Chemical Solution Deposition Of Semiconductor Films Gary Hodes

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Advanced Polymeric Materials Elsevier
Guiding engineering and technology students for over five decades, DeGarmo's Materials and Processes in Manufacturing provides a comprehensive introduction to manufacturing materials, systems, and processes. Coverage of materials focuses on properties and behavior, favoring a practical approach over complex mathematics; analytical equations and mathematical models are only presented when they strengthen comprehension and provide clarity. Material production processes are examined in the context of practical application to promote efficient understanding of basic principles, and broad coverage of manufacturing processes illustrates the mechanisms of each while exploring their respective advantages and limitations. Aiming for both accessibility and completeness, this text offers introductory students a comprehensive guide to material behavior and selection, measurement and inspection, machining, fabrication, molding, fastening, and other important processes using plastics, ceramics, composites, and ferrous and nonferrous metals and alloys. This extensive overview of the field gives students a solid foundation for advanced study in any area of engineering, manufacturing, and technology.

Chemical Solution Deposition Of Semiconductor Films Elsevier
This book will cover the most recent progress on the use of low-cost nanomaterials and development of low-cost/large scale processing techniques for greener and more efficient energy related applications, including but not limited to solar cells, energy storage, fuel cells, hydrogen generation, biofuels, etc. Leading researchers will be invited to author chapters in the field with their expertise. Each chapter will provide general introduction to a specific topic, current status of research and development, research challenges and outlook for future direction of research. This book aims to benefit a broad readership, from undergraduate/graduate students to researchers working on renewable energy.

Epitaxial Growth of Complex Metal Oxides William Andrew
The aim of this new compendium is to provide a solid understanding of the recent developments in advanced polymeric materials from macro- to nano-length scales. Composites are becoming more important because they can help to improve our quality of life, such as being put into service in flight vehicles, automobiles, boats, pipelines, buildings, roads, bridges, and dozens of other products, including medical products. The chapters cover a multitude of important advances, including explanations of the significance of the new fillers, like graphene and carbon nanotubes, in different matrix systems. Coverage of the application of these materials in biological and others fields also makes this book unique. Topics include advances on the processing, properties, recyclability, and reparability, and applications for polymer matrix composites, ceramic matrix composites, carbon matrix composites, wood-based composites, biocomposites, ecocomposites, nanocomposites, and more.

Proceedings of the Fifth International Symposium on Quantum Confinement, Nanostructures Springer Science & Business Media
Principles of Chemical Vapor Deposition provides a simple introduction to heat and mass transfer, surface and gas phase chemistry, and plasma discharge characteristics. In addition, the book includes discussions of practical films and reactors to help in the development of better processes and equipment. This book will assist workers new to chemical vapor deposition (CVD) to understand CVD reactors and processes and to comprehend and exploit the literature in the field. The book reviews several disparate fields with which many researchers may have only a passing acquaintance, such as heat and mass transfer, discharge physics, and surface chemistry, focusing on key issues relevant to CVD. The book also examines examples of realistic industrial reactors and processes with simplified analysis to demonstrate how to apply the principles to practical situations. The book does not attempt to exhaustively survey the literature or to intimidate the reader with irrelevant mathematical apparatus. This book is as simple as possible while still retaining the essential physics and chemistry. The book is generously illustrated to assist the reader in forming the mental images which are the basis of understanding.

Principles of Chemical Vapor Deposition Springer
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.

Dekker Encyclopedia of Nanoscience and Nanotechnology John Wiley & Sons

This concise reference summarizes the latest results in nano-structured thin films, the first to discuss both deposition methods and electronic applications in detail. Following an introduction to this rapidly developing field, the authors present a variety of organic and inorganic materials along with new deposition techniques, and conclude with an overview of applications and considerations for their technology deployment.

