

Science and Technology of Electroceramic Thin Films

Edited by


Orlando Auciello and Rainer Waser

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Science And Technology Of Electroceramic Thin Films

Howard R. Huff, H. Tsuya, U. Gösele



Science And Technology Of Electroceramic Thin Films:

Science and Technology of Electroceramic Thin Films O. Auciello, Rainer Waser, 1995-02-28 Electroceramic thin films hold out the promise of applications in entirely new generations of advanced microdevices that may revolutionise technology creating multibillion dollar markets in the process Less glamorous than the high temperature superconductors but probably just as important are electrically conductive ferroelectric piezoelectric pyroelectric electro optic and magnetic films The list of potential applications of films having these properties is virtually endless but there are still some issues to be resolved before fully functioning devices reach the market All these issues and more are discussed in Science and Technology of Electroceramic Thin Films which provides one of the best most up to date summaries of the field currently available

Science and Technology of Electroceramic Thin Films O. Auciello, Rainer Waser, 1995-03-14 The basic and applied science of electroceramic thin films constitute one of the fast interdisciplinary evolving fields of research worldwide A major driving force for the extensive research being performed in many Universities and Industrial and National Laboratories is the promise of applications of electroceramic thin films into a whole new generation of advanced microdevices that may revolutionize various technologies and create new multibillion dollar markets Properties of electroceramic thin films that are being intensively investigated include electrical conductivity ferroelectricity piezoelectricity pyroelectricity electro optic activity and magnetism Perhaps the most publicized application of electroceramics is that related to the new high temperature superconducting HTSC materials which has been extensively discussed in numerous national and international conferences including NATO ASI s and ARW s Less glamorously publicized applications but as important as those of HTSC materials are those involving the other properties mentioned above which were the subject of this ARW Investigation on ferroelectric thin films has experienced a tremendous development in recent years due to the advent of sophisticated film synthesis techniques and a substantial improvement in the understanding of the related materials science and implementation of films in various novel devices A major driving force behind the progress in this interdisciplinary field of research is the promise of the development of a new generation of non volatile memories with long endurance and fast access time that can overcome the problems encountered in the semiconductor non volatile memory of ferroelectric materials as high technology

Science and Technology of Integrated Ferroelectrics Carlos Pazde-Araujo, Ramamoorthy Ramesh, George W Taylor, 2001-01-11 The aim of this book is to present in one volume some of the most significant developments that have taken place in the field of integrated ferroelectrics during the last decade of the twentieth century The book begins with a comprehensive introduction to integrated ferroelectrics and follows with fifty three papers selected by Carlos Paz de Arauj

Frontiers of Thin Film Technology , 2000-11-07 Frontiers of Thin Film Technology Volume 28 focuses on recent developments in those technologies that are critical to the successful growth fabrication and characterization of newly emerging solid state thin film device architectures Volume 28 is a condensed sampler of the

Handbook for use by professional scientists engineers and students involved in the materials design fabrication diagnostics and measurement aspects of these important new devices

Materials Science of Thin Films Milton Ohring, 2002 This is the first book that can be considered a textbook on thin film science complete with exercises at the end of each chapter Ohring has contributed many highly regarded reference books to the AP list including Reliability and Failure of Electronic Materials and the Engineering Science of Thin Films The knowledge base is intended for science and engineering students in advanced undergraduate or first year graduate level courses on thin films and scientists and engineers who are entering or require an overview of the field Since 1992 when the book was first published the field of thin films has expanded tremendously especially with regard to technological applications The second edition will bring the book up to date with regard to these advances Most chapters have been greatly updated and several new chapters have been added

Thin Film Ferroelectric Materials and Devices R. Ramesh, 2013-11-27 The past five years have witnessed some dramatic developments in the general area of ferroelectric thin films materials and devices Ferroelectrics are not new materials by any stretch of imagination Indeed they have been known since the early part of this century and popular ferroelectric materials such as Barium Titanate have been in use since the second world war In the late sixties and seventies a considerable amount of research and development effort was made to create a solid state nonvolatile memory using ferroelectrics in a very simple matrix addressed scheme These attempts failed primarily due to problems associated with either the materials or due to device architectures The early eighties saw the advent of new materials processing approaches such as sol gel processing that enabled researchers to fabricate sub micron thin films of ferroelectric materials on a silicon substrate These pioneering developments signaled the onset of a revival in the area of ferroelectric thin films especially ferroelectric nonvolatile memories Research and development effort in ferroelectric materials and devices has now hit a feverish pitch Many university laboratories national laboratories and advanced R D laboratories of large IC manufacturers are deeply involved in the pursuit of ferroelectric device technologies Many companies worldwide are investing considerable manpower and resources into ferroelectric technologies Some have already announced products ranging from embedded memories in micro controllers low density stand alone memories microwave circuit elements and RFID identification tags There is now considerable optimism that ferroelectric devices and products will occupy a significant market share in the new millennium

