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Sub-Micron Semiconductor Devices - Ashish Raman 2022-05-11
This comprehensive reference text discusses novel semiconductor devices, including nanostructure field-effect transistors, photodiodes, high electron mobility transistors, and oxide-based devices. The text covers submicron semiconductor devices, device modeling, novel materials for devices, novel semiconductor devices, optimization techniques, and their application in detail. It covers such important topics as negative capacitance devices, surface-plasmon resonance devices, Fermi-level pinning, external stimuli-based optimization techniques, optoelectronic devices, and architecture-based optimization techniques. The book: Covers novel semiconductor devices with submicron dimensions Discusses comprehensive device optimization techniques Examines conceptualization and modeling of semiconductor devices Covers circuit and sensor-based application of the novel devices Discusses novel materials for next-generation devices This text will be useful for graduate students and professionals in fields including electrical engineering, electronics and communication engineering, materials science, and nanoscience.
Physics of Semiconductor Devices - Vikram Kumar 2002

Phonons in Semiconductor Nanostructures - J.P. Leburton 2012-12-06
In the last ten years, the physics and technology of low dimensional structures has experienced a tremendous development. Quantum structures with vertical and lateral confinements are now routinely fabricated with feature sizes below 100 run. While quantization of the electron states in mesoscopic systems has been the subject of intense investigation, the effect of confinement on lattice vibrations and its influence on the electron-phonon interaction and energy dissipation in nanostructures received atten tion only recently. This NATO Advanced Research Workshop on Phonons in Sem iconductor Nanostructures was a forum for discussion on the latest developments in the physics of phonons and their impact on the electronic properties of low-dimensional structures. Our goal was to bring together specialists in lattice dynamics and nanos tructure physics to assess the increasing importance of phonon effects on the physical properties of one-(lD) and zero-dimensional (OD) structures. The Workshop addressed various issues related to phonon physics in III-V, II-VI and IV semiconductor nanostructures. The following topics were successively covered: Models for confined phonons in semiconductor nanostructures, latest experimental observations of confined phonons and electron-phonon interaction in two-dimensional systems, elementary excitations in nanostructures, phonons and optical processes in reduced dimensionality systems, phonon limited transport phenomena, hot electron effects in quasi - ID structures, carrier relaxation and phonon bottleneck in quantum dots.
Thin Film Growth Techniques for Low-Dimensional Structures - R.F.C. Farrow 2013-03-09
This work represents the account of a NATO Advanced Research Workshop on "Thin Film Growth Techniques for Low Dimensional Structures", held at the University of Sussex, Brighton, England from 15-19 Sept. 1986. The objective of the workshop was to review the problems of the growth and characterisation of thin semiconductor and metal layers. Recent advances in deposition techniques have made it possible to design new material which is based on ultra-thin layers and this is now posing challenges for scientists, technologists and engineers in the assessment and utilisation of such new material. Molecular beam epitaxy (MBE) has become well established as a method for growing thin single crystal layers of semiconductors. Until recently, MBE was confined to the growth of III-V compounds and alloys, but now it is being used for group IV semiconductors and II-VI compounds. Examples of such work are given in this volume. MBE has one major advantage over other crystal growth techniques in that the structure of the growing layer can be continuously monitored using reflection high energy electron diffraction (RHEED). This technique has offered a rare bonus in that the time dependent intensity variations of RHEED can be used to determine growth rates and alloy composition rather precisely. Indeed, a great deal of new information about the kinetics of crystal growth from the vapour phase is beginning to emerge.
New Horizons in Low-Dimensional Electron Systems - H. Aoki 2012-12-06
In Bird of Passage by Rudolf Peierls, we find a paragraph in which he de scribes his Cambridge days in the 1930s: On these [relativistic field theory] problems my main contacts were Dirac, and the younger theoreticians. These included in particular Nevill (now Sir Nevill) Mott, perhaps the friendliest among many kind and friendly people we met then. Professor Kamimura became associated with Sir Rudolf Peierls in the 1950s, when he translated, with his colleagues, Peierls's 1955 textbook, Quantum Theory of Solids, into Japanese. This edition, to which Sir Rudolf himself contributed a preface, benefitted early generations of Japanese solid state physicists. Later in 1974/5, during a sabbatical year spent at the Cavendish Laboratory, Professor Kamimura met and began a long association with Sir Nevill Mott. In particular, they developed ideas for disordered systems. One of the outcomes is a paper coauthored by them on ESR-induced variable range hopping in doped semiconductors. A series of works on disordered systems, together with those on two-dimensional systems, have served as building blocks for Physics of Interacting Electrons in Disordered Systems, in the International Series of Monographs on Physics, coauthored by Aoki and published in 1989 by the Oxford University Press. Soon after Professor Kamimura obtained a D. Sc. in 1959 for the work on the ligand field theory under the supervision ofMasao Kotani, his strong con nections in the international physical community began when he worked at the Bell Telephone Laboratories in 1961/64.
Fabrication, Properties and Applications of Low-Dimensional Semiconductors - M. Balkanski 2012-12-06
A recent major development in high technology, and one which bears considerable industrial potential, is the advent of low-dimensional semiconductor quantum structures. The research and development activity in this field is moving fast and it is thus important to afford scientists and engineers the opportunity to get updated by the best experts in the field. The present book draws together the latest developments in the fabrication technology of quantum structures, as well as a competent and extensive review of their fundamental properties and some remarkable applications. The book is based on a set of lectures that introduce different aspects of the basic knowledge available, it has a tutorial content and could be used as a textbook. Each aspect is reviewed, from elementary concepts up to the latest developments. Audience: Undergraduates and graduates in electrical engineering and physics schools. Also for active scientists and engineers, updating their knowledge and understanding of the frontiers of the technology.
Progress in Nanoscale and Low-Dimensional Materials and Devices - Hilmi Ünlü 2022-11-19
This book describes most recent progress in the properties, synthesis, characterization, modelling, and applications of nanomaterials and nanodevices. It begins with the review of the modelling of the structural, electronic and optical properties of low dimensional and nanoscale semiconductors, methodology of synthesis, and characterization of quantum dots and nanowires, with special attention towards Dirac materials, whose electrical conduction and sensing properties far exceed those of silicon-based materials, making them strong competitors. The contributed reviews presented in this book touch on broader issues associated with the environment, as well as energy production and storage, while highlighting important achievements in materials

