Download File PDF Physics Semiconductor Elementary

If you ally obsession such a referred **Physics Semiconductor Elementary** book that will meet the expense of you worth, acquire the entirely best seller from us currently from several preferred authors. If you desire to entertaining books, lots of novels, tale, jokes, and more fictions collections are as well as launched, from best seller to one of the most current released.

You may not be perplexed to enjoy all book collections Physics Semiconductor Elementary that we will no question offer. It is not concerning the costs. Its just about what you infatuation currently. This Physics Semiconductor Elementary, as one of the most working sellers here will no question be in the middle of the best options to review.

KEY=SEMICONDUCTOR - HODGES HANNAH

Elementary Semiconductor Physics

Theory of Electron Transport in Semiconductors

A Pathway from Elementary Physics to Nonequilibrium Green Functions

Springer Science & Business Media This book originated out of a desire to provide students with an instrument which might lead them from knowledge of elementary classical and quantum physics to moderntheoreticaltechniques for the analysisof electrontransport in semiconductors. The book is basically a textbook for students of physics, material science, and electronics. Rather than a monograph on detailed advanced research in a speci?c area, it intends to introduce the reader to the fascinating ?eld of electron dynamics in semiconductors, a ?eld that, through its applications to electronics, greatly contributed to the transformationof all our lives in the second half of the twentieth century, and continues to provide surprises and new challenges. The ?eld is so extensive that it has been necessary to leave aside many subjects, while others could be dealt with only in terms of their basic principles. The book is divided into ?ve major parts. Part I moves from a survey of the fundamentals of classical and quantum physics to a brief review of basic semiconductor physics. Its purpose is to establish a common platform of language and symbols, and to make the entire treatment, as far as pos- ble, self-contained. Parts II and III, respectively, develop transport theory in bulk semiconductors in semiclassical and quantum frames. Part IV is devoted to semiconductor structures, including devices and mesoscopic coherent s- tems. Finally, Part V develops the basic theoretical tools of transport theory within the modern nonequilibrium Green-function formulation, starting from an introduction to second-quantization formalism.

Basic Semiconductor Physics

Springer Science & Business Media A detailed description of the basic physics of semiconductors. All the important equations describing the properties of these materials are derived without the help of other textbooks. The reader is assumed to have only a basic command of mathematics and some elementary semiconductor physics. The text covers a wide range of important semiconductor phenomena, from the simple to the advanced.

Physical Limitations of Semiconductor Devices

Springer Science & Business Media Providing an important link between the theoretical knowledge in the field of non-linier physics and practical application problems in microelectronics, the purpose of the book is popularization of the physical approach for reliability assurance. Another unique aspect of the book is the coverage given to the role of local structural defects, their mathematical description, and their impact on the reliability of the semiconductor devices.

Semiconductor Physics

An Introduction

Springer Science & Business Media It is a pleasure to take the opportunity to express my sincere grati tude to many colleagues who provided valuable hints for improvements, even including lists of misprints (which I hope have now been complete ly eliminated). It is not possible to name all of them, and so I will only mention the interesting discussions over so many years I had with Pro fessor Hans W. Pötzl of the Technical University of Vienna on the oc casion of our common weekly semiconductor seminar. I am grateful to Professor H.-J. Queisser and Professor M. Cardona for helpful criticism. Special thanks are due to Frau Jitka Fucik for typing and Frau Viktoria Köver for drawing services. The cooperation with Dr. H.K. Lotsch of Springer-Verlag has been a pleasure. Vienna, January 1982 K. Seeger Contents 1. Elementary Properties of Semiconductors . . .. I 1.1 Insulator - Semiconductor - Semimetal - Metal 1 1.2 The Positive Hole ... 3 1.3 Conduction Processes, Compensation, Law ofMass Action 4 Problems . 8 2. Energy Band Structure . 10 2.1 Single and Periodically Repeated Potential Well 10 2.2 Energy Bands by Tight Binding ofElectrons to Atoms 17 2.3 The Brillouin Zone 21 2.4 Constant Energy Surfaces 30 Problems . 33 3. Semiconductor Statistics 34 3.1 Fermi Statistics ... 35 3.2 Occupation Probabilities ofImpurity Levels 39 Problems . 45 4. Charge and Energy Transport in a Nondegenerate Electron Gas.

Fundamentals of Semiconductor Physics and Devices

World Scientific This book is an introduction to the principles of semiconductor physics, linking its scientific aspects with practical applications. It is addressed to both readers who wish to learn semiconductor physics and those seeking to understand semiconductor devices. It is particularly well suited for those who want to do both.

