B. Heinrich · J. A. C. Bland
Editors

ULTRATHIN MAGNETIC STRUCTURES IV

Applications of Nanomagnetism

Springer

Ultrathin Magnetic Structures Iv Applications Of Nanomagnetism V 4

Frank J. Owens

Ultrathin Magnetic Structures Iv Applications Of Nanomagnetism V 4:

Ultrathin Magnetic Structures IV Bretislav Heinrich,J.A.C. Bland,2005-12-07 The ability to understand and control the unique properties of interfaces has created an entirely new field of magnetism which already has a profound impact in technology and is providing the basis for a revolution in electronics The last decade has seen dramatic progress in the development of magnetic devices for information technology but also in the basic understanding of the physics of magnetic nanostructures Volume III describes thin film magnetic properties and methods for characterising thin film structure topics that underpin the present spintronics revolution in which devices are based on combined magnetic materials and semiconductors The present volume IV deals with the fundamentals of spintronics magnetoelectronic materials spin injection and detection micromagnetics and the development of magnetic random access memory based on GMR and tunnel junction devices Together these books provide readers with a comprehensive account of an exciting and rapidly developing field The treatment is designed to be accessible both to newcomers and to experts already working in this field who would like to get a better understanding of this very diversified area of research **Ultrathin Magnetic Structures III** J.A.C. Bland,Bretislav Heinrich,2004-12-13 The ability to understand and control the unique properties of interfaces has created an entirely new field of magnetism which already has a profound impact in technology and is providing the basis for a revolution in electronics The last decade has seen dramatic progress in the development of magnetic devices for information technology but also in the basic understanding of the physics of magnetic nanostructures This volume describes thin film magnetic properties and methods for characterising thin film structure topics that underpin the present spintronics revolution in which devices are based on combined magnetic materials and semiconductors Volume IV deals with the fundamentals of spintronics magnetoelectronic materials spin injection and detection micromagnetics and the development of magnetic random access memory based on GMR and tunnel junction devices Together these books provide readers with a comprehensive account of an exciting and rapidly developing field The treatment is designed to be accessible both to newcomers and to experts already working in this field who would like to get a better understanding of this very diversified area of research *Modern Magnetic and Spintronic Materials* Andreas Kaidatzis,Serhii Sidorenko,Igor Vladymyrskyi,Dimitrios Niarchos,2020-07-14 Magnetic and spintronic materials are ubiquitous in modern technological applications e g in electric motors power generators sensors and actuators not to mention information storage and processing Medical technology has also greatly benefited from magnetic materials especially magnetic nanoparticles for therapy and diagnostics methods All of the above mentioned applications rely on the properties of the materials used These properties in turn depend on intrinsic and extrinsic material parameters The former are related to the actual elements used and their properties e g atomic magnetic moment and exchange interaction between atoms the latter are related to the structural and microstructural properties of the materials used e g their crystal structure grain size and grain boundary phases Focusing on state of the art magnetic and

spintronic materials this book will introduce readers to a range of related topics in Physics and Materials Science Phenomena and processes at the nanoscale are of particular importance in this context accordingly much of the book addresses such topics **Spintronics for Next Generation Innovative Devices** Katsuaki Sato,Eiji Saitoh,2015-07-22 Spintronics short for spin electronics or spin transport electronics exploits both the intrinsic spin of the electron and its associated magnetic moment in addition to its fundamental electronic charge in solid state devices Controlling the spin of electrons within a device can produce surprising and substantial changes in its properties Drawing from many cutting edge fields including physics materials science and electronics device technology spintronics has provided the key concepts for many next generation information processing and transmitting technologies This book discusses all aspects of spintronics from basic science to applications and covers magnetic semiconductors topological insulators spin current science spin caloritronics ultrafast magnetization reversal magneto resistance effects and devices spin transistors quantum information devices This book provides a comprehensive introduction to Spintronics for researchers and students in academia and industry

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 Handbook of Spin Transport and Magnetism Evgeny Y. Tsymbal,Igor Zutic,2016-04-19 In the past several decades the research on spin transport and magnetism has led to remarkable scientific and technological breakthroughs including Albert Fert and Peter Grunberg s Nobel Prize winning discovery of giant magnetoresistance GMR in magnetic metallic multilayers Handbook of Spin Transport and Magnetism provides a comprehensive bal **Principles of Nanomagnetism** Alberto P. Guimarães,2017-07-10 The second edition of this book on nanomagnetism presents the basics and latest studies of low dimensional magnetic nano objects It highlights the intriguing properties of nanomagnetic objects such as thin films nanoparticles nanowires nanotubes nanodisks and nanorings as well as novel phenomena like spin currents It also describes how nanomagnetism was an important factor in the rapid evolution of high density magnetic recording and is developing into a decisive element of spintronics Further it presents a number of biomedical applications With exercises and solutions it serves as a graduate textbook *Spintronics-Based Neuromorphic Computing* Debanjan Bhowmik,2024-07-15 The book discusses almost all aspects of spintronics based neuromorphic computing starting from a very basic level and will be of interest to both spintronics and neuromorphic computing communities The chapters also cover most simulation and experimental studies reported recently by researchers worldwide

