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KEY=FUNCTIONAL - COLEMAN ALEXZANDER

Chemical Solution Deposition of Functional Oxide Thin Films

Springer Science & Business Media This is the first text to cover all aspects of solution processed functional oxide thin-films. Chemical Solution Deposition (CSD) comprises all solution based thin- film deposition techniques, which involve chemical reactions of precursors during the formation of the oxide films, i. e. sol-gel type routes, metallo-organic decomposition routes, hybrid routes, etc. While the development of sol-gel type processes for optical coatings on glass by silicon dioxide and titanium dioxide dates from the mid-20th century, the first CSD derived electronic oxide thin films, such as lead zirconate titanate, were prepared in the 1980's. Since then CSD has emerged as a highly flexible and cost-effective technique for the fabrication of a very wide variety of functional oxide thin films. Application areas include, for example, integrated dielectric capacitors, ferroelectric random access memories, pyroelectric infrared detectors, piezoelectric micro-electromechanical systems, antireflective coatings, optical filters, conducting-, transparent conducting-, and superconducting layers, luminescent coatings, gas sensors, thin film solid-oxide fuel cells, and photoelectrocatalytic solar cells. In the appendix detailed "cooking recipes" for selected material systems are offered.

Chemical Solution Synthesis for Materials Design and Thin Film Device Applications

Elsevier Chemical Solution Synthesis for Materials Design and Thin Film Device Applications presents current research on wet chemical techniques for thin-film based devices. Sections cover the quality of thin films, types of common films used in devices, various thermodynamic properties, thin film patterning, device configuration and applications. As a whole, these topics create a roadmap for developing new materials and incorporating the results in device fabrication. This book is suitable for graduate, undergraduate, doctoral students, and researchers looking for quick guidance on material synthesis and device fabrication through wet chemical routes. Provides the different wet chemical routes for materials synthesis, along with the most relevant thin film structured materials for device applications Discusses patterning and solution processing of inorganic thin films, along with solvent-based processing techniques Includes an overview of key processes and methods in thin film synthesis, processing and device fabrication, such as nucleation, lithography and solution processing

Epitaxial Growth of Complex Metal Oxides

Elsevier The atomic arrangement and subsequent properties of a material are determined by the type and conditions of growth leading to epitaxy, making control of these conditions key to the fabrication of higher quality materials. Epitaxial Growth of Complex Metal Oxides reviews the techniques involved in such processes and highlights recent developments in fabrication quality which are facilitating advances in applications for electronic, magnetic and optical purposes. Part One reviews the key techniques involved in the epitaxial growth of complex metal oxides, including growth studies using reflection high-energy electron diffraction, pulsed laser deposition, hybrid molecular beam epitaxy, sputtering processes and chemical solution deposition techniques for the growth of oxide thin films. Part Two goes on to explore the effects of strain and stoichiometry on crystal structure and related properties, in thin film oxides. Finally, the book concludes by discussing selected examples of important applications of complex metal oxide thin films in Part Three. Provides valuable information on the improvements in epitaxial growth processes that have resulted in higher quality films of complex metal oxides and further advances in applications for electronic and optical purposes Examines the techniques used in epitaxial thin film growth Describes the epitaxial growth and functional properties of complex metal oxides and explores the effects of strain and defects

Solution Processed Metal Oxide Thin Films for Electronic Applications

Elsevier Solution Processed Metal Oxide Thin Films for Electronic Applications discusses the fundamentals of solution processing materials chemistry techniques as they are applied to metal oxide materials systems for key device applications. The book introduces basic information (materials properties, materials synthesis, barriers), discusses ink formulation and solution processing methods, including sol-gel processing, surface functionalization aspects, and presents a comprehensive accounting on the electronic applications of solution processed metal oxide films, including thin film transistors, photovoltaic cells and other electronics devices and circuits. This is an important reference for those interested in oxide electronics, printed electronics, flexible electronics and large-area electronics. Provides in-depth information on solution processing fundamentals, techniques, considerations and barriers combined with key device applications Reviews important device applications, including transistors, light-emitting diodes, and photovoltaic cells Includes an overview of metal oxide materials systems (semiconductors, nanomaterials and thin films), addressing materials synthesis, properties, limitations and surface aspects

Epitaxial Growth of Complex Metal Oxides

Woodhead Publishing Epitaxial Growth of Complex Metal Oxides, Second Edition reviews techniques and recent developments in the fabrication quality of complex metal oxides, which are facilitating advances in electronic, magnetic and optical applications. Sections review the key techniques involved in the epitaxial growth of complex metal oxides and explore the effects of strain and stoichiometry on crystal structure and related properties in thin film oxides. Finally, the book concludes by discussing selected examples of important applications of complex metal oxide thin films, including optoelectronics, batteries, spintronics and neuromorphic applications. This new edition has been fully updated, with brand new chapters on topics such as atomic layer deposition, interfaces, STEM-EELs, and the epitaxial growth of multiferroics, ferroelectrics and nanocomposites. Examines the techniques used in epitaxial thin film growth for complex oxides, including atomic layer deposition, sputtering techniques, molecular beam epitaxy, and chemical solution deposition techniques Reviews materials design strategies and materials property analysis methods, including the impacts of defects, strain, interfaces and stoichiometry Describes key applications of epitaxially grown metal oxides, including optoelectronics, batteries, spintronics and neuromorphic applications

