Ferroelectric Phenomena In Crystals Physical Foun

The expansion of the application of ferroelectric crystals in engineering as well as of a number of fundamental problems of solid-state physics, which have not yet been solved and which bear a direct relation to ferro electricity, has lately stimulated much interest in the problem of ferroelectricity. In courses

of solid-state physics ferroelectricity is studied today along with traditional disciplines, such as magnetism, superconductivity, and 'semiconducting phe nomena. Moreover, new specialities have been born concerned directly with the development and utilization of ferroelectric material~ in optics, acous tics, computer technology, and capacitor engineering. Special courses in the physics of ferroelectrics are read in a number of colleges and universities. The study of

the nature of ferro electricity has currently reached such a level of development that we may speak of having gained a rather deep insight into the physical essence of a number of phenomena, which contribute to the generation of a spontaneous electric polarization in crystals. It is exactly at this level that it has become possible to single out that part of the problem, the physical picture of which can be depicted in a rather unsophisticated manner and which is the foundation for

the construction of a building of "complete understanding".
Polarization Effects in Semiconductors: From Ab Initio Theory to Device Applications presents the latest understanding of the solid state physics, electronic implications and practical applications of the unique spontaneous or pyro-electric polarization charge of wurtzite compound semiconductors, and associated piezo-electric effects in strained thin film heterostructures. These heterostructures are used in

wide band gap semiconductor based sensors, in addition to various electronic and opto-electronic semiconductor devices. The book covers the ab initio theory of polarization in cubic and hexagonal semiconductors, growth of thin film GaN, GaN/AlGaN GaAlN/ AlGaInN, and other nitrides, and SiC heterostructures. It discusses the effects of spontaneous and piezoelectric polarization on band diagrams and electronic properties of abrupt and compositionally

graded heterostructures, electronic characterization of polarization-induced charge distributions by scanning-probe spectroscopies, and gauge factors and strain effects. In addition, polarization in extended defects, piezo-electric strain/charge engineering, and application to device design and processing are covered. The effects of polarization on the fundamental electron transport properties, and on the basic optical transitions are described. The crucial role of polarization in

devices such as high electron mobility transistors (HEMTs) and light-emitting diodes (LEDs) is covered. The chapters are authored by professors and researchers in the fields of physics, applied physics and electrical engineering, who worked for 5 years under the "Polarization Effects in Semiconductors" DOD funded Multi Disciplinary University Research Initiative. This book will be of interest to graduate students and researchers working in the field of wide-bandgap semiconductor

physics and their device applications. It will also be useful for practicing engineers in the field of wide-bandgap semiconductor device research and development. This two volume set reviews the key issues in processing and characterization of nanoscale ferroelectrics and multiferroics, and provides a comprehensive description of their properties, with an emphasis in differentiating size effects of extrinsic ones like boundary or interface effects. Recently described nanoscale novel phenomena

are also addressed. Organized into three parts it addresses key issues in processing (nanostructuring), characterization (of the nanostructured materials) and nanoscale effects. Taking full advantage of the synergies between nanoscale ferroelectrics and multiferroics, the text covers materials nanostructured at all levels, from ceramic technologies like ferroelectric nanopowders, bulk nanostructured ceramics and thick films, and

magnetoelectric nanocomposites, to thin films, either polycrystalline layer heterostructures or epitaxial systems, and to nanoscale free standing objects with specific geometries, such as nanowires and tubes at different levels of development. This set is developed from the high level European scientific knowledge platform built within the COST (European Cooperation in Science and Technology) Action on Single and multiphase ferroics and multiferroics

with restricted geometries (SIMUFER, ref. MP0904). Chapter contributors have been carefully selected, and have all made major contributions to knowledge of the respective topics, and overall, they are among most respected scientists in the field.

Offers a comprehensive treatment of surface chemistry and its applications to chemical engineering, biology, and medicine. Focuses on the chmical and physical structure of oil-water interfaces and membrane

surfaces. Details interfacial potentials, ion solvation, and electrostatic instabilities in double layers.

