, engineers, graduate students, and researchers with an interest in the multidisciplinary applications, as well as the ongoing research in the field.

Molecular Simulation on Cement-Based

Materials

Nanotechnology in Civil Infrastructure is a state-of-the-art reference source describing the latest developments in nano-engineering and nano-modification of construction materials to improve the bulk properties, development of sustainable, intelligent, and smart concrete materials through the integration of nanotechnology based self-sensing and self-powered materials and cyber infrastructure technologies, review of nanotechnology applications in pavement engineering, development of novel, cost-effective, high-performance and long-lasting concrete products and processes through nanotechnology-based innovative processing of cement and cement paste, and advanced nanoscience modeling, visualization, and measurement systems for characterizing and testing civil infrastructure materials at the nano-scale. Researchers, practitioners, undergraduate and graduate students engaged in nanotechnology related research will find this book very useful.

Nanomaterials in Concrete

Book Advances in Nanofibers is a research publication that covers original research on developments within the Nanofibers field of study. The book is a collection of reviewed scholarly contributions written by different authors. Each scholarly contribution represents a chapter and each chapter is complete in itself but related to the major topics and objectives. The target audience comprises scholars and

specialists in the field.

New Uses of Micro and Nanomaterials

The 3rd International Symposium on Nanotechnology in Construction (NICOM 3) follows the highly successful NICOM 1 (Paisley, UK 2003) and NICOM 2 (Bilbao, Spain 2005) Symposia. The NICOM3 symposium was held in Prague, Czech Republic from May 31 to June 2, 2009 under the auspices of the Czech Technical University in Prague. It was a cross-disciplinary event, bringing together R&D experts and users from different fields all with interest in nanotechnology and construction. The conference was aimed at: Understanding of internal structures of existing construction materials at nano-scale
Modification at nano-scale of existing construction materials. Production and properties of nanoparticulate materials, nanotubes and novel polymers. Modeling and simulation of nanostructures. Instrumentation, techniques and metrology at nano-scale. Health and safety issues and environmental impacts related to nanotechnology during research, manufacture and product use. Review of current legislation. Societal and commercial impacts of nanotechnology in construction, their predictions and analysis.

Sustainability of Construction Materials

A recent initiative within the civil engineering field is the use of nanotechnology and materials within the construction industry. While there has been great

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success in the adoption of various nanomaterials, there is still room for development and improvement. Advanced Research on Nanotechnology for Civil Engineering Applications highlights emergent research and theoretical concepts in the implementation of nanotechnology within the construction, geotechnical, and transportation engineering fields. Examining the application of nanomaterials, current trends within the topic area, and the potential health impacts of material usage on the environment, this book is a pivotal reference for professionals, engineers, students, and researchers.

New Materials in Civil Engineering

New smart materials are developing thanks to nanotechnology. Many books are on the market, but the demand for specialized analyses of particular topics still remains. This multiauthor book focuses on the application of nanotechnology to cement-based materials for engineering applications. The addition of novel smart nanofillers allows the development of multifunctional composite materials and not just with respect to higher mechanical strength, as investigated in the past. Special attention is given to types of nano-inclusions, novel techniques to mix components, and analysis of properties that can be achieved by paste, mortar, or concrete if they are added with nanofillers. Among these properties, the capability of self-sensing is very promising. Moreover, the use of phase-changing materials improves energy efficiency of nanocomposites, with important applications in the field of engineering, and new

nanomodified composites have applications in energy harvesting and electromagnetic shielding.

Smart Nanoconcretes and Cement-Based Materials

Nanotechnology is a new and emerging discipline that is multidisciplinary and interdisciplinary. The usage of nanosystems, nanomaterials, nano-devices, etc. permeates all aspects of society. Cancer targeting and curing nanosystems are being introduced into the biomedical and pharmaceutical industries; so are lightweight energy absorbing or blast-proof nanohybrid material in the aerospace, automotive and marine industries and high-efficiency energy harvesting nanomaterials, etc. Society has a vested interest in knowing how these new materials, devices and systems are changing the economy and similar landscapes. The book outlines the regulatory and environmental issues related to nanotechnology per industry, offers guidelines in assessing the risks and discusses the legal and socioeconomical issues involved. Case studies will be utilized to provide examples of the positive and negative impacts of nanotechnology. Provides an overview and the basis for understanding the critical importance of the reactivity and efficacy of nanomaterials and the emerging role of nanotechnology in society Explains the fundamentals, ethics, regulatory and environmental issues of nanosafety and how they shape the emerging nanotechnology industry and markets and includes extensive lists of glossary terms, terminologies and concepts needed for