Sol-Gel Processing for Conventional and Alternative Energy

Springer Science & Business Media Sol-Gel Processing for Conventional and Alternative Energy is a comprehensive source of information on the use of sol-gel processing in materials in energy systems, conversion, storage, and generation. The volume editors include numerous applications, primarily in nuclear fuel processing, electrolytes for fuel cells, and dye-sensitized solar cells (DSSC). In addition to examining contemporary processing, properties, and industrial applications, "Sol-Gel Processing for Conventional and Alternative Energy" identifies materials challenges presented by conventional and alternative energy generation that require new materials and innovative processing. Each chapter is written by an internationally respected researcher. The book provides a state-of-the-art treatment of different aspects of materials for energy production, with a focus on processing, and covers related topics such as carbon sequestration, clean energy, and biofuels.

Advanced Ceramic Materials

John Wiley & Sons Ceramic materials are inorganic and non-metallic porcelains, tiles, enamels, cements, glasses and refractory bricks. Today, "ceramics" has gained a wider meaning as a new generation of materials influence on our lives; electronics, computers, communications, aerospace and other industries rely on a number of their uses. In general, advanced ceramic materials include electro-ceramics, optoelectronic-ceramics, superconductive ceramics and the more recent development of piezoelectric and dielectric ceramics. They can be considered for their features including mechanical properties, decorative textures, environmental uses, energy applications, as well as their usage in bio-ceramics, composites, functionally graded materials, intelligent ceramics and so on. Advanced Ceramic Materials brings together a group of subject matter experts who describe innovative methodologies and strategies adopted in the research and development of the advanced ceramic materials. The book is written for readers from diverse backgrounds across chemistry, physics, materials science and engineering, medical science, pharmacy, environmental technology, biotechnology, and biomedical engineering. It offers a comprehensive view of cutting-edge research on ceramic materials and technologies. Divided into 3 parts concerning design, composites and functionality, the topics discussed include: Chemical strategies of epitaxial oxide ceramics nanomaterials Biphasic, triphasic and multiphasic calcium orthophosphates Microwave assisted processing of advanced ceramic composites Continuous fiber reinforced ceramic matrix composites Yytria and magnesia doped alumina ceramic Oxidation induced crack healing SWCNTs vs MWCNTs reinforcement agents Organic and inorganic wastes in clay brick production Functional tantalum oxides Application of silver tin research on hydroxyapatite

Functional Oxide Based Thin-Film Materials

MDPI This Special Issue on Functional Oxide-Based Thin-Film Materials touches on the latest advancements in several aspects related to material science: the synthesis of novel oxide, photoluminescence characteristics, photocatalytic ability, energy storage, light emitter studies, low-emissivity glass coatings, and investigations of both nanostructure and thin-film properties. It represents an amalgamation of specialists working with device applications and shedding light on the properties and behavior of thin-film oxides (e.g., GaOx, Ga2O3, HfO2, LiNbO3, and doped ZnO, among numerous others). The papers cover many aspects of thin-film science and technology, from thin film to nanostructure and from material properties to optoelectronic applications, thus reflecting the many interests of the community of scientists active in the field.

Transparent Conductive Materials

Materials, Synthesis, Characterization, Applications

Wiley-VCH Edited by well-known pioneers in the field, this handbook and ready reference provides a comprehensive overview of transparent conductive materials with a strong application focus. Following an introduction to the materials and recent developments, subsequent chapters discuss the synthesis and characterization as well as the deposition techniques that are commonly used for energy harvesting and light emitting applications. Finally, the book concludes with a look at future technological advances. All-encompassing and up-to-date, this interdisciplinary text runs the gamut from chemistry and materials science to engineering, from academia to industry, and from fundamental challenges to readily available applications.

The Sol-Gel Handbook

Synthesis, Characterization and Applications, 3-Volume Set

John Wiley & Sons This comprehensive three-volume handbook brings together a review of the current state together with the latest developments in sol-gel technology to put forward new ideas. The first volume, dedicated to synthesis and shaping, gives an in-depth overview of the wet-chemical processes that constitute the core of the sol-gel method and presents the various pathways for the successful synthesis of inorganic and hybrid organic-inorganic materials, bio- and bio-inspired materials, powders, particles and fibers as well as sol-gel derived thin films, coatings and surfaces. The second volume deals with the mechanical, optical, electrical and magnetic properties of sol-gel derived materials and the methods for their characterization such as diffraction methods and nuclear magnetic resonance, infrared and Raman spectroscopies. The third volume concentrates on the various applications in the fields of membrane science, catalysis, energy research, biomaterials science, biomedicine, photonics and electronics.

