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SERIES IN CONDENSED MATTER PHYSICS

THE MAGNETOCALORIC EFFECT AND ITS APPLICATIONS

A M TISHIN
Y I SPICHKIN

IoP

BALYAN

Magnetocaloric Effect And Its Applications

University Joseph Fourier

A decorative red circular graphic with a gradient, appearing as a partial circle or a stylized 'C' shape, located to the right of the University Joseph Fourier text.

Magnetocaloric Effect And Its Applications:

The Magnetocaloric Effect and its Applications A.M. Tishin, Y.I. Spichkin, 2003-09-01 The magnetocaloric effect describes the change in temperature of a magnetic material under adiabatic conditions through the application or removal of an external magnetic field. This effect is particularly pronounced at temperatures and fields corresponding to magnetic phase transitions and it is a powerful and widely used tool for investigating the magnetic state and mechanisms of these transitions. Recently there has been significant interest in its possible exploitation in magnetic refrigeration and cryocooling systems. The Magnetocaloric Effect and its Applications presents a complete overview of theoretical and experimental research results surrounding the magnetocaloric effect and a comprehensive discussion of current and potential applications of the phenomenon. The book reviews those materials with magnetic moment both of band and localized nature and various types of magnetic ordering. It also considers materials with more exotic magnetic structures and gives a detailed discussion on experimental and theoretical studies of a great number of rare earth magnetic materials with emphasis on the physical interpretation of observed phenomena. The Magnetocaloric Effect and its Applications A.M. Tishin, Y.I.

Spichkin, 2016-04-19 The magnetocaloric effect describes the change in temperature of a magnetic material under adiabatic conditions through the application or removal of an external magnetic field. This effect is particularly pronounced at temperatures and fields corresponding to magnetic phase transitions and it is a powerful and widely used tool for investigating t. **Magnetocaloric Energy Conversion** Andrej Kitanovski, Jaka Tušek, Urban Tomc, Uroš Plaznik, Marko Ozbolt, Alojz Poredoš, 2015-01-10 This book provides the latest research on a new alternative form of technology: the magnetocaloric energy conversion. This area of research concerns magnetic refrigeration and cooling, magnetic heat pumping and magnetic power generation. The book's systematic approach offers the theoretical basis of magnetocaloric energy conversion and its various sub domains and this is supported with practical examples. Besides these fundamentals, the book also introduces potential solutions to engineering problems in magnetocalorics and to alternative technologies of solid state energy conversion. The aim of the book is therefore to provide engineers with the most up to date information and also to facilitate the understanding, design and construction of future magnetocaloric energy conversion devices. The magnetocaloric energy conversion represents an alternative to compressor based refrigerators and heat pumps. It is a serious alternative to power generation with low enthalpy heat sources. This green technology offers an opportunity to use environmentally friendly solid refrigerants and the potentially high energy efficiency follows the trends of future energy conversion devices. This book is intended for postgraduate students and researchers of refrigeration, heat pumping, power generation, alternatives, heat regenerators and advanced heat transfer mechanisms. *Field Theories in Condensed Matter Physics* Sumathi Rao, 2019-04-24 The application of field theoretic techniques to problems in condensed matter physics has generated an array of concepts and mathematical techniques to attack a range of problems such as the theory of quantum

phase transitions the quantum Hall effect and quantum wires While concepts such as the renormalization group topology and bosonization h

Handbook of Magnetic Materials Ekkes H. Brück, 2020-11-29 Handbook of Magnetic Materials Volume 29 highlights new advances in the field with this new volume presenting interesting chapters written by an international board of authors on topics such as spin orbit torque Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Handbook of Magnetic Materials series

