Thermoelectric Power In Nanostructure Materials Strong Magnetic Fields

#thermoelectric power #nanostructure materials #strong magnetic fields #energy conversion nanomaterials #magnetic field effects thermoelectric

Explore the intricate relationship between thermoelectric power generation and nanostructure materials, particularly under the influence of strong magnetic fields. This area of study delves into optimizing energy conversion efficiencies by manipulating material properties at the nanoscale, offering advancements in solid-state cooling and power generation technologies for various applications.

Thermoelectric Power in Nanostructured Materials

This is the first monograph which solely investigates the thermoelectric power in nanostrcutured materials under strong magnetic field (TPSM) in quantum confined nonlinear optical, III-V, II-VI, n-GaP, n-Ge, Te, Graphite, PtSb2, zerogap, II-V, Gallium Antimonide, stressed materials, Bismuth, IV-VI, lead germanium telluride, Zinc and Cadmium diphosphides, Bi2Te3, Antimony and carbon nanotubes, III-V, II-VI, IV-VI and HgTe/CdTe superlattices with graded interfaces and effective mass superlattices under magnetic quantization, the quantum wires and dots of the aforementiond superlattices by formulating the approprate respective carrier energy spectra which in turn control the quantum processes in quantum effect devices. The TPSM in macro, quantum wire and quantum dot superlattices of optoelectronic materials in the presence of external photo-excitation have also been studied on the basis of newly formulated electron dispersion laws. This monograph contains 150 open research problems which form the very core and are useful for PhD students and researchers in the fields of materials science, solid-state sciences, computational and theoretical nanoscience and technology, nanostructured thermodynamics and condensed matter physics in general in addition to the graduate courses on modern thermoelectric materials in various academic departments of many institutes and universities.

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courses on modern thermoelectric materials in various academic departments of many institutes and universities.

Next Generation Smart Nano-Bio-Devices

This book addresses challenges for the development of a point-of-care-test platform. The book describes printed chip-based assay (Lab-on-a-Chip, Lab-on-a-PCB) for rapid, inexpensive biomarkers detection in real samples. The main challenges of point-of-care testing require implementing complex analytical methods into low-cost technologies. This is particularly true for countries with less developed healthcare infrastructure. Washing-free, Lab-on-Chip, and Lab-on-PCB techniques are very simple and innovative for point-of-care device development. The redox cycling technology detects several interesting targets at the same time on a printed chip. The proposed areas are inherently cross-disciplinary, combining expertise in biosensing, electrochemistry, electronics and electrical engineering, health care, and manufacturing. This book focuses on recent advances and different research issues in the nanobiotechnology-enabled biosensor technology and also seeks out theoretical, methodological, well-established, and validated empirical work dealing with these different topics.

Magneto Thermoelectric Power in Heavily Doped Quantized Structures

This pioneering monograph solely deals with the Magneto Thermoelectric Power (MTP) in Heavily Doped (HD) Quantized Structures. The materials considered range from HD quantum confined non-linear optical materials to HgTe/CdTe HD superlattices with graded interfaces and HD effective mass superlattices under magnetic quantization. An important concept of the measurement of the band gap in HD optoelectronic materials in the presence of external photo-excitation has been discussed in this perspective. The influences of magnetic quantization, crossed electric and quantizing fields, the intense electric field on the TPM in HD semiconductors and superlattices are also discussed. This book contains 200 open research problems which form the integral part of the text and are useful for both PhD aspirants and researchers in the various fields for which this particular series is dedicated. Contents:Part I: Magneto Thermoelectric Power (MTP) in HD Quantum Confined Non-Parabolic Semiconductors:The MTP in Quantum Wells (QWs) of Heavily Doped (HD) Non-Parabolic Semiconductors-The MTP in Nano Wires (NWs) of Heavily Doped (HD) Non-Parabolic SemiconductorsThe MTP from Quantum Box (QB) of Heavily Doped (HD) Non-Parabolic SemiconductorsThe MTP in Heavily Doped (HD) Non-Parabolic Semiconductors Under Magnetic QuantizationThe MTP in Heavily Doped (HD) Non-Parabolic Semiconductors Under Magneto-Size QuantizationPart II: The MTP in Heavily Doped (HD) Quantum Confined Superlattices:The MTP in Quantum Wire HDSLsThe MTP in Quantum Dot HDSLsThe MTP in HDSLs Under Magnetic QuantizationPart III: Few Related Applications, Conclusions and Future Research and Appendices:Few Related ApplicationsConclusion and Scope for Future ResearchAppendices:The MTP Under Photo Excitation in HD Kane-Type SemiconductorsThe MTP in Doping Superlattices of HD Non-Parabolic SemiconductorsThe MTP in QWHDSLs Under Magnetic QuantizationThe MTP in Accumulation and Inversion Layers of Non-Parabolic SemiconductorsThe MTP in HDs Under Cross-Fields ConfigurationThe MTP in Heavily Doped Ultra-Thin Films (HDUFs) Under Cross-Fields ConfigurationThe MTP in Doping Superlattices of HD Non-Parabolic Semiconductors Under Magnetic QuantizationThe MTP in Accumulation and Inversion Layers of Non-Parabolic Semiconductors Under Magnetic QuantizationThe MTP in QWHDSLsThe MTP under Intense Electric Field in HD Kane Type Semiconductors Readership: Graduate students, researchers and academics interested in advanced solid state physics and nanoelectronics. Keywords:Quantum Confined Structures;Heavily Doped;Nano-Structures;Opto-Electric Materials;Superlattices;Ternary Semiconductors;Quarternary Semiconductors;Low Dimensional Materials;Nonparabolic Semiconductors

