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Nanomaterials in Extreme Environments

Fundamentals and Applications



Springer

Nanomaterials Extreme Environments Fundamentals Applications

Dongfang Yang



Nanomaterials Extreme Environments Fundamentals Applications:

Nanomaterials in Extreme Environments Rostislav Andrievski, Arsen Khatchoyan, 2015-11-27 This book focuses on the behaviour of nanomaterials under extreme conditions of high temperature irradiation by electron ions and neutrons as well as in mechanical and corrosion extremes The theoretical approaches and modeling are presented with numerous results of experimental studies Different processing methods of extreme tolerant nanomaterials are described Many application examples from high temperature technique nuclear reactors of new generations aerospace industry chemical and general engineering sensor facility power engineering electronics catalysis and medical preparations are also contained Some unresolved problems are emphasized

Nanomaterials under Extreme Conditions Manuel Ahumada, María Belén Camarada, 2023-08-04 Nanomaterials have supported humankind's advancement becoming one of the most important industry sectors and are expected to rise to the top by 2030 However significant challenges must be overcome such as the performance and efficiency of the material under different environmental conditions This book seeks to promote a critical view on using nanomaterials under extreme conditions found in our body planet and outer space Therefore nanomaterials are covered from multiple points of view allowing the reader to get an enriching presentation of current knowledge on nanomaterials limitations advancements and applications under extreme conditions

The Green Revolution: Building Sustainable Solutions Kumud Kant Awasthi, Subodh Srivastava, Sushila Rathore, 2025-11-01 This book showcases some of the research that was presented at the RTESD 2023 the 3rd international conference on recent trends in environment and sustainable development with topics that explore important global issues This book covers cutting edge research and creative solutions in four key areas nanomaterials in biological applications renewable energy agrifood and sustainability Discussions about environment protection cover a wide range of topics including how to manage environment resources sustainably how to improve governance and the effects of climate change Chapters on energy production urban and industrial systems governance issues and the crucial shift towards circular economies are all included in the section on energy The Agrifood domain looks into innovative food processing techniques the impact of climate change on food production and sustainable agricultural practises As a final note the Sustainability segment covers a wide range of subjects including the sustainability of the bioeconomy cyber physical systems the effects of climate change and resource efficiency supporting the urgent need for a comprehensive strategy for achieving global sustainability

Advanced Materials Engineering Fundamentals Richard Skiba, 2025-01-14 Advanced Materials Engineering Fundamentals provides a guide to advanced materials engineering exploring the science technologies and applications that shape the field It is designed for a wide audience including students professionals researchers and entrepreneurs offering them the knowledge to understand and innovate with advanced materials across various industries The initial chapters introduce foundational concepts covering atomic and molecular structures mechanical and thermal properties and the historical evolution of materials science These sections lay a solid

groundwork for understanding advanced materials pivotal role in industries like aerospace automotive construction and electronics making them particularly useful for students and early career professionals Later chapters focus on specific categories of advanced materials including composites nanomaterials and bioplastics These sections detail synthesis methods properties and applications providing insights for researchers and professionals engaged in material design and innovation The chapters on bioplastics and sustainable materials are especially relevant for those working on eco friendly solutions The book also addresses critical techniques for material testing characterization and development explaining methods like XRD SEM and TEM This content is essential for laboratory professionals and researchers utilizing advanced equipment to analyse and optimize material properties Sustainability is a central theme with discussions on lifecycle analysis recycling and reducing the carbon footprint of material production These chapters make the book a valuable resource for academia and industry professionals committed to environmentally responsible material innovation With sections on computational materials engineering and emerging trends like self healing materials quantum materials and bio inspired designs the book remains at the forefront of technological advancements It concludes with practical career guidance skills development and entrepreneurial opportunities making it a must read for anyone looking to excel in this dynamic and impactful field