Photoenergy and Thin Film Materials

John Wiley & Sons This book provides a fundamental discussion, latest research & developments, and the future of thin films and photoenergy materials, two developing areas that have the potential to spearhead the future of industry. Photoenergy materials are expected to be a next generation key material to provide secure, safe, sustainable and affordable energy. Photoenergy devices are known to convert the sunlight into electricity. This type of devices is very much simple in design with having a major advantage with their structure as stand-alone systems to provide outputs up to megawatts. They have been applied as a power source, solar home systems, remote buildings, water pumping, megawatt scale power plants, satellites, communications, and space vehicles. With such a list of enormous applications, the demand for photoenergy devices is growing every year. On the other hand, thin films coating, which can be defined as fusion of surface science, materials science, and applied physics, are progressing as a unified discipline of scientific industry. A thin film can be termed as a very fine or thin layer of material coated on a particular surface, that can be in the range of a nanometer in thickness to several micrometers in size. Thin films are being applied it a number of fields ranging from protection purposes to electronic semiconductor devices.

Thin Film Growth and Deposition of Functional Perovskite Oxides

The research documented in this work focuses on the growth and deposition of thin film perovskite oxides for their electronic and photonic functionalities. The ever increasing demand for faster electronic devices, particularly in the realm of micro and nanoelectronics, is requiring diversification of the materials used in typical semiconductor-based integrated circuits. Metal oxides, particularly those in the perovskite family of materials, offers a wide range of functionalities that can both increase device performance and add new capabilities such as optical interconnects. The process in which perovskite oxide thin films are deposited and integrated with one another and conventional semiconductors can have many effects on the properties of the resulting device. This work explores these effects in the context of BaTiO3 (BTO) and Ba [subscript x] Sr1- [subscript x] TiO3 (BST) second order nonlinear optical effects, which includes second harmonic generation (SHG) and the linear electro-optic effect (Pockels effect). The work also studies the growth effects on the apparent interfacial conductivity of LaTiO3/SrTiO3 (LTO/STO) heterostructures. BTO thin films grown epitaxially on STO(001) by molecular beam epitaxy (MBE) experience strain relaxation due to misfit dislocations for increasing thickness while epitaxial BST thin films remain strained at equivalent thicknesses due to the smaller lattice mismatch. These strained BST films exhibit larger second harmonic generation than relaxed BTO films, for particular compositions, suggesting that the epitaxial strain enhances their polarization and second order nonlinear susceptibility beyond what is capable in equivalently thick, relaxed BTO films. We also explore the deposition of BTO and BST thin films by a chemical solution method under atmospheric conditions. The films are epitaxial with STO(001) template layers prepared by MBE on Si(001) wafers. Presence of the Pockels effect is confirmed in the films, although optical hysteresis and remanent polarization is not observed owing to the films' small (10-100 nm) grain size, structural defects, and residual tensile stress. Effective Pockels coefficients decrease monotonically with decreasing Ba composition. Non-zero Pockels response is observed in even Sr-rich films, which is explained by the tensile stress that deforms the normally cubic crystal structure into a non-centrosymmetric structure. Post-deposition annealing can increase the Pockels response by approximately four times and is attributed to an increase in grain size and the elimination of structural defects. Finally, we study the effects of oxygen vacancies caused by varying MBE growth conditions of LTO thin films on STO(001) single crystals and thin STO layers on Ge(001). Electrical conductivity of the heterostructures is LTO-thickness dependent, and LTO growth on STO/Ge structures requires orders of magnitude higher partial pressures of molecular oxygen in order to achieve crystalline LTO with proper oxidation states. This is explained by the propensity of LTO to scavenge oxygen from STO during growth, which is limited in LTO/STO/Ge heterostructures, and generates many free carriers and leads to the observed conductivity of the LTO/STO systems

Modern Technologies for Creating the Thin-film Systems and Coatings

BoD – Books on Demand Development of the thin film and coating technologies (TFCT) made possible the technological revolution in electronics and through it the revolution in IT and communications in the end of the twentieth century. Now, TFCT penetrated in many sectors of human life and industry: biology and medicine; nuclear, fusion, and hydrogen energy; protection against corrosion and hydrogen embrittlement; jet engine; space materials science; and many others. Currently, TFCT along with nanotechnologies is the most promising for the development of almost all industries. The 20 chapters of this book present the achievements of thin-film technology in many areas mentioned above but more than any other in medicine and biology and energy saving and energy efficiency.