Nanoscale Magnetic Materials and Applications J. Ping Liu, Eric Fullerton, Oliver Gutfleisch, D.J. Sellmyer, 2010-04-05 Nanoscale Magnetic Materials and Applications covers exciting new developments in the field of advanced magnetic materials Readers will find valuable reviews of the current experimental and theoretical work on novel magnetic structures nanocomposite magnets spintronic materials domain structure and domain wall motion in addition to nanoparticles and patterned magnetic recording media Cutting edge applications in the field are described by leading experts from academic and industrial communities These include new devices based on domain wall motion magnetic sensors derived from both giant and tunneling magnetoresistance thin film devices in micro electromechanical systems and nanoparticle applications in biomedicine In addition to providing an introduction to the advances in magnetic materials and applications at the nanoscale this volume also presents emerging materials and phenomena such as magnetocaloric and ferromagnetic shape memory materials which motivate future development in this exciting field Nanoscale Magnetic Materials and Applications also features a foreword written by Peter Gr nberg recipient of the 2007 Nobel Prize in Physics

Magnetic Materials and Technologies for Medical Applications Alexander Tishin, 2021-11-18 The study of electromagnetic fields in the treatment of various diseases is not a new one however we are still learning how magnetic fields impact the human body and its organs Many novel magnetic materials and technologies could potentially transform medicine Magnetic Materials and Technologies for Medical Applications explores these current and emerging technologies Beginning with foundational knowledge on the basics of magnetism this book then details the approaches and methods used in the creation of novel magnetic materials and devices This book also discusses current technologies and applications as well as the commercial aspects of introducing new technologies to the field This book serves as an excellent introduction for early career researchers or a reference to more experienced researchers who wish to stay abreast of current trends and developing technologies in the field This book could also be used by clinicians working in medicine and companies interested in establishing new medical technologies Each chapter provides novel tasks for future scientific and technology research studies Outlines the basics of magnetism for enhanced understanding of its applications in medicine Covers novel magnetic devices as well as technologies still under development including magnetic brain stimulation biosensors and nanoparticles for drug delivery Explores commercial opportunities and obstacles to market entry for new magnetic materials and technologies for the medical field

Physics of Magnetism and Magnetic Materials K.H.J Buschow, F.R. de Boer, 2007-05-08 In this book the fundamentals of magnetism

are treated starting at an introductory level The origin of magnetic moments the response to an applied magnetic field and the various interactions giving rise to different types of magnetic ordering in solids are presented and many examples are given Crystalline electric field effects are treated at a level that is sufficient to provide the basic knowledge necessary in understanding the properties of materials in which these effects play a role Itinerant electron magnetism is presented on a similar basis Particular attention has been given to magnetocrystalline magnetic anisotropy and the magnetocaloric effect Also the usual techniques for magnetic measurements are presented About half of the book is devoted to magnetic materials and the properties that make them suitable for numerous applications The state of the art is presented of permanent magnets high density recording materials soft magnetic materials Invar alloys and magnetostrictive materials Many references are given

Magnetism University Joseph Fourier,2002-10-31 This book begins with a phenomenological treatment of magnetism introducing magnetic effects at the atomic mesoscopic and macroscopic levels This is followed by a section on atomic aspects of magnetism and finally a presentation of magneto caloric magneto elastic magneto optical and magneto transport coupling effects

New Trends in Magnetism, Magnetic Materials, and Their Applications J.L.

Morán-López, José M. Sánchez,2013-11-11 During August 24 27 1993 approximately 60 scientists from the Americas Europe and Japan gathered in the city of Guanajuato in the state of Guanajuato Mexico at the II Latin American Workshop on Magnetism Magnetic Materials and their Applications The group of scientists converging into the beautiful city of Guanajuato had come from Argentina Chile Brazil Venezuela Cuba several places in Mexico U S A Japan Spain France Italy Germany Austria Switzerland and Denmark The event attested to the success of the previous Workshop on Magnetism Magnetic Materials and their Applications held in Havana Cuba in 1991 as well as to the interest level of activity and quality of the work being carried out in Latin America in the area of magnetism and magnetic materials Equally important to everyone present was the fact that we had come to honor a friend Professor L M Falicov on his sixtieth birthday The choice of a Latin American Workshop on magnetism as a Festschrift for Leo Falicov was in our opinion quite appropriate not only because of Leo s strong ties to Latin America but also because of his superb contributions to science and in particular to magnetism Professor Falicov was born in Buenos Aires Argentina where he spent a good part of his formative years

