

Bio-Medical Applications of Carbon Nanotubes

<u>Carbon Nanotubes For Biomedical Applications Carbon Nanostructures</u>

Giorgia Pastorin

Carbon Nanotubes For Biomedical Applications Carbon Nanostructures:

Carbon Nanostructures for Biomedical Applications Tatiana Da Ros, Nazario Martín, Jean-Francois Nierengarten, 2021-02-03 Carbon nanostructures namely fullerenes single and multiwall carbon nanotubes graphene as well as the most recent graphene quantum dots and carbon nanodots have experienced a tremendous progress along the last two decades in terms of the knowledge acquired on their chemical and physical properties These insights have enabled their increasing use in biomedical applications from scaffolds to devices Edited by renowned experts in the subject this book collects and delineates the most notable advances within the growing field surrounding carbon nanostructures for biomedical purposes Exploration ranges from fundamentals around classifications to toxicity biocompatibility and the immune response Modified nanocarbon based materials and emergent classes such as carbon dots and nanohorns are discussed with chapters devoted from carriers for drug delivery and inhibitors of emergent viruses infection to applications across imaging biosensors tissue scaffolding and biotechnology The book will provide a valuable reference resource and will extensively benefit researchers and professionals working across the fields of chemistry materials science and biomedical and chemical engineering Carbon Nanotubes for Biomedical Applications Rüdiger Klingeler, Robert B. Sim, 2011-02-09 This book explores the potential of multi functional carbon nanotubes for biomedical applications It combines contributions from chemistry physics biology engineering and medicine The complete overview of the state of the art addresses different synthesis and biofunctionalisation routes and shows the structural and magnetic properties of nanotubes relevant to biomedical applications Particular emphasis is put on the interaction of carbon nanotubes with biological environments i e toxicity biocompatibility cellular uptake intracellular distribution interaction with the immune system and environmental impact The insertion of NMR active substances allows diagnostic usage as markers and sensors e.g. for imaging and contactless local temperature sensing The potential of nanotubes for therapeutic applications is highlighted by studies on chemotherapeutic drug filling and release targeting and magnetic hyperthermia studies for anti-cancer treatment at the Carbon Nanotubes for Biomedical Applications Rüdiger Klingeler, Robert B. Sim, 2011-07-23 This book cellular level explores the potential of multi functional carbon nanotubes for biomedical applications It combines contributions from chemistry physics biology engineering and medicine The complete overview of the state of the art addresses different synthesis and biofunctionalisation routes and shows the structural and magnetic properties of nanotubes relevant to biomedical applications Particular emphasis is put on the interaction of carbon nanotubes with biological environments i e toxicity biocompatibility cellular uptake intracellular distribution interaction with the immune system and environmental impact The insertion of NMR active substances allows diagnostic usage as markers and sensors e g for imaging and contactless local temperature sensing The potential of nanotubes for the applications is highlighted by studies on chemotherapeutic drug filling and release targeting and magnetic hyperthermia studies for anti cancer treatment at the