Nanoscale Ferroelectrics and Multiferroics

Key Processing and Characterization Issues, and Nanoscale Effects

John Wiley & Sons "Covers topics such as nanostructuring, functional ceramics based on nanopowders micromechanical systems, self-assembling and patterning, porous structures etc."--

Ferroelectricity in Doped Hafnium Oxide

Materials, Properties and Devices

Woodhead Publishing Ferroelectricity in Doped Hafnium Oxide: Materials, Properties and Devices covers all aspects relating to the structural and electrical properties of HfO2 and its implementation into semiconductor devices, including a comparison to standard ferroelectric materials. The ferroelectric and field-induced ferroelectric properties of HfO2-based films are considered promising for various applications, including non-volatile memories, negative capacitance field-effect-transistors, energy storage, harvesting, and solid-state cooling. Fundamentals of ferroelectric and piezoelectric properties, HfO2 processes, and the impact of dopants on ferroelectric properties are also extensively discussed in the book, along with phase transition, switching kinetics, epitaxial growth, thickness scaling, and more. Additional chapters consider the modeling of ferroelectric phase transformation, structural characterization, and the differences and similarities between HFO2 and standard ferroelectric materials. Finally, HfO2 based devices are summarized. Explores all aspects of the structural and electrical properties of HfO2, including processes, modelling and implementation into semiconductor devices Considers potential applications including FeCaps, FeFETs, NCFETs, FTJs and more Provides comparison of an emerging ferroelectric material to conventional ferroelectric materials with insights to the problems of downscaling that conventional ferroelectrics face

Functional Ceramic Coatings

MDPI Ceramic materials in the form of coatings can significantly improve the functionality and applications of other engineering materials. Due to a wide range of controllable features and various deposition methods, it is possible to create tailored substrate–coating systems that meet the requirements of modern technologies. Therefore, it is crucial to understand the relationships between the structures, morphology and the properties of ceramic coatings and expand the base of scientific knowledge about them. This book contains a series of fourteen articles which present research on the production and properties of ceramic coatings designed to improve functionality for advanced applications.

Microwave Heating

Electromagnetic Fields Causing Thermal and Non-Thermal Effects

BoD – Books on Demand More than 80 years of experience in the practical application of electromagnetic energy in various fields of human activity (industry, agriculture, science, medicine, etc.) suggests that microwave heating is an effective application of electromagnetic energy. This book presents the latest investigations on the applications of microwave energy and the effects of microwave radiation on various materials and mediums. Divided into two sections on thermal and nonthermal effects, this volume contains eight chapters that examine the use of microwave energy to extract bioactive compounds from plant materials, for rock-breaking operations, to synthesize functional dyes and nanomaterials, and more.

Nanoscaled Films and Layers

BoD – Books on Demand In recent years, scientific investigations and technological developments have resulted in many new results. Direct applications of quantum mechanical laws to system with length scales lower than 100 nm (nano) had opened a way to construction of new equipment in the field f.e. of nano- and optoelectronics. This book fits into this trend summarizing the results related to discoveries and technological applications of nanolayer in different fields of material science and even life science. The chapters are organized into three subfields: 1) Preparation and fabrications of nanolayers with different methods. 2) Description of recent achievements related to very important III-V heterostructures. 3) Descriptions of mechanical, thermal, optoelectronic, photocatalytic, and tribological properties of nanolayered structures. Some environmentally friendly applications are also treated in this book. The presented book provides a description of specific and original results obtained by authors. We hope that the volume will be of interest for a wide range of readers working in the field of material science.

Applied Surface Science

BoD – Books on Demand This book covers the state of the art and recent advances in the field of surface science of a variety of materials for different applications and provides an in-depth understanding of mechanisms involved in achieving the desired surface properties. The book is extremely useful to materials scientists, system design engineers, maintenance engineers, manufacturing experts and executives, industrialists, mechanical engineers, chemical engineers, aeronautical engineers, academic researchers, and undergraduate and postgraduate students.

Tailored Functional Oxide Nanomaterials

From Design to Multi-Purpose Applications

John Wiley & Sons Tailored Functional Oxide Nanomaterials A comprehensive exploration of the preparation and application of metal oxide nanomaterials Tailored Functional Oxide Nanomaterials: From Design to Multi-Purpose Applications delivers a one-of-a-kind discussion of the fundamentals and key applications of metal oxide nanomaterials. The book explores everything from their preparation to the mastering of their characteristics in an interdisciplinary view. The distinguished authors address theoretical research and advanced technological utilizations, illustrating key issues for the understanding and real-world end-uses of the most important class of inorganic materials. The interplay between the design, preparation, chemico-physical characterization, and functional behaviors of metal oxide nanomaterials in a variety of fields is presented. Up-to-date work and knowledge on these materials is also described, with fulsome summaries of important applications that are relevant to researchers pursuing safety, sustainability, and energy end-uses. Readers will also find: A thorough introduction to vapor phase growth of metal oxide thin films and nanostructures Comprehensive

explorations of addressing complex transition metal oxides at the nanoscale, including bottom-up syntheses of nano-objects and properties Practical discussions of nanosized oxides supported on mats of carbon nanotubes, including synthesis strategies and performances of Ti/CNT systems In-depth examinations of computational approaches to the study of oxide nanomaterials and nanoporous oxides Perfect for materials scientists, inorganic chemists, physicists, catalytic chemists, and chemical engineers, Tailored Functional Oxide Nanomaterials will also earn a place in the libraries of solid-state chemists.

