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D2MYKV - STEWART JAEDEN

There continues to be a worldwide interest in the size-dependent properties of nanostructured materials and their applications in many diverse fields such as catalysis, sensors, energy conversion processes, and biomedicine to name a few. The eleven chapters of this book written by different researchers include four chapters on the different methods of fabrication of specific materials followed by characterization of their properties, and the remaining seven chapters focusing on the fabrications and applications including three chapters on biomedical applications, two chapters on sensors, one chapter on solar cells, and one chapter on the use of nanoparticles in herbicides. These chapters provide up-to-date reviews useful for current and future researchers in these specific areas.

Zinc Oxide (ZnO) powder has been widely used as a white paint pigment and industrial processing chemical for nearly 150 years. However, following a rediscovery of ZnO and its potential applications in the 1950s, science and industry alike began to realize that ZnO had many interesting novel properties that were worthy of further investigation. ZnO is a leading candidate for the next generation of electronics, and its biocompatibility makes it viable for medical devices. This book covers recent advances including crystal growth, processing and doping and also discusses the problems and issues that seem to be impeding the commercialization of devices. Topics include: Energy band structure and spintronics Fundamental optical and electronic properties Electronic contacts of ZnO Growth of ZnO crystals and substrates Ultraviolet photodetectors ZnO quantum wells Zinc Oxide Materials for Electronic and Optoelectronic Device Applications is ideal for university, government, and industrial research and development laboratories, particularly those engaged in ZnO and related materials research.

Recently, a significant effort has been devoted to the investigation of ZnO as a suitable semiconductor for UV light-emitting diodes, lasers, and detectors and hetero-substrates for GaN. Research is driven not only by the technological requirements of state-of-the-art applications but also by the lack of a fundamental understanding of growth processes, the role of intrinsic defects and dopants, and the properties of hydrogen. The NATO Advanced Research Workshop on “Zinc oxide as a material for micro- and optoelectronic applications”, held from June 23 to June 25 2004 in St. Petersburg, Russia, was organized accordingly and started with the growth of ZnO. A variety of growth methods for bulk and layer growth were discussed. These techniques comprised growth methods such as closed space vapor transport (CSVT), metal-organic chemical vapor deposition, reactive ion sputtering, and pulsed laser deposition. From a structural point of view using these growth techniques ZnO can be fabricated ranging from single crystalline bulk material to polycrystalline ZnO and nanowhiskers. A major aspect of the ZnO growth is doping. n-type doping is relatively easy to accomplish with elements such al Al or Ga. At room temperature single crystal ZnO exhibits a resistivity of about 0. 3 -cm, an electron mobility of 2 17 -3 225 cm /Vs, and a carrier concentration of 10 cm . In n-type ZnO two shallow donors are observable with activation energies of 30 – 40 meV and 60 – 70 meV.

The environment is prone to suffer pollution and toxic insult from generations of nanomaterials as well from accidental releases during production, transportation, and disposal operations. The NMs could interact with and cause adverse biological effects at cellular, subcellular, and molecular levels. Assessing potential environmental/ecological risks requires quality information on transport and fate of nanoparticles in the environment, exposures and vulnerabilities of organisms to the nanomaterials and standard methods for assessing toxicity for aquatic or terrestrial organisms and human health. The systematic risk characterization and evaluation of the safety of nanomaterials require a multidisciplinary approach and convergence of knowledge and efforts from researchers and experts from toxicology, biotechnology, materials science, chemistry, physics, engineering, and other branches of life sciences. Although studies are beginning to appear in the literature addressing the toxicity of various nanomaterials and their potential for exposure, at this stage definitive statements regarding the impacts of nanomaterials on human health and the environment remain sketchy requiring an increased level of precautions with regard to nanomaterials, as has happened with other emerging contaminants and technologies (e.g., biotechnology). The need for an increased level of understanding the perception of risk and of benefits will vary and is likely to influence public, regulatory, and non-governmental activities regarding risk and benefit evaluations. Systematic identification and assessment of the risks posed by any new technology are essential. A prudent, integrated, and holistic approach is required to develop best practices based on the scientific understanding about what we know and what we don’t know but need to know. Nanomaterials addresses key issues of ecotoxicological actions and effects of nanomaterials on life and environment, their threats, vulnerability, risks, and public perception. The readers learn to read bad news objectively and think about and search for ecological ‘green’ solutions to current environmental and ecological problems with blue, grey, brown, and red shades for building a sustainable ecosystem. It shows how this molecular terrain is a common ground for interdisciplinary research and education that will be an essential component of science, engineering and technology in the future. The book is divided into three sections. Section I includes general topics related to ecotoxicity of nanomaterials to microbes, plants, human and environment. Section 2 incorporates risks generated by the use of nanomaterials. Section 3 discusss safety issues and the public.