Proceedings of the IV Advanced Ceramics and Applications Conference CRC Press

Discover the materials set to revolutionize the electronics industry The search for electronic materials that can be cheaply solution-processed into films, while simultaneously providing quality device characteristics, represents a major challenge for materials scientists. Continuous semiconducting thin films with large carrier mobilities are particularly desirable for high-speed microelectronic applications, potentially providing new opportunities for the development of low-cost, large-area, flexible computing devices, displays, sensors, and solar cells. To date, the majority of solution-processing research has focused on molecular and polymeric organic films. In contrast, this book reviews recent achievements in the search for solution-processed inorganic semiconductors and other critical electronic components. These components offer the potential for better performance and more robust thermal and mechanical stability than comparable organic-based systems. Solution Processing of Inorganic Materials covers everything from the more traditional fields of sol-gel processing and chemical bath deposition to the cutting-edge use of nanomaterials in thin-film deposition. In particular, the book focuses on materials and techniques that are compatible with high-throughput, low-cost, and low-temperature deposition processes such as spin coating, dip coating, printing, and stamping. Throughout the text, illustrations and examples of applications are provided to help the reader fully appreciate the concepts and opportunities involved in this exciting field. In addition to presenting the state-of-the-art research, the book offers extensive background material. As a result, any researcher involved or interested in electronic device fabrication can turn to this book to become fully versed in the solution-processed inorganic materials that are set to revolutionize the electronics industry.

Ceramic Materials for Electronics, Third Edition Woodhead Publishing

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.

Design and Engineering of Microreactor and Smart-Scaled Flow Processes John Wiley & Sons

Zinc Oxysulfide (ZnOS) has demonstrated potential in the last decade to replace CdS as a buffer layer material since it is a wide-band-gap semiconductor with performance advantages over CdS (Eg = 2.4 eV) in the near UV-range for solar energy conversion. However, questions remain on the growth mechanisms of chemical bath deposited ZnOS. In this study, a detailed model is employed to calculate solubility diagrams that describe simple conditions for complex speciation control using only ammonium hydroxide without additional base. For these conditions, ZnOS is deposited via aqueous solution deposition on a quartz crystal microbalance in a continuous flow cell. Data is used to analyze the growth rate dependence on temperature and also to elucidate the effects of dimethylsulfoxide (DMSO) when used as a co-solvent. Activation energies (EA) of ZnOS are calculated for different flow rates and solution compositions. As a result, the measured EA relationships are affected by changes in the primary growth mechanism when DMSO is included.

Transparent Conductive Materials MDPI

Chemical Solution Deposition Of Semiconductor FilmsCRC Press

Handbook of Deposition Technologies for Films and Coatings Springer Nature

Field-coupled nanocomputing (FCN) paradigms offer fundamentally new approaches to digital information processing that do not utilize transistors or require charge transport. Information transfer and computation are achieved in FCN via local field interactions between nanoscale building blocks that are organized in patterned arrays. Several FCN paradigms are currently under active investigation, including quantum-dot cellular automata (QCA), molecular quantum cellular automata (MQCA), nanomagnetic logic (NML), and atomic quantum cellular automata (AQCA). Each of these paradigms has a number of unique features that make it attractive as a candidate for post-CMOS nanocomputing, and each faces critical challenges to realization. This State-of-the-Art-Survey provides a snapshot of the current developments and novel research directions in the area of FCN. The book is divided into five sections. The first part, Field-Coupled Nanocomputing Paradigms, provides valuable background information and perspectives on the QDCA, MQCA, NML, and AQCA paradigms and their evolution. The second section, Circuits and Architectures, addresses a wide variety of current research on FCN clocking strategies, logic synthesis, circuit design and test, logic-in-memory, hardware security, and architecture. The third section, Modeling and Simulation, considers the theoretical modeling and computer simulation of large FCN circuits, as well as the use of simulations for gleaning physical insight into elementary FCN building blocks. The fourth section, Irreversibility and Dissipation, considers the dissipative consequences of irreversible information loss in FCN circuits, their quantification, and their connection to circuit structure. The fifth section, The Road Ahead: Opportunities and Challenges, includes an edited transcript of the panel discussion that concluded the FCN 13 workshop.

Advanced Nano Deposition Methods Elsevier

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.

Electrochemistry of Metal Chalcogenides CRC Press

The author provides a unified account of the electrochemical material science of metal chalcogenide (MCh) compounds and alloys with regard to their synthesis, processing and applications. Starting with the chemical fundamentals of the chalcogens and their major compounds, the initial part of the book includes a systematic description of the MCh solids on the basis of the Periodic Table in terms of their structures and key properties. This is followed by a general discussion on the electrochemistry of chalcogen species, and the principles underlying the electrochemical formation of inorganic compounds/alloys. The core of the book offers an insight into available experimental results and inferences regarding the electrochemical preparation

and microstructural control of conventional and novel MCh structures. It also aims to survey their photoelectrochemistry, both from a material-oriented point of view and as connected to specific processes such as photocatalysis and solar energy conversion. Finally, the book illustrates the relevance of MCh materials to various applications of electrochemical interest such as (electro)catalysis in fuel cells, energy storage with intercalation electrodes, and ion sensing.