Superconductivity

From Materials Science to Practical Applications

Springer Nature This book provides readers with a comprehensive overview of the science of superconducting materials. It serves as a fundamental information source on the actual techniques and methodologies involved in superconducting materials growth, characterization and processing. This book includes coverage of several categories of medium and high-temperature superconducting materials: cuprate oxides, borides, and iron-based chalcogenides and pnictides. Provides a single-source reference on superconducting materials growth, characterization and processing; Bridges the gap between materials science and applications of superconductors; Discusses several categories of superconducting materials such as cuprate oxides, borides, and iron-based chalcogenides and pnictides; Covers synthesis, characterization, and processing of superconducting materials, as well as the nanoengineering approach to tailor the properties of the used materials at the nanoscale level.

Renewable Polymers and Polymer-Metal Oxide Composites

Synthesis, Properties, and Applications

Elsevier Renewable Polymers and Polymer-Metal Oxide Composites: Synthesis, Properties, and Applications serves as a reference on the key concepts of the advances of polymer-oxide composites. The book reviews knowledge on polymer-composite theory, properties, structure, synthesis, and their characterization and applications. There is an emphasis on coupling metal oxides with polymers from renewable sources. Also, the latest advances in the relationship between the microstructure of the composites and the resulting improvement of the material's properties and performance are covered. The applications addressed include desalination, tissue engineering, energy storage, hybrid energy systems, food, and agriculture. This book is suitable for early-career researchers in academia and R&D in industry who are working in the disciplines of materials science, engineering, chemistry and physics. Provides basic principles, theory and synthetic methods of composite materials, polymer composites and metal oxides Reviews the latest advances in polymer-oxide-based applications in medicine, water treatment, energy and sensing Discusses materials from renewable resources, including lifecycle assessment, economic aspects and potential application in tissue engineering, photovoltaics and food packaging

Titanium Dioxide (TiO2) and Its Applications

Elsevier Scientific interest in TiO2-based materials has exponentially grown in the last few decades. Titanium Dioxide (TiO2) and Its Applications introduces the main physicochemical properties of TiO2 which are the basis of its applications in various fields. While the basic principles of the TiO2 properties have been the subject of various previous publications, this book is mainly devoted to TiO2 applications. The book includes contributions written by experts from a wide range of disciplines in order to address titanium dioxide's utilization in energy, consumer, materials, devices, and catalytic applications. The various applications identified include: photocatalysis, catalysis, optics, electronics, energy storage and production, ceramics, pigments, cosmetics, sensors, and heat transfer. Titanium Dioxide (TiO2) and Its Applications is suitable for a wide readership in the disciplines of materials science, chemistry, and engineering in both academia and industry. Includes a wide range of current and emerging applications of titanium dioxide in the fields of energy, consumer applications, materials, and devices Provides a brief overview of titanium dioxide and its properties, as well as techniques to design, deposit, and study the material Discusses the relevant properties, preparation methods, and other apposite considerations in each application-focused chapter

Who is Who in Thermal Analysis and Calorimetry

Springer This is an expanded and revised second edition, presenting accurate and comprehensive information about our leading thermal scientists to current and future generations. In our globalized world, most researchers in thermal analysis do not know each other in person and are not familiar with each other's achievements. This volume provides the reader with an up-to-date list of the prominent members in this community. The publication contains only living scientists. The selection is based partly on several decades of the editors' personal professional experience and also partly on the opinion of the Regional Editors of the Journal of Thermal Analysis and Calorimetry.

Biomaterial Science

Anatomy and Physiology Aspects

Walter de Gruyter GmbH & Co KG This books bridges the gap between a clinician's knowledge and the biomaterial designer's by elucidating upon the different biomaterials used in anatomical systems and how those materials react to the human body. It explores established and future prospectives of biomaterial types/designs, considerations/characterization and synthesis, in order to guide students in understanding the relations of material science and the human body.