pertinent to the fields of biology and medicine, exhibiting an outstanding confluence of basic physical science with vital human endeavor. The subjects treated in this book are attractive to the broader readership of graduate and advanced undergraduate students in physics, chemistry, biology, and medicine, as well as in electrical, chemical, biological, and mechanical engineering. Seasoned researchers and experts from the semiconductor/device industry also greatly benefit from the book's treatment of cutting-edge application studies.

Nuclear Spectroscopy on Charge Density Wave Systems - T. Butz 2013-04-17

Nuclear magnetic resonance (NMR), nuclear quadrupole resonance (NQR), time differential perturbed angular correlations (TDPAC), and the Mössbauer effect (ME) have been applied to the study of charge density wave (CDW) systems. These hyperfine techniques provide unique tools to probe the structure and symmetry of commensurate CDWs, give a clear fingerprint of incommensurate CDWs, and are ideally suited for CDW dynamics. This book represents a new attempt in the series `Physics and Chemistry of Materials with Low-dimensional Structures' to bring together a consistent group of scientific results obtained by nuclear spectroscopy related to CDW phenomena in pseudo-one- and two-dimensional systems. The individual chapters contain: the theory of CDWs in chain-like transition metal tetrachalcogenides; NMR, NQR, TDPAC, and ME investigations of layered transition metal dichalcogenides; NMR studies of CDW-transport in chain-like NbSe3 and molybdenum bronzes; multinuclear NMR of KCP; high resolution NMR of organic conductors. This book is of interest to graduate students and all scientists who want to acquire a broader knowledge of nuclear spectroscopy techniques applied to CDW systems.

Introduction to Surface Engineering and Functionally Engineered Materials - Peter Martin 2011-10-04

This book provides a clear and understandable text for users anddevelopers of advanced engineered materials, particularly in thearea of thin films, and addresses fundamentals of modifying theoptical, electrical, photo-electric, triboligical, and corrosionresistance of solid surfaces and adding functionality to solids byengineering their surface, structure, and electronic, magnetic andoptical structure. Thin film applications are emphasized. Throughthe inclusion of multiple clear examples of the technologies, howto use them,and the synthesis processes involved, the reader willgain a deep understanding of the purpose, goals, and methodology ofsurface engineering and engineered materials. Virtually every advance in thin film, energy, medical,tribological materials technologies has resulted from surfaceengineering and engineered materials. Surface engineering involvesstructures and compositions not found naturally in solids and isused to modify the surface properties of solids and involvesapplication of thin film coatings, surface functionalization andactivation, and plasma treatment. Engineered materials are thefuture of thin film technology. Engineered structures such assuperlattices, nanolaminates, nanotubes, nanocomposites, smartmaterials, photonic bandgap materials, metamaterials, molecularlydoped polymers and structured materials all have the capacity toexpand and increase the functionality of thin films and coatingsused in a variety of applications and provide new applications. Newadvanced deposition processes and hybrid processes are being usedand developed to deposit advanced thin film materials andstructures not possible with conventional techniques a decade ago.Properties can now be engineered into thin films that achieveperformance not possible a decade ago.

