

FERROELECTRIC THIN FILMS: SYNTHESIS AND BASIC PROPERTIES

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FERROELECTRICITY AND RELATED PHENOMENA, VOLUME 14
SERIES OF MONOGRAPHIES ON MATERIALS SCIENCE, PART 1

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Ferroelectric Thin Films Synthesis And Basic Properties

V. Alexander Stefan



Ferroelectric Thin Films Synthesis And Basic Properties:

Ferroelectric Thin Films Carlos Paz de Araujo, James F. Scott, George W. Taylor, 1996 The impetus for the rapid development of thin film technology relative to that of bulk materials is its application to a variety of microelectronic products Many of the characteristics of thin film ferroelectric materials are utilized in the development of these products namely their nonvolatile memory and piezoelectric pyroelectric and electro optic properties It is befitting therefore that the first of a set of three complementary books with the general title Integrated Ferroelectric Devices and Technologies focuses on the synthesis of thin film ferroelectric materials and their basic properties Because it is a basic introduction to the chemistry materials science processing and physics of the materials from which integrated ferroelectrics are made newcomers to this field as well as veterans will find this book self contained and invaluable in acquiring the diverse elements requisite to success in their work in this area It is directed at electronic engineers and physicists as well as process and system engineers ceramicists and chemists involved in the research design development manufacturing and utilization of thin film ferroelectric materials

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requisite to success in their work in this area It is directed at electronic engineers and physicists as well as process and system engineers ceramicists and chemists involved in the research design development manufacturing and utilization of thin film ferroelectric materials 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 **Nanoscale Phenomena in Ferroelectric Thin Films** Seungbum Hong, 2013-11-27

This book presents the recent advances in the field of nanoscale science and engineering of ferroelectric thin films It comprises two main parts i e electrical characterization in nanoscale ferroelectric capacitor and nano domain manipulation and visualization in ferroelectric materials Well known leading experts both in relevant academia and industry over the world U S Japan Germany Switzerland Korea were invited to contribute to each chapter The first part under the title of electrical characterization in nanoscale ferroelectric capacitors starts with Chapter 1 Testing and characterization of ferroelectric thin film capacitors written by Dr I K Yoo The author provides a comprehensive review on basic concepts and terminologies of ferroelectric properties and their testing methods This chapter also covers reliability issues in FeRAMs that are crucial for commercialization of high density memory products In Chapter 2 Size effects in ferroelectric film capacitors role of the film thickness and capacitor size Dr I Stolichnov discusses the size effects both in in plane and out of plane dimensions of the ferroelectric thin film The author successfully relates the electric performance and domain dynamics with proposed models of charge injection and stress induced phase transition The author's findings present both a challenging problem and the clue to its solution of reliably predicting the switching properties for ultra thin ferroelectric capacitors In Chapter 3 Ferroelectric

thin films for memory applications nanoscale characterization by scanning force microscopy Prof A 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 **Ferroelectrics** Mickaël Lallart, 2011-08-23 Ferroelectric materials have been and still are widely used in many applications that have moved from sonar towards breakthrough technologies such as memories or optical devices This book is a part of a four volume collection covering material aspects physical effects characterization and modeling and applications and focuses on the characterization of ferroelectric materials including structural electrical and multiphysic aspects as well as innovative techniques for modeling and predicting the performance of these devices using phenomenological approaches and nonlinear methods Hence the aim of this book is to provide an up to date review of recent scientific findings and recent advances in the field of ferroelectric system characterization and modeling allowing a deep understanding of ferroelectricity **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 Araujo Orlando Auciello Ramamoorthy Ramesh and George W Taylor These fifty three papers were selected from more than one thousand papers published over the last eleven years in the proceedings of the International Symposia on Integrated Ferroelectrics ISIF These papers were chosen on the basis that they give a broad view of the advances that have been made and indicate the future direction of research and technological development Readers who wish for a more in depth treatment of the subject are encouraged to refer to volumes 1 to 27 of Integrated Ferroelectrics the main publication vehicle for papers in this field **Nanoscale Ferroelectrics and Multiferroics** Miguel Alguero, J. Marty Gregg, Liliana Mitoseriu, 2016-03-24 Dieses Buch beleuchtet die

