

COLOSSAL MAGNETORESISTIVE MANGANITES

Richard Rupp

Department of Chemistry

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Colossal Magnetoresistive Manganites

Frank Mack



Colossal Magnetoresistive Manganites:

Colossal Magnetoresistive Manganites Tapan Chatterji, 2012-12-06 The physics of transition metal oxides has become a central topic of interest to condensed matter scientists ever since high temperature superconductivity was discovered in hole doped cuprates with perovskite like structures Although the renewed interest in hole doped perovskite manganites following the discovery of their colossal magnetoresistance CMR properties began in 1993 about a decade after the discovery of high temperature superconductivity their first investigation started as early as 1950 and basic theoretical ideas were developed during 1951 1960 Experience in sample preparation and characterization and in growth of single crystals and epitaxial thin films gained during the research on high temperature superconductors and the development of theoretical tools were very efficiently used in research on CMR manganites In early nineties it appeared to many condensed matter physicists that although the problem of high temperature superconductivity is a difficult one to solve a quantitative understanding of CMR phenomena might be well within reach This book is intended to be an account of the latest developments in the physics of CMR manganites When I planned this book back in 2000 I thought that research on the physics of CMR manganites would be more or less consolidated by the time this would be published I was obviously very optimistic indeed We are now in 2003 and we still do not have a quantitative understanding of the central CMR effect Meanwhile the field has expanded It is still a very active field of research on both the experimental and theoretical fronts

Colossal Magnetoresistive Manganites Tapan Chatterji, 2004-02-29 Colossal Magnetoresistive Oxides Yoshinori Tokura, 2000-05-30 The features and mechanism of Colossal Magnetoresistance or CMR in manganese oxides as well as device physics are highlighted in this book with a focus on tunneling MR for some artificial structures Underlying new science such as tunable electron lattice interaction in a metal and roles of orbital degrees of freedom in producing an unconventional

Electronic and Magnetic Ordering Phenomena in Multiferroic and Colossal Magnetoresistive Manganites Marios Garganourakis, Johannes Friso van der Veen (Physicist, Netherlands), 2013 *Nanoscale Phase Separation and Colossal Magnetoresistance* Elbio Dagotto, 2003-01-17 The study of the spontaneous formation of nanostructures in single crystals of several compounds is now a major area of research in strongly correlated electrons These structures appear to originate in the competition of phases The book addresses nanoscale phase separation focusing on the manganese oxides known as manganites that have the colossal magnetoresistance CMR effect of potential relevance for device applications It is argued that the nanostructures are at the heart of the CMR phenomenon The book contains updated information on manganite research directed to experts both theorists and experimentalists However graduate students or postdocs will find considerable introductory material including elements of computational physics *Epitaxial Growth of Complex Metal Oxides* Gertjan Koster, Mark Huijben, Guus Rijnders, 2022-04-22 Epitaxial Growth of Complex Metal Oxides Second Edition reviews techniques and recent developments in the fabrication quality of complex metal oxides which are facilitating advances in electronic magnetic and optical

applications Sections review the key techniques involved in the epitaxial growth of complex metal oxides and explore the effects of strain and stoichiometry on crystal structure and related properties in thin film oxides Finally the book concludes by discussing selected examples of important applications of complex metal oxide thin films including optoelectronics batteries spintronics and neuromorphic applications This new edition has been fully updated with brand new chapters on topics such as atomic layer deposition interfaces STEM EELS and the epitaxial growth of multiferroics ferroelectrics and nanocomposites Examines the techniques used in epitaxial thin film growth for complex oxides including atomic layer deposition sputtering techniques molecular beam epitaxy and chemical solution deposition techniques Reviews materials design strategies and materials property analysis methods including the impacts of defects strain interfaces and stoichiometry Describes key applications of epitaxially grown metal oxides including optoelectronics batteries spintronics and neuromorphic applications