Two-Dimensional Electron Systems - E.Y. Andrei 2012-12-06

Recent studies on two-dimensional systems have led to new insights into the fascinating interplay between physical properties and dimensionality. Many of these ideas have emerged from work on electrons bound to the surface of a weakly polarizable substrate such as liquid helium or solid hydrogen. The research on this subject continues to be at the forefront of modern condensed matter physics because of its fundamental simplicity as well as its connection to technologically useful devices. This book is the first comprehensive overview of experimental and theoretical research in this exciting field. It is intended to provide a coherent introduction for graduate students and non-experts, while at the same time serving as a reference source for active researchers in the field. The chapters are written by individuals who made significant contributions and cover a variety of specialized topics. These include the origin of the surface states, tunneling and magneto-tunneling out of these states, the phase diagram, collective excitations, transport and magneto-transport.

Electron Spectroscopies Applied to Low-Dimensional Structures - H.P. Hughes 2006-04-11

The effect of reduced dimensionality, inherent at the crystallographic level, on the electronic properties of low dimensional materials can be dramatic, leading to structural and electronic instabilities—including supercond- tivity at high temperatures, charge density waves, and localisation—which continue to attract widespread interest. The layered transition metal dichalcogenides have engaged attention for many years, partly arising from the charge density wave effects which some show and the controlled way in which their properties can be modified by intercalation, while the development of epitaxial growth techniques has opened up promising areas based on dichalcogenide heterostructures and quantum wells. The discovery of high-temperature superconducting oxides, and the realisation that polymeric materials too can be exploited in a controlled way for various opto-electronic applications, have further sti- lated interest in the effects of structural dimensionality. It seems timely therefore to draw together some strands of recent research involving a range of disparate materials which share some common char- teristics of low dimensionality. This resulting volume is aimed at researchers with specialist interests in the particular materials discussed but who may also wish to examine the related phenomena observed in different systems, and at a more general solid state audience with broad interests in electronic properties and low dimensional phenomena. Space limitations have required us to be selective as regards particular materials, though we have managed to include those as dissimilar as polymeric semiconductors, superconducting oxides, bronzes and layered chalcogenides.

Low-Dimensional Semiconductor Structures - Keith Barnham 2001-07-12

Low-Dimensional Semiconductor Structures provides a seamless, atoms-to-devices introduction to the latest quantum heterostructures. It covers their fabrication, their electronic, optical and transport properties, their role in exploring physical phenomena, and their utilization in devices. The authors begin with a detailed description of the epitaxial growth of semiconductors. They then deal with the physical behaviour of electrons and phonons in low-dimensional structures. A discussion of localization effects and quantum transport phenomena is followed by coverage of the optical properties of quantum wells. They then go on to discuss non-linear optics in quantum heterostructures. The final chapters deal with semiconductor lasers, mesoscopic devices, and high-speed heterostructure devices. The book contains many exercises and comprehensive references. It is suitable as a textbook for graduate-level courses in electrical engineering and applied physics. It will also be of interest to engineers involved in the development of semiconductor devices.

Nonlinear Optics - S. Miyata 2012-12-02

The field of nonlinear optics developed gradually with the invention of lasers. After the discovery of second-harmonic generation in quartz, many other interesting nonlinear optical processes were rapidly discovered. Simultaneously theoretical programmes for the understanding of nonlinear optical phenomena were stimulated in accordance to develop structure-property relationships. In the beginning, research advances were made on inorganic ferroelectric materials followed by semiconductors. In the 1970's, the importance of organic materials was realised because of their nonlinear optical responses, fast optical response, high laser damage thresholds, architectural flexibility, and ease of fabrication. At present materials can be classified into three categories - inorganic ferroelectrics, semiconductors, and organic materials. Advances have also been made in quantum chemistry approaches to investigate nonlinear optical susceptibilities and in the development of novel nonlinear optical devices. Generally, inorganic and organic nonlinear optical materials and their related optical processes are reported in separate meetings. This book collects for the first time papers covering the recent developments and areas of present research in the field of nonlinear optical materials.