cellular level Carbon Nanomaterials for Biomedical Applications Mei Zhang, Rajesh R. Naik, Liming Dai, 2015-11-06 This book covers a wide range of topics relating to carbon nanomaterials from synthesis and functionalization to applications in advanced biomedical devices and systems As they possess unique and attractive chemical physical optical and even magnetic properties for various applications considerable effort has been made to employ carbon nanomaterials e q fullerenes carbon nanotubes graphene nanodiamond as new materials for the development of novel biomedical tools such as diagnostic sensors imaging agents and drug gene delivery systems for both diagnostics and clinical treatment Tremendous progress has been made and the scattered literature continues to grow rapidly With chapters by world renowned experts providing an overview of the state of the science as well as an understanding of the challenges that lie ahead Carbon Nanomaterials for Biomedical Applications is essential reading not only for experienced scientists and engineers in biomedical and nanomaterials areas but also for graduate students and advanced undergraduates in materials science and engineering chemistry and biology Carbon Nanostructures in Biomedical Applications Md Saguib Hasnain, Amit Kumar Nayak, Saad Alkahtani, 2023-05-04 This book provides a holistic compilation on applications of carbon nanostructures especially in advanced healthcare applications It comprises chapters on utility of diverse multifunctional nanocarriers in drug delivery and biomedical applications especially emphasizing on the synthesis and characterizations of nanosystems along with surface engineering approaches used for active targeting of the drugs Moreover the chapters also include the recent updates on the applications of the nanocarriers to fulfill the needs of various healthcare systems **Carbon Nanomaterials** for Bioimaging, Bioanalysis, and Therapy Yuen Y. Hui, Huang-Cheng Chang, Haifeng Dong, Xueji Zhang, 2018-11-13 A comprehensive reference on biochemistry bioimaging bioanalysis and therapeutic applications of carbon nanomaterials Carbon nanomaterials have been widely applied for biomedical applications in the past few decades because of their unique physical properties versatile functionalization chemistry and biological compatibility. This book provides background knowledge at the entry level into the biomedical applications of carbon nanomaterials focusing on three applications bioimaging bioanalysis and therapy Carbon Nanomaterials for Bioimaging Bioanalysis and Therapy begins with a general introduction to carbon nanomaterials for biomedical applications including a discussion about the pros and cons of various carbon nanomaterials for the respective therapeutic applications It then goes on to cover fluorescence imaging deep tissue imaging photoacoustic imaging pre clinical clinical bioimaging applications carbon nanomaterial sensors for cancer and disease diagnosis targeted cancer therapy and photothermal photodynamic therapy Each chapter briefly introduces the biomedical application and emphasizes the most appropriate carbon nanomaterial s for the application Provides an introduction to the biomedical applications of carbon nanomaterials for early career scientists as well as background and context for mid career scientists and researchers Contains four sections covering biochemistry bioimaging bioanalysis and therapeutic applications of carbon nanomaterials Presented by experts who have strong background in the field of

nanotechnology for biomedical applications Covers a hot area of research which has very unique physical properties versatile functionalization chemistry and biological compatibility Carbon Nanomaterials for Bioimaging Bioanalysis and Therapy is an excellent resource for academic researchers and industrial scientists working on preparation and bio application of carbon nanomaterials biomedical engineering and nanotechnology Functionalized Carbon Nanotubes for Biomedical Applications Jeenat Aslam, Chaudhery Mustansar Hussain, Ruby Aslam, 2023-02-14 FUNCTIONALIZED CARBON NANOTUBES FOR BIOMEDICAL APPLICATIONS The book highlights established research and technology on current and emerging trends and biomedical applications of functionalized carbon nanotubes by providing academic researchers and scientists in industry as well as high tech start ups with knowledge of the modern practices that will revolutionize using functionalized carbon nanotubes Nanotechnology suggests fascinating opportunities for a variety of applications in biomedical fields including bioimaging and targeted delivery of biomacromolecules into cells Numerous strategies have been recommended to functionalize carbon nanotubes with raised solubility for efficient use in biomedical applications Functionalized carbon nanotubes have unique arrangements and extravagant mechanical thermal magnetic optical electrical surface and chemical properties and the combination of these features gives them widespread biomedical applications Functionalized carbon nanotubes are relatively flexible and interact with the cell membranes and penetrate different biological tissues owing to a snaking effect therefore both the pharmacological and toxicological profiles of functionalized carbon nanotubes have gathered much attention in recent times This book covers a broad range of topics relating to carbon nanotubes from synthesis and functionalization to applications in advanced biomedical devices and systems As they possess unique and attractive physical chemical optical and even magnetic properties for various applications considerable effort has been made to employ functionalized carbon nanotubes as new materials for the development of novel biomedical tools such as diagnostic sensors imaging agents and drug gene delivery systems for both diagnostics and clinical treatment Audience The book is intended for a very broad audience of researchers and scientists working in the fields of nanomaterials nanomedicine bioinspired nanomaterials nanotechnology and biomedical application of nanomaterials Carbon Nanotubes for Biomedical Applications and Healthcare Chin Hua Chia, Swati Gokul Talele, Ann Rose Abraham, A. K. Haghi, 2024-03-12 Recent advancements and research in nanotechnology biotechnology materials engineering the applications of nanomaterial are evolving Carbon nanotubes CNT and CNT based systems possess unique chemical physical and biological properties that make them good candidates in biomedical applications but they also have some inherent properties that cause great concern about their biosafety This volume explores the practical applications of carbon nanotubes in biomedical science and human health It discusses the synthesis properties modification and recent progress of carbon nanotubes and their applications for biosensing cancer treatment antibacterial therapy tissue engineering targeted drug delivery and toxicity It relays the potential and promise of carbon based nanomaterials for host of applications while also looking at the challenges in synthesis