Novel

Functional Magnetic Materials Arcady Zhukov,2018-04-22 This book presents current research on advanced magnetic materials and multifunctional composites Recent advances in technology and engineering have resulted from the development of advanced magnetic materials with improved functional magnetic and magneto transport properties Certain industrial sectors such as magnetic sensors microelectronics and security demand cost effective materials with reduced dimensionality and desirable magnetic properties such as enhanced magnetic softness giant magnetic field sensitivity and large magnetocaloric effect Expert chapters present the most up to date information on the fabrication process processing tailoring of properties and applications of different families of modern functional materials for advanced smart applications

Topics covered include novel magnetic materials and applications amorphous and nanocrystalline magnetic materials and applications hard magnetic materials magnetic shape memory alloys and magnetic oxides The book's highly interdisciplinary and forward looking approach will benefit the scientific community particularly researchers and advanced graduate students working in the field of advanced magnetic materials composites and high performance sensor and microwave devices

Properties of Materials Robert E. Newnham, 2005 Crystals are sometimes called Flowers of the Mineral Kingdom In addition to their great beauty crystals and other textured materials are enormously useful in electronics optics acoustics and many other engineering applications This richly illustrated text describes the underlying principles of crystal physics and chemistry covering a wide range of topics and illustrating numerous applications in many fields of engineering using the most important materials today Tensors matrices symmetry and structure property relationships form the main subjects of the book While tensors and matrices provide the mathematical framework for understanding anisotropy on which the physical and chemical properties of crystals and textured materials often depend atomistic arguments are also needed to quantify the property coefficients in various directions The atomistic arguments are partly based on symmetry and partly on the basic physics and chemistry of materials After introducing the point groups appropriate for single crystals textured materials and ordered magnetic structures the directional properties of many different materials are described linear and nonlinear elasticity piezoelectricity and electrostriction magnetic phenomena diffusion and other transport properties and both primary and secondary ferroic behavior With crystal optics its roots in classical mineralogy having become an important component of the information age nonlinear optics is described along with the piezo optics magneto optics and analogous linear and nonlinear acoustic wave phenomena Enantiomorphism optical activity and chemical anisotropy are discussed in the final chapters of the book

Advanced Magnetic Materials Leszek Malkinski, 2012-05-24 This book reports on recent progress in emerging technologies modern characterization methods theory and applications of advanced magnetic materials It covers broad spectrum of topics technology and characterization of rapidly quenched nanowires for information technology fabrication and properties of hexagonal ferrite films for microwave communication surface reconstruction of magnetite for spintronics synthesis of multiferroic composites for novel biomedical applications optimization of electroplated inductors for microelectronic devices theory of magnetism of Fe Al alloys and two advanced analytical approaches for modeling of magnetic materials using Everett integral and the inverse problem approach This book is addressed to a diverse group of readers with general background in physics or materials science but it can also benefit specialists in the field of magnetic materials

Magnetic Properties of Fine Particles J. L. Dormann, D. Fiorani, 1992 Hardbound The aim of this volume is to advance the understanding of the fundamental properties of fine magnetic particles and to discuss the latest developments from both the theoretical and experimental viewpoints with special emphasis being placed on the applications in different branches of science and technology All aspects of fine magnetic particles are covered in the 46 papers The topics are