Generation, Detection and Processing of Terahertz Signals

This book contains detailed descriptions and associated discussions regarding different generation, detection and signal processing techniques for the electrical and optical signals within the THz frequency spectrum (0.3–10 THz). It includes detailed reviews of some recently developed electronic and photonic devices for generating and detecting THz waves, potential materials for implementing THz passive circuits, some newly developed systems and methods associated with THz wireless communication, THz antennas and some cutting-edge techniques associated with the THz signal and image processing. The book especially focuses on the recent advancements and several research issues related to THz sources, detectors and THz signal and image processing techniques; it also discusses theoretical, experimental, established and validated empirical works on these topics. The

book caters to a very wide range of readers from basic science to technological experts as well as students.

Emerging Trends in Terahertz Engineering and System Technologies

This book highlights emerging trends in terahertz engineering and system technologies, mainly, devices, advanced materials, and various applications in THz technology. It includes advanced topics such as terahertz biomedical imaging, pattern recognition and tomographic reconstruction for THz biomedical imaging by use of machine learning and artificial intelligence, THz imaging radars for autonomous vehicle applications, THZ imaging system for security and surveillance. It also discusses theoretical, experimental, established and validated empirical work on these topics and the intended audience is both academic and professional.

Electron Statistics In Quantum Confined Superlattices

The concepts of the Electron Statistics (ES) and the ES dependent electronic properties are basic pillars in semiconductor electronics and this first-of-its-kind book deals with the said concepts in doping superlattices (SLs), quantum well, quantum wire and quantum dot SLs, effective mass SLs, SLs with graded interfaces and Fibonacci SLs under different physical conditions respectively. The influences of intense radiation and strong electric fields under said concepts have been considered together with the heavily doped SLs in this context on the basis of newly formulated the electron energy spectra in all the cases. We have suggested experimental determinations of the Einstein relation for the Diffusivity-Mobility ratio, the Debye screening length, Elastic Constants and the content of this book finds 25 different applications in the arena of nanoscience and nanotechnology.This book contains hundred open research problems which form the integral part of the text and are useful for both PhD aspirants and researchers. It is written for post graduate students of various departments of different academic organizations, engineers and professionals in the fields of solid state electronics, materials science, solid state sciences, nano-science, nanotechnology and nano materials in general.

Fowler-Nordheim Field Emission

This monograph solely presents the Fowler-Nordheim field emission (FNFE) from semiconductors and their nanostructures. The materials considered are quantum confined non-linear optical, III-V, II-VI, Ge, Te, carbon nanotubes, PtSb2, stressed materials, Bismuth, GaP, Gallium Antimonide, II-V, Bi2Te3, III-V, II-VI, IV-VI and HgTe/CdTe superlattices with graded interfaces and effective mass superlattices under magnetic quantization and quantum wires of the aforementioned superlattices. The FNFE in opto-electronic materials and their quantum confined counterparts is studied in the presence of light waves and intense electric fields on the basis of newly formulated electron dispersion laws that control the studies of such quantum effect devices. The importance of band gap measurements in opto-electronic materials in the presence of external fields is discussed from this perspective. This monograph contains 200 open research problems which form the very core and are useful for Ph. D students and researchers. The book can also serve as a basis for a graduate course on field emission from solids.