Defects in Advanced Electronic Materials and Novel Low Dimensional Structures - Jan Stehr 2018-06-29

Defects in Advanced Electronic Materials and Novel Low Dimensional Structures provides a comprehensive review on the recent progress in solving defect issues and deliberate defect engineering in novel material systems. It begins with an overview of point defects in ZnO and group-III nitrides, including irradiation-induced defects, and then look at defects in one and two-dimensional materials, including carbon nanotubes and graphene. Next, it examines the ways that defects can expand the potential applications of semiconductors, such as energy upconversion and quantum processing. The book concludes with a look at the latest advances in theory. While defect physics is extensively reviewed for

conventional bulk semiconductors, the same is far from being true for novel material systems, such as low-dimensional 1D and 0D nanostructures and 2D monolayers. This book fills that necessary gap. Presents an in-depth overview of both conventional bulk semiconductors and low-dimensional, novel material systems, such as 1D structures and 2D monolayers Addresses a range of defects in a variety of systems, providing a comparative approach Includes sections on advances in theory that provide insights on where this body of research might lead
JJAP - 2001

Physics and Chemistry of Metal Cluster Compounds - L.J. de Jongh 2013-03-09
On Friday, February 20, 1980, I had the pleasure to be present at the inaugural lecture of my colleague Jan Reedijk, who had just been named at the Chair of Inorganic Chemistry of Leiden University. According to tradition, the ceremony took place in the impressive Hall of the old University Academy Building. In the course of his lecture, Jan mentioned a number of recent developments in chemistry which had struck him as particularly important or interesting. Among those was the synthesis of large metal cluster compounds, and, to my luck, he showed a slide ofthe molecular structure of [PtI9(C)b]4-. (To my luck, since at traditional Leiden University it is quite unusual to show slides at such ceremonies.) This constituted my first acquaintance with this exciting new class of materials. I became immediately fascinated by this molecule, partly because of the esthetic beauty of its fivefold symmetry, partly because as a physicist it struck me that it could be visualized as an "embryonically small" metal particle, embedded in a shell of CO ligands.
Optical Properties of Narrow-Gap Low-Dimensional Structures - Clivia M. Sotomayor Torres 2012-12-06
This volume contains the Proceedings of the NATO Advanced Research Workshop on "Optical Properties of Narrow-Gap Low-Dimensional Structures", held from July 29th to August 1st, 1986, in St. Andrews, Scotland, under the auspices of the NATO International Scientific Exchange Program. The workshop was not limited to optical properties of narrow-gap semiconductor structures (Part III). Sessions on, for example, the growth methods and characterization of III-V, II-VI, and IV-VI materials, discussed in Part II, were an integral part of the workshop. Considering the small masses of the carriers in narrow-gap low dimensional structures (LOS), in Part I the enhanced band mixing and magnetic field effects are explored in the context of the envelope function approximation. Optical nonlinearities and energy relaxation phenomena applied to the well-known systems of HgCdTe and GaAs/GaAIAs, respectively, are reviewed with comments on their extension to narrow gap LOS. The relevance of optical observations in quantum transport studies is illustrated in Part IV. A review of devices based on epitaxial narrow-gap materials defines a frame of reference for future ones based on two-dimensional narrow-gap semiconductors; in addition, an analysis of the physics of quantum well lasers provides a guide to relevant parameters for narrow-gap laser devices for the infrared (Part V). The roles and potentials of special techniques are explored in Part VI, with emphasis on hydrostatic pressure techniques, since this has a pronounced effect in small-mass, narrow-gap, non-parabolic structures.
Low Dimensional Properties Of Solids: Nobel Jubilee Symposium - Proceedings Of The Nobel Jubilee Symposium - Claeson T 1993-03-08