Graded Ferroelectrics, Transpacitors and Transponents

Evolution and Future of a Technology

Liquid Crystals Statistical and Quantum Approaches

Nanostructures in Ferroelectric Films for Energy Applications From Ab Initio Theory to Device Applications

This book by Kaplan and Vekhter brings together the molecular

world of the chemist with the condensed matter world of the physicist. Prior to the collapse of the Soviet Union, chemists in the West devoted lit to relationships between molecular electronic structure and tle attention solid-state vibronic phenomena. Treating quantum mechanical problems wherein the adiabatic Born-Oppenheimer approximation fails was done by "brute force. " With bigger and better computers available in the West, molecular orbital calculations were done on observed and conceived static structures with little concern for any cooperativity of vibrational

behavior that might connect these states. While it had long been understood in the West that situations do occur in which different static structures are found for molecules that have identical or nearly identical electronic structures, little attention had been paid to understanding the vibrational states that could connect such structures. It was easier to calculate the electronic structure observed with several possible distortions than to focus on ways to couple electronic and vibrational behavior. In the former Soviet Union, computational power was not as

acces sible as in the West. Much greater attention, therefore, was devoted to conserving computational time by considering fundamental ways to han dle the vibrational connectivity between degenerate or nearly degenerate electronic states.

Liquid Crystals - Self-Organized Soft Functional Materials for Advanced Applications is focused on both theoretical models and experimental results, pointing out the chemical and physical properties (thermodynamics, electro-optic switching behavior, and non-linear optic phenomena) of liquid

crystals used in a wide range of devices. In this respect, the chapters cover the following topics: chemical structure and phase transitions in bent-core liquid crystals, phase and structural behavior of liquid crystals used to align carbon nanotubes, molecular alignment, and photorefractive effect in the ferroelectric phase, which has the potential to be used as transistors, for image storage, and in optical signal processing. It is expected that the book will be of interest to researchers in academia and industries, as well as advanced students.

Composite Magnetoelectrics:

Materials, Structures, and Applications gives the reader a summary of the theory behind magnetoelectric phenomena, later introducing magnetoelectric materials and structures and the techniques used to fabricate and characterize them. Part two of the book looks at magnetoelectric devices. Applications include magnetic and current sensors, transducers for energy harvesting, microwave and millimeter wave devices, miniature antennas and medical imaging. The final chapter discusses progress towards magnetoelectric memory. Summarises clearly the theory

behind magnetoelectric phenomena Strong coverage of fabrication and characterisation techniques Reviews a broad range of current and potential magnetoelectric devices

This book presents the basic physics of ferroelectric and antiferroelectric liquid crystals in a simple and transparent way. It treats both the basic and the applied aspects of ferroelectric and antiferroelectric liquid crystal research, starting from the discovery of ferroelectricity in liquid crystals in 1975 and ending with the resonant X-ray experiment in ferrielectric and antiferrielectric phases in 1998.

Particular attention is paid to the optical properties, electrooptic effects, phase transitions and experimental methods used in liquid crystal research. Special chapters are devoted to dielectric spectroscopy, light scattering, NMR, STM and AFM in complex fluids. The more than 300 illustrations help to present the basic physics of liquid crystalline ferroelectrics and antiferroelectrics in a way that can be easily followed by students, engineers and scientists dealing with liquid crystal research.

Nanoscale Ferroelectrics and Multiferroics

Composite Magnetoelectrics
Functional Thin Films and Functional Materials
Key Processing and Characterization Issues, and Nanoscale Effects, 2 Volumes
New Generation of Coolers
Ferroelectricity at the Nanoscale

The book examines domain structuring due to the loss of the initial phase stability in materials of finite size. It also covers aspects such as the behaviour of domain boundaries during their interaction with lattice defects, their structure in real ferroelectrically ordered materials, the effect of the lattice potential relief on their movement, and the flexural and translational components of their dynamics in ferroelectric crystals. The

contribution of the domain boundaries to the dielectric properties of ferroelectrics and elastic properties of ferroelectric elastomers is evaluated. The book discusses the underlying physical principles of piezoelectric materials, important properties of ferroelectric/piezoelectric materials used in today's transducer technology, and the principles used in transducer design. It provides examples of a wide range of applications of such materials along with the appertaining rationales. With contributions from distinguished researchers, this is a comprehensive reference on all the pertinent aspects of piezoelectric materials.