on this topic The book includes an introductory chapter on nanomagnetism and spin physics and another on neural network algorithms covering both the machine learning and neuroscience aspects of these algorithms These introductory chapters will help the readers build their background and truly appreciate the recent research results on spintronics based neuromorphic computing presented in the later chapters of the book Various numerical simulation exercises are also provided in the book Ultrathin Magnetic Structures Applications Of Nanomagnetism B. Heinrich (editore.),J.A.C. Bland (editore.),2005 *Comprehensive Nanoscience and Nanotechnology* ,2019-01-02 Comprehensive Nanoscience and Technology Second Edition Five Volume Set allows researchers to navigate a very diverse interdisciplinary and rapidly changing field with up to date comprehensive and authoritative coverage of every aspect of modern nanoscience and nanotechnology Presents new chapters on the latest developments in the field Covers topics not discussed to this degree of detail in other works such as biological devices and applications of nanotechnology Compiled and written by top international authorities in the field Ultrathin Magnetic Structures III J.A.C. Bland,Bretislav Heinrich,2009-09-02 The ability to understand and control the unique properties of interfaces has created an entirely new field of magnetism which already has a profound impact in technology and is providing the basis for a revolution in electronics The last decade has seen dramatic progress in the development of magnetic devices for information technology but also in the basic understanding of the physics of magnetic nanostructures This volume describes thin film magnetic properties and methods for characterising thin film structure topics that underpin the present spintronics revolution in which devices are based on combined magnetic materials and semiconductors Volume IV deals with the fundamentals of spintronics magnetoelectronic materials spin injection and detection micromagnetics and the development of magnetic random access memory based on GMR and tunnel junction devices Together these books provide readers with a comprehensive account of an exciting and rapidly developing field The treatment is designed to be accessible both to newcomers and to experts already working in this field who would like to get a better understanding of this very diversified area of research **The COxFéx Metal/native Oxide Multilayer** Geoffrey Stephen David Beach,2003 **Nanoscale Non-collinear Magnetic Structures in Co-based Epitaxial Ultrathin Films** Marco Perini,2019 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 Nanostructures in Modern Technology Bruno Azzerboni,Giovanni Asti,Luigi Pareti,Massimo Ghidini,2007-10-14 In this book a team of outstanding scientists in the field of modern magnetic nanotechnologies illustrates the state of the art in several areas of advanced magneto electronic devices magnetic micro electromechanical systems and high density information storage technologies Providing a unique source of information for the young physicist chemist or engineer the book also serves as a crucial reference for the expert scientist and the teacher of advanced university courses

Fabrication of Nanowire-based Magnetic Structures for Magnetic Resonance Applications Teresa Holly Emery,Axel Scherer,California Institute of Technology. Division of Engineering and Applied Science,2008 **Nanofabrication, Nanomagnetism and Other Applications of Nanostructures** Chang-Peng Li,2007 Nanostructured magnets have attracted great interest recently due to their new magnetic properties which are completely different from those in the bulk and their potential application in device miniaturization approaching the Tbit in2 recording density In this thesis we have fabricated sub 100 nm magnetic dots covering over 1 cm2 area by electron beam evaporation using self assembled nanopores in anodized alumina as a shadow mask Due to the large pattern coverage and high degree of uniformity in both dot size and periodicity magnetic measurements of such a dot array can be used to investigate the magnetism of a single dot of the average size For Fe dots with a thickness of 20 nm we find a transition from a single domain to a vortex state as the dot diameter is increased up to 60 nm This single domain to vortex state transition has also been studied by the first order reversal curve method which quantifies the magnetic phase fractions and distributions of vortex nucleation and annihilation fields A magnetic vortex core size of 16 3 nm which is close to or even smaller than the magnetic force microscopy MFM resolution is measured by polarized neutron reflectivity measurements and verified by micromagnetic simulations In addition to applications in magnetic memory systems and ultrasmall magnetic field sensors magnetic nanostructures can also be used as the artificial pinning centers for superconducting vortices We have observed asymmetric superconducting flux pinning effects with first matching fields above 2 kOe Most importantly we find that the properties of a magnetic vortex can be imprinted into transport properties of adjacent Al superconducting thin films with dots magnetic reversal events imprinted and magnified in the superconducting behavior Chemical sensing and biosensing in porous alumina films which exhibit more easily controlled pore sizes and higher chemical stability as compared to other porous materials is studied using optical interferometry The measured vapor capillary condensation and adsorption desorption hysteresis is in qualitative agreement with theoretical models and a variety of simulations **Physics of Magnetic Nanostructures** Frank J. Owens,2015-06-11 A comprehensive coverage of the physical properties and real world applications of magnetic nanostructures This book