Chemical Solution Deposition of Functional Oxide Thin Films Theodor Schneller, Rainer Waser, Marija Kosec, David Payne, 2014-01-24 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 1980s

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

Pulsed Laser Deposition of Thin Films Robert Eason, 2007-12-14 Edited by major contributors to the field this text summarizes current or newly emerging pulsed laser deposition application areas It spans the field of optical devices electronic materials sensors and actuators biomaterials and organic polymers Every scientist technologist and development engineer who has a need to grow and pattern to apply and use thin film materials will regard this book as a must have resource

Handbook of Thin Films Hari Singh Nalwa, 2001-11-17 This five volume handbook focuses on processing techniques characterization methods and physical properties of thin films thin layers of insulating conducting or semiconductor material The editor has composed five separate thematic volumes on thin films of metals semimetals glasses ceramics alloys organics diamonds graphites porous materials noncrystalline solids supramolecules polymers copolymers biopolymers composites blends activated carbons intermetallics chalcogenides dyes pigments nanostructured materials biomaterials inorganic polymer composites organoceramics metallocenes disordered systems liquid crystals quasicrystals and layered structures Thin films is a field of the utmost importance in today s materials science electrical engineering and applied solid state physics with both research and industrial applications in microelectronics computer manufacturing and physical devices Advanced high performance computers high definition TV digital camcorders sensitive broadband imaging systems flat panel displays robotic systems and medical electronics and diagnostics are but a few examples of miniaturized device technologies that depend the utilization of thin film materials The Handbook of Thin Films Materials is a comprehensive reference focusing on processing techniques characterization methods and physical properties of these thin film materials

Silicon Materials Science and Technology Howard R. Huff, H. Tsuya, U. Gösele, 1998 **Silicon Materials Science and Technology**, 1998 **Ceramics Science and Technology, Volume 1** Ralf Riedel, I-Wei Chen, 2015-11-18

Although ceramics have been known to mankind literally for millennia research has never ceased Apart from the classic uses as a bulk material in pottery construction and decoration the latter half of the twentieth century saw an explosive growth of application fields such as electrical and thermal insulators wear resistant bearings surface coatings lightweight armour or aerospace materials In addition to plain hard solids modern ceramics come in many new guises such as fabrics ultrathin films microstructures and hybrid composites Built on the solid foundations laid down by the 20 volume series Materials Science and Technology Ceramics Science and Technology picks out this exciting material class and illuminates it from all sides Materials scientists engineers chemists biochemists physicists and medical researchers alike will find this work a treasure

trove for a wide range of ceramics knowledge from theory and fundamentals to practical approaches and problem solutions

Comprehensive Semiconductor Science and Technology, 2011-01-28 Semiconductors are at the heart of modern living Almost everything we do be it work travel communication or entertainment all depend on some feature of semiconductor technology Comprehensive Semiconductor Science and Technology Six Volume Set captures the breadth of this important field and presents it in a single source to the large audience who study make and exploit semiconductors Previous attempts at this achievement have been abbreviated and have omitted important topics Written and Edited by a truly international team of experts this work delivers an objective yet cohesive global review of the semiconductor world The work is divided into three sections The first section is concerned with the fundamental physics of semiconductors showing how the electronic features and the lattice dynamics change drastically when systems vary from bulk to a low dimensional structure and further to a nanometer size Throughout this section there is an emphasis on the full understanding of the underlying physics The second section deals largely with the transformation of the conceptual framework of solid state physics into devices and systems which require the growth of extremely high purity nearly defect free bulk and epitaxial materials The last section is devoted to exploitation of the knowledge described in the previous sections to highlight the spectrum of devices we see all around us Provides a comprehensive global picture of the semiconductor world Each of the work s three sections presents a complete description of one aspect of the whole Written and Edited by a truly international team of experts

Multifunctional Polycrystalline Ferroelectric Materials Lorena Pardo, Jesús Ricote, 2011-02-14 This book presents selected topics on processing and properties of ferroelectric materials that are currently the focus of attention in scientific and technical research Ferro piezoelectric ceramics are key materials in devices for many applications such as automotive healthcare and non destructive testing As they are polycrystalline non centrosymmetric materials their piezoelectricity is induced by the so called poling process This is based on the principle of polarization reversal by the action of an electric field that characterizes the ferroelectric materials This book was born with the aim of increasing the awareness of the multifunctionality of ferroelectric materials among different communities such as researchers electronic engineers end users and manufacturers working on and with ferro piezoelectric ceramic materials and devices which are based on them The initiative to write this book comes from a well established group of researchers at the Laboratories of Ferroelectric Materials Materials Science Institute of Madrid ICMC CSIC This group has been working in different areas concerning thin films and bulk ceramic materials since the mid 1980s It is a partner of the Network of Excellence on Multifunctional and Integrated Piezoelectric Devices MIND of the EC in which the European Institute of Piezoelectric Materials and Devices has its origin