Photoemission from Optoelectronic Materials and their Nanostructures

In recent years, with the advent of fine line lithographical methods, molecular beam epitaxy, organometallic vapour phase epitaxy and other experimental techniques, low dimensional structures having quantum confinement in one, two and three dimensions (such as ultrathin films, inversion layers, accumulation layers, quantum well superlattices, quantum well wires, quantum wires superlattices, magneto-size quantizations, and quantum dots) have attracted much attention not only for their potential in uncovering new phenomena in nanoscience and technology, but also for their interesting applications in the areas of quantum effect devices. In ultrathin films, the restriction of the motion of the carriers in the direction normal to the film leads to the quantum size effect and such systems find extensive applications in quantum well lasers, field effect transistors, high speed digital networks and also in other quantum effect devices. In quantum well wires, the carriers are quantized in two transverse directions and only one-dimensional motion of the carriers is allowed.

New Materials for Thermoelectric Applications: Theory and Experiment

Thermoelectric devices could play an important role in making efficient use of our energy resources but their efficiency would need to be increased for their wide scale application. There is a multidisciplinary search for materials with an enhanced thermoelectric responses for use in such devices. This volume covers the latest ideas and developments in this research field, covering topics ranging from the fabrication and characterization of new materials, particularly those with strong electron correlation, use of nanostructured, layered materials and composites, through to theoretical work to gain a deeper understanding of thermoelectric behavior. It should be a useful guide and stimulus to all working in this very topical field.

Quantum Effects, Heavy Doping, And The Effective Mass

The importance of the effective mass (EM) is already well known since the inception of solid-state physics and this first-of-its-kind monograph solely deals with the quantum effects in EM of heavily doped (HD) nanostructures. The materials considered are HD quantum confined nonlinear optical, III-V, II-VI, IV-VI, GaP, Ge, PtSb2, stressed materials, GaSb, Te, II-V, Bi2Te3, lead germanium telluride, zinc and cadmium diphosphides, and quantum confined III-V, II-VI, IV-VI, and HgTe/CdTe super-lattices with graded interfaces and effective mass super-lattices. The presence of intense light waves in optoelectronics and strong electric field in nano-devices change the band structure of semiconductors in fundamental ways, which have also been incorporated in the study of EM in HD quantized structures of optoelectronic compounds that control the studies of the HD quantum effect devices under strong fields. The importance of measurement of band gap in optoelectronic materials under intense external fields has also been discussed in this context. The influences of magnetic quantization, crossed electric and quantizing fields, electric field and light waves on the EM in HD semiconductors and super-lattices are discussed. The content of this book finds twenty-eight different applications in the arena of nano-science and nano-technology. This book contains 200 open research problems which form the integral part of the text and are useful for both PhD aspirants and researchers in the fields of condensed matter physics, materials science, solid state sciences, nano-science and technology and allied fields in addition to the graduate courses in semiconductor nanostructures. The book is written for post-graduate students, researchers, engineers and professionals in the fields of condensed matter physics, solid state sciences, materials science, nanoscience and technology and nanostructured materials in general.

Effective Electron Mass in Low-Dimensional Semiconductors

This book deals with the Effective Electron Mass (EEM) in low dimensional semiconductors. The materials considered are quantum confined non-linear optical, III-V, II-VI, GaP, Ge, PtSb2, zero-gap, stressed, Bismuth, carbon nanotubes, GaSb, IV-VI, Te, II-V, Bi2Te3, Sb, III-V, II-VI, IV-VI semiconductors and quantized III-V, II-VI, IV-VI and HgTe/CdTe superlattices with graded interfaces and effective mass superlattices. The presence of intense electric field and the light waves change the band structure of optoelectronic semiconductors in fundamental ways, which have also been incorporated in the study of the EEM in quantized structures of optoelectronic compounds that control the studies of the quantum effect devices under strong fields. The importance of measurement of band gap in optoelectronic materials under strong electric field and external photo excitation has also been discussed in this context. The influence of crossed electric and quantizing magnetic fields on the EEM and the EEM in heavily doped semiconductors and their nanostructures is discussed. This book contains 200 open research problems which form the integral part of the text and are useful for both Ph. D aspirants and researchers in the fields of solid-state sciences, materials science, nanoscience and technology and allied fields in addition to the graduate courses in modern semiconductor nanostructures. The book is written for post graduate students, researchers and engineers, professionals in the fields of solid state sciences, materials science, nanoscience and technology, nanostructured materials and condensed matter physics.

Magnetic Nanomaterials

Details the frontier of magnetic nanotechnology from the persepctive of scientists, engineers and physicians that have shaped this unique and highly collaborative field of research.

Magnetic Nanoparticles

This interdisciplinary approach to the topic brings together reviews of the physics, chemistry, fabrication and application of magnetic nanoparticles and nanostructures within a single cover. With its discussion

of the basics as well as the most recent developments, and featuring many examples of practical applications, the result is both a clear and concise introduction to the topic for beginners and a guide to relevant comprehensive physical phenomena and essential technological applications for experienced researchers.