Versatility, extended compositional ranges, better homogeneity, lesser energy consumption, and requirement of nonexpensive equipments have boosted the use of sol-gel process on top of the popularity in the synthesis of nanosystems. The sol-gel technique has not only revolutionized oxide ceramics industry and/or material science but has also extended widely into multidimensional applications. The book Recent Applications in Sol-Gel Synthesis comprises 14 chapters that deal mainly with the application-oriented aspects of the technique. Sol-gel prepared metal oxide (MO) nanostructures like nanospheres, nanorods, nanoflakes, nanotubes, and nanoribbons have been employed in biomedical applications involving drug deliveries, mimicking of natural bone, and antimicrobial activities. The possibility of controlling grain size in aerogel and preparation of ultrahigh-temperature ceramic (UHTC)-based materials, fluorescent glasses, ultraviolet photosensors, and photocatalysts have been discussed in detail by the experts in the field. The usefulness of sol-gel materials as active GRIN, as textile finisher, and as leather modifier with water-repellent and oil-resistive properties would be an incentive for researchers keen to pursue the field.

This dissertation, "Zinc Oxide Nanorods: Hydrothermal Growth, Properties and Applications" by Kaihang, Tam, □□□, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Abstract of thesis entitled ZINC OXIDE NANORODS: HYDROTHERMAL GROWTH, PROPERTIES AND APPLICATIONS Submitted by Tam Kai Hang for the degree of Master of Philosophy at The University of Hong Kong in December 2007 One-dimensional wide band-gap semiconductor nanostructures, such as nanorods, nanowires and nanobelts, have recently attracted much attention for their potential use as fundamental building blocks for new generation of electronic and photonic devices. Various semiconducting 1-D nanostructures have been synthesized, such as TiO, SnO, 2 2 GaN, GaAs, Si and ZnO. Among these nanostructures, zinc oxide (ZnO) has became particularly intersting in optoelectronic, field emission, gas sensing and biomedicine applications. ZnO is a wide band-gap (3.37 eV) semiconductor with high excitonic binding energy (60 meV), and it is non-toxic and environmentally friendly. Hydrothermal growth of ZnO provides an inexpensive method to fabricate large amounts of ZnO nanorods or nanowires on various substrates. However, the controversies still remain about the native defects in ZnO. In this work, ZnO nanorod arrays were fabricated by a hydrothermal method. The structural properties were characterized with scanning electron microscopy (SEM), transmission electron microscopy (TEM) and x-ray diffraction (XRD). Well-oriented nanorods, which exhibited strong defect-related photoluminescence (PL) were obtained. Stimulated UV emission was achieved in forming gas or oxygen annealed nanorods. Change in lasing threshold and defect emission, as well as spontaneous decay time, indicated that yellow defect emission was not caused by interstitial oxygen, which was commonly assumed to be dominant in the yellow emitted ZnO. The origins of defects emissions were investigated by x-ray photoelectron spectroscopy (XPS) and positron annihilation spectroscopy (PAS). The results showed that yellow emission of the as-grown nanorods originated from the presence of Zn(OH) on surface, while the green emission which appeared after annealing was due to the defect complex related to zinc vacancy. On the other hand, it was also observed that green emission originated from grain boundary in other ZnO nanostructures, such as nanoshells. The origin of the green emission has not yet been determined, but there was evidence that the emission was surface-related. Heterojunction of n-ZnO nanorod arrays / p-GaN film light-emitting-diodes (LEDs) were fabricated. Influence of annealing conditions on the performance of devices was examined. It was found that the position of recombination zone was shifted after annealing in some cases. Emission wavelength could be controlled through annealing processes. This study could help improve the performance of these heterojunction devices. In order to have more comprehensive studies on applications of these versatile ZnO nanorods, antibacterial properties of the nanorods were investigated. ZnO nanorods coating have exhibited great antibacterial activity. Other ZnO morphologies (nanoparticles and powder) were also studies for comparison. Mechanisms of ZnO against different bacteria were investigated. It was found that damaging of E. coli cell was partly due to the relaxation of hydrogen peroxide (H O) from the structures. 2 2 DOI: 10.5353/th_b3955734 Subjects: Zinc oxide Nanostructures Nanotechnology