Nanotechnology, Food Security and Water Treatment K M Gothandam, Shivendu Ranjan, Nandita Dasgupta, Chidambaram Ramalingam, Eric Lichtfouse, 2018-01-08 This book reviews advanced nanotechnology in food health water and agriculture In food nanobiosensors display an unprecedented efficiency for the detection of allergens genetically modified organisms and pathogens In agriculture nanofertilisers improve plant nutrition by releasing nutrients slowly and steadily Nanomaterials synthesised using biomass such as fungi are further found remarkable to clean waters polluted by heavy metals However as newly introduced materials in the environment nanoparticles may exhibit toxic effects which are reviewed in this book In the context of climate change methods for water desalinisation are also presented

Smart Nanomaterials for Environmental Applications Olusola Olaitan Ayeleru, Azeez Olayiwola Idris, Sadanand Pandey, Peter Apata

Olubambi, 2024-08-26 Smart nanomaterials are making their presence ever so noticeable in areas like environmental protection and remediation as well as in many other fields of study The international team of expert researchers behind Smart Nanomaterials for Environmental Applications aims to spotlight the latest rapid developments in the design and manipulation of materials at the nanoscale and to concisely present information regarding their novel methods of utilization for the safeguard of the environment while at the same time apprising readers of challenges encountered and anticipated prospects The volume illustrates state of the art actionable content which is relevant and extremely valuable for those who want to apply this up to date knowledge in industry too Offers fundamentals of smart nanomaterials including characterization design and fabrication methods Includes advanced information on fine tuning different morphologies of smart nanomaterials Features three case studies on real life applications of smart nanomaterials

Fundamentals of

Nanoparticles -Synthesis, Properties & Classifications Dr. Manoj Kumar Banjare,2025-08-06 The book Fundamentals of Nanoparticles synthesis properties and classifications provides a thorough and in depth analysis of the architecture and nanoparticles of nanostructured materials currently in use This book organized into three main sections is primarily concerned with the characterization properties and synthesis of nanoscale materials For materials scientists and chemical and mechanical engineers working in research and development as well as academia who wish to learn more about the characterization and engineering of nanoparticles and nanomaterials this is an invaluable resource Nanoparticle creation self assembly in nanostructure architecture types and classifications of nanoparticles signature physical and chemical properties toxicity and regulations are all covered in Part 1 Different approaches to creating nanometre particles are discussed in Part 2 including top down and bottom up methods the classical and non classical theories of nanoparticle formation and self assembly surface functionalisation and other surface treatments that enable practical use The Part 3 section discusses the types of nanoparticles and nano structured materials including their size shape atomic and electronic structures and other significant characteristics

Fundamentals and Industrial Applications of Magnetic Nanoparticles Ketaki Ketan Patankar,Chaudhery Mustansar Hussain,2022-03-30 Fundamentals and Industrial Applications of Magnetic Nanomaterials highlights industrial applications of magnetic nanoparticles reviews their rapidly emerging applications and discusses future research directions The book emphasizes the structure property functionality of magnetic nanoparticles for the most relevant industry applications After reviewing the fundamentals industry applications in the biomedical pharma environmental cosmetics and energy industries are explored Cross cutting barriers to commercialization are then discussed along with legal health and safety implications Finally opportunities for enabling a more sustainable future are covered This book is suitable for researchers and practitioners in academia and industry in materials science and engineering chemistry and chemical engineering Reveals fundamental concepts of magnetic nanoparticles for modern industries and perspectives Establishes routes for the utilization of magnetic nanoparticles in commercial scale manufacturing Discusses opportunities for magnetic nanoparticles to help enable sustainable applications

Fundamentals, Properties, and Applications of Polymer Nanocomposites Joseph H. Koo,2016-10-31 This book is focused primarily on polymer nanocomposites based on the author's research experience as well as open literature The environmental health and safety aspects of nanomaterials and polymer nanocomposites risk assessment and safety standards and fire toxicity of polymer nanocomposites are 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 whole family of polymeric materials whose properties are capable of being tailored to meet specific applications This volume serves as a general introduction to students and researchers just entering the field and to scholars from other subfields seeking information