The Science of Hysteresis: Hysteresis in materials I. D. Mayergoyz, 2006 Volume 1 covers Mathematical models Differential equations Stochastic aspects of hysteresis Binary detection using hysteresis Models of unemployment in economics Volume 2 covers Physical models of magnetic hysteresis All aspects of magnetisation dynamics Volume 3 covers

Hysteresis phenomena in materials Over 2100 pages rich with supporting illustrations figures and equations Contains contributions from an international list of authors from a wide range of disciplines Covers all aspects of hysteresis from differential equations and binary detection to models of unemployment and magnetisation dynamics Advances in Nanotechnology Research and Application: 2012 Edition, 2012-12-26 Advances in Nanotechnology Research and Application 2012 Edition is a ScholarlyEditions eBook that delivers timely authoritative and comprehensive information about Nanotechnology The editors have built Advances in Nanotechnology Research and Application 2012 Edition on the vast information databases of ScholarlyNews You can expect the information about Nanotechnology in this eBook to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Advances in Nanotechnology Research and Application 2012 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is available at <http://www.ScholarlyEditions.com>

Ferroelectric Memories James F. Scott, 2013-06-29 Ferroelectric memories have changed in 10 short years from academic curiosities of the university research labs to commercial devices in large scale production This is the first text on ferroelectric memories that is not just an edited collection of papers by different authors Intended for applied physicists electrical engineers materials scientists and ceramists it includes ferroelectric fundamentals especially for thin films circuit diagrams and processsing chapters but emphasises device physics Breakdown mechanisms switching kinetics and leakage current mechanisms have lengthly chapters devoted to them The book will be welcomed by research scientists in industry and government laboratories and in universities It also contains 76 problems for students making it particularly useful as a textbook for fourth year undergraduate or first year graduate students **Chemical Processing of Ceramics** Burtrand Lee, Sridhar Komarneni, 2005-07-15 Many believe that the silicon information age is heading to the Age of Biology and that the next frontier in ceramics will most likely require molecular level or nanoscale control What then is the role of ceramics in the age of biology As we change from an energy rich society to an energy declining society how can ceramic materials appease the **Electroceraic-Based MEMS** Nava Setter, 2006-03-30 The book is focused on the use of functional oxide and nitride films to enlarge the application range of MEMS microelectromechanical systems including micro sensors micro actuators transducers and electronic components for microwaves and optical communications systems Applications emerging applications fabrication technology and functioning issues are presented and discussed The book covers the following topics Part A Applications and devices with electroceramic based MEMS Chemical microsensors Microactuators based on thin films Micromachined ultrasonic transducers Thick film piezoelectric and magnetostrictive devices Pyroelectric microsystems RF bulk acoustic wave resonators and filters High frequency tunable devices MEMS for optical functionality Part B Materials

fabrication technology and functionality Ceramic thick films for MEMS Piezoelectric thin films for MEMS Materials and technology in thin films for tunable high frequency devices Permittivity tunability and loss in ferroelectrics for reconfigurable high frequency electronics Microfabrication of piezoelectric MEMS Nano patterning methods for electroceramics Soft lithography emerging techniques The book is addressed to engineers scientists and researchers of various disciplines device engineers materials engineers chemists physicists and microtechnologists who are working and or interested in this fast growing and highly promising field The publication of this book follows a Special Issue on electroceramic based MEMS that was published in the Journal of Electroceramics at the beginning of 2004 The ten invited papers of that special issue were adapted by the authors into chapters of the present book and five additional chapters were added *Piezoelectric Materials and Devices* Farzad Ebrahimi, 2013-02-27 This book is a result of contributions of experts from international scientific community working in different aspects of piezoelectric materials and devices through original and innovative research studies Through its 7 chapters the reader will have access to works related to the various applications of piezoelectric materials such as piezoelectric stacks in level sensors pressure sensors actuators for functionally graded plates active and passive health monitoring systems machining processes nondestructive testing of aeronautical structures and acoustic wave velocity measurements The text is addressed not only to researchers but also to professional engineers students and other experts in a variety of disciplines both academic and industrial seeking to gain a better understanding of what has been done in the field recently and what kind of open problems are in this area

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