Colossal Magnetoresistive Manganites for Sensing Applications Paolo Perna, 2008 The growth of high quality epitaxial $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ thin films was controlled on various substrates including SrTiO_3 001 110 vicinal substrates and Si The design and development of applications such as uncooled bolometers and spintronic devices could then be considered In this work different deposition techniques were used sputtering pulsed laser deposition assisted or not by RHEED Reflection High Energy Electron Diffraction The samples were characterized by X ray diffraction particularly studying epitaxy and strain in the layers Further analyzes using RHEED LEED Low Energy Electron Diffraction and STM AFM Scanning Tunneling and Atomic Force Microscopies were also conducted as well as resistivity and magnetization measurements as a function of the temperature The effect of the orientation of the SrTiO_3 substrate has been demonstrated Finally three examples of spintronic devices based on dead layer vicinal surfaces or spin injection are presented

Magnetic Nanostructured Materials Ahmed A. El Gendy, Jose Manuel Barandiaran, Ravi L. Hadimani, 2018-06-29

Magnetic Nanostructured Materials From Lab to Fab presents a complete overview of the translation of nanostructured materials into realistic applications drawing on the most recent research in the field to discuss the fundamentals synthesis and characterization of nanomagnetism A wide spectrum of nanomagnetic applications is included covering industrial environmental and biomedical fields and using chemical physical and biological methods Materials such as Fe Co CoxC MnGa GdSi ferrite nanoparticles and thin films are highlighted with their potential applications discussed such as magnetic refrigeration energy harvesting magnetic sensors hyperthermia MRI drug delivery permanent magnets and data storage devices Offering interdisciplinary knowledge on the materials science of nanostructured materials and magnetism this book will be of interest to researchers in materials science engineering physics and chemistry with interest in magnetic nanomaterials as well as postgraduate students and professionals in industry and government Provides interdisciplinary knowledge on the materials science of nanostructured materials and magnetism Aids in the understanding of complex fundamentals and synthesis methods for magnetic nanomaterials Includes examples of real applications Shows how

laboratory work on magnetic nanoparticles connects to industrial implementation and applications **Theoretical**

Investigation of the Spin, Charge, and Orbital Dynamics in Colossal Magnetoresistive Manganites Frank

Mack,1999 **Spintronics Handbook, Second Edition: Spin Transport and Magnetism** Evgeny Y. Tsymbal,Igor

Žutić,2019-05-20 The second edition offers an update on the single most comprehensive survey of the two intertwined fields of spintronics and magnetism covering the diverse array of materials and structures including silicon organic semiconductors carbon nanotubes graphene and engineered nanostructures It focuses on seminal pioneering work together with the latest in cutting edge advances notably extended discussion of two dimensional materials beyond graphene topological insulators skyrmions and molecular spintronics The main sections cover physical phenomena spin dependent tunneling control of spin and magnetism in semiconductors and spin based applications *Polarons in Advanced Materials* Alexandre S.

Alexandrov,2008-01-11 This book first introduces a single polaron and describes recent achievements in analytical and numerical studies of polaron properties in different e ph models It then describes multi polaron physics as well as many key physical properties of high temperature superconductors colossal magnetoresistance oxides conducting polymers and molecular nanowires which were understood with polarons and bipolarons *Nodal Quasiparticle in Pseudogapped Colossal Magnetoresistive Manganites* ,2010 A characteristic feature of the copper oxide high temperature superconductors is the dichotomy between the electronic excitations along the nodal diagonal and antinodal parallel to the Cu O bonds directions in momentum space generally assumed to be linked to the d wave symmetry of the superconducting state Angle resolved photoemission measurements in the superconducting state have revealed a quasiparticle spectrum with a d wave gap structure that exhibits a maximum along the antinodal direction and vanishes along the nodal direction Subsequent measurements have shown that at low doping levels this gap structure persists even in the high temperature metallic state although the nodal points of the superconducting state spread out in finite Fermi arcs This is the so called pseudogap phase and it has been assumed that it is closely linked to the superconducting state either by assigning it to fluctuating superconductivity or by invoking orders which are natural competitors of d wave superconductors Here we report experimental evidence that a very similar pseudogap state with a nodal antinodal dichotomous character exists in a system that is markedly different from a superconductor the ferromagnetic metallic groundstate of the colossal magnetoresistive bilayer manganite $\text{La}_{1-x}\text{Sr}_x\text{Mn}_2\text{O}_4$ Our findings therefore cast doubt on the assumption that the pseudogap state in the copper oxides and the nodal antinodal dichotomy are hallmarks of the superconductivity state **Disorder and**