remarkably interdisciplinary covering theory materials preparation structural characterization optical and electrical properties magnetic properties studied by different techniques and applications Some new fundamental properties such as quantum tunneling and transverse fluctuations of magnetic moments are also explored Research workers involved in these aspects of materials technology will find this book of great interest *Molecular Magnetic Materials* Barbara Sieklucka, Dawid Pinkowicz, 2017-01-17 A comprehensive overview of this rapidly expanding interdisciplinary field of research After a short introduction to the basics of magnetism and molecular magnetism the text goes on to cover specific properties of molecular magnetic materials as well as their current and future applications Design strategies for acquiring molecular magnetic materials with desired physical properties are discussed as are such multifunctional materials as high T_c magnets chiral and luminescent magnets magnetic sponges as well as photo and piezo switching magnets The result is an excellent resource for materials scientists chemists physicists and crystal engineers either entering or already working in the field

Spin-Crossover Materials Malcolm A. Halcrow, 2013-01-07 The phenomenon of spin crossover has a large impact on the physical properties of a solid material including its colour magnetic moment and electrical resistance Some materials also show a structural phase change during the transition Several practical applications of spin crossover materials have been demonstrated including display and memory devices electrical and electroluminescent devices and MRI contrast agents Switchable liquid crystals nanoparticles and thin films of spin crossover materials have also been achieved *Spin Crossover Materials Properties and Applications* presents a comprehensive survey of recent developments in spin crossover research highlighting the multidisciplinary nature of this rapidly expanding field Following an introductory chapter which describes the spin crossover phenomenon and historical development of the field the book goes on to cover a wide range of topics including Spin crossover in mononuclear polynuclear and polymeric complexes Structure function relationships in molecular spin crossover materials Charge transfer induced spin transitions Reversible spin pairing in crystalline organic radicals Spin state switching in solution Spin crossover compounds in multifunctional switchable materials and nanotechnology Physical and theoretical methods for studying spin crossover materials *Spin Crossover Materials Properties and Applications* is a valuable resource for academic researchers working in the field of spin crossover materials and topics related to crystal engineering solid state chemistry and physics and molecular materials Postgraduate students will also find this book useful as a comprehensive introduction to the field **Single-Molecule Magnets** Malgorzata Holynska, 2019-02-11 Concise overview of synthesis and characterization of single molecule magnets Molecular magnetism is explored as an alternative to conventional solid state magnetism as the basis for ultrahigh density memory materials with extremely fast processing speeds In particular single molecule magnets SMM are in the focus of current research both because of their intrinsic magnetization properties as well as because of their potential use in molecular spintronic devices SMMs are fascinating objects on the example of which one can explain many concepts *Single Molecule Magnets Molecular Architectures and*

Building Blocks for Spintronics starts with a general introduction to single molecule magnets SMM which helps readers to understand the evolution of the field and its future The following chapters deal with the current synthetic methods leading to SMMs their magnetic properties and their characterization by methods such as high field electron paramagnetic resonance paramagnetic nuclear magnetic resonance and magnetic circular dichroism The book closes with an overview of radical bridged SMMs which have shown application potential as building blocks for high density memories Covers a hot topic single molecule magnetism is one of the fastest growing research fields in inorganic chemistry and materials science Provides researchers and newcomers to the field with a solid foundation for their further work Single Molecule Magnets Molecular Architectures and Building Blocks for Spintronics will appeal to inorganic chemists materials scientists molecular physicists and electronics engineers interested in the rapidly growing field of study

Theory Of Magnetism: Application To Surface Physics Hung-the Diep, 2013-12-24 The book is intended for graduate students and researchers who wish to master the main properties of magnetic materials in the bulk state and at the nanometric scale such as for thin films and multilayers This textbook provides the theories and methods of simulation to study and to understand these properties in an explicit manner In the first part of the book the quantum theory of magnetism is presented while the second part of the book is devoted to the application of the theory of magnetism to surface physics Numerous examples covering typical cases in ferromagnets antiferromagnets ferrimagnets helimagnets and frustrated spin systems are all illustrated Fundamental surface effects are shown and discussed Lastly the spin transport is described in which the basic formulation of the Boltzmann s equation is recalled and the recent methods of Monte Carlo simulation to deal with the spin resistivity are explained This book contains a large number of detailed solutions for the problems given in each chapter to help readers discover new related phenomena and applications as well as an appendix on elements of statistical physics included at the end to make the book self contained