Modern electrodynamics in different media is a wide branch of electrodynamics which combines the exact theory of electromagnetic fields in the presence of electric charges and

currents with statistical description of these fields in gases, plasmas, liquids and solids; dielectrics, conductors and superconductors. It is widely used in physics and in other natural sciences (such as astrophysics and geophysics, biophysics, ecology and evolution of terrestrial climate), and in various technological applications (radio electronics, technology of artificial materials, laser-based technological processes, propagation of bunches of charges particles, linear and nonlinear electromagnetic waves, etc.). Electrodynamics of matter is based on the exact fundamental (microscopic) electrodynamics but is supplemented with specific descriptions of electromagnetic fields in various media using the methods of statistical physics, quantum mechanics, physics of condensed matter (including theory

of superconductivity), physical kinetics and plasma physics. This book presents in one unique volume a systematic description of the main electrodynamic phenomena in matter: - A large variety of theoretical approaches used in describing various media - Numerous important manifestations of electrodynamics in matter (magnetic materials, superconductivity, magnetic hydrodynamics, holography, radiation in crystals, solitons, etc.) - A description of the applications used in different branches of physics and many other fields of natural sciences - Describes the whole complexity of electrodynamics in matter including material at different levels. - Oriented towards 3-4 year bachelors, masters, and PhD students, as well as lectures, and engineers and scientists working

in the field. - The reader will need a basic knowledge of general physics, higher mathematics, classical mechanics and microscopic (fundamental) electrodynamics at the standard university level - All examples and problems are described in detail in the text to help the reader learn how to solve problems - Advanced problems are marked with one asterisk, and the most advanced ones with two asterisks. Some problems are recommended to be solved first, and are are marked by filled dots; they are more general and important or contain results used in other problems.

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 underlying mechanisms of ferroelectric materials, including general ferroelectric effect, piezoelectricity, optical properties, and multiferroic and magnetoelectric devices. 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 systems, allowing a deep understanding of the physical aspect of ferroelectricity.

Electrocaloric Materials

Physical Effects

The Science of Hysteresis

Nanostructured Multiferroics

Adsorption Phenomena and Anchoring Energy in Nematic Liquid Crystals

Fundamentals of Piezoelectric Sensorics

This book addresses and analyzes the mechanisms responsible for functionality of two technologically relevant materials, giving emphasis on the relationship between structural transitions and electromechanical properties. The author investigates the atomic crystal structure and microstructure by means of thermal analysis, as well as diffraction and microscopy techniques. Electric field-, temperature- and frequency-dependent electromechanical properties are also described. Apart from this correlation

between structure and properties, characterization was also performed to bridge between basic research and optimization of application-oriented parameters required for technological implementation. The author proposes guidelines to the reader in order to engineer functional properties in other piezoelectric systems, as well as in other similar functional materials with the perovskite structure.

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-Börnstein, 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. This comprehensive text covers the basic physics of the solid state starting at an elementary level suitable for undergraduates but then advancing, in stages, to a graduate and advanced graduate level. In addition to treating the fundamental elastic, electrical, thermal, magnetic, structural, electronic, transport, optical, mechanical and compositional properties, we also discuss topics like superfluidity and superconductivity along with special topics such as strongly correlated systems, high-

temperature superconductors, the quantum Hall effects, and graphene. Particular emphasis is given to so-called first principles calculations utilizing modern density functional theory which for many systems now allow accurate calculations of the electronic, magnetic, and thermal properties.