This first systematic, authoritative and thorough treatment in one comprehensive volume presents the fundamentals and technologies of the topic, elucidating all aspects of ZnO materials and devices. Following an introduction, the authors look at the general properties of ZnO, as well as its growth, optical processes, doping and ZnO-based dilute magnetic semiconductors. Concluding sections treat bandgap engineering, processing and ZnO nanostructures and nanodevices. Of interest to device engineers, physicists, and semiconductor and solid state scientists in general.

This book is a printed edition of the Special Issue "Zinc Oxide Nanostructures: Synthesis and Characterization" that was published in Materials

"In Zinc Oxide: Production, Properties and Applications, the authors first provide a summary of the natural sources available for the synthesis of zinc oxide nanoparticles, enlisting some plant-mediated synthesized zinc oxide nanoparticles showing promising antimicrobial, antioxidant, cytotoxic and photocatalytic properties. Important technological opportunities and challenges emphasizing the electrical and optoelectronic features of elongated zinc oxide nanoparticle nanosystems are reviewed. The various nonlinear optical phenomenon observed in zinc oxide thin film, including nonlinear absorption, nonlinear refraction, nonlinear scattering and harmonic generations are introduced. Selected literature on the use of zinc oxide nanoparticles for the immobilization of enzymes is reviewed, as well as the use of zinc oxide nanoparticle/enzyme systems in the fabrication of biosensors. The authors explore transition metal doped zinc oxide nanoparticles for a wide range of catalytic organic reactions, further exploring their catalytic applications for organic transformations at mild reaction conditions. The basic concepts behind the development of nanostructured zinc oxide nanoparticles, including the solid state reaction, hydrothermal method, solvothermal method and co-precipitation method are discussed. Lastly, a facile, eco-friendly synthesis of zinc oxide nanoparticles using the peel extract of Musa paradisiaca L, Punica granatum L, and Citrus reticulata Blanco as bioreducing agent is reported"--

Zinc oxide (ZnO) belongs to the class of transparent conducting oxides that can be used as transparent electrodes in electronic devices or heated windows. In this book the material properties of, the deposition technologies for, and applications of zinc oxide in thin film solar cells are described in a comprehensive manner. Structural, morphological, optical and electronic properties of ZnO are treated in this review.

With an in-depth exploration of the following topics, this book covers the broad uses of zinc oxide within the fields of materials science and engineering: - Recent advances in bulk, thin film and nanowire growth of ZnO (including MBE, MOCVD and PLD), - The characterization of the resulting material (including the related ternary systems ZgMgO and ZnCdO), - Improvements in device processing modules (including ion implantation for doping and isolation, Ohmic and Schottky contacts, wet and dry etching), - The role of impurities and defects on materials properties - Applications of ZnO in UV light emitters/detectors, gas, biological and chemical-sensing, transparent electronics, spintronics and thin film

Through their application in energy-efficient and environmentally friendly devices, zinc oxide (ZnO) and related classes of wide gap semiconductors, including GaN and SiC, are revolutionizing numerous areas, from lighting, energy conversion, photovoltaics, and communications to biotechnology, imaging, and medicine. With an emphasis on engineering a