Applications of Nanomaterials in Civil and Environmental Engineering Mohammad Asif Raja,Md Daniyal,Mohammad Parwez Akhtar,Behrouz

Gordan,2025-06-28 This book explores the transformative use of nanomaterials in civil engineering emphasizing sustainability and innovation in addressing enduring challenges It covers the enhancement of construction materials including cementitious composites coatings and structural components with nanomaterials to improve corrosion resistance mechanical properties and cement performance The integration of nanotechnology with Industry 4.0 and digital twins is also discussed promoting smarter engineering practices Additionally it details the applications of nanomaterials in pavement construction and soil property enhancement for seismic resilience It addresses soil stabilization slope stability ground improvement and scour protection for waterfront infrastructure Furthermore it delves into environmental engineering applications such as advanced wastewater treatment soil remediation and air quality improvement through nanotechnology This book features seventeen chapters by leading experts offering research insights and practical guidance for sustainable infrastructure and environmental solutions **Nanomaterials** Dheeraj Kumar Singh, Sanjay Singh, Prabhakar

Singh,2023-01-13 This book highlights recent advances and evolution of various nanomaterials and their potential in diverse research fields The book covers the synthesis and characterization of various nanomaterials followed by discussion on desired applications such as clean and green renewable energy coating sensors thermal applications microelectronics biomedical applications such as drug carriers nutrition biosensors and detection of cancer cells The chapters in this book not only illustrate the capability of nanomaterials in such novel usages but also reveal their potential drawbacks and the possible ways to overcome the pitfalls The book covers interdisciplinary research advancement of nanomaterials beneficial for researchers and professionals working in both science and engineering *Environmental Biotechnology* Jeyabalan

Sangeetha, Devarajan Thangadurai, Muniswamy David, Mohd Azmuddin Abdullah,2016-10-14 With focus on the practical use of modern biotechnology for environmental sustainability this book provides a thoughtful overview of molecular aspects of environmental studies to create a new awareness of fundamental biological processes and sustainable ecological concerns It covers the latest research by prominent scientists in modern biology and delineates recent and prospective applications in the sub areas of environmental biotechnology with special focus on the biodegradation of toxic pollutants bioremediation of contaminated environments and bioconversion of organic wastes toward a green economy and sustainable future

Applications of Laser Ablation Dongfang Yang,2016-12-21 Laser ablation refers to the phenomenon in which a low wavelength and short pulse ns fs duration of laser beam irradiates the surface of a target to induce instant local vaporization of the target material generating a plasma plume consisting of photons electrons ions atoms molecules clusters and liquid or solid particles This book covers various aspects of using laser ablation phenomenon for material processing including laser ablation applied for the deposition of thin films for the synthesis of nanomaterials and for the chemical compositional analysis and surface modification of materials Through the 18 chapters written by experts from international scientific community the reader will have access to the most recent research and development findings on laser ablation through original research

studies and literature reviews **Handbook Of Carbon Nano Materials (In 2 Volumes) - Volume 3: Medicinal And Bio-related Applications; Volume 4: Materials And Fundamental Applications** Karl M Kadish,Francis

D'souza,2012-05-15 A hands on reference guide for scientists working in the area of medicine biology chemistry physics materials science sensor and biosensor devices and nanotechnology The first volume compiles topics from leading authors on medicinal and bio related applications while the second volume covers topics ranging from materials and fundamental applications In depth and comprehensive coverage of topics combined with the perspectives for future research by the contributing authors An invaluable reference source essential for both beginning and advanced researchers in the field