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Material Data Safety Sheets Discusses the relevance and specificity of nanosafety issues per industry and includes discussions on the "Homeland Security and Infrastructure Industries" of interest to society in general Includes nanotechnology risk assessment and delineates and quantifies the risk assessment process for nanotechnology safety of paramount importance to most industries and systems Outlines the legal and intellectual property ramifications of nanotechnology and its impact on productivity and society

Advanced Polymer Concretes and Compounds

International Symposium on Engineering under Uncertainty: Safety Assessment and Management (ISEUSAM - 2012) is organized by Bengal Engineering and Science University, India during the first week of January 2012 at Kolkata. The primary aim of ISEUSAM 2012 is to provide a platform to facilitate the discussion for a better understanding and management of uncertainty and risk, encompassing various aspects of safety and reliability of engineering systems. The conference received an overwhelming response from national as well as international scholars, experts and delegates from different parts of the world. Papers received from authors of several countries including Australia, Canada, China, Germany, Italy, UAE, UK and USA, besides India. More than two hundred authors have shown their interest in the symposium. The Proceedings presents ninety two high quality papers which address issues of uncertainty encompassing various fields of

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engineering, i.e. uncertainty analysis and modelling, structural reliability, geotechnical engineering, vibration control, earthquake engineering, environmental engineering, stochastic dynamics, transportation system, system identification and damage assessment, and infrastructure engineering.

Nano-Engineered Cementitious Composites

Concrete is widely used because of its versatility, affordability, and availability of raw materials, strength, and durability. Urban development that took place through the world in the last few decades yielded significant developments for concrete technology. The term high-performance concrete (HPC) is relatively new, and it refers to many properties such as strength, durability, sound and heat insulation, waterproofing, and side advantages such as air purification, self-cleaning, etc.

Researchers and engineers are constantly working for improving concrete properties. This book provides the state of the art on recent progress in the high-performance concrete applications written by researchers and experts of the field. The book should be useful to graduate students, researchers, and practicing engineers in related fields.

Nanotechnology in Construction

Transportation Research Record: Journal of the Transportation Research Board, No. 2142 includes 20 papers that report on a laboratory study of a self-

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healing cementitious composite, nanocement enhancement of reactive powder concrete, nanocellulose and microcellulose fibers, nanotechnology to manipulate mortar performance, and an exploratory investigation of nanomaterials. This issue of the TRR also examines nanoporous thin film technology, calcium silicate hydrate, molecular dynamics of hydrated cement, carbon nanofibers and nanotubes in cementitious composites, nanoengineering ultra-high-performance concrete, and a road map for research for nanotechnology-based concrete materials.

Nanotechnology in Civil Infrastructure

This book is a collection of select papers presented at the Tenth Structural Engineering Convention 2016 (SEC-2016). It comprises plenary, invited, and contributory papers covering numerous applications from a wide spectrum of areas related to structural engineering. It presents contributions by academics, researchers, and practicing structural engineers addressing analysis and design of concrete and steel structures, computational structural mechanics, new building materials for sustainable construction, mitigation of structures against natural hazards, structural health monitoring, wind and earthquake engineering, vibration control and smart structures, condition assessment and performance evaluation, repair, rehabilitation and retrofit of structures. Also covering advances in construction techniques/practices, behavior of structures under blast/impact loading, fatigue and fracture, composite materials and

structures, and structures for non-conventional energy (wind and solar), it will serve as a valuable resource for researchers, students and practicing engineers alike.