"Zinc oxide (ZnO) is an n-type semiconductor with versatile applications such as optical devices in ultraviolet region, piezoelectric transducers, transparent electrode for solar cells and gas sensors. This book "ZnO Thin Films: Properties, Performance and Applications" gives a deep insight in the intriguing science of zinc oxide thin films. It is devoted to cover the most recent advances and reviews the state of the art of ZnO thin films applications involving energy harvesting, microelectronics, magnetic devices, photocatalysis, photovoltaics, optics, thermoelectricity, piezoelectricity, electrochemistry,

temperature sensing. It serves as a fundamental information source on the techniques and methodologies involved in zinc oxide thin films growth, characterization, post-deposition plasma treatments and device processing. This book will be invaluable to the experts to consolidate their knowledge and provide insight and inspiration to beginners wishing to learn about zinc oxide thin films"--

Nanostructured Zinc Oxide covers the various routes for the synthesis of different types of nanostructured zinc oxide including; 1D (nanorods, nanowires etc.), 2D and 3D (nanosheets, nanoparticles, nanospheres etc.). This comprehensive overview provides readers with a clear understanding of the various parameters controlling morphologies. The book also reviews key properties of ZnO including optical, electronic, thermal, piezoelectric and surface properties and techniques in order to tailor key properties. There is a large emphasis in the book on ZnO nanostructures and their role in optoelectronics. ZnO is very interesting and widely investigated material for a number of applications. This book presents up-to-date information about the ZnO nanostructures-based applications such as gas sensing, pH sensing, photocatalysis, antibacterial activity, drug delivery, and electrodes for optoelectronics. Reviews methods to synthesize, tailor, and characterize 1D, 2D, and 3D zinc oxide nanostructured materials Discusses key properties of zinc oxide nanostructured materials including optical, electronic, thermal, piezoelectric, and surface properties Addresses most relevant zinc oxide applications in optoelectronics such as light-emitting diodes, solar cells, and sensors

Photocatalysis is a hot topic because it is an environmentally friendly approach toward the conversion of light energy into chemical energy at mild reaction environments. Also, it is well applied in several major areas such as water splitting, bacterial inactivation, and pollutants elimination, which is a possible solution to energy shortage and environmental issues. The fundamental knowledge and the frontier research progress in typical photocatalytic materials, such as TiO2-based and non--TiO2-based photocatalysts, are included in this book. Methods to improve the photocatalytic efficiency and to provide a hint for the rational design of the new photocatalysts are covered.

With an in-depth exploration of the following topics, this book covers the broad uses of zinc oxide within the fields of materials science and engineering: - Recent advances in bulk , thin film and nanowire growth of ZnO (including MBE, MOCVD and PLD), - The characterization of the resulting material (including the related ternary systems ZgMgO and ZnCdO), - Improvements in device processing modules (including ion implantation for doping and isolation ,Ohmic and Schottky contacts , wet and dry etching), - The role of impurities and defects on materials properties - Applications of ZnO in UV light emitters/detectors, gas, biological and chemical-sensing, transparent electronics, spintronics and thin film

The semiconductor material of zinc oxide (ZnO) has been studied intensively for decades due to its numerous unique electrical and optical properties, such as wide bandgap, high exciton binding energy at room temperature, and high refractive index. These properties can lead ZnO material to the applications of electronics and optoelectronics. More importantly, the realization of various kinds of ZnO micro- or nano-structures, makes ZnO capable to improve the electrical and/or optical performances of the devices. Different micro- or nano-structured ZnO has attracted much attention from researchers worldwide in the recent years as this will bright the future of ZnO in the applications of light emitting diodes (LEDs) and solar cells. And thus, developing a simple, low-cost, and environmental friendly method to grow ZnO having desired micro- or nano-structures is of great importance in the research field of ZnO material, and this becomes a key issue when a large-scale production is required in the industry. Meanwhile, the parameter control during the synthesis procedure is essential to be modified and clarified. The main focus of this thesis is on developing a simple, inexpensive, and solution based thermal method to grow spherical shaped ZnO particles having uniformly distributed size. The growth parameters for controlling the size and shape, such as the hydrate, solvent, salt concentration, reaction temperature, reaction time, seed solution, and heating rate, are experimentally studied and clarified in this thesis. This method has the advantage of large-scale production and good reproductivity with low requirements in regard to the facilities and experimental conditions in industry. At the same time, the related growth mechanism of the submicron ZnO spheres is studied, derived, and theoretically analyzed in this thesis, based on the observation in the experiments. Another focus of this thesis is on the study of the surface morphologies and optical properties of the synthesized ZnO particles. The surface morphologies are analyzed by the techniques of field emission scanning electron microscopy, X-ray diffraction, and transmission electron microscopy. The optical properties of the synthesized ZnO particles are experimentally investigated by Raman spectroscopy and photoluminescence at room temperature. Furthermore, the related luminescence mechanism is theoretically studied, modelled, and presented in this thesis. In order to explore the applications of the synthesized ZnO spheres, the composite of ZnO/V2O5 (zinc oxide/vanadium pentoxide) is designed, fabricated, experimentally investigated, and theoretically analyzed. The experimental results indicate that this transition metal oxide mixture can be developed to create a group of new light emission materials with high efficiency. Moreover, a silicon-based ZnO light emission device is presented in this thesis, reporting that visible light emission is observed at room temperature from the ZnO material which deposited on the hot electron emitting substrate (HEES). Finally, some of the future works of this research are suggested.