Magnetocaloric Effect in Perovskite Manganites H. Gencer, V.S. Kolat, T. Izgi, N. Bayri, S. Atalay, 2020-09-15 For environmental concerns it is highly desirable to replace gas based refrigeration by magnetic refrigeration Magnetic refrigeration has significant advantages such as small volume chemical stability low cost non toxicity and not causing sound pollution Among the pertinent magnetocaloric materials perovskite manganites are of special interest because they exhibit extremely large magnetic entropy and adiabatic temperature variations a small thermal or magnetic hysteresis high chemical stability Further the Curie temperature and saturation magnetization can be tailored by changing doping element and doping concentrations The book references 289 original resources and includes their direct web link for in depth reading Keywords Magnetic Refrigeration Magnetocaloric Effect Perovskite Manganites Perovskite Structure Magnetic Entropy Magnetic Hysteresis Thermal Hysteresis Chemical Stability Curie Temperature Saturation Magnetization Lanthanides

Matter and Methods at Low Temperatures Frank Pobell, 2013-04-17 The aim of this book is to provide information about performing experiments at low temperatures as well as basic facts concerning the low temperature properties of liquid and solid matter

To orient the reader I begin with chapters on these low temperature properties The major part of the book is then devoted to refrigeration techniques and to the physics on which they are based Of equal importance of course are the definition and measurement of temperature hence low temperature thermometry is extensively discussed in subsequent chapters Finally I describe a variety of design and construction techniques which have turned out to be useful over the years The content of the book is based on the three hour per week lecture course which I have given several times at the University of Bayreuth between 1983 and 1991 It should be particularly suited for advanced students whose intended masters diploma or Ph D subject is experimental condensed matter physics at low temperatures However I believe that the book will also be of value to experienced scientists since it describes several very recent advances in experimental low temperature physics and technology for example new developments in nuclear refrigeration and thermometry

The book delves into Magnetocaloric Effect And Its Applications. Magnetocaloric Effect And Its Applications is an essential topic that needs to be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Magnetocaloric Effect And Its Applications, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:

- Chapter 1: Introduction to Magnetocaloric Effect And Its Applications
- Chapter 2: Essential Elements of Magnetocaloric Effect And Its Applications
- Chapter 3: Magnetocaloric Effect And Its Applications in Everyday Life
- Chapter 4: Magnetocaloric Effect And Its Applications in Specific Contexts
- Chapter 5: Conclusion

2. In chapter 1, the author will provide an overview of Magnetocaloric Effect And Its Applications. This chapter will explore what Magnetocaloric Effect And Its Applications is, why Magnetocaloric Effect And Its Applications is vital, and how to effectively learn about Magnetocaloric Effect And Its Applications.

3. In chapter 2, this book will delve into the foundational concepts of Magnetocaloric Effect And Its Applications. This chapter will elucidate the essential principles that must be understood to grasp Magnetocaloric Effect And Its Applications in its entirety.

4. In chapter 3, the author will examine the practical applications of Magnetocaloric Effect And Its Applications in daily life. This chapter will showcase real-world examples of how Magnetocaloric Effect And Its Applications can be effectively utilized in everyday scenarios.

5. In chapter 4, the author will scrutinize the relevance of Magnetocaloric Effect And Its Applications in specific contexts. The fourth chapter will explore how Magnetocaloric Effect And Its Applications is applied in specialized fields, such as education, business, and technology.

6. In chapter 5, the author will draw a conclusion about Magnetocaloric Effect And Its Applications. This chapter will summarize the key points that have been discussed throughout the book.

This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Magnetocaloric Effect And Its Applications.

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Magnetocaloric Effect And Its Applications Introduction

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