Strain-Induced Complexity in Functional Materials Tomoyuki Kakeshita,Takashi Fukuda,Avadh Saxena,Antoni

Planes,2011-10-27 This book brings together an emerging consensus on our understanding of the complex functional materials including ferroics perovskites multiferroics CMR and high temperature superconductors The common theme is the existence of many competing ground states and frustration as a collusion of spin charge orbital and lattice degrees of

freedom in the presence of disorder and both dipolar and elastic long range forces An important consequence of the complex unit cell and the competing interactions is that the emergent materials properties are very sensitive to external fields thus rendering these materials with highly desirable technologically important applications enabled by cross response

Electronic Structure of Materials Natalia Chezhina, Dmitry Korolev, 2019-04-01 This book is a short survey of magnetochemistry as a promising method for revealing the electronic structure of inorganic substances particularly solid oxide materials It is supported by five chapters that describe materials with various structures and applications showing how the method of magnetic dilution with the aid of other physical methods electron spin resonance magnetization Raman and Mossbauer spectroscopy and electrical conductivity accompanied by thorough structural and quantum mechanical studies may be used for describing the states of atoms and interatomic interactions in multicomponent oxide systems The book will serve as a guide for researchers in the field of various oxide materials since it shows the roots for selecting the best structures and qualitative and quantitative compositions of oxide materials on the basis of the knowledge about their electronic structure It is devoted to some of the most popular structures of multicomponent oxides among modern materials perovskites and pyrochlores giving a unified approach to their chemical structure

Metallic Films for Electronic, Optical and Magnetic Applications Katayun Barmak, Kevin Coffey, 2014-02-13 Metallic films play an important role in modern technologies such as integrated circuits information storage displays sensors and coatings Metallic Films for Electronic Optical and Magnetic Applications reviews the structure processing and properties of metallic films Part one explores the structure of metallic films using characterization methods such as x ray diffraction and transmission electron microscopy This part also encompasses the processing of metallic films including structure formation during deposition and post deposition reactions and phase transformations Chapters in part two focus on the properties of metallic films including mechanical electrical magnetic optical and thermal properties Metallic Films for Electronic Optical and Magnetic Applications is a technical resource for electronics components manufacturers scientists and engineers working in the semiconductor industry product developers of sensors displays and other optoelectronic devices and academics working in the field Explores the structure of metallic films using characterization methods such as x ray diffraction and transmission electron microscopy Discusses processing of metallic films including structure formation during deposition and post deposition reactions and phase transformations Focuses on the properties of metallic films including mechanical electrical magnetic optical and thermal properties

Detection and Interaction of Single Quantum States Sishen Xie, 2023-07-25 This book highlights the findings and achievements in the major research plan Detection and Interaction of Single Quantum States funded by the National Natural Science Foundation of China NSFC The 8 year plan started in 2011 and consisted of 107 projects conducted by Chinese universities and research institutes The book covers the plan s research background achievements and follow up prospects The plan aimed to tackle one of the major challenges for researchers worldwide to

establish precise detection and control of single quantum states in time space energy and momentum The plan integrated precise detection means with the ultrahigh resolution of time space and energy under extreme conditions such as ultrahigh vacuum ultralow temperature high magnetic field and ultrahigh pressure using interdisciplinary research methods in physics chemistry informatics and materials science The book focuses on the exploration of new phenomena theories and concepts of single quantum states describes new techniques and methods of single quantum states and presents the purification and construction of single quantum state systems It is a concise and valuable source of information for researchers in quantum science and graduate students interested in the research field