Neutron Scattering in Layered Copper-Oxide Superconductors - Albert Furrer 2012-12-06
The phenomenon of superconductivity - after its discovery in metals such as mercury, lead, zinc, etc. by Kamerlingh-Onnes in 19]] - has attracted many scientists. Superconductivity was described in a very satisfactory manner by the model proposed by Bardeen, Cooper and Schrieffer, and by the extensions proposed by Abrikosov, Gorkov and Eliashberg. Relations were established between superconductivity and the fundamental properties of solids, resulting in a possible upper limit of the critical temperature at about 23 K. The breakthrough that revolutionized the field was made in 1986 by Bednorz and Muller with the discovery of high-temperature superconductivity in layered copper-oxide perovskites. Today the record in transition temperature is 133 K for a Hg based cuprate system. The last decade has not only seen a revolution in the size of the critical temperature, but also in the myriads of research groups that entered the field. In addition, high-temperature superconductivity became a real interdisciplinary topic and brought together physicists, chemists and materials scientists who started to investigate the new compounds with almost all the available experimental techniques and theoretical methods. As a consequence we have witnessed an avalanche of publications which has never occurred in any field of science so far and which makes it difficult for the individual to be thoroughly informed about the relevant results and trends. Neutron scattering has outstanding properties in the elucidation of the basic properties of high-temperature superconductors.
The Physics of Fullerene-Based and Fullerene-Related Materials - W. Andreoni 2012-12-06
Krätschmer and Huffman's revolutionary discovery of a new solid phase of carbon, solid C60, in 1990 opened the way to an entire new class of materials with physical properties so diverse that their richness has not yet been fully exploited. Moreover, as a by-product of fullerene research, carbon nanotubes were later identified, from which novel nanostructures originated that are currently fascinating materials scientists worldwide. Rivers of words have been written on both fullerenes and nanotubes, in the form of journal articles, conference proceedings and books. The present book offers, in a concise and self-contained manner, the basics of the science of these materials as well as detailed information on those aspects that have so far been better explored. Structural, electronic and dynamical properties are described as obtained from various measurements and state-of-the-art calculations. Their interrelation emerges as well as their possible dependence on, for example, preparation conditions or methods of investigation. By presenting and comparing data from different sources, experiment and theory, this book helps the reader to rapidly master the basic knowledge, to grasp important issues and critically discuss them. Ultimately, it aims to inspire him or her to find novel ways to approach still open questions. As such, this book is addressed to new researchers in the field as well as experts.
Nano-Optoelectronics - Marius Grundmann 2002-07-03
Traces the quest to use nanostructured media for novel and improved optoelectronic devices. Leading experts - among them Nobel laureate Zhores Alferov - write here about the fundamental concepts behind nano-optoelectronics, the material basis, physical phenomena, device physics and systems.
Foundations of Nanotechnology, Volume Two - Sabu Thomas 2014-10-24
The collection of topics in this book reflects the diversity of recent advances in nanoelements formation and interactions in nanosystems with a broad perspective that is useful for scientists as well as for graduate students and engineers. One of the main tasks in making nanocomposites is building the dependence of the structure and shape of the nanoelements, forming the basis for the composite of their sizes. This is because with an increase or a decrease in the specific size of nanoelements, their physical–mechanical properties such as the coefficient of elasticity, strength, and deformation parameter, vary by over one order. The calculations show that this is primarily due to a significant rearrangement of the atomic structure and the shape of the nanoelement. The investigation of the above parameters of the nanoelements is technically complicated and laborious because of their small sizes. When the characteristics of powder nanocomposites are calculated, it is also very important to take into account the interaction of the nanoelements since the changes in their original shapes and sizes in the interaction process and during the formation of the nanocomposite can lead to a significant change in its properties and a cardinal structural rearrangement. In addition, the studies show the appearance of the processes of the ordering and self-assembling leading to a more organized form of a nanosystem. The above phenomena play an important role in nanotechnological processes. They allow nanotechnologies to be developed for the formation of nanostructures by the self-assembling method (which is based on self-organizing processes) and building up complex spatial nanostructures consisting of different nanoelements. The study of the above dependences based on the mathematical modeling methods requires the solution of the aforementioned problem at the atomic level. This requires large computational aids and computational time, which makes the development of economical calculation methods urgent. The objective of this volume is the development of such a technique in various nanosystems.
Isotope Low-Dimensional Structures - Vladimir G. Plekhanov 2012-05-08
This Briefs volume describes the properties and structure of elementary excitations in isotope low-dimensional structures. Without assuming prior knowledge of quantum physics, the present book provides the basic knowledge needed to understand the recent developments in the sub-disciplines of nanoscience isotopetronics, novel device concepts and materials for nanotechnology. It is the first and comprehensive interdisciplinary account of the newly developed scientific discipline

