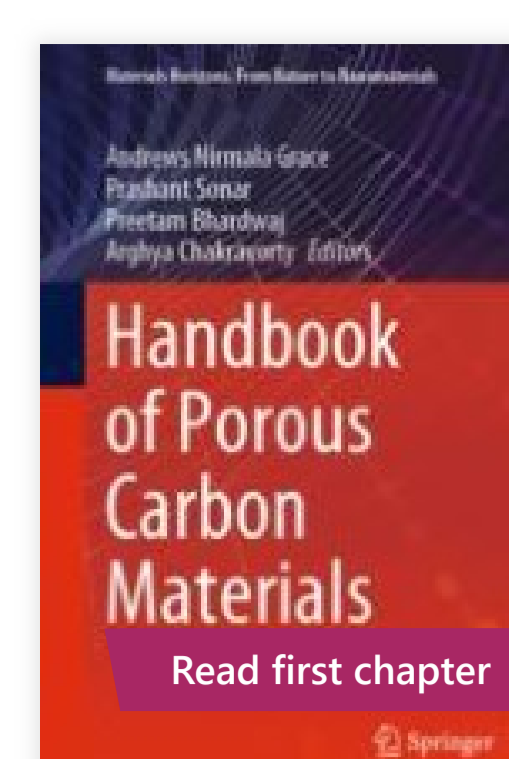


2023 | Book

# Handbook of Porous Carbon Materials

Editors: Andrews Nirmala Grace, Prashant Sonar, Preetam Bhardwaj, Arghya Chakravorty

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## About this book

This handbook summarizes the current advancements and growth in sustainable carbonaceous porous materials for fabrication and revival of energy devices, fuel cells, sensors technology, solar cell technology, stealth technology in addition to biomedical applications. It also covers the potential applications of carbon materials in various fields such as chemical, engineering, biomedical and environmental sciences. It also confers the prospective utilization of 2D and 3D hierarchical porous carbon in different interdisciplinary engineering applications. The book discusses major challenges faced in the development of cost-effective future energy storage strategies and provides effective solutions for improvement in the performance of carbon-based materials. Given the content, this handbook will be useful for students, researchers and professionals working in the area of material chemistry and allied fields.

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### Applications in Therapeutics and Diagnostics

#### Chapter 32. Carbon Nanotubes–Based Anticancer Nanomedicine

Abstract

Advancement in the field of nanotechnology has extended the applications of nanoparticles to therapy. Novel nanoparticles with tuneable physical and chemical properties are being synthesized and functionalized with bioactive agents in order to ensure targeted delivery, sustained release, and long-term effects for many diseases, including cancer. It is estimated that around 9.6 million deaths worldwide in 2018 were associated with cancer.

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#### Chapter 33. Porous Carbon Materials Enhanced the Therapeutic Efficacy of Anticancer Drugs

Abstract

Anticancer drugs are natural or synthetic drugs extensively used to cure cancer. These anticancer drugs have preventive roles in various types of cancer. Many anticancer drugs have shown a poor therapeutic outcome due to the lack of selectivity and pleiotropic nature. These anticancer drugs are also restricted in therapeutic uses due to low solubility, poor bioavailability, and hydrophobicity. Recently, porous carbon material (PCMs)

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#### Chapter 34. Biocompatible Carbon–Coated Magnetic Nanoparticles for Biomedical Applications

Abstract

Both magnetic and carbon materials are known to humankind for many centuries, and both materials have played a pivotal role in both civilization as well as in technological development. Still, many researchers are fascinated about both the materials due to the unfolding of new properties and technologies. Many researchers have studied the combination of magnetic and carbon nanomaterials for biomedical applications. Currently,

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#### Chapter 35. Noscapinoids: A Family of Microtubule–Targeted Anticancer Agent