characterization and applications of nanomaterials and how to overcome them Carbon Nanotubes Giorgia Pastorin, 2019-05-08 This book represents a critical evaluation of the most recent discoveries about carbon nanotubes and includes a cautious description of their impact on personal health and environmental pollution It also offers an overview of the main research groups around the world which have been focusing their efforts on the exploitation of this intriguing material with the purpose of inspiring young scientists to follow their pathway Handbook of Functionalized Carbon *Nanostructures* Ahmed Barhoum, Kalim Deshmukh, 2024-10-03 This book highlights all newly reported carbon nanostructures including graphene and its derivatives carbon nanotubes metal organic frameworks fullerenes nanorods nanospheres nano onions porous nanoparticles nanohorns nanofibers and nanoribbons nanodiamonds graphitic carbon nitrides carbon aerogels and hydrogels graphdiyne and graphenylene It presents the historical development of carbon nanostructures technologies different types and classifications and different fabrication and functionalization techniques including outer inner surface functionalization and covalent and noncovalent functionalization This Handbook discusses the unique properties of functionalized carbon nanostructures that can be obtained by modifying their structures composition and surface It gives the reader an in depth look at the current achievements of research and practice while pointing you ahead to new possibilities in functionalizing and using carbon nanomaterials Finally it covers the various applications of functionalized carbon nanostructures including adsorbents additives active materials in energy accumulating systems batteries hydrogen storage systems and supercapacitors filtering media catalysts or supports for catalysts sensors or substrates for sensors additives for polymers ceramic composites metal and carbon alloys glasses digital textiles and composite materials Silvana Fiorito, 2008-05-31 Fiorito presents an overall view of carbon nanotubes CNTs describing both the positive and negative aspects of this material She explains the physicochemical properties of CNTs discusses their applications in mechanics and sensors and biology and medicine and describes the possible toxic effects associated with their use

Biomedical Applications and Toxicology of Carbon Nanomaterials Chunying Chen, Haifang Wang, 2016-04-01 An overview of biomedical applications and the toxicity properties of carbon nanomaterials aimed at helping to avoid detrimental health effects while laying the groundwork for further research in this highly relevant field Summarizing recent research the book starts with the synthesis and functionalization of carbon nanomaterials as well as identification and detection in biosystems It then moves on to the interaction between carbon nanoparticles and biocomponents focusing on the toxicity and mechanisms to various organs and systems and potential biomedical applications as well Each section highlights the challenges outlines unanswered questions and suggests directions for further research and development efforts *Carbon Based Nanomaterials for Drug Delivery* Sarat Kumar Swain, 2025-01-27 This book comprehensively reviews the incorporation of different types of carbon based nanomaterials for application in targeted and controlled drug delivery systems Carbon based nanomaterials play a vital role as vectors and scaffolds during drug delivery owing to their ultra small size non toxicity