Spin Physics in Semiconductors

Springer Science & Business Media The purpose of this collective book is to present a non-exhaustive survey of sp- related phenomena in semiconductors with a focus on recent research. In some sense it may be regarded as an updated version of theOpticalOrientation book, which was entirely devoted to spin physics in bulk semiconductors. During the 24 years that have elapsed, we have witnessed, on the one hand, an extraordinary development in the wonderful semiconductor physics in two dim- sions with the accompanying revolutionary applications. On the other hand, during the last maybe 15 years there was a strong revival in the interest in spin phen- ena, in particular in low-dimensional semiconductor structures. While in the 1970s and 1980s the entire world population of researchers in the ?eld never exceeded 20 persons, now it can be counted by the hundreds and the number of publications by the thousands. This explosive growth is stimulated, to a large extent, by the hopes that the electron and/or nuclear spins in a semiconductor will help to accomplish the dream of factorizing large numbers by quantum computing and eventually to develop a new spin-based electronics, or “spintronics”. Whether any of this will happen or not, still remains to be seen. Anyway, these ideas have resulted in a large body of interesting and exciting research, which is a good thing by itself. The ?eld of spin physics in semiconductors is extremely rich and interesting with many spectacular effects in optics and transport.

Introduction to Semiconductor Materials and Devices

John Wiley & Sons Incorporated This comprehensive introduction to the elementary theory and properties of semiconductors describes the basic physics of semiconductor materials and technologies for fabrication of semiconductor devices. Addresses approaches to modeling and provides details of measurement techniques. Includes numerous illustrative examples and graded problems.

Fundamentals of Semiconductors

Physics and Materials Properties

Springer Science & Business Media Excellent bridge between general solid-state physics textbook and research articles packed with providing detailed explanations of the electronic, vibrational, transport, and optical properties of semiconductors "The most striking feature of the book is its modern outlook ... provides a wonderful foundation. The most wonderful feature is its efficient style of exposition ... an excellent book." Physics Today "Presents the theoretical derivations carefully and in detail and gives thorough discussions of the experimental results it presents. This makes it an excellent textbook both for learners and for more experienced researchers wishing to check facts. I have enjoyed reading it and strongly recommend it as a text for anyone working with semiconductors ... I know of no better text ... I am sure most semiconductor physicists will find this book useful and I recommend it to them." Contemporary Physics Offers much new material: an extensive appendix about the important and by now well-established, deep center known as the DX center, additional problems and the solutions to over fifty of the problems at the end of the various chapters.

Basic Semiconductor Physics

Springer The new edition of this textbook presents a detailed description of basic semiconductor physics. The text covers a wide range of important phenomena in semiconductors, from the simple to the advanced. Four different methods of energy band calculations in the full band region are explained: local empirical pseudopotential, non-local pseudopotential, KP perturbation and tight-binding methods. The effective mass approximation and electron motion in a periodic potential, Boltzmann transport equation and deformation potentials used for analysis of transport properties are discussed. Further, the book examines experiments and theoretical analyses of cyclotron resonance in detail. Optical and transport properties, magneto-transport, two-dimensional electron gas transport (HEMT and MOSFET) and quantum transport are reviewed, while optical transition, electron-phonon interaction and electron mobility are also addressed. Energy and electronic structure of a quantum dot (artificial atom) are explained with the help of Slater determinants. The physics of semiconductor lasers is also described, including Einstein coefficients, stimulated emission, spontaneous emission, laser gain, double heterostructures, blue lasers, optical confinement, laser modes, and strained quantum well lasers, offering insights into the physics of various kinds of semiconductor lasers. In this third edition, energy band calculations in full band zone with spin-orbit interaction are presented, showing all the matrix elements and equipping the reader to prepare computer programs of energy band calculations. The Luttinger Hamiltonian is discussed and used to analyze the valence band structure. Numerical calculations of scattering rate, relaxation time, and mobility are presented for typical semiconductors, which are very helpful for understanding of transport. Energy band structures and effective masses of nitrides such as GaN, InN, AlN and their ternary alloys are discussed because they are very important materials for the blue light emission, and high power devices with and high frequency. Learning and teaching with this textbook is supported by problems and solutions in the end of the chapters. The book is written for bachelor and upper undergraduate students of physics and engineering.

Microwave Semiconductor Devices

Springer Science & Business Media We have reached the double conclusion: that invention is choice, that this choice is imperatively governed by the sense of scientific beauty. Hadamard (1945), Princeton University Press, by permission. The great majority of all sources and amplifiers of microwave energy, and all devices for receiving or detecting microwaves, use a semiconductor active element. The development of microwave semiconductor devices, de scribed in this book, has proceeded from the simpler, two-terminal, devices such as GUNN or IMPATT devices, which originated in the 1960s, to the sophisticated monolithic circuit MESFET three-terminal active elements, of the 1980s and 1990s. The microwave field has experienced a renais sance in electrical engineering departments in the last few years, and much of this growth has been associated with microwave semiconductor devices. The University of Massachusetts has recently developed a well recognized program in microwave engineering. Much of the momentum for this pro gram has been provided by interaction with industrial companies, and the influx of a large number of industry-supported students. This program had a need for a course in microwave semiconductor devices, which covered the physical aspects, as well as the aspects of interest to the engineer who incorporates such devices in his designs. It was also felt that it would be im portant to introduce the most recently developed devices (HFETs, HBTs, and other advanced devices) as early as possible.