wichtigsten Aspekte der Verarbeitung und Charakterisierung von Ferroelektrika und Multiferroika auf Nanoebene präsentiert eine umfassende Beschreibung der jeweiligen Eigenschaften und legt dabei den Schwerpunkt auf die Unterscheidung von Grenzeffekten bei extrinsischen Eigenschaften wie Rand oder Interface Effekte Eingegangen wird auch auf neuartige Nanoebene Das Fachbuch ist in drei Abschnitte unterteilt und beschreibt die Verarbeitung Nanostrukturierung Charakterisierung nanostrukturierter Materialien und Nanoeffekte Unter Rckgriff auf die Synergien zwischen Nano Ferroelektrika und Multiferroika werden Materialien behandelt die auf allen Ebenen einer Nanostrukturierung unterzogen werden von Technologien f r keramische Materialien wie ferroelektrische Nanopulver nanostrukturierte Keramiken und Dickschichten sowie magnetoelektrische Nanokomposit Materialien bis hin zu freistehenden Nanoobjekten mit spezifischen Geometrien wie Nanodrähte und Nanoröhren auf verschiedenen Entwicklungsstufen Grundlage des Buches ist die europäische Wissensplattform im Wissenschaftsbereich innerhalb der Aktion von COST Europäische Zusammenarbeit in Wissenschaft und Technik zu ein und mehrphasigen Ferroika und Multiferroika mit begrenzten Geometrien SIMUFER Ref MP0904 Die Autoren der Kapitelbeiträge wurden sorgfältig ausgewählt haben allesamt ganz wesentlich zur Wissensbasis für das jeweilige Thema beigetragen und gehen vor allem zu den renommiertesten Wissenschaftlern des Fachgebiets

Ferroelectric Random Access Memories Hiroshi Ishiwara, Masanori Okuyama, Yoshihiro Arimoto, 2004-04-16 The book consists of 5 parts 1 ferroelectric thin films 2 deposition and characterization methods 3 fabrication process and circuit design 4 advanced type memories and 5 applications and future prospects each part is further divided into several chapters Because of the wide range of topics discussed each chapter in this book was written by one of the best authors knowing the specific topic very well

Physics of Ferroelectrics Karin M. Rabe, Charles H. Ahn, Jean-Marc Triscone, 2007-07-20 During the past two decades revolutionary breakthroughs have occurred in the understanding of ferroelectric materials both from the perspective of theory and experiment First principles approaches including the Berry phase formulation of ferroelectricity now allow accurate quantitative predictions of material properties and single crystalline thin films are now available for fundamental studies of these materials In addition the need for high dielectric constant insulators and nonvolatile memories in semiconductor applications has motivated a renaissance in the investigation of these materials This book addresses the paradigmatic shifts in understanding brought about by these breakthroughs including the consideration of novel fabrication methods and nanoscale applications of these materials and new theoretical methods such as the effective Hamiltonian approach and density functional theory