Proceedings of the International Symposium on Engineering under Uncertainty: Safety Assessment and Management (ISEUSAM - 2012)

One way of improving performance attributes of building structures is to use a new class of materials—polymer composites. They have unique properties that combine high strength with features of non-metallic materials. Polymer concretes (PC) appear to offer many possibilities for producing new materials with desired physical and mechanical characteristics, such as improved mechanical strength, low permeability, and greater chemical resistance. *Advanced Polymer Concretes and Compounds* presents the results of theoretical and experimental research on efficient building material composites based on advanced polymer binders. This book examines the composition and properties of two new polymer concretes that have potential to solve various construction issues: rubber concrete based on a polybutadiene binder and silicate polymer concrete with an organo-silicate matrix. It examines the physical, mechanical, and technological properties of these PCs as well as their behavior in harsh environments and durability and reliability issues. The authors describe a new environmentally friendly polymer for monolithic industrial floor coverings and

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coatings—nonisocyanate polyurethanes. They also discuss advanced crack-resistant coatings based on water dispersion of chlorosulfonated polyethylene, which can be used on concrete, metal, and plastic for various industrial uses such as aircraft, automobiles, paint, and in shipbuilding and civil engineering. The book covers a new type of epoxy composition with nano-heterogenic structure with potential for better mechanical properties and chemical resistance, acid-resistant building materials based on a nanostructured binder, and an advanced environmentally friendly and weather-resistant fire-protective coating for indoor and outdoor application to flammable substrates. With a focus on novel concretes and protective compounds for a variety of environments, this book reflects the newest developments in the rapidly growing field of building materials engineering.

Nanotechnology in Eco-Efficient Construction

Encyclopedia of Renewable and Sustainable Materials provides a comprehensive overview, covering research and development on all aspects of renewable, recyclable and sustainable materials. The use of renewable and sustainable materials in building construction, the automotive sector, energy, textiles and others can create markets for agricultural products and additional revenue streams for farmers, as well as significantly reduce carbon dioxide (CO₂) emissions, manufacturing energy requirements, manufacturing costs and waste. This book provides

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researchers, students and professionals in materials science and engineering with tactics and information as they face increasingly complex challenges around the development, selection and use of construction and manufacturing materials. Covers a broad range of topics not available elsewhere in one resource
Arranged thematically for ease of navigation
Discusses key features on processing, use, application and the environmental benefits of renewable and sustainable materials
Contains a special focus on sustainability that will lead to the reduction of carbon emissions and enhance protection of the natural environment with regard to sustainable materials

Fiber-Reinforced Nanocomposites: Fundamentals and Applications

Smart Nanoconcretes and Cement-Based Materials: Properties, Modelling and Applications explores the fundamental concepts and applications of smart nanoconcretes with self-healing, self-cleaning, photocatalytic, antibacterial, piezoelectrical, heating and conducting properties and how they are used in modern high-rise buildings, hydraulic engineering, highways, tunnels and bridges. This book is an important reference source for materials scientists and civil engineers who are looking to enhance the properties of smart nanomaterials to create stronger, more durable concrete. Explores the mechanisms through which active agents are released from nanocontainers inside concrete Shows how embedded smart nanosensors, including carbon cement-based smart sensors and micro/nano strain-sensors, are

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used to increase concrete performance Discusses the major challenges of integrating smart nanomaterials into concrete composites

Nanotechnology in Concrete Materials

This book focuses on civil engineering materials and nanotechnology. Highlighting recent advances in the field of nano-engineered cementitious composites, it discusses their key principles, design and fabrication, testing and characterization, performance and mechanisms, as well as applications. Future developments and remaining challenges are also outlined. Nano-engineered cementitious composites are exceptionally strong, durable and offer multifunctional/smart performance that differs considerably from that of normal cementitious composites. Providing valuable insights into these composites' future development, the book offers an essential source of information, inspiration, theory and practical guidance for developing sustainable cementitious composites. As such, it will benefit researchers, scientists and engineers in the fields of civil engineering materials and nanotechnology alike.