This book covers the physical properties of nanosized ferroics, also called nanoferroics. Nanoferroics are an important class of ceramic materials that substitute conventional ceramic ferroics in modern electronic devices. They include ferroelectric,

ferroelastic, magnetic and multiferroic nanostructured materials. The phase transitions and properties of these nanostructured ferroics are strongly affected by the geometric confinement originating from surfaces and interfaces. As a consequence, these materials exhibit a behavior different from the corresponding bulk crystalline, ceramic and powder ferroics. This monograph offers comprehensive coverage of size- and shape-dependent effects at the nanoscale; the specific properties that these materials have been shown to exhibit; the theoretical

approaches that have been successful in describing the size-dependent effects observed experimentally; and the technological aspects of many chemical and physico-chemical nanofabrication methods relevant to making nanoferroic materials and composites. The book will be of interest to an audience of condensed matter physicists, material scientists and engineers, working on ferroic nanostructured materials, their fundamentals, fabrication and device applications.

Springer Handbook of Condensed Matter and

Materials Data
Domain Structure in Ferroelectrics and Related Materials
Piezoelectricity
New Concepts and Technologies
Nanoferroics
Domains, Grains, Interfaces and the Engineering Methods

Discovered in 1880, piezoelectric materials play a key role in an innovative market of several billions of dollars. Recent advances in applications derive from new materials and their development, as well as to new market requirements. With the exception of quartz, ferroelectric materials are used for

they offer both high efficiency and sufficient versatility to meet adequately the multidimensional requirements for application. Consequently, strong emphasis is placed on tailoring materials and technology, whether one deals with single crystals, ceramics or plastic materials. Tailoring requires a basic understanding of both physical principles and technical possibilities and limitations. This report elucidates these developments by a broad spectrum of examples, comprising ultrasound in medicine and defence industry, frequency control, signal processing by SAW-devices, sensors, actuators, including novel valves for modern

motor management. It delivers a mutual fertilization of technology push and market pull that should be of interest not only to materials scientists or engineers but also to managers who dedicate themselves to a sound future-oriented R&D policy.

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.

The unique and practical Materials Handbook (third edition) provides quick and easy access to the physical and chemical properties of very many classes of materials. Its coverage has been expanded to include whole new families of materials such as minor metals, ferroalloys, nuclear materials, food, natural oils, fats, resins, and waxes.

Many of the existing families—notably the metals, gases, liquids, minerals, rocks, soils, polymers, and fuels—are broadened and refined with new material and up-to-date information. Several of the larger tables of data are expanded and new ones added. Particular emphasis is placed on the properties of common industrial materials in each class. After a chapter introducing some general properties of materials, each of twenty-four classes of materials receives attention in its own chapter. The health and safety issues connected with the use and handling of industrial materials are included. Detailed appendices provide

additional information on subjects as diverse as crystallography, spectroscopy, thermochemical data, analytical chemistry, corrosion resistance, and economic data for industrial and hazardous materials. Specific further reading sections and a general bibliography round out this comprehensive guide. The index and tabular format of the book makes light work of extracting what the reader needs to know from the wealth of factual information within these covers. Dr. François Cardarelli has spent many years compiling and editing materials data. His professional expertise and experience combine to make this handbook an indispensable

reference tool for scientists and engineers working in numerous fields ranging from chemical to nuclear engineering. Particular emphasis is placed on the properties of common industrial materials in each class. After a chapter introducing some general properties of materials, materials are classified as follows. ferrous metals and their alloys; ferroalloys; common nonferrous metals; less common metals; minor metals; semiconductors and superconductors; magnetic materials; insulators and dielectrics; miscellaneous electrical materials; ceramics, refractories and glasses; polymers and elastomers; minerals,

ores and gemstones; rocks and meteorites; soils and fertilizers; construction materials; timbers and woods; fuels, propellants and explosives; composite materials; gases; liquids; food, oils, resin and waxes; nuclear materials. food materials

Presents the fundamental physics of piezoelectric sensors. Only book with this scope Targeted to those engineers, phycisists and chemists who are involved in materials processing, device design and manufacturing.

