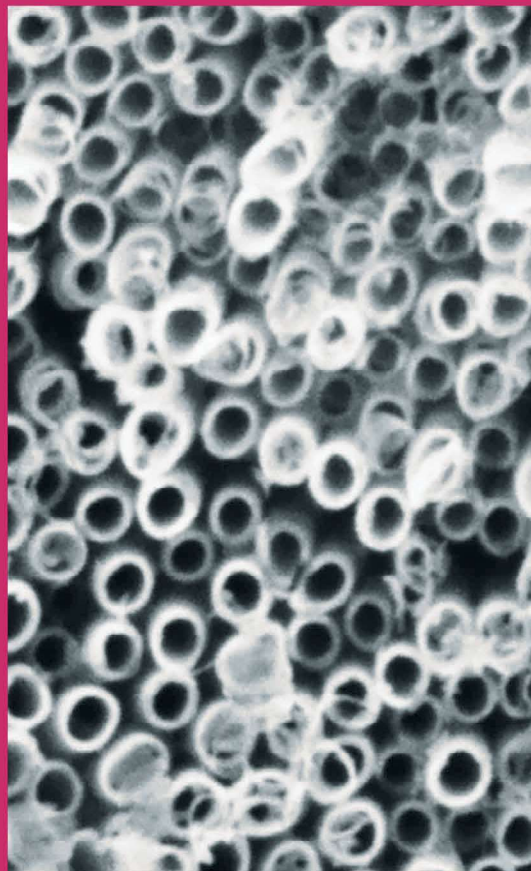
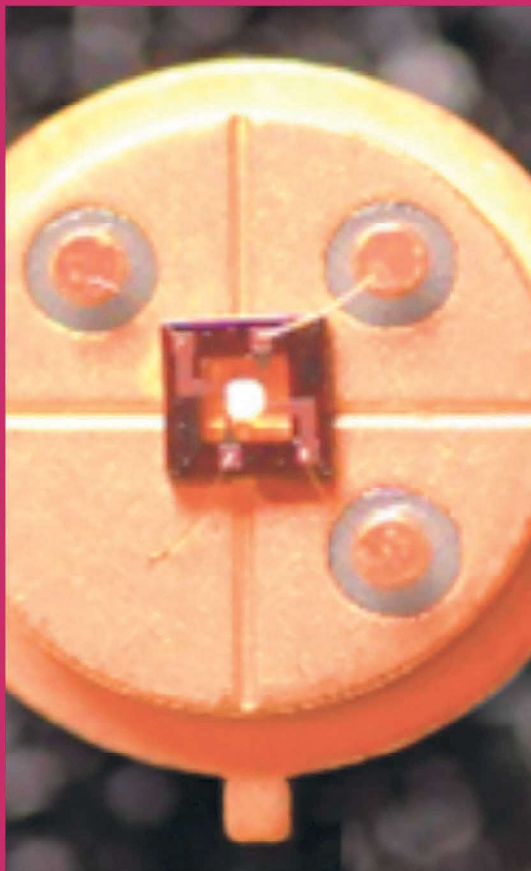




EMERGING MATERIALS AND TECHNOLOGIES

NANOMATERIAL-BASED SENSORS FOR HEALTHCARE APPLICATION

Edited by
BASANTA BHOWMIK



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Nanomaterial-based Sensors for Healthcare Application

This book primarily focuses on nanomaterial synthesis, properties, sensor fabrication, and their uses for disease diagnosis and therapy. Major topics covered include synthesis of different dimensional nanomaterials, characterizations and analysis of nanomaterials, procedure for non-invasive disease diagnosis, and measurement principles of medical devices or sensor devices. It also illustrates state-of-the-art nanomaterials for drug delivery supported by practical examples and case studies.

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Introduces various nanomaterials for fabrication sensors.

Discusses the applications of sensors in disease diagnostics and therapy.

Covers nanomaterial characterizations techniques such as XRD, FESEM, AFM, and TEM.

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3 Nanotechnology Tools for Diagnosis and Therapy

Arnab De, Santanu Ghosh, Sourav De, Sabyasachi Banerjee, Indranil Banerjee, Amit Kundu, Soumik Podder, and Biplab Debnath

3.1 INTRODUCTION

Nanotechnology is now regarded as the most promising technology of the twenty-first century based on the exploitation of the unique properties of quasi-atomic particles at a size scale ranging from 1 to 100 nm.¹ The concept of nanotechnology was first introduced in 1959 by Richard Feynman, an American physicist. Nanotechnology has been widely used in the field of drug delivery systems, tissue-engineered constructs, implants, and pharmaceutical therapeutics. Nanocarriers can be used for targeted drug delivery, which can improve the dosage and accuracy of drug release, thereby reducing the toxic and side effects of drugs on normal tissues. Additionally, nanoparticles (NPs) can be functionalized based on the surface chemistry of the particles and conjugation of ligands (small molecules, antibodies, and peptides) to precisely target the expressed receptors.^{2,3}

Managing and treating a disease requires an understanding of its underlying causes, which includes information about the patient's medical background and physical examination, as well as applying diagnostic methods to identify and characterize symptoms.⁴ Nanodiagnosics has emerged as a modality that utilizes nanoscale properties, such as unique physiochemical and optical properties to meet the demand for early detection, high sensitivity, and point-of-care testing, particularly for community clinics in developing countries.^{5,6}

Recent advancements in nanotechnology have enabled an opportunity to combine diagnosis and therapy in a single platform or carrier.⁷ Theranostic nanosystems have been recognized as a potential breakthrough to revolutionize future disease management. The term 'theranostics' integrates the technology with concurrent and complementary diagnostic and therapeutic capabilities to achieve more specific and personalized disease management.^{8,9} Some common nanotechnology tools employed in the development of theranostic formulations are shown in Figure 3.1.

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