Eco-Efficient Concrete

A new high-level book for professionals from Atlantis Press providing an overview of nanotechnologies now and their applications in a broad variety of fields, including information and communication technologies, environmental sciences and engineering, societal life, and medicine, with provision

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of customized treatments. The book shows where nanotechnology is now - a fascinating time when the science is transitioning into complex systems with impact on new products. Present and future developments are addressed, as well as a larger number of new industrial and research opportunities deriving from this domain. An overview for professionals, researchers and policy-makers of this very rapidly expanding field. Brief chapters and colour figures with a contained overall length make the book attractive at an attractive price - a must for every professional's shelf. Mihail C. Roco, National Science Foundation and National Nanotechnology Initiative, wrote the preface underlying the importance and weight of the present book to this exciting and epoch-awakening field of research and applications: "Nanotechnology is well recognized as a science and technology megatrend for the beginning of the 21st century. This book aims to show where nanotechnology is now - transitioning to complex systems and fundamentally new products - and communicates the societal promise of nanotechnology to specialists and the public. Most of what has already made it into the marketplace is in the form of "First Generation" products, passive nanostructures with steady behaviour. Many companies have "Second Generation" products, active nanostructures with changing behaviour during use, and embryonic "Third Generation" products, including 3-dimensional nanosystems. Concepts for "Fourth Generation" products, including heterogeneous molecular nanosystems, are only in research."

High Performance Concrete Technology and Applications

With its focus on concrete methods and recent advances in applying nanotechnology to develop new drug therapies and medical diagnostics, this book provides an overall picture of the field, from the fundamentals of nanopharmacy with the characterisation and manufacturing methods to the role of nanoparticles and substances. Actual examples of utilization include drug development issues, translation to the clinic, market prospects, and industrial commercialization aspects. The applications described are taken from cancer treatment as well as other major therapeutic areas, such as infectious diseases and dermatology. An in-depth discussion on safety, regulatory, and societal aspects rounds off the book. Written by a top team of editors and authors composed of the leading experts in Europe and the USA who have pioneered the field of nanopharmacy!

Nanotechnology in Construction

As the environmental impact of existing construction and building materials comes under increasing scrutiny, the search for more eco-efficient solutions has intensified. Nanotechnology offers great potential in this area and is already being widely used to great success. Nanotechnology in eco-efficient construction is an authoritative guide to the role of nanotechnology in the development of eco-efficient construction materials and sustainable construction. Following an introduction to the use of

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nanotechnology in eco-efficient construction materials, part one considers such infrastructural applications as nanoengineered cement-based materials, nanoparticles for high-performance and self-sensing concrete, and the use of nanotechnology to improve the bulk and surface properties of steel for structural applications. Nanoclay-modified asphalt mixtures and safety issues relating to nanomaterials for construction applications are also reviewed before part two goes on to discuss applications for building energy efficiency. Topics explored include thin films and nanostructured coatings, switchable glazing technology and third generation photovoltaic (PV) cells, high-performance thermal insulation materials, and silica nanogel for energy-efficient windows. Finally, photocatalytic applications are the focus of part three, which investigates nanoparticles for pollution control, self-cleaning and photosterilisation, and the role of nanotechnology in manufacturing paints and purifying water for eco-efficient buildings. Nanotechnology in eco-efficient construction is a technical guide for all those involved in the design, production and application of eco-efficient construction materials, including civil engineers, materials scientists, researchers and architects within any field of nanotechnology, eco-efficient materials or the construction industry. Provides an authoritative guide to the role of nanotechnology in the development of eco-efficient construction materials and sustainable construction Examines the use of nanotechnology in eco-efficient construction materials Considers a range of important infrastructural applications, before discussing applications for building energy efficiency

Self-Sensing Concrete in Smart Structures

Cement-based materials have been used by humans nearly since the dawn of civilization. The Egyptians used lime and gypsum cement to bind their aggregate materials, mud and straw, resulting in bricks that are used for building their famous Egyptian pyramids (between 3000 and 2500 BC). Hydrated cement is a cement material bonded together with water and used for building construction; it is characterized by acceptable chemical, physical, thermal, mechanical, and structural stability. It plays a main role in the creation of vessels for storage, roads to travel on, weather-resistant structure for protection, inert hard stabilizer for hazardous wastes, and so on. Due to the composition of these materials and their advantages, it has been practiced in different applications. Cement is an essential component of making concrete, the single most prevalent building material used worldwide for construction, skyscrapers, highways, tunnels, bridges, hydraulic dams, and railway ties. Besides their numerous desired properties, there are some undesirable features. To overcome these disadvantages, several studies were established to prepare, improve, and evaluate innovative cement-based materials. Despite its oldness and deep research, every year several methods and materials evolve and so do cement technology. This book intends to provide a comprehensive overview on recent advances in the evaluation of these materials.