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

Ferroelectrics, Vol. 2 V. Alexander

Stefan, 2002-08-16 CONTENTS Preface XI List of Contributors XIII Part I Reports Relation Between the Vacancy Charge Distribution and the ϵ_{fg} in Cubic Perovskite Type Compounds R E Alonso and A Lopez Garcia 3 Boracites A Structural Family Presenting a Variety of Ferroic Phase Transitions A G Castellanos Guzman M Czank J Reyes Gomez J Campa Molina Arun Kumar Gurvinderjit Singh V S Tiwari and V K Wadhawan 37 Ferroelectric Dram Cell Without a Storage Capacitor Jan Ping Han 73 Investigation of the Two Dimensional Polar Molecular Assembly Using Multipurpose Nonlinear Optical Microscope Norikata Kato Kentaro Saito Toshinori Serata Hiroaki Aida and Yoshiaki Uesu 81 Investigation of the Two Dimensional Polar Molecular Assembly Using Multipurpose Nonlinear Optical Microscope J K Kr ger C Fischer J Baller A le Coutre W Manglkammer P Damman B Ploss R Heppelmann 111 Hydrothermal PZT Thin Film and its Application to Actuators and Sensors Minoru K Kurosawa Takeshi Morita Takefumi Kanda Hidehiko Yasui and Toshiro Higuchi 149 Dielectric And Structural Properties And Quasi One Dimensionality of The BetaineArsenate Phosphate Mixed Crystal System S Lanceros M ndez and G Schaack A Kl perpieper 159 The Relation Between Ferroelectric And Magnetic Transitions In A Hexagonal RbCoBr₃ Kiyoko Morishita 209 Part II Brief Reports Preparation of Tungsten Bronze Structured Ferroelectric Ba₂Nb₅O₁₅ Thin Films and Their Characterizations Shizutoshi Ando and Takeyo Tsukamoto 223 New Mechanism of Molecular Ferroelectricity Thermo and Photo Induced Neutral Ionic Transformation H Cailleau E Collet M Buron Le Cointe M H Lemee Cailleau T Luty S Koshihara and P Czarnecki 231 Scanning Force Microscopy Approach Polarization Phenomena in Ferroelectrics at Nanoscale Alexei Gruverman 235 Relaxation Time Distribution Function Of Dipole Glass dradp Jong Jean Kim Yun Seock Choi and Bog Gi Kim 239 Thin Film Growth Interdiffusion and Hydrogen Induced Degradation Phenomena in Pb_{1-x}Sn_xTe and SrBi₂Ta₂O₉ Sbt Ferroelectric Capacitors A R Krauss O Auciello J Im A Dhote R Ramesh and S Aggarwal 243 A Discussion on the Crystal Structures of the Pb Based Complex Perovskites PbFe_{0.5}Nb_{0.5}O₃ and PbFe_{0.5}Ta_{0.5}O₃ Nathascia Lampis Alessandra Geddo Lehmann and Philippe Sciau 245 Field Induced Evolution of the Multidomain Microregions in Relaxor 686535 PLZT Ceramics E L Rumyantsev and V Ya Shur 249 Domain Engineering in Bulk Ferroelectrics V Ya Shur 253 Study of the Phase Diagram of the Sn₂P₂S₁₆ Crystal Family Using a Lattice Model G H F van Raaij and T Janssen 257 Ferroelectricity in Photorefractives Tat yana R Volk 259 Thin Film Effects in the Ferroelectric PbTiO₃ Kiyotaka Wasa 263 Key Word Index 269 Contents of FERROELECTRICS Vol 1 Frontier in Science and Technology Series List of Titles FSRC BOOKS of ABSTRACTS in Science and Technology Conference Series List of Titles *Springer Handbook of Materials Data* Hans Warlimont, Werner Martienssen, 2018-07-27 The second edition of this well received handbook is the most concise yet comprehensive compilation of materials data The chapters provide succinct descriptions and summarize essential and reliable data for various types of materials The information is amply illustrated with 900 tables and 1050 figures selected primarily from well established data collections such as Landolt B rstein which is now part of the SpringerMaterials database The new edition of the Springer Handbook of Materials Data starts by presenting the latest

CODATA recommended values of the fundamental physical constants and provides comprehensive tables of the physical and physicochemical properties of the elements 25 chapters collect and summarize the most frequently used data and relationships for numerous metals nonmetallic materials functional materials and selected special structures such as liquid crystals and nanostructured materials Along with careful updates to the content and the inclusion of timely and extensive references this second edition includes new chapters on polymers materials for solid catalysts and low dimensional semiconductors This handbook is an authoritative reference resource for engineers scientists and students engaged in the vast field of materials science