Thermoelectric Power of Metals

Thermoelectric and related transport properties of metals have been a source of information and, also, exasperation to physicists for over a century. Perhaps the principal reasons for interest in these phenomena are their sensitivity to composition, structure and external fields and, until fairly recently, the distressing fact that often even gross experimental features such as the sign of the thermopower eluded theoretical understanding. During the past two decades many of the previously perplexing aspects of thermoelectricity have yielded to more sophisticated theoretical treat ment. As a result of this effort and concomitant experimental work using advanced measurement techniques, there is now good reason to believe that thermoelectric phenomena can shed much light on the interactions between electrons and phonons, impurities, and other defects. The last few years have witnessed new and fascinating developments that promise to stimulate new activity in this field. In contrast to the more conventional transport properties, second-and high-order contributions in electron scattering theory appear to play a profound role in thermoelectricity-the controversy surrounding ordinary and "phony" phonon drag is far from resolved; the startlingly large effect of magnetic fields on the thermopower of metals appears to be linked intimately to scattering anisotropy; quantum oscillations of thermopower are orders of magnitude larger than corresponding oscillations of the magnetoresistance; a new approach to thermoelectric studies allows extension of thermopower measurements into the millikelvin region of temperature; finally, the advent of superconducting detection devices permits the precise measurement of extremely small voltages, an essential requirement in this field.

Handbook of Advanced Magnetic Materials

In December 2002, the world's first commercial magnetic levitation super-train went into operation in Shanghai. The train is held just above the rails by magnetic levitation (maglev) and can travel at a speed of 400 km/hr, completing the 30km journey from the city to the airport in minutes. Now consumers are enjoying 50 GB hard drives compared to 0.5 GB hard drives ten years ago. Achievements in magnetic materials research have made dreams of a few decades ago reality. The objective of the four volume reference, Handbook of Advanced Magnetic Materials, is to provide a comprehensive review of recent progress in magnetic materials research. Each chapter will have an introduction to give a clear definition of basic and important concepts of the topic. The details of the topic are then elucidated theoretically and experimentally. New ideas for further advancement are then discussed. Sufficient references are also included for those who wish to read the original work. In the last decade, one of the most significant thrust areas of materials research has been nanostructured magnetic materials. There are several critical sizes that control the behavior of a magnetic material, and size effects become especially critical when dimensions approach a few nanometers, where quantum phenomena appear. The first volume of the book, Nanostructured Advanced Magnetic Materials, has therefore been devoted to the recent development of nanostructured magnetic materials, emphasizing size effects. Our understanding of magnetism has advanced with the establishment of the theory of atomic magnetic moments and itinerant magnetism. Simulation is a powerful tool for exploration and explanation of properties of various magnetic materials. Simulation also provides insight for further development of new materials. Naturally, before any simulation can be started, a model must be constructed. This requires that the material be well characterized. Therefore the second volume, Characterization and Simulation provides a comprehensive review of both experimental methods and simulation techniques for the characterization of magnetic materials. After an introduction, each section gives a detailed description of the method and the following sections provide examples and results of the method. Finally further development of the method will be discussed. The success of each type of magnetic material depends on its properties and cost which are directly related to its fabrication process. Processing of a material can be critical for development of artificial materials such as multilayer films, clusters, etc. Moreover, cost-effective processing usually determines whether a material can be commercialized. In recent years processing of materials has continuously evolved from improvement of traditional methods to more sophisticated and novel methods. The objective of the third volume, Processing of Advanced Magnetic Materials, is to provide a comprehensive review of recent developments in processing of advanced magnetic materials. Each chapter will have an introduction and a section to provide a detailed description of the processing method. The following sections give

detailed descriptions of the processing, properties and applications of the relevant materials. Finally the potential and limitation of the processing method will be discussed. The properties of a magnetic material can be characterized by intrinsic properties such as anisotropy, saturation magnetization and extrinsic properties such as coercivity. The properties of a magnetic material can be affected by its chemical composition and processing route. With the continuous search for new materials and invention of new processing routes, magnetic properties of materials cover a wide spectrum of soft magnetic materials, hard magnetic materials, recording materials, sensor materials and others. The objective of the fourth volume, Properties and Applications of Advanced Magnetic Materials, is to provide a comprehensive review of recent development of various magnetic materials and their applications. Each chapter will have an introduction of the materials and the principles of their applications. The following sections give a detailed description of the processing, properties and applications. Finally the potential and limitation of the materials will be discussed.