Handbook of Research on Diverse Applications of Nanotechnology in Biomedicine, Chemistry, and Engineering

A fundamental part of modern technology is composed of devices that use special materials as main components. Since the last few decades of the last century and even more recently, a remarkable development has been achieved in new micro- and nanostructured materials with compositional structures and production methods that open unprecedented technological, economic, and ecological perspectives due to high yields, economies of scale, the possibility of reducing weight and size, and the low environmental impact of the equipment that contains them. This book offers a collection of excellent studies that use state-of-the-art methodologies developed by professional researchers from different countries in diverse areas of materials. In this way, this book is particularly useful to academics, scientists, practicing researchers, and postgraduate students whose work relates to the latest nanomaterial technologies.

Nanotechnology in a Nutshell

Sustainability of Construction Materials, Second Edition, explores an increasingly important aspect of construction. In recent years, serious consideration has been given to environmental and societal issues in the manufacturing, use, disposal, and recycling of construction materials. This book provides comprehensive and detailed analysis of the

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sustainability issues associated with these materials, mainly in relation to the constituent materials, processing, recycling, and lifecycle environmental impacts. The contents of each chapter reflect the individual aspects of the material that affect sustainability, such as the preservation and repair of timber, the use of cement replacements in concrete, the prevention and control of metal corrosion and the crucial role of adhesives in wood products. Provides helpful guidance on lifecycle assessment, durability, recycling, and the engineering properties of construction materials Fully updated to take on new developments, with an additional nineteen chapters added to include natural stone, polymers and plastics, and plaster products Provides essential reading for individuals at all levels who are involved in the construction and selection, assessment and use, and maintenance of materials

Nano Materials

The book presents original work on how nanomaterials are applied to concrete through electromutagenic processes, which modify the microstructure of concrete materials in situ without changing their dimensions or appearance. In essence, it shows how high-performance concrete can be mixed without expensive additives. The book offers a method for dispersing nanoparticles in concrete and explains how their presence reduces porosity, increases strength and prevents cracking—information that can be used for more efficient repair and rehabilitation. Nanomaterials are

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shown to improve barrier-formation, anti-corrosiveness, and other functions of concrete. Extensive practical guidelines are given on formulation, set-up, mixing, and testing.

Advanced Research on Nanotechnology for Civil Engineering Applications

Concrete Repair, Rehabilitation and Retrofitting

Carbon atoms have the amazing ability to bond in remarkable different manners that can assume distinct astonishing dimensional arrangements from which absolutely diverse and interesting nanostructured carbon materials are obtained. This book aims to cover the most recent advances in (i) Graphene and derivatives, including graphene-based magnetic composites, membranes, wafer devices, and nanofibers for several applications, as well as some particular properties, such as light emission from graphene; (ii) Carbon nanotubes heaters and fibers for reinforcement of cement and diamond-based thin films; and (iii) Nanofluids consisting of both graphene and carbon nanotubes, apart from reporting some important case studies dealing with carbon nanostructures and their use in sensors, coatings, or electromagnetic wave absorbers.

Nanosensors for Smart Cities

Focusing on the breakthrough field of molecular

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engineering--a new technology enabling scientists to build tiny machines atom by atom--the author offers projections on how this technological revolution will affect the future of computer science, space travel, medicine, and manufacturing

Synthesis, Technology and Applications of Carbon Nanomaterials

New Materials in Civil Engineering provides engineers and scientists with the tools and methods needed to meet the challenge of designing and constructing more resilient and sustainable infrastructures. This book is a valuable guide to the properties, selection criteria, products, applications, lifecycle and recyclability of advanced materials. It presents an A-to-Z approach to all types of materials, highlighting their key performance properties, principal characteristics and applications. Traditional materials covered include concrete, soil, steel, timber, fly ash, geosynthetic, fiber-reinforced concrete, smart materials, carbon fiber and reinforced polymers. In addition, the book covers nanotechnology and biotechnology in the development of new materials. Covers a variety of materials, including fly ash, geosynthetic, fiber-reinforced concrete, smart materials, carbon fiber reinforced polymer and waste materials Provides a "one-stop resource of information for the latest materials and practical applications Includes a variety of different use case studies