Neutron Scattering from Magnetic Materials

Tapan Chatterji, 2005-11-29 Neutron Scattering from Magnetic Materials is a comprehensive account of the present state of the art in the use of the neutron scattering for the study of magnetic materials The chapters have been written by well known researchers who are at the forefront of this field and have contributed directly to the development of the techniques described Neutron scattering probes magnetic phenomena directly The generalized magnetic susceptibility which can be expressed as a function of wave vector and energy contains all the information there is to know about the statics and dynamics of a magnetic system and this quantity is directly related to the neutron scattering cross section Polarized neutron scattering techniques raise the sophistication of measurements to even greater levels and gives additional information in many cases The present book is largely devoted to the application of polarized neutron scattering to the study of magnetic materials It will be of particular interest to graduate students and researchers who plan to investigate magnetic materials using neutron scattering Written by a group of scientist who have contributed directly in developing the techniques described A complete treatment of the polarized neutron scattering not available in literature Gives practical hints to solve magnetic structure and determine exchange interactions in magnetic solids Application of neutron scattering to the study of the novel electronic materials

On the Properties of Colossal Magnetoresistive Perovskite Manganites

Douglas Oliver James Green, 2011 Twinning Microstructure and Charge Ordering in the Colossal Magnetoresistive Manganite Nd₁₂Sr₁₂MnO₃, 2000 Charge ordering C O in the colossal magnetoresistive CMR manganites gives rise to an insulating high resistance state This charge ordered state can be melted into a low resistance metallic like state by the application of magnetic field Thus the potential to attain high values of magnetoresistance with the application of small magnetic fields may be aided by a better understanding of the charge ordering phenomenon This study focused on microstructural characterization in Nd₁₂Sr₁₂MnO₃ In Nd₁₂Sr₁₂MnO₃ the nominal valence of Mn is 3.5 On cooling charge can localize and lead to a charge ordering between Mn³⁺ and Mn⁴⁺ The ordering of charge results in a superlattice structure and a reduction in symmetry Thin foil specimens were prepared from bulk samples by conventional thinning and ion milling at LiqN₂ temperature methods The room temperature TEM observation of Nd₁₂Sr₁₂MnO₃ reveals that it contains a highly twinned microstructure together with a small number of stacking faults SFS A figure shows the same area of the specimen at

different zone axes obtained by tilting around two perpendicular directions as indicated Three grains A B and C are labeled for each of the zone axes The room temperature EDPs from the matrix and twins shows an approximate 90 rotation suggesting a 90 twin orientation These results are further confirmed by C O at low temperatures The twinning planes can be determined by tilting with large angles

EMMA-2000 V.G. Baryakhtar, 2001-08-08 European Magnetic Materials and Applications Proceedings of the 8th European Magnetic Materials and Applications Conference Kyiv Ukraine June 7 10 2000

Unveiling the Energy of Verbal Beauty: An Emotional Sojourn through **Colossal Magnetoresistive Manganites**

In a global inundated with monitors and the cacophony of instant interaction, the profound power and emotional resonance of verbal beauty frequently fade into obscurity, eclipsed by the continuous barrage of noise and distractions. Yet, set within the lyrical pages of **Colossal Magnetoresistive Manganites**, a interesting work of literary brilliance that impulses with natural feelings, lies an unique journey waiting to be embarked upon. Composed by way of a virtuoso wordsmith, that exciting opus instructions visitors on a psychological odyssey, softly revealing the latent potential and profound impact stuck within the elaborate internet of language. Within the heart-wrenching expanse with this evocative evaluation, we can embark upon an introspective exploration of the book is central themes, dissect their interesting publishing type, and immerse ourselves in the indelible impact it leaves upon the depths of readers souls.

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Colossal Magnetoresistive Manganites Introduction

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