Advances in Sustainable Materials Ajay Kumar,Parveen Kumar,Victor Gambhir,Ramesh Chander Kuhad,2024-11-05 Advances in Sustainable Materials Fundamentals Modelling and Characterization provides a comprehensive review of recent technological developments and research accomplishments in this important field The chapters cover characterization techniques modeling of sustainable materials the role of artificial intelligence Industry 4 0 nature inspired algorithms and optimization possibilities Various computational and simulation approaches for maintaining the sustainability of materials are also covered in detail In addition to the above various case studies are also included on the application of sustainable materials in medical environmental production mechanical and civil engineering This collection of state of the art techniques with an emphasis on using various analytical strategies and computational and simulation approaches as well as artificial intelligence will encourage researchers as well as manufacturers to develop more innovative sustainable materials Covers various types of sustainable materials including polymers metals ceramics composites biomaterials biodegradable materials smart materials and functionallygraded materials Focuses on characterization modeling and applications of sustainable materials Describes the outstanding properties of various classes of materials and their suitability for different types of industrial applications **Resilient Hybrid Electronics for Extreme/Harsh Environments** Amanda Schrand,Larry (L.J.)

Richard Holmes,Eric MacDonald,2024-06-06 The success of future innovative technology relies upon a community with a shared vision Here we present an overview of the latest technological progress in the field of printed electronics for use in harsh or extreme environments Each chapter unlocksscientific and engineering discoveries that will undoubtedly lead to progression from proof of concept to device creation The main topics covered in this book include some of the most promising materials methods and the ability to integrate printed materials with commercial components to provide the basis for the next generation of electronics that are dubbed survivable in environments with high g forces corrosion vibration and large temperature fluctuations A wide variety of materials are discussed that contribute to robust hybrid electronics including printable conductive composite inks ceramics and ceramic matrix composites polymer erived ceramics thin metal films elastomers solders and epoxies to name a few Collectively these materials and associated components are used to construct conductive traces interconnects antennas pressure sensors temperature sensors power inducting devices strain

sensors and gauges soft actuators supercapacitors piezo ionic elements resistors waveguides filters electrodes batteries various detectors monitoring devices transducers and RF systems and graded dielectric or graded index GRIN structures New designs that incorporate the electronics as embedded materials into channels slots and other methods to protect the electronics from the extreme elements of the operational environment are also envisioned to increase their survivability while remaining cognizant of the required frequency of replacement reapplication and integration of power sources Lastly the ability of printer manufacturers software providers and users to work together to build multi axis multi material and commercial off the shelf COTS integration into user friendly systems will be a great advancement for the field of printed electronics Therefore the blueprint for manufacturing resilient hybrid electronics consists of novel designs that exploit the benefits of advances in additive manufacturing that are then efficiently paired with commercially available components to produce devices that exceed known constraints As a primary example metals can be deposited onto polymers in a variety of ways including aerosol jetting microdispensing electroplating sintering vacuum deposition supersonic beam cluster deposition and plasma based techniques to name a few Taking these scientific discoveries and creatively combining them into robotic multi material factories of the future could be one shared aim of the printed electronics community toward survivable device creation

Biopolymeric Nanomaterials Shamsheer S. Kanwar, Ashok Kumar Nadda, Tuan Anh Nguyen, Swati Sharma, Yassine Slimani, 2021-09-24 Biopolymeric Nanomaterials Fundamentals and Applications outlines the fundamental design concepts and emerging applications of biopolymeric nanomaterials The book also provides information on emerging applications of biopolymeric nanomaterials including in biomedicine manufacturing and water purification as well as assessing their physical chemical and biological properties This is an important reference source for materials scientists engineers and biomedical scientists who are seeking to increase their understanding of how polymeric nanomaterials are being used for a range of biomedical and industrial applications Biopolymeric nanomaterials refer to biocompatible nanomaterials consisting of biopolymers such as protein silk collagen gelatin casein zein and albumin protein mimicked polypeptides and polysaccharides chitosan alginate pullulan starch and heparin Biopolymeric nanomaterials may be used as i delivery systems for bioactive compounds in food application ii for delivery of therapeutic molecules drugs and genes or for iii tissue engineering Provides information on the design concepts and synthesis of biopolymeric nanomaterials in biomedical and industrial applications Highlights the major properties and processing methods for biopolymeric nanomaterials Assesses the major challenges of producing biopolymeric nanomaterials on an industrial scale