Pharmaceutical Nanotechnology

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Innovative Developments of Advanced Multifunctional Nanocomposites in Civil and Structural Engineering focuses on nanotechnology, the innovation and control of materials at 100 nm or smaller length scales, and how they have revolutionized almost all of the various disciplines of science and engineering study. In particular, advances in synthesizing, imaging, and manipulating materials at the nano-scale have provided engineers with a broader array of materials and tools for creating high-performance devices. Nanomaterials possess drastically different properties than those of their bulk counterparts mainly because of their high surface-to-mass ratios and high surface energies/reactivity. For instance, carbon nanotubes have been shown to possess impressive mechanical strength, stiffness, and electrical conductivity superior to that of bulk carbon. Whilst nanotechnology has become deeply rooted in electrical, chemical, and materials engineering disciplines, its proliferation into civil engineering did not begin until fairly recently. This book covers that proliferation and the main challenges associated with the integration of nanomaterials and nano-scale design principles into civil and structural engineering. Examines nanotechnology and its application to not only structural engineering, but also transportation, new infrastructure materials, and the applications of nanotechnology to existing structural systems Focuses on how nanomaterials can provide enhanced sensing capabilities and mechanical reinforcement of the original structural material Analyzes experimental and computational work carried out by world-renowned researchers

Functionalized Engineering Materials and Their Applications

Scientists and researchers are looking for new smart materials to replace old or conventional materials for better performance and for new applications. The use of polymeric materials and nanomaterials is increasing due to their wide-spectrum tunability and many properties. It is now easier to formulate materials for special purposes using these materials than using conventional materials and methods. Many commercial products made from polymeric materials and nanomaterials are now in use and on the market. This book presents a diverse selection of cutting-edge research on the development of polymeric materials and nanomaterials for new and different applications. These include electrical applications, biomedical applications, sensing applications, coating applications, and others. A few chapters dedicated to materials for construction applications are also included. Discussions include the properties, behavior, preparation, processing, and characterization of various polymeric materials, nanomaterials, and their composites. Some of the chapter authors present theoretical studies of these systems, which can help readers to develop a better understanding in this area.

Nanotechnology in Cement-Based Construction

In this book, architects, interior designers and designers will find an introduction to the functions

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and use of nano materials, specifically tailored to their needs and illustrated by numerous international project examples.

Cement Based Materials

Nanofabrication for Smart Nanosensor Applications addresses the design, manufacture and applications of a variety of nanomaterials for sensing applications. In particular, the book explores how nanofabrication techniques are used to create more efficient nanosensors, examines their major applications in biomedicine and environmental science, discusses the fundamentals of how nanosensors work, explores different nanofabrication techniques, and comments on toxicity and safety issues relating to the creation of nanosensors using certain nanomaterial classes. This book is an important resource for materials scientists and engineers who want to make materials selection decisions for the creation of new nanosensor devices. Summarizes current research and applications of a variety of nanofabrication techniques for the creation of efficient sensing devices Provides readers with an understanding of surfaces and interfaces, a key challenge for those working on hybrid nanomaterials, carbon nanotubes, graphene, polymers and liquid crystal electro-optical imaging Discusses the variability and sight recognition of biopolymers, such as DNA molecules, which offer a wide range of opportunities for the self-organization of nanostructures into much more complex patterns

Nanotechnology in Construction

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Eco-efficient concrete is a comprehensive guide to the characteristics and environmental performance of key concrete types. Part one discusses the eco-efficiency and life cycle assessment of Portland cement concrete, before part two goes on to consider concrete with supplementary cementitious materials (SCMs). Concrete with non-reactive wastes is the focus of part three, including municipal solid waste incinerator (MSWI) concrete, and concrete with polymeric, construction and demolition wastes (CDW). An eco-efficient approach to concrete carbonation is also reviewed, followed by an investigation in part four of future alternative binders and the use of nano and biotech in concrete production. With its distinguished editors and international team of expert contributors, Eco-efficient concrete is a technical guide for all professionals, researchers and academics currently or potentially involved in the design, manufacture and use of eco-efficient concrete. The first part of the book examines the eco-efficiency and life cycle assessment of Portland cement concrete. Chapters in the second part of the book consider concrete with supplementary cementitious materials, including properties and performance. Reviews the eco-efficient approach to concrete carbonation.