Elastic Constants In Heavily Doped Low Dimensional Materials

The elastic constant (EC) is a very important mechanical property of the these materials and its significance is already well known in literature. This first monograph solely deals with the quantum effects in EC of heavily doped (HD) low dimensional materials. The materials considered are HD quantum confined nonlinear optical, III-V, II-VI, IV-VI, GaP, Ge, PtSb,, stressed materials, GaSb, Te, II-V, Bi,Tef, lead germanium telluride, zinc and cadmium diphosphides, and quantum confined III-V, II-VI, IV-VI, and HgTe/CdTe super-lattices with graded interfaces and effective mass super-lattices. The presence of intense light waves in optoelectronics and strong electric field in nano-devices changes the band structure of semiconductors in fundamental ways, which have also been incorporated in the study of EC in HD low dimensional optoelectronic compounds that control the studies of the HD quantum effect devices under strong fields. The importance of measurement of band gap in optoelectronic materials under intense external fields has also been discussed in this context. The influences of magnetic quantization, crossed electric and quantizing fields, electric field and light waves on the EC in HD semiconductors and super-lattices are discussed.The content of this book finds twenty-five different applications in the arena of nano-science and nano-technology. We The authors have discussed the experimental methods of determining the Einstein Relation, screening length and EC in this context. This book contains circa 200 open research problems which form the integral part of the text and are useful for both PhD aspirants and researchers in the fields of condensed matter physics, materials science, solid state sciences, nano-science and technology and allied fields in addition to the graduate courses in semiconductor nanostructures.

Advances in Terahertz Technology and Its Applications

This book highlights the growing applications of THz technology and various modules used for their successful realization. The enormous advantages of THz devices like higher resolution, spatial directivity, high-speed communication, greater bandwidth, non-ionizing signal nature and compactness make them useful in various applications like communication, sensing, security, safety, spectroscopy, manufacturing, bio-medical, agriculture, imaging, etc. Since the THz radiation covers frequencies from 0.1THz to around 10THz and highly attenuated by atmospheric gases, they are used in short-distance applications only. The book focuses on recent advances and different research issues in terahertz technology and presents theoretical, methodological, well-established and validated empirical works dealing with the different topics.

Applications of High-Tc Superconductivity

This book is a collection of the chapters intended to study only practical applications of HTS materials. You will find here a great number of research on actual applications of HTS as well as possible future applications of HTS. Depending on the strength of the applied magnetic field, applications of HTS may be divided in two groups: large scale applications (large magnetic fields) and small scale applications (small magnetic fields). 12 chapters in the book are fascinating studies about large scale applications as well as small scale applications of HTS. Some chapters are presenting interesting research on the synthesis of special materials that may be useful in practical applications of HTS. There are also research about properties of high-Tc superconductors and experimental research about HTS materials with potential applications. The future of practical applications of HTS materials is very exciting. I hope that this book will be useful in the research of new radical solutions for practical applications of HTS

materials and that it will encourage further experimental research of HTS materials with potential technological applications.

Principles of Nanomagnetism

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.

Thermoelectric Micro / Nano Generators, Volume 2

This book explores a key technology regarding the importance of connections via an Internet of Things network and how this helps us to easily communicate with others and gather information. Namely, what would happen if this suddenly became unavailable due to a shortage of power or electricity? Using thermoelectric generators is a viable solution as they use the heat around us to generate the much-needed electricity for our technological needs. This second volume on the challenges and prospects of thermoelectric generators covers the reliability and durability of thermoelectric materials and devices, the effect of microstructures on the understanding of electronic properties of complex materials, thermoelectric nanowires, the impact of chemical doping or magnetism, thermoelectric generation using the anomalous Nernst effect, phonon engineering, the current state and future prospects of thermoelectric technologies, transition metal silicides, and past, present and future applications of thermoelectrics.

Nanotechnology for Energy Sustainability, 3 Volume Set

In three handy volumes, this ready reference provides a detailed overview of nanotechnology as it is applied to energy sustainability. Clearly structured, following an introduction, the first part of the book is dedicated to energy production, renewable energy, energy storage, energy distribution, and energy conversion and harvesting. The second part then goes on to discuss nano-enabled materials, energy conservation and management, technological and intellectual property-related issues and markets and environmental remediation. The text concludes with a look at and recommendations for future technology advances. An essential handbook for all experts in the field - from academic researchers and engineers to developers in industry.

Magnetic Fusion Technology

Magnetic Fusion Technology describes the technologies that are required for successful development of nuclear fusion power plants using strong magnetic fields. These technologies include: • magnet systems, • plasma heating systems, • control systems, • energy conversion systems, • advanced materials development, • vacuum systems, • cryogenic systems, • plasma diagnostics, • safety systems, and • power plant design studies. Magnetic Fusion Technology will be useful to students and to specialists working in energy research.