Ferroelectric Phenomena in Crystals

Mechanical, Dielectric, and Thermodynamical Properties of Piezoelectric Materials

Topological Structures in Ferroic Materials

The Physics of Ferroelectric and Antiferroelectric Liquid Crystals

Ferroelectric Crystals for Photonic Applications

Advances in Ferroelectrics

Despite the large quantity of phenomenological information concerning the bulk properties of nematic phase liquid crystals, little is understood about the origin of the surface energy, particularly the surface, interfacial, and anchoring properties of liquid crystals that affect the performance of liquid crystal devices.

Self-contained and unique, The four-volume treatment Modern Crystallography presents an encyclopaedic exposition of problems concerning the structure of crystals, their growth and their properties. Structure of Crystals deals with crystal structures in inorganic and organic compounds, polymers, liquid crystals, biological crystals and macromolecules.

It has been more than 80 years since Valasek first recognized the existence of a dielectric analogue to ferromagnetism,

ferroelectricity, in Rochelle salt. Much as with semiconductor research, the initial studies of ferroelectric materials focused on homogeneous materials. Unlike semiconductor research, however, which rapidly expanded into n-homogeneous structures and devices, investigations of compositionally graded and layered ferroelectrics have been relatively recent endeavors. Indeed, many of the most significant results and analysis pertaining to polarization-graded

ferroelectrics have only appeared in publication within the last ten years. Further extensions of these concepts to the general class of order-parameter graded ferroic materials, as depicted on the cover of this book, have (with one exception) been totally lacking. It was thus with a great deal of excitement that we assembled the manuscript for this book. The primary focus of this study is directed toward polarization-graded ferroelectrics and their active components,

transpacitors; however, the findings presented here are quite general. The theory of graded 2 and 5; whereas, much of the ferroics is put on a solid foundation in chapters introductory material relies more heavily upon analogy. This was done so as to provide the reader with an intuitive approach to graded ferroics, thereby enabling them to see heterogeneous ferroics as clearly logical extensions of passive semiconductor junction devices such as p-n and n-p diodes and their active

manifestations, transistors, to: transpacitors, transductors, translastics, and ultimately to the general active ferroic elements, transponents.
Proceedings of the NATO Advanced Research Workshop, Predeal, Romania, 24-27 May, 1999
The Science of Hysteresis: Mathematical modeling and applications
Modern Crystallography 2
The Physics of Solids
Cooperative Phenomena in Jahn—Teller Crystals
Self-Organized Soft

Functional Materials for Advanced Applications

Piezoelectric Materials: Advances in Science, Technology and Applications

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.

Ferroelectric materials, in addition to possessing the unique property of a reversible,

spontaneous polarization, exhibit a range of other significant and useful properties. These include high values of piezoelectric, pyroelectric, nonlinear optic, electrooptic, photorefractice and dielectric permittivity coefficients. Another fascinating property of ferroelectric materials is their photovoltaic effect. Photovoltaic effects have been extensively studied in the past in symmetric materials such as silicon. This volume is the first concentrated treatment of the characteristics, theory and potential applications of the photovoltaic effect in noncentrosymmetric materials, which include ferroelectrics and piezoelectrics. The book also deals

with the relationship between the photovoltaic and the photorefractive effects. The latter has already been well-studied and is finding many applications in optical processing and computing. This volume should prove to be an important text as well as a comprehensive reference source for basic and applied researchers working on photovoltaic, photorefractive and other photoeffects in ferroelectrics and related materials.

This book provides a state-of-the art overview of a highly interesting emerging research field in solid state physics/nanomaterials science, topological structures in ferroic

materials. Topological structures in ferroic materials have received strongly increasing attention in the last few years. Such structures include domain walls, skyrmions and vortices, which can form in ferroelectric, magnetic, ferroelastic or multiferroic materials. These topological structures can have completely different properties from the bulk material they form in. They also can be controlled by external fields (electrical, magnetic, strain) or currents, which makes them interesting from a fundamental research point of view as well as for potential novel nanomaterials applications. To provide a comprehensive overview,

international leading researches in these fields contributed review-like chapters about their own work and the work of other researchers to provide a current view of this highly interesting topic.