Advances in Carbon Nanostructures

Nanosensors for Smart Cities covers the fundamental design concepts and emerging applications of nanosensors for the creation of smart city infrastructures. Examples of major applications include logistics management, where nanosensors

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could be used in active transport tracking devices for smart tracking and tracing, and in agri-food productions, where nanosensors are used in nanochips for identity, and food inspection, and smart storage. This book is essential reading for researchers working in the field of advanced sensors technology, smart city technology and nanotechnology, and stakeholders involved in city management.

Nanomaterials based sensors (nanosensors) can offer many advantages over their microcounterparts, including lower power consumption, high sensitivity, lower concentration of analytes, and smaller interaction distance between object and sensor. With the support of artificial intelligence (AI) tools, such as fuzzy logic, genetic algorithms, neural networks, and ambient-intelligence, sensor systems are becoming smarter. Provides information on the fabrication and fundamental design concepts of nanosensors for intelligent systems Explores how nanosensors are being used to better monitor and maintain infrastructure services, including street lighting, traffic management and pollution control Assesses the challenges for creating nanomaterials-enhanced sensors for mass-market consumer products

Innovative Developments of Advanced Multifunctional Nanocomposites in Civil and Structural Engineering

Concrete is the second most used building material in the world after water. The problem is that over time the material becomes weaker. As a response, researchers and designers are developing self-sensing

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concrete which not only increases longevity but also the strength of the material. Self-Sensing Concrete in Smart Structures provides researchers and designers with a guide to the composition, sensing mechanism, measurement, and sensing properties of self-healing concrete along with their structural applications Provides a systematic discussion of the structure of intrinsic self-sensing concrete Compositions of intrinsic self-sensing concrete and processing of intrinsic self-sensing concrete Explains the sensing mechanism, measurement, and sensing properties of intrinsic self-sensing concrete

Encyclopedia of Renewable and Sustainable Materials

Fiber-reinforced Nanocomposites: Fundamentals and Applications explores the fundamental concepts and emerging applications of fiber-reinforced nanocomposites in the automobile, aerospace, transportation, construction, sporting goods, optics, electronics, acoustics and environmental sector. In addition, the book provides a detailed overview of the properties of fiber-reinforced nanocomposites, including discussion on embedding these high-strength fibers in matrices. Due to the mismatch in structure, density, strain and thermal expansion coefficients between matrix and fibers, their thermo-mechanical properties strongly depend not only on the preparative methods, but also on the interaction between reinforcing phase and matrix phase. This book offers a concise overview of these advances and how they are leading to the creation of stronger, more

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durable classes of nanocomposite materials. Explores the interaction between fiber, nanoreinforcers and matrices at the nanoscale Shows how the properties of fiber-enforced nanocomposites are ideal for use for a variety of consumer products Outlines the major challenges to creating fiber-reinforced nanocomposites effectively

Nanofabrication for Smart Nanosensor Applications

The importance of nanotechnology related research and development has become recognised worldwide. Substantial public and private investment is now being ploughed into research and development in a number of industrial sectors, where nanotechnology has become established and has led to new commercial products. The construction industry, having major economic significance with nano-scale research and development which is only emerging, offers a wide scope for exploitation of nanotechnology. With international contributions from experts in the field, Nanotechnology in Construction amalgamates previously fragmented research and emerging trends. It reflects the inherent multi-disciplinary nature of nano-scale research in construction and contributions cover a wide spectrum, from highly scientific investigations to futuristic applications. The book is organised into four broad sections, the first reviews and analyses the prospects of exploitation of nanotechnology in construction, the second discusses novel tools and their capabilities, the final two sections show existing significant

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products where nanotechnology has been already been exploited or where product development is under-way. Nanotechnology in Construction will appeal to researchers already working in this field as well as those wishing to enter it. It will also inform governmental and other funding agencies of the most promising future directions and their related timescales. Practical applications are considered and explanations of the underlying basics are given, raising awareness and understanding of what nanotechnology can offer to construction professionals in general.