Molecular Beam Epitaxy Mohamed Henini, 2018-06-27 Molecular Beam Epitaxy MBE From Research to Mass Production Second Edition provides a comprehensive overview of the latest MBE research and applications in epitaxial growth along with a detailed discussion and how to on processing molecular or atomic beams that occur on the surface of a heated crystalline substrate in a vacuum The techniques addressed in the book can be deployed wherever precise thin film devices with enhanced and unique properties for computing optics or photonics are required It includes new semiconductor materials new device structures that are commercially available and many that are at the advanced research stage This second edition covers the advances made by MBE both in research and in the mass production of electronic and optoelectronic devices Enhancements include new chapters on MBE growth of 2D materials Si Ge materials AlN and GaN materials and hybrid ferromagnet and semiconductor structures Condenses the fundamental science of MBE into a modern reference speeding up literature review Discusses new materials novel applications and new device structures grounding current commercial applications with modern understanding in industry and research Includes coverage of MBE as mass production epitaxial technology and how it enhances processing efficiency and throughput for the semiconductor industry and nanostructured semiconductor materials research community

Recent Developments in Electronic Materials and Devices K. M. Nair, Amar S. Bhalla, S.-I. Hirano, 2012-03-28 With information on the subject of dielectric materials this volume brings important updates to electronic device engineers and researchers in the area of ferroelectric materials Topics include materials processes properties and electronic devices based on these materials and systems Proceedings of the symposium held at the 103rd Annual Meeting of The American Ceramic Society April 22 25 2001 in Indiana Ceramic Transactions Volume 131

Springer Handbook of Condensed Matter and Materials Data Werner Martienssen, Hans Warlimont, 2006-09-21 Springer Handbook of Condensed Matter and Materials Data provides a concise compilation of data and functional relationships from the fields of solid state physics and materials in this 1200 page volume The data encapsulated in 914 tables and 1025 illustrations have been selected and extracted primarily from the extensive high quality data collection Landolt B r nstein and also from other systematic data sources and recent publications of physical and technical property data Many chapters are authored by Landolt B r nstein editors including the prominent Springer Handbook editors W Martienssen and H Warlimont themselves The Handbook is designed to be useful as a desktop reference for fast

and easy retrieval of essential and reliable data in the lab or office References to more extensive data sources are also provided in the book and by interlinking to the relevant sources on the enclosed CD ROM Physicists chemists and engineers engaged in fields of solid state sciences and materials technologies in research development and application will appreciate the ready access to the key information coherently organized within this wide ranging Handbook From the reviews this is the most complete compilation I have ever seen When I received the book I immediately searched for data I never found elsewhere and I found them rapidly No doubt that this book will soon be in every library and on the desk of most solid state scientists and engineers It will never be at rest Physicalia Magazine

Microelectromechanical Systems National Research Council, Division on Engineering and Physical Sciences, National Materials Advisory Board, Commission on Engineering and Technical Systems, Committee on Advanced Materials and Fabrication Methods for Microelectromechanical Systems, 1997-12-01 Microelectromechanical systems MEMS is a revolutionary field that adapts for new uses a technology already optimized to accomplish a specific set of objectives The silicon based integrated circuits process is so highly refined it can produce millions of electrical elements on a single chip and define their critical dimensions to tolerances of 100 billionths of a meter The MEMS revolution harnesses the integrated circuitry know how to build working microsystems from micromechanical and microelectronic elements MEMS is a multidisciplinary field involving challenges and opportunities for electrical mechanical chemical and biomedical engineering as well as physics biology and chemistry As MEMS begin to permeate more and more industrial procedures society as a whole will be strongly affected because MEMS provide a new design technology that could rival perhaps surpass the societal impact of integrated circuits

Advances in Ferroelectrics Aimé Peláiz-Barranco, 2012-11-19 Ferroelectricity is one of the most studied phenomena in the scientific community due the importance of ferroelectric materials in a wide range of applications including high dielectric constant capacitors pyroelectric devices transducers for medical diagnostic piezoelectric sonars electrooptic light valves electromechanical transducers and ferroelectric random access memories Actually the ferroelectricity at nanoscale receives a great attention to the development of new technologies The demand for ferroelectric systems with specific applications enforced the in depth research in addition to the improvement of processing and characterization techniques This book contains twenty two chapters and offers an up to date view of recent research into ferroelectricity The chapters cover various formulations their forms bulk thin films ferroelectric liquid crystals fabrication properties theoretical topics and ferroelectricity at nanoscale

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