Heterogeneous Photocatalysis

Relationships with Heterogeneous Catalysis and Perspectives

Elsevier Heterogeneous Photocatalysis: Relationships with Heterogeneous Catalysis and Perspectives highlights the differences between thermal-catalysis and photo-catalysis and indicates borderlines, in particular, the possible synergism between them. The book outlines the basic aspect of thermal- and photo-catalysis, along with the most important characterization techniques. In addition, it presents case studies of thermal-catalytic and photo-catalytic or thermal-photo-catalytic reactions and includes a comparison between the results obtained using an inorganic solid as thermal catalyst and photocatalyst for the same reaction, and in the same setup. Final sections offer information on the preparation methods of (photo)catalysts, various techniques used for their characterization, engineering and economical aspects. This book will be a valuable reference source for students and researchers involved in heterogeneous photocatalysis and catalysis, chemistry, chemical engineering, materials science, materials engineering, environment engineering, nanotechnology and green chemistry. Provides selective methods for the preparation of microcrystalline/nanocrystalline solids or films used in catalytic and photocatalytic processes Describes (photo)reactions that can be carried out catalytically and/or photocatalytically Outlines the different mechanisms, yields and experimental conditions under which photocatalytic reactions can take place Describes various (photo)reactors and set ups under which the photacatalytic reactions can be carried out Provides an economic assessment to understand the feasibility of some photocatalytic reactions

Microwave Materials and Applications

John Wiley & Sons The recent rapid progress in wireless telecommunication, including the Internet of Things, 5th generation wireless systems, satellite broadcasting, and intelligent transport systems has increased the need for low-loss dielectric materials and modern fabrication techniques. These materials have excellent electrical, dielectric, and thermal properties and have enormous potential, especially in wireless communication, flexible electronics, and printed electronics. Microwave Materials and Applications discusses the methods commonly employed for measuring microwave dielectric properties, the various attempts reported to solve problems of materials chemistry and crystal structure, doping, substitution, and composite formation, highlighting the processing techniques, morphology influences, and applications of microwave materials whilst summarizing many of the recent technical research accomplishments in the area of microwave dielectrics and applications Chapters examine: Oxide ceramics for dielectric resonators and substrates HTCC, LTCC and ULTCC tapes for substrates Polymer ceramic composites for printed circuit boards Elastomer-ceramic composites for flexible electronics Dielectric inks EMI shielding materials Microwave ferrites A comprehensive Appendix presents the fundamental properties for more than 4000 low-loss dielectric ceramics, their composition, crystal structure, and their microwave dielectric properties. Microwave Materials and Applications presents a comprehensive view of all aspects of microwave materials and applications, making it useful for scientists, industrialists, engineers, and students working on current and emerging applications of wireless communications and consumer electronics.

Advanced Rare Earth-Based Ceramic Nanomaterials

Elsevier Advanced Rare Earth-Based Ceramic Nanomaterials focuses on recent advances related to preparation methods and applications of advanced rare earth-based ceramic nanomaterials. Different approaches for synthesizing rare earth-based ceramic nanomaterials are discussed, along with their advantages and disadvantages for applications in various fields. Sections cover rare earth-based ceramic nanomaterials like ceria and rare earth oxides (R2O3), rare earth vanadates, rare earth titanates, rare earth zirconates, rare earth stannates, rare earth-based tungstates, rare earth-based manganites, ferrites, cobaltites, nickelates, rare earth doped semiconductor nanomaterials, rare earth molybdates, rare earth-based nanocomposites, rare earth-based compounds for solar cells, and laser nanomaterials based on rare-earth compounds. Reviews the chemistry and processing of rare earth doped ceramic nanomaterials and their characteristics and applications Covers a broad range of materials, including ceria and rare earth oxides (R2O3), vanadates, titanates, zirconates, stannates, tungstates, manganites, ferrites, cobaltites, nickelates, rare earth doped semiconductor nanomaterials, rare earth molybdates, rare earth-based nanocomposites, rare earth-based compounds for solar cells, and laser nanomaterials based on rare-earth compounds Includes different approaches to synthesizing each family of rare earth-based ceramic nanomaterials, along with their advantages and disadvantages Provides green chemistry-based methods for the preparation of advanced rare earth-based ceramic nanomaterials

Chemically Deposited Nanocrystalline Metal Oxide Thin Films

Synthesis, Characterizations, and Applications

Springer Nature This book guides beginners in the areas of thin film preparation, characterization, and device making, while providing insight into these areas for experts. As chemically deposited metal oxides are currently gaining attention in development of devices such as solar cells, supercapacitors, batteries, sensors, etc., the book illustrates how the chemical deposition route is emerging as a relatively inexpensive, simple, and convenient solution for large area deposition. The advancement in the nanostructured materials for the development of devices is fully discussed.

Smart and Flexible Energy Devices

CRC Press The scientific community and industry have seen tremendous progress in efficient energy production and storage in the last few years. With the advancement in technology, new devices require high-performance, stretchable, bendable, and twistable energy sources, which can be integrated into next-generation wearable, compact, and portable electronics for medical, military, and civilian applications. Smart and Flexible Energy Devices examines the materials, basic working principles, and state-of-the-art progress of flexible devices, like fuel cells, solar cells, batteries, and supercapacitors. Covering the synthesis approaches for advanced energy materials in flexible devices and fabrications and fundamental design concepts of flexible energy devices, such as fuel cells, solar cells, batteries, and supercapacitors, top author teams explore how newer materials with advanced properties are used to fabricate the energy devices to meet the future demand for flexible electronics. Additional features include: Addressing the materials, technologies, and challenges of various flexible energy devices under one cover Emphasizing future demand and challenges of the field Considering all flexible energy types, like fuel cells, solar cells, batteries, and supercapacitors Suitability for undergraduate and postgraduate students of material science and energy programs This is a valuable resource for academics and industry professionals working in the field of energy materials, nanotechnology, and energy devices.