and high water solubility The chapters in this book present the use of different carbon based nanomaterials such as graphene carbon quantum dots carbon nanotubes fullerenes and carbon nanofibers into polymeric and polysaccharide based matrices for the designing of effective drug delivery vehicles which demonstrate superior performance compared to traditional drug delivery systems In particular it demonstrates the incorporation of carbon based nanomaterials into supramolecular drug delivery systems leading to improved drug delivery properties This book aims to be a reference for researchers and scientists interested in new nanomaterials for drug delivery applications Handbook of Carbon Nanotubes Jiji Abraham, Sabu Thomas, Nandakumar Kalarikkal, 2022-11-16 This Handbook covers the fundamentals of carbon nanotubes CNT their composites with different polymeric materials both natural and synthetic and their potential advanced applications Three different parts dedicated to each of these aspects are provided with chapters written by worldwide experts in the field It provides in depth information about this material serving as a reference book for a broad range of scientists industrial practitioners graduate and undergraduate students and other professionals in the fields of polymer science and engineering materials science surface science bioengineering and chemical engineering Part 1 comprises 22 chapters covering early stages of the development of CNT synthesis techniques growth mechanism the physics and chemistry of CNT various innovative characterization techniques the need of functionalization and different types of functionalization methods as well as the different properties of CNT A full chapter is devoted to theory and simulation aspects Moreover it pursues a significant amount of work on life cycle analysis of CNT and toxicity aspects Part 2 covers CNT based polymer nanocomposites in approximately 23 chapters It starts with a short introduction about polymer nanocomposites with special emphasis on CNT based polymer nanocomposites different manufacturing techniques as well as critical issues concerning CNT based polymer nanocomposites The text deeply reviews various classes of polymers like thermoset elastomer latex amorphous thermoplastic crystalline thermoplastic and polymer fibers used to prepare CNT based polymer composites It provides detailed awareness about the characterization of polymer composites The morphological rheological mechanical viscoelastic thermal electrical electromagnetic shielding properties are discussed in detail A chapter dedicated to the simulation and multiscale modelling of polymer nanocomposites is an additional attraction of this part of the Handbook Part 3 covers various potential applications of CNT in approximately 27 chapters It focuses on individual applications of CNT including mechanical applications energy conversion and storage applications fuel cells and water splitting solar cells and photovoltaics sensing applications nanofluidics nanoelectronics and microelectronic devices nano optics nanophotonics and nano optoelectronics non linear optical applications piezo electric applications agriculture applications biomedical applications thermal materials environmental remediation applications anti microbial and antibacterial properties and other miscellaneous applications and multi functional applications of CNT based polymer nanocomposites One chapter is fully focussed on carbon nanotube research developments published papers and patents Risks associated with carbon nanotubes and competitive analysis of

carbon nanotubes with other carbon allotropes are also addressed in this Handbook Chemically Modified Carbon Nanotubes for Commercial Applications Jeenat Aslam, Chaudhery Mustansar Hussain, Ruby Aslam, 2022-12-20 Chemically Modified Carbon Nanotubes for Commercial Applications Discover the go to handbook for developers and application oriented researchers who use carbon nanotubes in real products Carbon nanotubes have held much interest for researchers since their discovery in 1991 Due to their low mass density large aspect ratio and unique physical chemical and electronic properties they provide a fertile ground for innovation in nanoscale applications. The development of chemical modifications that can enhance the poor dispersion of carbon nanotubes in solvents and improve interactions with other materials have enabled extensive industrial applications in a variety of fields As the chemistry of carbon nanotubes and their functionalization becomes better understood Chemically Modified Carbon Nanotubes for Commercial Applications presents the most recent developments of chemically modified carbon nanotubes and emphasizes the broad appeal for commercial purposes along many avenues of interest The book reviews their already realized and prospective applications in fields such as electronics photonics separation science food packaging environmental monitoring and protecting sensing technology and biomedicine By focusing on their commercialization prospects this resource offers a unique approach to a significant and cutting edge discipline In Chemically Modified Carbon Nanotubes for Commercial Applications readers will also find Case studies that emphasize the information presented in each chapter Each chapter includes important websites and suggested reading materials Discussion of current applications of the relevant methodologies in every chapter A look at future perspectives in each application area to highlight the scope for next steps within the industry Chemically Modified Carbon Nanotubes for Commercial Applications is a valuable reference for material scientists chemists especially those focused on environmental concerns and chemical and materials engineering scientists working in R D and academia who want to learn more about chemically modified carbon nanotubes for various scalable commercial applications It is also a useful resource for a broad audience anyone interested in the fields of nanomaterials nanoadsorbents nanomedicine bioinspired nanomaterials nanotechnology nanodevices nanocomposites biomedical application of nanomaterials nano engineering and Carbon Nanomaterials Yury Gogotsi, Volker Presser, 2013-10-24 This book provides high energy applications information on synthesis properties and applications of carbon nanomaterials With novel materials such as graphene atomically flat carbon or carbon onions carbon nanospheres the family of carbon nanomaterials is rapidly growing This book provides a state of the art overview and in depth analysis of the most important ca **Carbon Nanotubes and** Biomedicine Rishabha Malviya, Selcan Karakus, Sonali Sundram, Sathvik Belagodu Sridhar, 2025-09-10 This book explores the advanced integration of nanotechnology and biomedicine providing an in depth analysis of the transformative impact of carbon nanotubes CNTs on healthcare It provides a comprehensive coverage of the distinctive characteristics of CNTs including their remarkable mechanical strength electrical conductivity and large surface area which make them very suitable for numerous biomedical uses The book provides an overview of the process of synthesizing and functionalizing CNTs It then delves into the specific applications of CNTs in drug delivery systems to improve the effectiveness and targeting of therapeutic agents Additionally the book explores the use of CNTs in imaging and diagnostics enhancing techniques such as MRI and fluorescence imaging The book also discusses the involvement of CNTs in tissue engineering namely in the fabrication of scaffolds that facilitate cell growth and tissue regeneration It explores the application of CNTs in biosensors where their high sensitivity enables early and accurate identification of diseases Antibacterial characteristics of CNTs are reviewed in order to hinder infections in medical devices and implants The potential of CNTs in gene therapy to enhance genetic treatments is also explored in the book It addresses the concerns related to the toxicity biocompatibility and regulatory issues of CNTs It carefully balances the promising potential of CNTs with the practical implications of their usage in the field of biomedicine This book is indispensable for researchers doctors and individuals with an interest in the cutting edge utilisation of nanotechnology in the field of medicine