Extremophiles: Applications in Nanotechnology Sonia Tiquia-Arashiro, Debora Frigi Rodrigues, 2016-09-29 This book discusses the extremophiles explored for biosynthesis of nanoparticles Nanotechnology is a widely emerging field involving interdisciplinary subjects such as biology physics chemistry and medicine A wide variety of microorganisms such as bacteria fungi and algae are employed as biological agents for the synthesis of nanoparticles Novel routes by which extremophiles can be employed to generate

nanoparticles have yet to be discovered The book is divided into 5 major chapters 1 Major types of nanoparticles in nanotechnology 2 Diversity of microbes in the synthesis of nanoparticles 3 Extremophiles in nanoparticle biosynthesis 4 Applications of nanoparticles produced by extremophiles 5 Challenges and Future perspectives **Biobased**

Nanomaterials Shakeel Ahmed,2024-05-13 This book comprehensively covers various aspects of biobased nanomaterials including their types fabrication methods characterization techniques and applications in different fields The book starts with an introduction to biobased nanomaterials highlighting their significance in various fields due to their unique properties The first few chapters cover the different types of biobased nanomaterials their properties and how they are extracted from various natural sources The methods of fabrication of biobased nanomaterials are discussed in detail including the techniques for controlling their size shape and composition It then delves into the characterization of biobased nanomaterials discussing the different techniques used to determine their properties including their morphology size structure and composition The subsequent chapters explore the various applications of biobased nanomaterials in different fields such as environmental applications wound healing tissue engineering food industry agriculture sensing technology biomedical applications and energy storage devices The advantages of biobased nanomaterials over traditional nanomaterials are highlighted including their biodegradability and sustainability The environmental concerns associated with biobased nanomaterials as well as the health and safety concerns are also discussed The book concludes by looking at the prospects of biobased nanomaterials and how they can contribute to sustainable development Overall the book is an informative and comprehensive book that provides a thorough understanding of biobased nanomaterials and their various applications It is a valuable resource for researchers students and professionals in various fields such as materials science chemistry biology and environmental science alike Nanoelectronic Materials Loutfy H. Madkour,2019-06-27 This book presents synthesis techniques for the preparation of low dimensional nanomaterials including 0D quantum dots 1D nanowires nanotubes and 2D thin films few layers as well as their potential applications in nanoelectronic systems It focuses on the size effects involved in the transition from bulk materials to nanomaterials the electronic properties of nanoscale devices and different classes of nanomaterials from microelectronics to nanoelectronics to molecular electronics Furthermore it demonstrates the structural stability physical chemical magnetic optical electrical thermal electronic and mechanical properties of the nanomaterials Subsequent chapters address their characterization fabrication techniques from lab scale to mass production and functionality In turn the book considers the environmental impact of nanotechnology and novel applications in the mechanical industries energy harvesting clean energy manufacturing materials electronics transistors health and medical therapy In closing it addresses the combination of biological systems with nanoelectronics and highlights examples of nanoelectronic cell interfaces and other advanced medical applications The book answers the following questions What is different at the nanoscale What is new about nanoscience What are nanomaterials NMs What are the fundamental issues in

nanomaterials Where are nanomaterials found What nanomaterials exist in nature What is the importance of NMs in our lives Why so much interest in nanomaterials What is at nanoscale in nanomaterials What is graphene Are pure low dimensional systems interesting and worth pursuing Are nanotechnology products currently available What are sensors How can Artificial Intelligence AI and nanotechnology work together What are the recent advances in nanoelectronic materials What are the latest applications of NMs

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