Abstract

Noscapine (C<sub>22</sub>H<sub>23</sub>NO<sub>7</sub>), benzyloisoquinoline alkaloid was reported to bind tubulin, limiting the process of division of cells at mitosis without changing the relatively stable state of tubulin's monomer/polymer ratio and selectively inducing apoptosis within cancer cells. This is a distinct advantage over presently existing antimicrotubular drugs, which at equimolar concentrations either overpolymerize (taxanes) or depolymerize (vincas) microtubules, resulting in a variety of debilitating toxicities such as leucocytopenias, diarrhea, alopecia, and peripheral neuropathies. Carbon consisting compound, noscapine hinders cellular growth over a broad range of cancer cells including those that are resistant to conventional chemotherapeutics. Another notable benefit of noscapine over currently existing antimitotic is its oral bioavailability. Although noscapine causes significant regression of localized tumor xenografts in mice models, a complete remission of the disease has not been established even at increased dosage. To improve therapeutic outcomes, several noscapine derivatives have been developed by modification of its scaffold structure at various positions. Several of these congeners have indeed been reported to block the progression of the cell cycle, massively reduce cellular proliferation, and cause apoptosis in a wide range of cancer cells both in vitro and in xenograft models of human cancers implanted in nude mice. In particular, the chemical modification at the C-9 position had a substantial effect on the therapeutic potential of noscapine. An overview of the development of C-9 derivatives of noscapine and their anticancer efficacy is presented together with their synthetic aspects and their future prospects.

Shruti Ganya Dash, Harish Chandra Joshi, Pradeep Kumar Naik

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#### Chapter 36. Recent Advances in Designing Porous Carbon Nanomaterial Based for Electrochemical Biosensing Prostate Cancer

Abstract

Prostate cancer (PCa), is the most prevalent type of cancer and is associated with a high mortality rate. The clinical assessments of cancer proteins or biomarkers are extremely vital in the early detection of cancer and the monitoring of recurrence of disorders after cancer therapy. Cancer biomarkers have gained significant clinical relevance as a result of their broad application spectrum in the detection, elimination, early identification,

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#### Chapter 37. Role of Nanosystems for Electrochemical Mapping Using Diverse Carbon–Based Nanomaterials

Abstract

Electrochemical approach for mapping of bioanalytes comes from the amalgamation of traditional cum chemical approaches with advanced in-line biosensors that constitutes a current–potential research hotspot. They vary in salient features of high selectivity; no false-positive output; simplified sample preparation and analysis; low-cost set-up; nanoquantity of sample and convenient technique with real-time sensing approach. These have

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#### Chapter 38. Carbon Nanomaterial–Based Biosensors: A Forthcoming Future for Clinical Diagnostics

Abstract

Advancements in various scientific domains such as genetics, bioinformatics, immunology, medicines, and computational analysis have a colossal impact for the evolution of diagnostics/sensing platforms. These advances contribute towards enhanced reliability, economic, quicker, and patient centric/compliant sensing platforms for ultrasensitive diagnosis of non-communicable diseases (cancer, cardiovascular ailments are few). According

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#### Chapter 39. Emerging Graphene–Based Nanomaterials for Cancer Nanotheranostics

Abstract

Recent times, graphene and its derivatives have drawn considerable interest encompassing multi-domains to extend our understanding of the physical world. As part of the greater spectrum of biomedicine, one such use veers towards "theranostics". Because of their unusual physicochemical properties, graphene oxide nanocomposites, graphene oxide, and its reduced derivatives veil our view. They exhibit ultra-high surface area suitable

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#### Chapter 40. Synthesis of Carbon Nanotubes with Merocyanine Dyes Decorated Carbon Nanotubes for Biomedical Imaging Devices

Abstract

We have investigated the interactions between SWCNTs with merocyanine dye molecules to design the optical properties and visualisation for biomedical device imaging applications. When SWCNTs interacted with merocyanine dyes used to fabricate the light-absorbing nano-array structure, the fluorescence emission of the SWCNTs with merocyanine dye structure was quenched by dip-coating technique. The SWCNT in the

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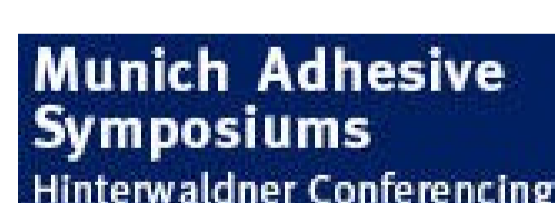
#### Chapter 41. Role of Carbon Nanostructures as Nano–Theranostics Against Breast and Brain Cancer

Abstract

Evolving as an efficient diagnostic as well as therapeutic, the theranostics approach is quite a naive field in the arena of clinical medicine. Even though modern technologies have attained a breakthrough in early diagnosis, prognosis and therapeutics, theranostics, specifically at the nanoscale has the potential to increase the patient survival due to the integration of early diagnosis and specific treatments, especially in fatal diseases such as

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