DeGarmo's Materials and Processes in Manufacturing Springer Science & Business Media

An up-to-date collection of tutorial papers on the latest advances in the deposition and growth of thin films for micro and nano technologies. The emphasis is on fundamental aspects, principles and applications of deposition techniques used for the fabrication of micro and nano devices. The deposition of thin films is described, emphasising the gas phase and surface chemistry and its effects on the growth rates and properties of films. Gas-phase phenomena, surface chemistry, growth mechanisms and the modelling of deposition processes are thoroughly described and discussed to provide a clear understanding of the growth of thin films and microstructures via thermally activated, laser induced, photon assisted, ion beam assisted, and plasma enhanced vapour deposition processes. A handbook for engineers and scientists and an introduction for students of microelectronics.

Chemical Solution Deposition of Semiconducting and Non-metallic Films The Electrochemical Society

An international group of leading scientists from the field has contributed to the 12th volume in this series, covering a range of different types of solar cells and including a critical comparison of the different techniques available for manufacturing the semiconductors needed. The result is an expert insight the central questions surrounding photovoltaic materials and systems, reflecting the latest developments in this hot and timely green topic.

Functionalized Nanomaterials Springer

The critical contribution of this dissertation is to provide a better understanding of the fundamental Chemical Bath Deposition (CBD) growth kinetic and mechanism for the well known II-VI semiconductor CdS using the newly developed continuous flow microreactor. This continuous flow microreactor provides the temporal resolution to control the homogeneous reaction of the chemical solution before it impinges on the substrate surface. This capability was used to decouple the homogeneous particle formation and deposition from the molecular level heterogeneous surface reaction to overcome the drawbacks associated with a conventional batch process. Transmission electron microscopy (TEM) analysis indicated an impinging flux without the formation of nanoparticles which could be obtained from this reactor in a short residence time. In addition, the reactor could be operated in a homogeneous particle formation regime. Size increasing CdS nanoparticles grown by homogeneous reaction were clearly observed from TEM and SEM micrographs by increasing the residence time from 1 to 280 sec using pre-heated precursor solutions. The formation of CdS nanorod and arrayed nanorod bundle structures using the CBD recipe were also observed in some areas and reported here for the first time. The growth kinetics were studied using a particle-free flux. The deposition results suggest that HS- ions formed through the thiourea hydrolysis reaction are the dominant sulfide ion source responsible for the CdS deposition rather than thioura itself that had been widely discussed in almost all of the previous literature. This finding could not be observed previously by a conventional CBD batch setup because all the reactant solutions were sequentially pulled into the reaction beaker and mixed all at once. An impinging flux without the formation of nanoparticles enables us to deposit extremely smooth and highly oriented nanocrystalline CdS semiconductor thin films at low temperature (80°C). Enhancement-mode functional thin film transistors with an effective mobility of mueff =1.46 cm2/V s, drain current on-to-off ratio of approximately 105 and turn-on voltage at 0 V were fabricated from the as-deposited films without any post annealing process. This microreactor could be adapted for the deposition of other compound semiconductor thin films such as highly transparent amorphous Indium Oxide (In2O3) thin films at low temperature (70°C) using chemical solution deposition and opens a low-cost avenue to fabricate thin film flexible electronics on polymeric substrates.

Solution Processing of Inorganic Materials John Wiley & Sons

This 3e, edited by Peter M. Martin, PNNL 2005 Inventor of the Year, is an extensive update of the many improvements in deposition technologies, mechanisms, and applications. This long-awaited revision includes updated and new chapters on atomic layer deposition, cathodic arc deposition, sculpted thin films, polymer thin films and emerging technologies. Extensive material was added throughout the book, especially in the areas concerned with plasma-assisted vapor deposition processes and metallurgical coating applications. * Explains in depth the many recent i

Chemical Solution Synthesis for Materials Design and Thin Film Device Applications CRC Press

This book is a printed edition of the Special Issue "Design and Engineering of Microreactor and Smart-Scaled Flow Processes" that was published in Processes

Field-Coupled Nanocomputing John Wiley & Sons

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

Solution Processed Metal Oxide Thin Films for Electronic Applications Elsevier Science Serials

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