Current oxide nanomaterials knowledge to draw from and build on Synthesis, Properties, and Applications of Oxide Nanomaterials summarizes the existing knowledge in oxide-based materials research. It gives researchers one comprehensive resource that consolidates general theoretical knowledge alongside practical applications. Organized by topic for easy access, this reference: * Covers the fundamental science, synthesis, characterization, physicochemical properties, and applications of oxide nanomaterials * Explains the fundamental aspects (quantum-mechanical and thermodynamic) that determine the behavior and growth mode of nanostructured oxides * Examines synthetic procedures using top-down and bottom-up fabrication technologies involving liquid-solid or gas-solid transformations * Discusses the sophisticated experimental techniques and state-of-the-art theory used to characterize the structural and electronic properties of nanostructured oxides * Describes applications such as sorbents, sensors, ceramic materials, electrochemical and photochemical devices, and catalysts for reducing environmental pollution, transforming hydrocarbons, and producing hydrogen With its combination of theory and real-world applications plus extensive bibliographic references, Synthesis, Properties, and Applications of Oxide Nanomaterials consolidates a wealth of current, complex information in one volume for practicing chemists, physicists, and materials scientists, and for engineers and researchers in government, industry, and academia. It's also an outstanding reference for graduate students in chemistry, chemical engineering, physics, and materials science.

Nanotechnology involves the creation and manipulation of materials at nanoscale levels to create products that exhibit novel properties. Nanomaterials possess increased structural integrity as well as unique mechanical, optical, chemical, electrical and magnetic properties. Because of these unique properties, NP can potentially impact the health of those exposed to them during industrial manufacturing and production. Although the applications and benefits of these engineered nanomaterials are extensively, there is a severe lack of information concerning the human health and environmental implications of occupational exposure during the manufacturing and handling process. As the production and application of ZnO nanoparticles expand, potential human exposure will also increase. In occupational settings, these ZnO nanoparticles may release into the surroundings in aerosol form. NP have been shown to reach the systemic circulation after inhalation, ingestion, or intravenous injection, with further distribution and accumulation in several organs such as lung, liver, spleen, kidneys.Therefore, we have undertaken this work to assess the toxicity of Zinc Oxide nanoparticles in rats

This book presents a review of recent advances in ZnO-based nanomaterials and devices. ZnO as a nanomaterial has gained substantial interest in the research area of wide bandgap semiconductors and is considered to be one of the major candidates for electronic and photonic applications. ZnO has distinguished and interesting electrical and optical properties and is considered to be a potential material in optoelectronic applications such as solar cells, surface acoustic wave devices, and UV emitters. ZnO's unique properties have attracted several researchers to study its electrical and optical properties. As a nanostructured material, ZnO exhibits many advantages for nanodevices. Moreover, it has the ability to absorb the UV radiation.