Fundamentals of Solar Cell Design

John Wiley & Sons Solar cells are semiconductor devices that convert light photons into electricity in photovoltaic energy conversion and can help to overcome the global energy crisis. Solar cells have many applications including remote area power systems, earth-orbiting satellites, wristwatches, water pumping, photodetectors and remote radiotelephones. Solar cell technology is economically feasible for commercial-scale power generation. While commercial solar cells exhibit good performance and stability, still researchers are looking at many ways to improve the performance and cost of solar cells via modulating the fundamental properties of semiconductors. Solar cell technology is the key to a clean energy future. Solar cells directly harvest energy from the sun's light radiation into electricity are in an ever-growing demand for future global energy production. Solar cell-based energy harvesting has attracted worldwide attention for their notable features, such as cheap renewable technology, scalable, lightweight, flexibility, versatility, no greenhouse gas emission, environment, and economy friendly and operational costs are quite low compared to other forms of power generation. Thus, solar cell technology is at the forefront of renewable energy technologies which are used in telecommunications, power plants, small devices to satellites. Aiming at large-scale implementation can be manipulated by various types used in solar cell design and exploration of new materials towards improving performance and reducing cost. Therefore, in-depth knowledge about solar cell design is fundamental for those who wish to apply this knowledge and understanding in industries and academics. This book provides a comprehensive overview on solar cells and explores the history to evolution and present scenarios of solar cell design, classification, properties, various semiconductor materials, thin films, wafer-scale, transparent solar cells, and so on. It also includes solar cells' characterization analytical tools, theoretical modeling, practices to enhance conversion efficiencies, applications and patents.

Current Trends and Future Developments on (Bio-) Membranes

Silica Membranes: Preparation, Modelling, Application, and Commercialization

Elsevier Current Trends and Future Developments on (Bio-) Membranes: Silica Membranes: Preparation, Modelling, Application, and Commercialization discusses one of the most promising inorganic membranes, namely silica membranes, and their different applications. In the field of membrane separation technology, silica membranes play a key role in the future of the chemical industry as one of the most promising alternatives for separations at high temperatures and aggressive media. This book details the latest research findings, along with the potential industrial applications of an area that has seen growing research activity on various type of membranes due to the necessity of gas separation and water treatment processes. Many industrial companies and academic centers will find immense interest in learning about the best strategies for carrying out these processes. Reviews available methods for the characterization, preparation, and applications of silica membranes Includes new and emerging modeling methods Discusses silica membrane applications for hydrogen production and applications in CO2 capturing, water treatment, and pervaporation

Apatites and their Synthetic Analogues

Synthesis, Structure, Properties and Applications

BoD – Books on Demand Apatite-type minerals and their synthetic analogues are of interest of many industrial branches and scientific disciplines including material sciences, chemical industry, agriculture, geology, medicine and dentistry. This book provides a basic overview of general knowledges of this topic in order to provide the comprehensive survey from a scientific and technological perspective. The book is divided into 10 chapters, which are devoted to the structure and properties of minerals from the supergroup of apatite, experimental techniques of preparation and characterization of synthetic analogues of apatite minerals, substitution in the structure of apatite as well as utilization of these materials in wide range of common and special advanced applications in industry, material sciences and research. Additionally, the phosphate rocks, their classification, geological role, mining and beneficiation of phosphate ore, production of elemental phosphorus, phosphoric acid and fertilizers are also described. Although this book is meant for chemist, material scientist and research engineers, the individual chapters contain theoretical background, historical aspects as well as examples of synthetic and analytical methods which may be also interesting for students and non-expert readers as well.

Atomic Layer Deposition for Semiconductors

Springer Science & Business Media Offering thorough coverage of atomic layer deposition (ALD), this book moves from basic chemistry of ALD and modeling of processes to examine ALD in memory, logic devices and machines. Reviews history, operating principles and ALD processes for each device.

Polymers Coatings

Technology and Applications

John Wiley & Sons The explores the cutting-edge technology of polymer coatings. It discusses fundamentals, fabrication strategies, characterization techniques, and allied applications in fields such as corrosion, food, pharmaceutical, biomedical systems and electronics. It also discusses a few new innovative self-healing, antimicrobial and superhydrophobic polymer coatings. Current industrial applications and possible potential activities are also discussed.