isotopetronics.
Low-Dimensional and Nanostructured Materials and Devices - Hilmi Ünlü 2015-12-01
This book focuses on the fundamental phenomena at nanoscale. It covers synthesis, properties, characterization and computer modelling of nanomaterials, nanotechnologies, bionanotechnology, involving nanodevices. Further topics are imaging, measuring, modeling and manipulating of low dimensional matter at nanoscale. The topics covered in the book are of vital importance in a wide range of modern and emerging technologies employed or to be employed in most industries, communication, healthcare, energy, conservation , biology, medical science, food, environment, and education, and consequently have great impact on our society.
Low Dimensional Structures Prepared by Epitaxial Growth or Regrowth on Patterned Substrates - K. Eberl 2012-12-06
Proceedings of the NATO Advanced Research Workshop, Ringberg in Rottach Egern, Germany, February 20--24, 1995
Low-Dimensional Structures in Semiconductors - A.R. Peaker 2013-06-29
This volume contains a sequence of reviews presented at the NATO Advanced Study Institute on 'Low Dimensional Structures in Semiconductors ... from Basic Physics to Applications.' This was part of the International School of Materials Science and 1990 at the Ettore Majorana Centre in Sicily. Technology held in July Only a few years ago, Low Dimensional Structures was an esoteric concept, but now it is apparent they are likely to playa major role in the next generation of electronic devices. The theme of the School acknowledged this rapidly developing maturity.' The contributions to the volume consider not only the essential physics, but take a wider view of the topic, starting from material growth and processing, then prog ressing right through to applications with some discussion of the likely use of low dimensional devices in systems. The papers are arranged into four sections, the first of which deals with basic con cepts of semiconductor and low dimensional systems. The second section is on growth and fabrication, reviewing MBE and MOVPE methods and discussing the achievements and limitations of techniques to reduce structures into the realms of one and zero dimensions. The third section covers the crucial issue of interfaces while the final section deals with devices and device physics.
Photoelectrochemistry and Photovoltaics of Layered Semiconductors - A. Aruchamy 2013-03-13
This volume aims at bringing together the results of extensive research done during the last fifteen years on the interfacial photoelectronic properties of the inorganic layered semiconducting materials, mainly in relation to solar energy conversion. Significant contributions have been made both on the fundamental aspects of interface characteristics and on the suitability of the layered materials in photoelectrochemical (semiconductor/electrolyte junctions) and in solid state photovoltaic(Schottky and p-n junctions) cells. New insights into the physical and chemical characteristics of the contact surfaces have been gained and many new applications of these materials have been revealed. In particular, the basal plane surface of the layered materials shows low chemical reactivity and specific electronic behaviour with respect to isotropic solids. In electrochemical systems, the inert nature of these surfaces characterized by saturated chemical bonds has been recognized from studies on charge transfer reactions and catalysis. In addition, studies on the role of the d-band electronic transitions and the dynamics of the photogene rated charge carriers in the relative stability of the photoelectrodes of the transition metal dichalcogenides have deepened the understanding of the interfacial photoreactions. Transition metal layered compounds are also recognized as ideal model compounds for the studies Involving surfaces: photoreactions, adsorption phenomena and catalysis, scanning tunneling microscopy and spectroscopy and epitaxial growth of thin films. Recently, quantum size effects have been investigated in layered semiconductor colloids.
Compound Semiconductors 1995, Proceedings of the Twenty-Second INT Symposium on Compound Semiconductors held in Cheju Island, Korea, 28 August-2 September, 1995 - Woo 1996-04-25
Compound Semiconductors 1995 focuses on emerging applications for GaAs and other compound semiconductors, such as InP, GaN, GaSb, ZnSe, and SiC, in the electronics and optoelectronics industries. The book presents the research and development work in all aspects of compound semiconductors. It reflects the maturity of GaAs as a semiconductor material and the rapidly increasing pool of research information on many other compound semiconductors. Covering the full breadth of the subject, from growth through processing to devices and integrated circuits, this volume provides researchers in materials science, device physics, condensed matter physics, and electrical and electronic engineering with a comprehensive overview of developments in this well-established research area.
Magnetic Properties of Layered Transition Metal Compounds - L.J. de Jongh 2012-12-06
In the last two decades low-dimensional (low-d) physics has matured into a major branch of science. Quite generally we may define a system with restricted dimensionality d as an object that is infinite only in one or two spatial directions (d = 1 and 2). Such a definition comprises isolated single chains or layers, but also fibres and thin layers (films) of varying but finite thickness. Clearly, a multitude of physical phenomena, notably in solid state physics, fall into these categories. As examples, we may mention: • Magnetic chains or layers (thin-film technology). • Metallic films (homogeneous or heterogeneous, crystalline, amorphous or microcristalline, etc.). • I-d or 2-d conductors and superconductors. • Intercalated systems. • 2-d electron gases (electrons on helium, semiconductor interfaces). • Surface layer problems (2-d melting of monolayers of noble gases on a substrate, surface problems in general). • Superfluid films of ~He or 'He. • Polymer physics. • Organic and inorganic chain conductors, superionic conductors. • I-d or 2-d molecular crystals and liquid crystals. • I-d or 2-d ferro- and antiferro electrics.
Laser Induced Damage in Optical Materials - 2007
Carbyne and Carbynoid Structures - R.B. Heimann 2012-12-06
This is a book on one of the most fascinating and controversial areas in contemporary science of carbon, chemistry, and materials science. It concisely summarizes the state of the art in topical and critical reviews written by professionals in this and related fields.
Low-dimensional Nitride Semiconductors - Bernard Gil 2002
Optoelectronics and electronics of the years to come are likely to change dramatically. Most of the outdoor lighting systems will be replaced by light-emitting diodes that operate in the whole visible part of the electromagnatic spectrum. Transistors operating at high frequency and with high power are under development and likely to hit the market very rapidly. Compact solid-state lasers that operate in the near-ultraviolet range are going to be utilized for such widely used applications as read-write tasks in printer and CD drives. Ultraviolet detectors will be used at a wide scale for many application, ranging from flame detectors to medical instruments. This book concerns itself with the questions why nitride semiconductors are so promising over such a wide range of applications, what the current issues are in the research laboratories, and what the prospects of new electronic devices are in the dawn of the twenty-first century.
Compound Semiconductors 1995, Proceedings of the Twenty-Second INT Symposium on Compound Semiconductors held in Cheju Island, Korea, 28 August-2 September, 1995 - Institute of Physics Conference 2020-10-28
Compound Semiconductors 1995 focuses on emerging applications for GaAs and other compound semiconductors, such as InP, GaN, GaSb, ZnSe, and SiC, in the electronics and optoelectronics industries. The book presents the research and development work in all aspects of compound semiconductors. It reflects the maturity of GaAs as a semiconductor material and the rapidly increasing pool of research information on many other compound semiconductors. Covering the full breadth of the subject, from growth through processing to devices and integrated circuits, this volume provides researchers in materials science, device physics, condensed matter physics, and electrical and electronic engineering with a comprehensive overview of developments in this well-established research area.
Foundations of Nanotechnology - Three Volume Set - A. K. Haghi 2015-05-30
Nanoscale science, engineering, and technology—commonly referred to collectively as nanotechnology—is believed by many to offer extraordinary economic and societal benefits. Nanotechnology is generally defined as the ability to create and use materials, devices, and systems with unique properties at the scale of approximately 1 to 100 nm. Nanotechnology offers society the promise of major benefits, but also raises questions of potential adverse effects. The first volume covers pore size in carbon-based nano-adsorbents, resulting in materials that exhibit unique sorptive properties with a general view of the recent activities on the study of pore structure control. The collection of topics in volume 2 reflects the diversity of recent advances in nanoelements formation and interactions in nanosystems with a broad perspective that will be useful for scientists and engineers as the use of nanotechnology