Porous ceramics have recently gained growing importance in industry because of their many applications like filters, absorbers, dust collectors, thermal insulation, hot gas collectors, dielectric resonators, bioreactors, bone replacement and automobile engine components. Generally, porous ceramics have good properties such as mechanical strength, abrasion resistance, and chemical and thermal stability. These porous network ceramic structures also have relatively low density, low mass and low thermal conductivity. Furthermore, permeability is one of the most important properties of porous ceramics for different applications such as membranes because this property directly relates to the pressure drop during filtration. Pore size control is one key factor in fabrication of porous ceramics. The size of particles and their distribution of the raw materials, manufacturing techniques, types of binder used, distribution of binder, and sintering affect the final porosity and pore connectivity, are important things that must be considered during the manufacturing of a porous ceramic body. Therefore, the development of porous ceramic research requires sufficient mechanical and chemical stability as well as permeability. This book covers a wide range of topics such as porous ceramic structure and properties, preparation, simulation and fabrication, sintering, applications for bioceramics, sensors, magnetics and energy saving.

This book provides an account of the biogenic synthesis of nanomaterials by using different microorganisms. The chapters are focused on the biosynthesis of various metal and metal oxide nanosized materials by using bacteria, actinomycetes, fungi, and algae, including mechanisms of microbial synthesis. Other chapters summarize recent developments of microbial-based nanostructures for the management of food-borne pathogens, plant pathogenic fungi, as nutrients, and biomedical applications. Microorganisms are discussed not only as biofactories for the synthesis of nanomaterials but also as removal agents of toxic metals from the environment. Exposure sources and ecotoxicity of microbially synthesized nanoparticles are also discussed.

This book highlights the functionality, significance, and applicability of nanostructure materials. The chapters in this book provide the logical and comprehensive information pertaining to the recent advances in the synthesis, characterization, and application of nanostructure materials for energy conversion and sensors. Written by an outstanding group of experts in the field, this book presents the latest advances and developments in nanostructure materials. We hope this book will help in describing the current position of nanostructure materials in the technological sphere as well as encourage scientists and engineers in deeper exploration of nanostructure materials to boost the technological advancement.

1-D metal oxide nanostructures, especially those with semiconducting properties, have attracted much attention in recent years due to their potential and emerging applications, specifically in environment purification and energy devices. For these applications, there have been many efforts to grow 1-D nanostructures in the form of nanotubes, nanorods, and nanowires using processes that conserve energy, are cost effective, and can be scaled up for large-scale production. 1-Dimensional Metal Oxide Nanostructures gathers under one title the most recent development of oxide nanomaterials, especially those fabricated via oxidation process in the nanoscale field. Thermal and anodic oxidation processes are reviewed with an aim to offer an in-depth understanding of mechanisms of 1-D nanostructure formation, their characteristics, and limitations. Other more common methods are also discussed, including sol-gel, hydrothermal, and other templated methods. Important applications of 1-D nanostructures are then presented, focusing on oxides like zinc oxide, titanium oxide, zirconium oxide, copper oxide, and iron oxide. A chapter on carbon nanotubes hybrid with these oxides is also included as well as one on silicon oxide nanowires formation by local anodic oxidation process. Aimed at researchers, academics, and engineers working across the fields of nanotechnology, materials science, chemistry, physics, semiconductors, and environmental and biomedical engineering, this essential reference enables readers to grasp the main concepts of nanomaterials in 1-D: formation technique, characteristics, and uses. It also encourages practical innovations in nanotechnology, especially in curbing pressing global issues related to energy, environment, and security.

Zinc-Based Nanostructures for Environmental and Agricultural Applications shows how zinc nanostructures are being used in agriculture, food and the environment. The book has been divided into two parts: Part I deals with the synthesis and characterization of zinc-based nanostructures such as biogenic, plant, microbial, and actinobacteria mediated synthesis of zinc nanoparticles, Part II is focused on agri-food applications such as antibacterial, antifungal, antimicrobial, plant disease management, controlling post-harvest diseases, pesticide sensing and degradations, plant promotions, ZnO nanostructure for food packaging application, safe animal food and feed supplement, elimination of mycotoxins, and veterinary applications. Part III reviews technological developments in environmental applications such as risks and benefits for aquatic organisms and the marine environment, antiseptic activity and toxicity mechanisms, wastewater treatment, and zinc oxide-based nanomaterials for photocatalytic degradation of environmental and agricultural pollutants. The book discusses various aspects, including the application of zinc-based nanostructures to enhance plant health and growth, the effect on soil microbial activity, antimicrobial mechanism, phytotoxicity and accumulation in plants, the possible impact of zinc-based nanostructures in the agricultural sector as nanofertilizer, enhancing crop productivity, and other possible antimicrobial mechanisms of ZnO nanomaterials. Explores the impact of a large variety of zinc-based nanostructures on agri-food and environment sectors Outlines how the properties of zinc-based nanostructures mean they are particularly efficient in environmental and agricultural application areas Assesses the major challenges of synthesizing and processing zinc-based nanostructured materials