This book deals with the latest achievements in the field of ferroelectric domain engineering and characterization at micro- and nano-scale dimensions and periods. The book collects the results obtained in the last years by world scientific leaders in the field, thus providing a valid and unique overview of the state-of-the-art and also a view to future applications of those engineered and used materials in the field of

photonics. The second edition covers the major aspects of ferroelectric domain engineering and combines basic research and latest updated applications such as challenging results by introducing either new as well as extended chapters on Photonics Crystals based on Lithium Niobate and Lithium Tantalate crystals; generation, visualization and controlling of THz radiation; latest achievements on Optical Parametric Oscillators for application in precise spectroscopy. Further more recent advancements in characterization by probe scanning microscopy and optical methods with device and

technological orientation. A state-of-the-art report on periodically poled processes and their characterization methods are provided on different materials (LiNbO3, KTP) furnishing update research on ferroelectric crystal by extending materials research and applications.

Photovoltaic and Photo-refractive Effects in Noncentrosymmetric Materials

Piezoelectric and Acoustic Materials for Transducer Applications

Physical Foundations

Symmetry, Group Theory, and the Physical Properties of Crystals

Liquid Interfaces In Chemical, Biological And Pharmaceutical

Applications

Electromagnetic Phenomena in Matter

This book provides an up-to-date introduction to the field of functional thin films and materials, encompassing newly developed technologies and fundamental new concepts. The focus is on the critical areas of novel thin films such as sol gel synthesis of membrane, ferroelectric thin films and devices, functional nanostructured thin films, micromechanical analysis of fiber-reinforced composites, and novel

applications. An important aspect of the book lies in its wide coverage of practical applications. It introduces not only the cutting-edge technologies in modern industry, but also unique applications in many rapidly advancing fields. This book is written for a wide readership including university students and researchers from diverse backgrounds such as physics, materials science, engineering and chemistry. Both undergraduate and graduate students will find it a

valuable reference book on key topics related to solid state and materials science.

Nanostructures in Ferroelectric Films for Energy Applications: Grains, Domains, Interfaces and the Engineering Methods presents methods of engineering nanostructures in ferroelectric films to improve their performance in energy harvesting and conversion and storage. Ferroelectric films, which have broad applications, including the emerging energy technology, usually

consist of nanoscale inhomogeneities. For polycrystalline films, the size and distribution of nano-grains determines the macroscopic properties, especially the field-induced polarization response. For epitaxial films, the energy of internal long-range electric and elastic fields during their growth are minimized by formation of self-assembled nano-domains. This book is an accessible reference for both instructors in academia and R&D professionals. Provides

the necessary components for the systematic study of the structure-property relationship in ferroelectric thin film materials using case studies in energy applications Written by leading experts in the research areas of piezoelectrics, electrocalorics, ferroelectric dielectrics (especially in capacitive energy storage), ferroelectric domains, and ferroelectric-Si technology Includes a well balanced mix of theoretical design and

simulation, materials processing and integration, and dedicated characterization methods of the involved nanostructures

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-Börnstein and also from other systematic data sources and recent publications of physical and technical property data. Many chapters are authored by Landolt-Börnstein 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

Complete with reference tables and sample problems, this volume serves as a textbook or reference for solid-state physics and chemistry, materials science, and

engineering. Chapters illustrate symmetry, and its role in determining solid properties, as well as a demonstration of group theory.

Basics and Applications

The Science of Hysteresis: Hysteresis in materials Volume 1 of 3-volume set

Novel Devices Based on Relaxor Ferroelectric PMN-PT Single Crystals

Strain Mechanisms in Lead-Free Ferroelectrics for Actuators

Defects

This book explores the applications of ferroelectric materials in information

technology by developing several prototype devices based on Pb(Mg1/3Nb2/3)O3-PbTiO3 (PMN-PT) single crystals. It describes how an optothermal field-effect transistor (FET) was constructed on the PMN-26PT single crystal, using a MoS2 monolayer as the channel semiconductor material. This fusion of pyroelectric effect and the interface engineering of 2D materials provides an effective strategy for the 'photon revolution' of FET. An ultra-broadband photodetector (UV ~ THz) was monolithically integrated into a [111]-oriented PMN-28PT single crystal by