Recent Advances in Structural Engineering, Volume 1

- Preface - Introduction - Organising Committee - Scientific and Technical Committee - Collaborating Institutions - Sponsoring Organisations with Exhibition - Exhibiting Organisations - Supporting Institutions - Opening paper THEME 1 TECHNIQUES, INSTRUMENTATION AND MATERIALS Keynote Paper - Micro-Damage Characterisation of Concrete Structures Based on Acoustic Emission - Scanning Probe Microscopy Techniques for the Study of Cementitious Materials as Nanoscale: Current Status and Challenges Ahead - Overview of Concrete Modelling - Size Effect in Nanoindentation of Cement Paste - Influence of Nano-Sized Mineral Additions on Performance of SCC THEME 2 THEORETICAL MODELLING AND APPLICATIONS Keynote Paper - Multi-Scale Modelling in Engineering Practice and Materials Research - A Vehicle for Progress - Creating Bio-

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mimetic Microstructures in Cement -A Preliminary Study - Effects of Nanosilica Additions on Cement Pastes - Nanostructural Superplasticizers for In-Lining Concrete in Underground Projects - Theory of the Stress-Strain Relationship of Concrete and Steel - Closing Paper - Index of Authors - Subject Index

Advances in Nanofibers

The First International Conference on Concrete Repair, Rehabilitation and Retrofitting (ICCRRR 2005) was held in Cape Town, South Africa, from 21-23 November 2005. The conference was a collaborative venture by researchers from the South African Research Programme in Concrete Materials (based at the Universities of Cape Town and The Witwatersrand) and The Construction Materials Section at Leipzig University in Germany. The conference has come at an opportune moment for concrete construction worldwide and sought to focus on an increasingly important aspect in modern infrastructure provision and retention: that of appropriately repairing, maintaining, rehabilitating, and if necessary retrofitting existing infrastructure with a view to extending its life and maximising its economic return. The conference Proceedings contain papers, presented at the conference, and classified into a total of 15 sub themes which can be grouped under the four main themes of (i) Concrete durability aspects, (ii) Condition assessment of concrete structures, (iii) Concrete repair, rehabilitation and retrofitting, and (iv) Performance monitoring and health assessment. The major interest in terms of

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submissions exists in the fields of concrete durability aspects in connection with material compositions, NDE/NDT and measurement techniques, repair methods and materials, and structural strengthening and retrofitting techniques. The large number of high-quality papers presented and the wide range of relevant topics covered confirm that these Proceedings will be a valued reference for many working in the important fields of concrete durability and repair and that they form a suitable base for discussion and provide suggestions for future development and research.

Nanotechnology in Cement and Concrete

Nanotechnology has already demonstrated surprising potential for improving the performance of construction materials and many of these recent developments were facilitated by NICOM symposia. The NICOM5 proceedings will cover the emerging opportunities and future use of nanotechnology in construction and will illustrate the broad potential for application of nanotechnology to challenging problems involving materials and infrastructure.

Engines of Creation

This book presents a number of studies on the molecular dynamics of cement-based materials. It introduces a practical molecular model of cement-hydrate, delineates the relationship between molecular structure and nanoscale properties, reveals the transport mechanism of cement-hydrate, and

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provides useful methods for material design. Based on the molecular model presented here, the book subsequently sheds light on nanotechnology applications in the design of construction and building materials. As such, it offers a valuable asset for researchers, scientists, and engineers in the field of construction and building materials.

Applications of Nanotechnology in Concrete Design

Synthesis, Technology and Applications of Carbon Nanomaterials explores the chemical properties of different classes of carbon nanomaterials and their major applications. As carbon nanomaterials are used for a variety of applications due to their versatile properties and characteristics, this book discusses recent advances in synthesis methods, characterization, and applications of 0D -3D dimensional carbon nanomaterials. It is an essential resource for readers focusing on carbon nanomaterials research. Explores the chemical properties of different classes of carbon nanomaterials and their major applications Discusses recent advances in synthesis methods, characterization, and applications of 0D -3D dimensional carbon nanomaterials

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