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## **Piezoelectric Materials**

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Oxide Nanowires on Fabric

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2012 by Gianni Ciofani, Arianna

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Due to the nanosize effect, piezoelectric nanomaterials find wide applications in guided locomotion and controlled drug delivery to the targeted tissues, especially in the area of cancer chemotherapeutics. 12 As therapeutic nanocarriers, they offer advantages such as easy delivery by minimally invasive procedures and

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transducers for the detection of biomolecules to “sensible” substrates for tissue engineering or cell stimulation.

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Nanoscale structures and materials have been explored in many biological applications because of their novel and impressive physical and chemical properties. Such properties allow

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remarkable opportunities to study and interact with complex biological processes. This book analyses the state of the art of piezoelectric nanomaterials and introduces their applications in the biomedical field. Despite their impressive potentials, piezoelectric materials have not yet received significant attention for bio-applications. This book shows that the exploitation of piezoelectric nanoparticles in nanomedicine is possible and realistic, and their impressive physical properties can be useful for several applications, ranging from sensors and transducers for the detection of biomolecules to “sensible” substrates for tissue engineering or cell stimulation.

Scientifically defined in 1880 by the Curie brothers, piezoelectricity - from

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the Greek piezein, meaning to press (squeeze), and ilektron, meaning amber, a material with electrostatic properties - is a phenomenon with many applications. The related piezoelectric materials have been undergoing a long-lasting evolution over the years until today. The field of organic and inorganic piezoelectric materials is continuously expanding in terms of new substances used, new structures, and new applications. The seven chapters of this book present modern aspects and technological advances in the field of piezoelectric materials and applications. To present a balanced view of the field, some chapters focus on new piezoelectric materials and structures, while others examine interesting applications of piezoelectric sensors, energy harvesters, and actuators.

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Novel Nanomaterials for Biomedical,  
Environmental, and Energy

Applications is a comprehensive study on the cutting-edge progress in the synthesis and characterization of novel nanomaterials and their subsequent advances and uses in biomedical, environmental and energy applications. Covering novel concepts and key points of interest, this book explores the frontier applications of nanomaterials. Chapters discuss the overall progress of novel nanomaterial applications in the biomedical, environmental and energy fields, introduce the synthesis, characterization, properties and applications of novel nanomaterials, discuss biomedical applications, and cover the electrocatalytical and photothermal effects of novel

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nanomaterials for efficient energy applications. The book will be invaluable to academic researchers and biomedical clinicians working with nanomaterials. Offers comprehensive details on novel and emerging nanomaterials Presents a comprehensive view of new and emerging tactics for the synthesis of efficient nanomaterials Describes and monitors the functions of applications of new and emerging nanomaterials in the biomedical, environmental and energy fields

A virus is considered a nanoscale organic material that can infect and replicate only inside the living cells of other organisms, ranging from animals and plants to microorganisms, including bacteria and archaea. The structure of viruses consists of two

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main parts: the genetic material from either DNA or RNA that carries genetic information, and a protein coat, called the capsid, which surrounds and protects the genetic material. By inserting the gene encoding functional proteins into the viral genome, the functional proteins can be genetically displayed on the protein coat to form bioengineered viruses. Therefore, viruses can be considered biological nanoparticles with genetically tunable surface chemistry and can serve as models for developing virus-like nanoparticles and even nanostructures. Via this process of viral display, bioengineered viruses can be mass-produced with lower cost and potentially used for energy and biomedical applications. This book highlights the recent developments and future directions of virus-based



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nanomaterials and nanostructures.

The virus-based biomimetic materials formulated using innovative ideas were characterized for the applications of biosensors and nanocarriers. The research contributions and trends on virus-based materials covering energy harvesting devices to tissue regeneration in the last two decades are discussed.

This book provides an introduction to nanogenerators, which are the newest technological advancement in the field of energy conversion. Chapters discuss the physics behind energy conversion using detailed research results and experimental techniques for fabricating triboelectric and piezoelectric devices, as well as nanogenerators in the field of biomedicine and the construction of

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The global success of the 1st edition of Nanochemistry, along with exceptionally rapid change in the field, has necessitated the publication of a 2nd edition after only three years. This truly major update highlights the latest breakthroughs using more than eighty new case histories, more problem sets, and more teaching principles. Nanotechnology is touted to begin a new era by bringing us materials that were not available before. This book describes the fascinating chemistry behind nanotechnology in a clear and easy to read style. Aimed at teachers, graduate students and advanced undergraduates it provides an authoritative, rigorous and hype-free guide to this burgeoning field. For

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those who already have some knowledge of the subject, the book remains invaluable as a reference and source of inspiration for future research or teaching. Suitable for those coming from a physics, biology, medicine, materials science, engineering or chemistry background, the book is ideal for whoever needs a birds-eye view of the field. The extensive bibliography allows the reader to find any level of detail behind each of the subjects.

This volume provides in-depth knowledge and recent research on polymers and nanostructured materials from synthesis to advanced applications. Leading researchers from industry, academia, government, and private research institutions across the globe have contributed to this volume,

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covering new research on  
nanocomposites, polymer technology,  
and electrochemistry.

Graphene is proving to be the magic material of the 21th century. It is widely accepted that it is the strongest material ever studied and can be an efficient substitute for silicon. Besides, fascinating properties of graphene, such as the highest electrical conductivity among the discovered substances, have dramatically shocked science and technology world. Graphene is a carbon based layer with high atomic density. Its extraordinary characteristics such as extremely high mechanical strength, hardness, and adjustable thermal and electrical conductivity, as well as excellent surface and optical feature through chemical marking, have

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received great deal of attention by many researchers. This book collects new advances of this interesting nanomaterial.

This unique compendium presents some new topics related to thin-walled structures, like beams, plates and shells used in aerospace structures. It highlights their dynamic behaviors and also the correlation between compressive loading and natural frequency to enable a correlation between the two, yielding a valuable non-destructive tool, to predict buckling for thin-walled structures. This useful reference text combines valuable data on metal materials and composite materials together with new adaptive and smart materials like piezoelectricity, shape memory alloys and optic fibers, which form the

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present state of the art in thin-walled  
structure domain.

Advanced Ceramics possess various unique properties and are able to withstand harsh environments. The aim of this book is to cover various aspects of the advanced ceramics like carbides, nitrides and oxides for energy and environment related applications. Advanced ceramics with additional functionality propose significant potential for greater impact in the field of energy and environmental technologies. This book focuses on the nanostructured ceramics synthesis, properties, structure-property relation and application in the area of energy and environment. It covers the high impact work from around 50 leading researchers throughout the world

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working in this field. This will help metallurgists, biologists, mechanical engineers, ceramicists, material scientists and researchers working in the nanotechnology field with inclusion of every aspect of advanced ceramics for energy and environmental applications.

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