Bioengineering Applications of Carbon Nanostructures

Ado Jorio, 2015-11-17 This book covers the development of biotechnology based on carbon nanostructures with a focus on nanotubes addressing also fullerenes and amorphous carbons The book is divided into 7 chapters addressing tissue engineering genetic engineering and therapy as well as the environmental and health impacts of carbon nanostructures

Carbon Nanomaterials for Biological and Medical Applications Sekhar Chandra Ray, Nikhil Ranjan Jana, 2017-03-07 Nanomaterials for Biological and Medical Applications explores the different applications of carbon nanomaterials in drug and gene therapies and their use in tissue regeneration biosensor diagnosis enantiomer separation of chiral drugs extraction and analysis of drugs and pollutants and as antitoxents The book describes the synthesis processing of carbon nanomaterials carbon composite nanomaterials and their different biological and biomedical applications including the removal of biologically toxic materials optical biosensor applications bio imaging probe drug delivery cancer treatments and other biomedical applications Explains the major synthesis chemical process of carbon nanomaterials for biological applications Discusses how carbon nanomaterials can be practically used to create more efficient nanodevices in biosensing medical imaging and drug delivery Explores how the unique physical properties of carbon nanomaterials allows them to remove biologically toxic materials Carbon Nanotubes for a Green Environment Shrikaant Kulkarni, Iuliana Stoica, A. K. Haghi, 2022-06-30 Carbon Nanotubes for a Green Environment Balancing the Risks and Rewards describes the synthesis characterization and unique applications of undoped and doped carbon nanotubes as well as hybrids of them with grapheme or nanocomposites focusing on green aspects of carbon nanotube applications. The volume shows new approaches used for tapping the potential and promise of key materials in isolation or combined with other materials. The research oriented chapters highlight a spectrum of applications of carbon nanotubes as novel materials for energy storage as well as for environmental remediation wastewater treatment green health care products and more Chapters explore the use of carbon

nanotubes for remediation methods for wastewater treatment such as by using graphene oxide carbon nanotube composites and by applying undoped and doped carbon nanotubes for removing contaminates The book also looks at the application of carbon nanotubes for enhanced oil recovery and for heavy metal separation Other chapters look at the rheological behavior of carbon nanotubes based materials and their role in processing for various products the thermal and electrical transport in carbon nanotubes composites carbon nanotubes based composite materials for electromagnetic shielding applications The biomedical applications of carbon nanotube based nanomaterials also explored such as FTIR spectroscopy

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