Introduction to Materials for Advanced Energy Systems

This first of its kind text enables today’s students to understand current and future energy challenges, to acquire skills for selecting and using materials and manufacturing processes in the design of energy systems, and to develop a cross-functional approach to materials, mechanics, electronics and processes of energy production. While taking economic and regulatory aspects into account, this textbook provides a comprehensive introduction to the range of materials used for advanced energy systems, including fossil, nuclear, solar, bio, wind, geothermal, ocean and hydropower, hydrogen, and nuclear, as well as thermal energy storage and electrochemical storage in fuel cells. A separate chapter is devoted to emerging energy harvesting systems. Integrated coverage includes the application of scientific and engineering principles to materials that enable different types of energy systems. Properties, performance, modeling, fabrication, characterization and application of structural, functional and hybrid materials are described for each energy system. Readers will appreciate the complex relationships among materials selection, optimizing design, and component operating conditions in

each energy system. Research and development trends of novel emerging materials for future hybrid energy systems are also considered. Each chapter is basically a self-contained unit, easily enabling instructors to adapt the book for coursework. This textbook is suitable for students in science and engineering who seek to obtain a comprehensive understanding of different energy processes, and how materials enable energy harvesting, conversion, and storage. In setting forth the latest advances and new frontiers of research, the text also serves as a comprehensive reference on energy materials for experienced materials scientists, engineers, and physicists. Includes pedagogical features such as in-depth side bars, worked-out and end-of- chapter exercises, and many references to further reading Provides comprehensive coverage of materials-based solutions for major and emerging energy systems Brings together diverse subject matter by integrating theory with engaging insights

Thermoelectric Nanomaterials

Presently, there is an intense race throughout the world to develop good enough thermoelectric materials which can be used in wide scale applications. This book focuses comprehensively on very recent up-to-date breakthroughs in thermoelectrics utilizing nanomaterials and methods based in nanoscience. Importantly, it provides the readers with methodology and concepts utilizing atomic scale and nanoscale materials design (such as superlattice structuring, atomic network structuring and properties control, electron correlation design, low dimensionality, nanostructuring, etc.). Furthermore, also indicates the applications of thermoelectrics expected for the large emerging energy market. This book has a wide appeal and application value for anyone being interested in state-of-the-art thermoelectrics and/or actual viable applications in nanotechnology.

Thermoelectric Micro / Nano Generators, Volume 1

This book explores a key technology regarding the importance of connections via an Internet of Things network and how this helps us to easily communicate with others and gather information. Namely, what would happen if this suddenly became unavailable due to a shortage of power or electricity? Using thermoelectric generators is a viable solution as they use the heat around us to generate the much-needed electricity for our technological needs. This first volume explores the computational and data-driven development of these thermoelectric generators, as well as the use of various abundant materials such as copper and silver chalcogenides and nanocarbons. It also offers reviews on universal property enhancement principles and the case of strongly correlated oxides, and goes on to explore the metrology of the thermal properties of thermoelectric generators, detailing methods of how to measure the absolute Seebeck coefficient using the Thomson effect and the thermal diffusivity of thin films using the ultrafast laser flash method.

Advances in Nanotechnology Research and Application: 2011 Edition

Advances in Nanotechnology Research and Application: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Nanotechnology. The editors have built Advances in Nanotechnology Research and Application: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Nanotechnology in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Advances in Nanotechnology Research and Application: 2011 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

Dispersion Relations in Heavily-Doped Nanostructures

This book presents the dispersion relation in heavily doped nano-structures. The materials considered are III-V, II-VI, IV-VI, GaP, Ge, Platinum Antimonide, stressed, GaSb, Te, II-V, HgTe/CdTe superlattices and Bismuth Telluride semiconductors. The dispersion relation is discussed under magnetic quantization and on the basis of carrier energy spectra. The influences of magnetic field, magneto inversion, and magneto nipi structures on nano-structures is analyzed. The band structure of optoelectronic materials changes with photo-excitation in a fundamental way according to newly formulated electron dispersion laws. They control the quantum effect in optoelectronic devices in the presence of light. The measurement of band gaps in optoelectronic materials in the presence of external photo-excitation

is displayed. The influences of magnetic quantization, crossed electric and quantizing fields, intense electric fields on the on the dispersion relation in heavily doped semiconductors and super-lattices are also discussed. This book contains 200 open research problems which form the integral part of the text and are useful for graduate students and researchers. The book is written for post graduate students, researchers and engineers.