Semiconductor Nanowires: Part B, and Volume 94 in the Semiconductor and Semimetals series, focuses on semiconductor nanowires. Includes experts contributors who review the most important recent literature Contains a broad view, including examination of semiconductor nanowires

Zinc oxide (ZnO) in its nanostructured form is emerging as a promising material with great potential for the development of many smart electronic devices. This book presents up-to-date information about various synthesis methods to obtain device-quality ZnO nanostructures. It describes both high--temperature (over 100° C) and low-temperature (under 100° C) approaches to synthesizing ZnO nanostructures; device applications for technical and medical devices, light-emitting diodes, electrochemical sensors, nanogenerators, and photodynamic therapy; and the concept of self-powered devices and systems using ZnO nanostructures. The book emphasizes the utilization of non-conventional substrates such as plastic, paper, and textile as new platforms for developing electronics.

The book deals with novel aspects and perspectives in metal oxide and hybrid material fabrication. The contributions are mainly focused on the search for a new group of advanced materials with de-

signed physicochemical properties, especially an expanded porous structure and defined surface activity. The proposed technological procedures result in an enhanced activity of the synthesized hybrid materials, which is of great importance when considering their potential fields of application. The use of such materials in different technological disciplines, including aspects associated with environmental protection, allows for the verification of the proposed synthesis method. Thus, it can be stated that those aspects are of interdisciplinary character and may be located at the interface of three scientific disciplines—chemistry, materials science, and engineering—as well as environmental protection. Furthermore, the presented scientific scope is in some way an answer to the continuous demand for such types of materials and opens new perspectives for their practical use

Zinc oxide (ZnO) is an n-type semiconductor with versatile applications such as optical devices in ultraviolet region, piezoelectric transducers, transparent electrode for solar cells and gas sensors. The book offers a deep insight in the intriguing science of zinc oxide thin films. It is devoted to cover the most recent advances and reviews the state of the art of ZnO thin films applications involving energy harvesting, microelectronics, magnetic devices, photocatalysis, photovoltaics, optics, thermoelectricity, piezoelectricity, electrochemistry, temperature sensing. It serves as a fundamental information source on the techniques and methodologies involved in zinc oxide thin films growth, characterisation, post-deposition plasma treatments and device processing. This book will be invaluable to the experts to consolidate their knowledge and provide insight and inspiration to beginners wishing to learn about zinc oxide thin films.

This dissertation, "Zinc Oxide Nanorods and Tetrapods: Properties and Applications" by Yuk-fan, Hsu, □□□, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. DOI: 10.5353/th_b4068760 Subjects: Zinc oxide Nanostructures Nanotechnology

This edited book, Toxicology - New Aspects to This Scientific Conundrum, is intended to provide an overview on the different xenobiotics employed every day in our anthropogenic activities. We hope that this book will continue to meet the expectations and needs of all interested in the implications for the living species of known and new toxicants and to guide them in the future investigations.

The book gives a comprehensive review of the present state-of-the-art in ZnO R+D, including growth, doping, lattice dynamics, electric magnetic and optical properties. The emphasis is on the electric and optical properties, because this is the area where novel applications may be expected with highest promise. The book highlights not only the most recent results but gives both an overview of past research and of the present status -- not avoiding critical and controversial discussions of various aspects such as bank symmetries and laser processes. Intended to have long-lasting impact on ZnO R+D, this monograph addresses (post-)graduate students but also advanced scientists, who want to embark on ZnO research or are already involved, the present state of the art and assists them in avoiding duplication of old results (or mistakes).