using silver nanowires in the transparent top electrode. The photodetector showed a dramatic improvement in operation frequency up to 3 kHz: an order of magnitude higher than that of traditional pyroelectric photodetectors. A self-powered integrated module was demonstrated through the combination of a triboelectric nanogenerator and a ferroelectric FET. The stored information can easily be written in the memory system using mechanical energy, solving the power consumption problem with regard to information writing in

ferroelectric nonvolatile memories. This book extends the applications of ferroelectric single crystals into areas other than piezoelectric devices, paving the way for exciting future developments.
The investigation of nanosized ferroelectric films and ferroelectric nanocrystals has attracted much attention during the past 15 – 20 years. There is interest in the fundamental and applied aspects. The theoretical basis is connected with the development of the Landau-Ginzburg-Devonshire (LGD) mean field and the first principles theories to the

*ultrathin ferroelectric films with thickness in the vicinity of critical size. Important potential applications are possible nanosize ferroelectric films in non-volatile memories, microelectronics, sensors, pyroelectric and electro-optic devices. This new area of research of ferroelectricity is still in impetuous development and far from completion. Many topics elucidated need generalization. The book contains theory and experimental data for a wide range of ferroelectric materials. The Science of Hysteresis 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
Springer Handbook of Materials Data
Including Nanoscale Fabrication and Characterization Techniques
3-volume set
Polarization Effects in Semiconductors
Materials Handbook
Ferroelectrics
Since the 1997 Kyoto protocol of reduction of greenhouse gas emissions, the development of novel refrigerators has been a priority within the scientific

community. Although magnetocaloric materials are promising candidates, they still need a large magnetic field to induce a giant ΔT as well as powerful and costly magnets. However, in electrocaloric materials (ECMs) a temperature change may be achieved by applying or removing an electric field. Since a giant electrocaloric effect on ferroelectric thin films was reported in Science in 2006, researchers have been inspired to explore such effect in different ferroelectric thin films. This book reviews electrocaloric effects observed in bulk materials as well as

recent promising advances in thin films, with special emphasis on the ferroelectric, antiferroelectric and relaxor nature of ECMs. It reports a number of considerations about the future of ECMs as a means of achieving an efficient, ecologically sustainable and low cost refrigerator.

Explore the state of the art in multiferroic materials with this cutting-edge resource Nanostructured Multiferroics delivers an overview of recent research developments in the area of nanostructured multiferroics, along with their preparation, characterization,

and applications. Covering single-phase and composite multiferroics, nanomultiferroics, and multiferroic composites, the book explains their physical properties, the underlying physical principles, and the technology and application aspects of the materials, including energy harvesting and spintronics. With multiferroics undergoing a renaissance of renewed interest and development in the past few years, and with promising new breakthroughs in areas like superconductivity, spintronics, and quantum computing, Nanostructured

Multiferroics offers both experienced scientists and young researchers inspirational and informative resources likely to spark ideas for further research. Along with chapters discussing topics such as the specific heat and magnetocaloric properties of manganite-based multiferroics for cryo-cooling applications and the multiferroic properties of barium-doped BiFeO3 particles, further topics are: * A comprehensive discussion about the physical properties of multiferroic nanocomposites * An exploration of the basic theory underpinning a variety of multiferroic interactions *

An in-depth analysis of the engineering functionality in nanomultiferroics * An introduction to nanostructured multiferroics accompanied by discussions of their synthesis, characterization, and common applications * A treatment of multiferroic materials, as well as single-phase and composite multiferroics * An examination of the use of nanostructured multiferroics in the field of spintronics Perfect for materials scientists, Nanostructured Multiferroics will also earn a place in the libraries of solid-state physicists and chemists who seek to improve their

understanding of the fundamentals of, and recent advances made in, multiferroics. The information contained within will inform anyone working in areas involving superconductivity, quantum computing, and spintronics.

Materials, Structures, and Applications

A Concise Desktop Reference

Domain Walls, Vortices and Skyrmions

Structure of Crystals