Polymer Coatings

A Guide to Chemistry, Characterization, and Selected Applications

John Wiley & Sons A practical guide to polymer coatings that covers all aspects from materials to applications Polymer Coatings is a practical resource that offers an overview of the fundamentals to the synthesis, characterization, deposition methods, and recent developments of polymer coatings. The text includes information about the different polymers and polymer networks in use, resins for solvent- and water-based coatings, and a variety of additives. It presents deposition methods that encompass frequently used mechanical and electrochemical approaches, in addition to the physical-chemical aspects of the coating process. The author covers the available characterization methods including spectroscopic, morphological, thermal and mechanical techniques. The comprehensive text also reviews developments in selected technology areas such as electrically conductive, anti-fouling, and self-replenishing coatings. The author includes insight into the present status of the research field, describes systems currently under investigation, and draws our attention to yet to be explored systems. This important text: • Offers a thorough overview of polymer coatings and their applications • Covers different classes of materials, deposition methods, coating processes, and ways of characterization • Contains a text that is designed to be accessible and helps to apply the acquired knowledge immediately • Includes information on selected areas of research with imminent application potential for functional coatings Written for chemists in industry, materials scientists, polymer chemists, and physical chemists, Polymer Coatings offers a text that contains the information needed to gain an understanding of the charaterization and applications of polymer coatings.

Green Electronics

BoD – Books on Demand The Green Electronics book is intended to stimulate people's thinking toward the new concepts of an environment-friendly electronics - the main challenge in the future. The book offers multiple solutions to push the classical electronic industry toward green concepts, aided by nanotechnologies, with revolutionary features that provide low power consumption in electronics, use biomaterials for integrated structures, and include environmental monitoring tools. Based on organic semiconductors/insulators without toxic precursors, green electronic technologies launched promising devices like OLED, OTFT, or nano-core-shell transistors. The Green Electronics book successfully presents the recent directions collected worldwide and leaves free space for continuing year by year with new subtopics.

Principles of Vapor Deposition of Thin Films

*Elsevier The goal of producing devices that are smaller, faster, more functional, reproducible, reliable and economical has given thin film processing a unique role in technology. Principles of Vapor Deposition of Thin Films brings in to one place a diverse amount of scientific background that is considered essential to become knowledgeable in thin film depostition techniques. Its ultimate goal as a reference is to provide the foundation upon which thin film science and technological innovation are possible. * Offers detailed derivation of important formulae. * Thoroughly covers the basic principles of materials science that are important to any thin film preparation. * Careful attention to terminologies, concepts and definitions, as well as abundance of illustrations offer clear support for the text.*

Tailored Functional Oxide Nanomaterials

From Design to Multi-Purpose Applications

John Wiley & Sons Tailored Functional Oxide Nanomaterials A comprehensive exploration of the preparation and application of metal oxide nanomaterials Tailored Functional Oxide Nanomaterials: From Design to Multi-Purpose Applications delivers a one-of-a-kind discussion of the fundamentals and key applications of metal oxide nanomaterials. The book explores everything from their preparation to the mastering of their characteristics in an interdisciplinary view. The distinguished authors address theoretical research and advanced technological utilizations, illustrating key issues for the understanding and real-world end-uses of the most important class of inorganic materials. The interplay between the design, preparation, chemico-physical characterization, and functional behaviors of metal oxide nanomaterials in a variety of fields is presented. Up-to-date work and knowledge on these materials is also described, with fulsome summaries of important applications that are relevant to researchers pursuing safety, sustainability, and energy end-uses. Readers will also find: A thorough introduction to vapor phase growth of metal oxide thin films and nanostructures Comprehensive explorations of addressing complex transition metal oxides at the nanoscale, including bottom-up syntheses of nano-objects and properties Practical discussions of nanosized oxides supported on mats of carbon nanotubes, including synthesis strategies and performances of Ti/CNT systems In-depth examinations of computational approaches to the study of oxide nanomaterials and nanoporous oxides Perfect for materials scientists, inorganic chemists, physicists, catalytic chemists, and chemical engineers, Tailored Functional Oxide Nanomaterials will also earn a place in the libraries of solid-state chemists.

Functional Oxides

John Wiley & Sons Functional oxides have a wide variety of applications in the electronic industry. The discovery of new metal oxides with interesting and useful properties continues to drive much research in chemistry, physics, and materials science. In Functional Oxides five topical areas have been selected to illustrate the importance of metal oxides in modern materials chemistry: Noncentrosymmetric Inorganic Oxide Materials Geometrically Frustrated Magnetic Materials Lithium Ion Conduction in Oxides Thermoelectric Oxides Transition Metal Oxides - Magnetoresistance and Half-Metallicity The contents highlight structural chemistry, magnetic and electronic properties, ionic conduction and other emerging areas of importance, such as thermoelectricity and spintronics. Functional Oxides covers these complex concepts in a clear and accessible manner providing an excellent introduction to this broad subject area.