discusses how the important properties of materials such as the cohesive energy and the electronic and vibrational structures are affected when materials have at least one length in the nanometer range The author uses relatively simple models of the solid state to explain why these changes in the size and dimension in the nanometer regime occur The text also reviews the physics of magnetism and experimental methods of measuring magnetic properties necessary to understanding how nanosizing affects magnetism Various kinds of magnetic structures are presented by the author in order to explain how nanosizing influences their magnetic properties The book also presents potential and actual applications of nanomaterials in the fields of medicine and computer data storage Physics of Magnetic Nanostructures Covers the magnetism in carbon and born nitride nanostructures bulk nanostructured magnetic materials nanostructured magnetic semiconductors and the fabrication of magnetic nanostructures Discusses emerging applications of nanomaterials such as targeted delivery of drugs enhancement of images in MRI ferrofluids and magnetic computer data storage Includes end of chapter exercises and five appendices Physics of Magnetic Nanostructures is written for senior undergraduate and graduate students in physics and nanotechnology material scientists chemists and physicists Characterization and Manipulation of the Magnetization of Nano-scale Magnetic Structures Wenming Ju,2019 Nano scale magnetic patterned structures and thin films have attracted attention over the past few years due to their unique magnetization distribution and promising application in nonvolatile data storage magnetic field sensors and spintronic devices Magnetization states and their switching processes are fundamental investigation subjects of such magnetic systems This dissertation discusses experimental work and theoretical analysis on investigating the magnetization of these nano scale magnetic structures and how we can characterize and manipulate the magnetization in order to realize industrial application The efforts done in this dissertation can be grouped into three topics First we focus on whether we can reverse the vortex circulation of the ferromagnetic nanodisk without breaking its symmetry so as to control and manipulate the chirality of the nanodisk The vortex state of ferromagnetic nanodisk is characterized with and without in plane magnetic field The vortex circulation switching is achieved by applying a local circular magnetic field which is created by passing current through an AFM tip that is in contact with the nanodisk The experimental results indicate the success of the reversal when a dielectric breakdown happens during the current application and the breakdown voltage is above a threshold value This implies that the concentration of the current in the center of the disk leads to a stronger magnetic field and lower switching current The analysis is supported by the results of micromagnetic simulations conducted in this work Second a magnetometer based on Magneto optical Kerr effect is constructed It is then used to record the hysteresis loop of permalloy and cobalt amorphous thin films At the same time the affect of skew angles in Magneto optical Kerr effect is also investigated so that the skew angle that leads to highest Kerr signal can be determined The setup lays a foundation which enables us to investigate the magnetic properties of various magnetic structures and develop other techniques for related study so some future work related to interlayer exchange coupling of trilayer structure and Magneto

optical Kerr imaging are proposed Last the thermal diffusivity measurement of Co Cu multilayer by laser flash technique is conducted with and without in plane magnetic field The experimental result shows that the application of magnetic field does not lead to a significant change in the thermal diffusivity of this structure This phenomenon is interesting as it is different from the behavior of the electrical conductivity of this structure when magnetic field is applied giant magnetoresistance effect Some exploratory discussion is presented in the end

Unveiling the Energy of Verbal Beauty: An Emotional Sojourn through **Ultrathin Magnetic Structures Iv Applications Of Nanomagnetism V 4**

In some sort of inundated with displays and the cacophony of quick connection, the profound power and mental resonance of verbal art frequently disappear in to obscurity, eclipsed by the constant barrage of sound and distractions. However, set within the musical pages of **Ultrathin Magnetic Structures Iv Applications Of Nanomagnetism V 4**, a interesting perform of fictional brilliance that pulses with organic thoughts, lies an unforgettable trip waiting to be embarked upon. Written with a virtuoso wordsmith, this exciting opus instructions visitors on a psychological odyssey, softly revealing the latent possible and profound affect embedded within the intricate internet of language. Within the heart-wrenching expanse of this evocative evaluation, we can embark upon an introspective exploration of the book is key subjects, dissect their fascinating publishing model, and immerse ourselves in the indelible effect it leaves upon the depths of readers souls.

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Ultrathin Magnetic Structures Iv Applications Of Nanomagnetism V 4 Introduction

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