in the consumer and industrial sectors is expected to increase significantly in the future. And the third volume discusses important issues and trends related to research strategy in mechanics of carbon nanotubes.

The Story of Semiconductors - John W. Orton 2008-12-11

The book provides an overview of the fascinating spectrum of semiconductor physics, devices and applications, presented from a historical perspective. It covers the development of the subject from its inception in the early nineteenth century to the recent millennium. Written in a lively, informal style, it emphasizes the interaction between pure scientific push and commercial pull, on the one hand, and between basic physics, materials, and devices, on the other. It also sets the various device developments in the context of systems requirements and explains how such developments met wide ranging consumer demands. It is written so as to appeal to students at all levels in physics, electrical engineering, and materials science, to teachers, lecturers, and professionals working in the field, as well as to a non-specialist scientific readership.

Localization and Confinement of Electrons in Semiconductors - Friedemar Kuchar 1990-12-10

The winter school on Localization and Confinement of Electrons in Semicon ductors was the sixth of a series dealing with new developments in solid~state physics organized by the Austrian Physical Society. The school, which was held in the castle of Mautemdorf, in the federal province of Salzburg, Austria, February 19-23, 1990, was attended by about 200 participants. This is the fourth such winter school to have the proceedings published in the Springer Series in Solid-State Sciences, the earlier ones appearing as Vols. 53, 67 and 83. The contributions of the invited speakers are arranged in seven parts according to topic: quantum boxes and quantum wires; localization and the metal-insulator transition; the integer and fractional quantum Hall effects and electron-electron interactions; tunneling and localization in low-dimensional structures and superlattices; optical properties of confined systems; impurities in quantum well structures; and optical and magnetic properties of dilute mag netic semiconductor quantum well. structures. A particular intention of this book is to present relevant introductory articles alongside the most recent research reports, all written by experts in the fields of localization and condensation of electrons in semiconductors, the quantum Hall effect, lateral superlattices, ballistic transport, etc. The fascinating subject of quantum boxes (dots) and quantum wires is treated in considerable detail. Experimental techniques for producing later ally structured two-dimensional electron gas systems are described together with methods for studying their electrical and optical properties.