Thermoelectric Micro / Nano Generators, Volume 1

This book explores a key technology regarding the importance of connections via an Internet of Things network and how this helps us to easily communicate with others and gather information. Namely, what would happen if this suddenly became unavailable due to a shortage of power or electricity? Using thermoelectric generators is a viable solution as they use the heat around us to generate the much-needed electricity for our technological needs. This first volume explores the computational and data-driven development of these thermoelectric generators, as well as the use of various abundant materials such as copper and silver chalcogenides and nanocarbons. It also offers reviews on universal property enhancement principles and the case of strongly correlated oxides, and goes on to explore the metrology of the thermal properties of thermoelectric generators, detailing methods of how to measure the absolute Seebeck coefficient using the Thomson effect and the thermal diffusivity of thin films using the ultrafast laser flash method.

Einstein Relation in Compound Semiconductors and Their Nanostructures

Focusing only on the Einstein relation in compound semiconductors and their nanostructures, this book deals with open research problems from carbon nanotubes to quantum wire superlattices with different band structures, and other field assisted systems.

Materials Science in Static High Magnetic Fields

Presents the most comprehensive review of the influence of highly intense magnetic fields on materials of various classes.

Nanomagnetism

This first book to focus on the applications of nanomagnetism presents those already realized while also suggesting bold ideas for further breakthroughs. The first part is devoted to the concept of spin electronics and its use for data storage and magnetic sensing, while the second part concentrates on magnetic nanoparticles and their use in industrial environment, biological and medical applications. The third, more prospective part goes on to describe emerging applications related to spin current creation and manipulation, dynamics, spin waves and binary logic based on nano-scale magnetism. With its unique choice of topics and authors, this will appeal to academic as well as corporate researchers in a wide range of disciplines from physics via materials science to engineering, chemistry and life science.

Inorganic Thermoelectric Materials

Thermoelectric devices convert a heat flux directly into electrical power. They afford opportunities to achieve efficiency savings in a variety of applications, through the conversion of otherwise waste heat into useful electrical energy. Operated in reverse mode, they provide effective thermal management in areas ranging from cooling of electronic components to battery conditioning in electric vehicles. Implementation of thermoelectric technology requires materials with improved performance and stability, containing readily-available and inexpensive elements. A range of thermoelectric materials for use in different temperature regimes has emerged. Knowledge of the complex relationship between composition, structure and physical properties is central to understanding the performance of these advanced materials. This book provides both an introduction to the field of thermoelectrics and a survey of the state-of-the-art. Chapters review the important new families of advanced materials that have emerged and taken the field beyond traditional thermoelectric materials such as Bi2Te3, PbTe and SiGe. The emphasis is on the relationship between chemical composition, structure over a range of length scales and the physical properties that underlie performance. Edited by a leader in the field, and with contributions from global experts, Inorganic Thermoelectric Materials serves as an introduction to thermoelectric materials and is accessible to advanced undergraduates and postgraduates, as well as experienced researchers

Nanostructured Magnetic Materials and their Applications

Interest in research on nanoscale materials is steadily increasing: nano-structured magnetic materials exhibit new and interesting physical properties, which cannot be found in the bulk. Many of these unique properties have great potential for technical applications in magneto-sensors, bio-sensors, magneto-electronics, data storage, magnetic heads of computer hard disks, single-electron devises, microwave electronic devices, etc. Current research concentrates on device design, synthesis and the characterization of nanostructured materials. The contributions to this book concentrate on magnetic properties of nanoscale magnetic materials, especially on fabrication and characterization, and the physics underlying the unique properties of these structures and devices.

Magnetic Nano- and Microwires

Magnetic Nano-and Microwires: Design, Synthesis, Properties and Applications, Second Edition, reviews the growth and processing of nanowires and nanowire heterostructures using such methods as sol-gel and electrodeposition, focused-electron/ion-beam-induced deposition, epitaxial growth by chemical vapor transport, and more. Other sections cover engineering nanoporous anodic alumina, discuss magnetic and transport properties, domains, domain walls in nano-and microwires. and provide updates on skyrmions, domain walls, magnetism and transport, and the latest techniques to characterize and analyze these effects. Final sections cover applications, both current and emerging, and new chapters on memory, sensor, thermoelectric and nanorobotics applications. This book will be an ideal resource for academics and industry professionals working in the disciplines of materials science, physics, chemistry, electrical and electronic engineering and nanoscience. Details the multiple key techniques for the growth, processing and characterization of nanowires and microwires Reviews the principles and difficulties involved in applying magnetic nano- and microwires to a wide range of applications, also including biomedical and sensing applications Discusses magnetism and transport in nanowires, skyrmions and domain walls in nanowires and the latest innovations in magnetic imaging

