

Junaid Ahmad Malik · Mohamed Jaffer Sadiq M. *Editors*

Modern Nanotechnology

Volume 2: Green Synthesis, Sustainable Energy and Impacts

This two-volume set provides a comprehensive overview of modern nanoscience, and encompasses advanced techniques of nanocomposite materials that make their way from the laboratory to the field for the revival of energy and environmental systems in a sustainable manner. It includes the design and the sophisticated fabrication of nanomaterials along with their potential energy and environmental applications, while looking at how nanoscience and nanotechnology can be used to promote environmentally friendly processes and strategies. The books' purpose is to promote eco-friendly methods and techniques by covering many elements of both the synthesis and uses of nanoparticles and nanofluids for energy and environmental engineering. They provide an up-to-date synthesis of nanocomposite materials for modern nanotechnology applications in the fields of environment protection, heterogeneous catalysis, wastewater treatment, fuel cells, electrochemical energy conversion, and storage applications. The set is designed for environmental scientists, nanotechnologists, chemists, engineers, and individuals seeking current research on nanotechnology and its applications in environmental engineering. Graduate students working in these fields will also find it a valuable resource.

Volume 2 focuses on toxicological assessment, negative impacts of nanomaterials, green synthesis, energy conversion, and storage applications.

Malik · Sadiq M. *Eds.*



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Editors

Modern Nanotechnology:

*Green Synthesis, Sustainable Energy and
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Preface

The progress of technological research and the acquisition of fresh materials was sparked by the first Industrial Revolution, which occurred at the end of the eighteenth century. Miniaturization of devices and equipment is a current problem; smaller volume, lower power consumption, but more performance. The advancement is dependent on the discovery of new desired materials and the capacity to create microscopic structures with great accuracy. The progression, on the other hand, is not that smooth and easy.

Nanotechnology is derived from the Greek word 'nano' which means 'dwarf' and refers to materials with extremely tiny size ranges. It is, indeed, the development of materials, components, devices, and systems at the atomic or molecular level. One of the dimensions of nanoproducts is usually between 1 and 100 nm in length. Fabricating, imaging, measuring, modelling, and manipulating matter at the atomic, molecular, and particle levels to dramatically alter the physical, chemical, physicochemical, and biological characteristics of materials and devices for various applications is part of this growing technology. Nanotechnology has been making its way from the lab to applications and consumer items from quite some time.

Nanotechnology is a multidisciplinary area that encompasses a wide range of disciplines, including biosciences, chemistry, physics, mechanical engineering, electrical engineering, material science engineering, and so on. Nanotechnology is the science and engineering for creating functional systems at molecular levels. Nanotechnology is one of the most inventive techniques devised to overcome current issues of environmental contamination and energy sustainability. In recent years, scientists and engineers have become more interested in nano-scale materials research. While nanoparticles have been a part of our daily lives for a long time, the nanotechnology industry has grown rapidly in the last two decades. Nanotechnology is being used to clean up organic contaminants that pollute groundwater and remove volatile organic compounds from the air, as well as to minimize pollution during the manufacturing process at low cost.

Nanotechnology is an interdisciplinary field with many open questions for the future, such as developing new technologies to safeguard the environment and identifying sustainable energy sources to fuel sustained economic expansion. As one of the most popular areas of nanotechnology today, nanocomposite materials continue to be a hotspot for academic research investigation. Since then, nanocomposite materials have been used for many different purposes. Their potential applications remain promising in areas such as solar cells, fuel cells, secondary batteries, supercapacitors, and water purification. Developing novel nanocomposite materials with the shortest reaction paths to enhance reaction kinetics is usually required for clean energy and environmental protection

applications. To achieve the essential productivity, life cycle, and sustainability in a wide range of technological applications, knowledge of the physico-chemical, structural, and surface features of nanocomposite materials is essential.

Nanomaterials may accidentally produce new hazardous compounds even when they are effective. Nanoparticles can end up in lymph, blood, and even bone marrow due to their ability to penetrate normally impenetrable barriers due to their incredibly tiny size. Applications of nanotechnology have the potential to damage the environment greatly if sources of harmful nanomaterials are mistakenly developed because of the unique access nanoparticles have to biological functions. Prior to its usage on a broad scale, nanoparticles must undergo thorough testing to identify any possible causes of toxicity.

This book, “*Modern Nanotechnology: Green Synthesis, Sustainable Energy and Impacts*” comprises the design and manufacture of high-level nanomaterials and their prospective energy and environmental applications. This book explores the ways in which nanoscience and nanotechnology may be utilized to advance energy and environmental sustainability via the adoption of greener practices. This book aims to spread environmentally friendly practices by explaining how to make and use nanoparticles and nanofluids in fields like energy and environmental engineering. This book compiles the most up-to-date data from studies and theoretical frameworks on the issue of micro/nano-scale technologies for environmental sustainability. For experts and academics alike, this book is an important resource, since it details the far-reaching effects of this technology on the worlds of energy production and environmental hygiene. As a corollary, this book is a comprehensive and up-to-date volume on the nanocomposite materials for modern science in nanotechnology in the field of environment protection, heterogeneous catalysis, wastewater treatment, electrochemical energy conversion, and storage applications. The effects of nanoparticles on the environment and animal health have also been explored.

The book is intended for academics and researchers with an interest in nanotechnology and nanomaterials, particularly in energy and environmental sustainability engineering. This book is preferably constructed for nanotechnologists, chemists, engineers, and scientists interested in the present state and future possible nanotechnology research in energy and environmental engineering applications.

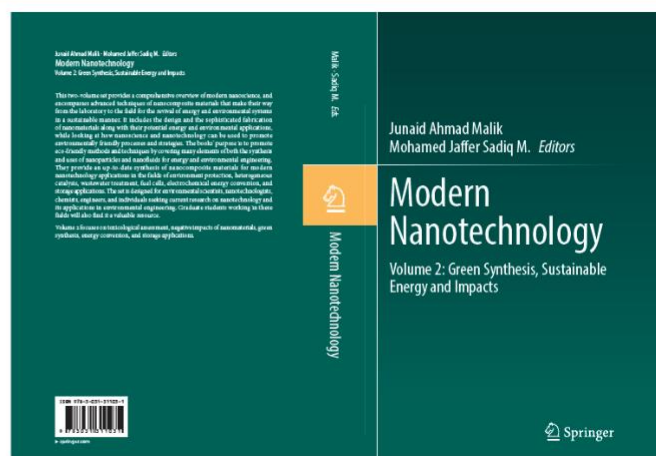
--Editors

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