Ceramic Science and Engineering - Kamakhya Prakash Misra 2022-05-07

Ceramic Science and Engineering: Basics to Recent Advancements covers the fundamentals, classification and applications surrounding ceramic engineering. In addition, the book contains an extensive review of the current published literature on established ceramic materials. Other sections present an extensive review of up-to-date research on new innovative ceramic materials and reviews recently published articles, case studies and the latest research outputs. The book will be an essential reference resource for materials scientists, physicists, chemists and engineers, postgraduate students, early career researchers, and industrial researchers working in R&D in the development of ceramic materials. Ceramic engineering deals with the science and technology of creating objects from inorganic and non-metallic materials. It combines the principles of chemistry, physics and engineering. Fiber-optic devices, microprocessors and solar panels are just a few examples of ceramic engineering being applied in everyday life. Advanced ceramics such as alumina, aluminum nitride, zirconia, ZnO, silicon carbide, silicon nitride and titania-based materials, each of which have their own specific characteristics and offer an economic and high-performance alternative to more conventional materials such as glass, metals and plastics are also discussed. Covers environmental barrier ceramic coatings, advanced ceramic conductive fuel cells, processing and machining technology in ceramic and composite materials, photoluminescent ceramic materials, perovskite ceramics and bioinspired ceramic materials Reviews both conventional, established ceramics and new, innovative advanced ceramics Contains an extensive review of the current published literature on established ceramic materials

Molecular Beam Epitaxy - Mohamed Henini 2018-06-27

Molecular Beam Epitaxy (MBE): From Research to Mass Production, Second Edition, provides a comprehensive overview of the latest MBE research and applications in epitaxial growth, along with a detailed discussion and ‘how to’ on processing molecular or atomic beams that occur on the surface of a heated crystalline substrate in a vacuum. The techniques addressed in the book can be deployed wherever precise thin-film devices with enhanced and unique properties for computing, optics or photonics are required. It includes new semiconductor materials, new device structures that are commercially available, and many that are at the advanced research stage. This second edition covers the advances made by MBE, both in research and in the mass production of electronic and optoelectronic devices. Enhancements include new chapters on MBE growth of 2D materials, Si-Ge materials, AIN and GaN materials, and hybrid ferromagnet and semiconductor structures. Condenses the fundamental science of MBE into a modern reference, speeding up literature review Discusses new materials, novel applications and new device structures, grounding current commercial applications with modern understanding in industry and research Includes coverage of MBE as mass production epitaxial technology and how it enhances processing efficiency and throughput for the semiconductor industry and nanostructured semiconductor materials research community

Phonons in Low Dimensional Structures - Vasilios N. Stavrou 2018-12-12

The field of low-dimensional structures has been experiencing rapid development in both theoretical and experimental research. Phonons in Low Dimensional Structures is a collection of chapters related to the properties of solid-state structures dependent on lattice vibrations. The book is divided into two parts. In the first part, research topics such as interface phonons and polaron states, carrier-phonon non-equilibrium dynamics, directional projection of elastic waves in parallel array of N elastically coupled waveguides, collective dynamics for longitudinal and transverse phonon modes, and elastic properties for bulk metallic glasses are related to semiconductor devices and metallic glasses devices. The second part of the book contains, among others, topics related to superconductor, phononic crystal carbon nanotube devices such as phonon dispersion calculations using density functional theory for a range of superconducting materials, phononic crystal-based MEMS resonators, absorption of acoustic phonons in the hyper-sound regime in fluorine-modified carbon nanotubes and single-walled nanotubes, phonon transport in carbon nanotubes, quantization of phonon thermal conductance, and phonon Anderson localization.

Low-Dimensional Electronic Properties of Molybdenum Bronzes and Oxides - C. Schlenker 2012-12-06

The history of low dimensional conductors goes back to the prediction, more than forty years ago, by Peierls, of the instability of a one dimensional metallic chain, leading to what is known now as the charge density wave state. At the same time, Frohlich suggested that an "ideal" conductivity could be associated to the sliding of this charge density wave. Since then, several classes of compounds, including layered transition metal dichalcogenides, quasi one-dimensional organic conduc tors and transition metal tri- and tretrachalcogenides have been extensively studied. The molybdenum bronzes or oxides have been discovered or rediscovered as low dimensional conductors in this last decade. A considerable amount of work has now been performed on this subject and it was time to collect some review papers in a single book. Although this book is focused on the molybdenum bronzes and oxides, it has a far more general interest in the field of low dimensional conductors, since several of the molybdenum compounds provide, from our point of view, model systems. This is the case for the quasi one-dimensional blue bronze, especially due to the availability of good quality large single crystals. This book is intended for scientists belonging to the fields of solid state physics and chemistry as well as materials science. It should especially be useful to many graduate students involved in low dimensional oxides. It has been written by recognized specialists of low dimensional systems.