Thermoelectrics for Power Generation

Thermoelectrics for Power Generation - A Look at Trends in the Technology is the first part of the InTech collection of international community works in the field of thermoelectric power generation. The authors from many counties have presented in this book their achievements and vision for the future development in different aspects of thermoelectric power generation. Remarkably, this hot topic unites together efforts of researchers and engineers from all continents of our planet. The reader will find in the book a lot of new interesting information concerning prospective materials for thermoelectric generators, both inorganic and organic; results of theoretical studies of materials characteristics; novel methods and apparatus for measuring performance of thermoelectric materials and devices; and thermoelectric power generator simulation, modeling, design, and practice.

Introduction to Thermoelectricity

This second edition is a comprehensive introduction to all aspects of thermoelectric energy conversion. It covers both theory and practice. The book is timely as it refers to the many improvements that have come about in the last few years through the use of nanostructures. The concept of semiconductor thermoelements led to major advances during the second half of the twentieth century, making Peltier refrigeration a widely used technique. The latest materials herald thermoelectric generation as the preferred technique for exploiting low-grade heat. The book shows how progress has been made by increasing the thermal resistivity of the lattice until it is almost as large as it is for glass. It points the way towards the attainment of similar improvements in the electronic parameters. It does not neglect practical considerations, such as the desirability of making thermocouples from inexpensive and environmentally acceptable materials. The second edition was extended to also include recent advances in thermoelectric energy conversion, particularly the production of bulk nanostructures, new materials with higher thermoelectric figures to use the possibility of large scale thermoelectric generation, as part of the worldwide strategy for making better use of energy resources. This book guides the newcomer towards the state of the art and shows the principles for further advancement to those who are already familiar with the subject. The author has been able to draw on his long experience to cover the science and technology in a balanced way while drawing on the expertise of others who have made major contributions to the field.

Electrodynamics of Metamaterials

Local electromagnetic field fluctuations and related enhancement of nonlinear phenomena in metal-dielectric composites near the percolation threshold (percolation composites) have recently become an area of active study, because of the many fundamental problems involved and the high potential for various applications. It has been recognized recently that local field fluctuations can be especially large in the optical and infrared spectral ranges due to the surface plasmon resonance in metallic granules and their clusters. The strong fluctuations of the local electric and magnetic fields result in the enhancement of various optical effects: anomalous absorption, Rayleigh and Raman scattering, generation of the higher harmonic, Kerr nonlinearity, etc. Nonlinear percolation composites are potentially of great practical importance as media with intensity-dependent dielectric functions and, in particular, as nonlinear filters and optical bistable elements. The optical response of nonlinear composites can be tuned, for example, by controlling the volume fraction and morphology of constituents. This book presents a new theory of electromagnetic field distribution and nonlinear optical processes in metal-dielectric composites. The new approach is based on a percolation theory and the fact that the problem of optical excitations in percolation composites mathematically maps the Anderson transition problem in quantum mechanics. The theory predicts localization of the excitations (surface plasmons) in percolation composites and describes in detail the localization pattern that allows one to obtain relatively simple expressions for the enhancement of linear and nonlinear optical responses. Thistheory is supported by recent near-field experiments where the surface plasmon localization has been directly observed in the percolating composites in optical and microwave bands.

Low-Dimensional Functional Materials

Maintaining and improving energy security is one of the biggest challenges worldwide. The NATO ARW conference in Tashkent, October 2012, was devoted to discussing visions and concepts that are currently discussed in different research fields. Leading scientists have written concise contributions to introduce the reader to this exciting topic. The present volume summarizes the discussions at the conference.

Nanomaterials and Nanocomposites, Nanostructure Surfaces, and Their Applications

This book highlights some of the latest advances in nanotechnology and nanomaterials from leading researchers in Ukraine, Europe and beyond. It features contributions presented at the 8th International Science and Practice Conference Nanotechnology and Nanomaterials (NANO2020), which was held on August 25–28, 2021 at Lviv Polytechnic National University, and was jointly organized by the Institute of Physics, the National Academy of Sciences of Ukraine, Lviv Polytechnic National University, University of Tartu (Estonia), University of Turin (Italy), Pierre and Marie Curie University (France), European Profiles S.A. (Greece), Representation of the Polish Academy of Sciences in Kyiv, University of Angers (France), Ruprecht Karl University of Heidelberg (Germany). Internationally recognized experts from a wide range of universities and research institutions share their knowledge and key findings on material properties, behavior, and synthesis. This book’s companion volume also addresses topics such as nano-optics, energy storage, and biomedical applications.