The Physics of Solids

Oxford University Press This comprehensive text covers the basic physics of the solid state starting at an elementary level suitable for undergraduates but then advancing, in stages, to a graduate and advanced graduate level. In addition to treating the fundamental elastic, electrical, thermal, magnetic, structural, electronic, transport, optical, mechanical and compositional properties, we also discuss topics like superfluidity and superconductivity along with special topics such as strongly correlated systems, high-temperature superconductors, the quantum Hall effects, and graphene. Particular emphasis is given to so-called first principles calculations utilizing modern density functional theory which for many systems now allow accurate calculations of the electronic, magnetic, and thermal

properties.

Semiconductor Physics

An Introduction

Springer Science & Business Media Televisions, telephones, watches, calculators, robots, airplanes and space vehicles all depend on silicon chips. Life as we know it would hardly be possible without semiconductor devices. An understanding of how these devices work requires a detailed knowledge of the physics of semiconductors, including charge transport and the emission and absorption of electromagnetic waves. This book may serve both as a university textbook and as a reference for research and microelectronics engineering. Each section of the book begins with a description of an experiment. The theory is then developed as far as necessary to understand the experimental results. Everyone with high-school mathematics should be able to follow the calculations. The band structure calculations for the diamond and zinc blende types of lattice are supplemented with a personal computer program. Semiconductor physics developed most rapidly in the two decades following the invention of the transistor, and naturally most of the references date from this time. But recent developments such as the Gunn effect, the acoustoelectric effect, superlattices, quantum well structures, and the quantum Hall effect are also discussed. The exercises provided (answers to which are available) will greatly assist the student in consolidating the material presented. From the reviews:"This book is a must for any theoretical and experimental physicist working in the area of semiconductor physics." #Physicalia#1

Semiconductor Physics

An Introduction

Springer Science & Business Media The first edition of "Semiconductor Physics" was published in 1973 by Springer-Verlag Wien-New York as a paperback in the Springer Study Edition. In 1977, a Russian translation by Professor Yu. K. Pozhela and coworkers at Vilnius/USSR was published by Izdatelstvo "MIR", Mo scow. Since then new ideas have been developed in the field of semi conductors such as electron hole droplets, dangling bond saturation in amorphous silicon by hydrogen, or the determination of the fine struc ture constant from surface quantization in inversion layers. New tech niques such as molecular beam epitaxy which has made the realization of the Esaki superlattice possible, deep level transient spectroscopy, and refined a. c. Hall techniques have evolved. Now that the Viennese edition is about to go out of print, Springer-Verlag, Berlin-Heidelberg-New York is giving me the opportunity to include these new subjects in a monograph to appear in the Solid-State Sciences series. Again it has been the intention to cover the field of semiconductor physics comprehensively, although some chapters such as diffusion of hot carriers and their galvanomagnetic phenomena, as well as super conducting degenerate semiconductors and the appendices, had to go for commercial reasons. The emphasis is more on physics than on device as pects.

High Magnetic Fields in Semiconductor Physics III

Quantum Hall Effect, Transport and Optics

Springer Science & Business Media High magnetic fields have, for a long time, been an important tool in the investigation of the electronic structure of semiconductors. In recent yearsstudies of heterostructures and superlattices have predominated, and this emphasis is reflected in these proceedings. The contributions concentrate on experiments using transport and optical methods, but recent theoretical developments are also covered. Special attention is paid to the quantum Hall effect, including the problem of edge currents, the influence of contacts, and Wigner condensation in the fractional quantum Hall effect regime. The 27 invited contributions by renowned expertsprovide an excellent survey of the field that is complemented by numerous contributed papers.

Elementary Solid State Physics

Principles and Applications

Addison-Wesley

Epitaxy of Semiconductors

Introduction to Physical Principles

Springer Science & Business Media Introduction to Epitaxy provides the essential information for a comprehensive upper-level graduate course treating the crystalline growth of semiconductor heterostructures. Heteroepitaxy represents the basis of advanced electronic and optoelectronic devices today and is considered one of the top fields in materials research. The book covers the structural and electronic properties of strained epitaxial layers, the thermodynamics and kinetics of layer growth, and the description of the major growth techniques metalorganic vapor phase epitaxy, molecular beam epitaxy and liquid phase epitaxy. Cubic semiconductors, strain relaxation by misfit dislocations, strain and confinement effects on electronic states, surface structures and processes during nucleation and growth are treated in detail. The Introduction to Epitaxy requires only little knowledge on solid-state physics. Students of natural sciences, materials science and electrical engineering as well as their lecturers benefit from elementary introductions to theory and practice of epitaxial growth, supported by pertinent references and over 200 detailed illustrations.

Conductors, Semiconductors, Superconductors

An Introduction to Solid-State Physics

Springer Nature This compact undergraduate textbook provides a concise yet thorough introduction to the fundamentals of solid-state physics, while also briefly discussing the historical context surrounding key scholars in the field. The vivid explanations and unique didactic approach adopted in the book aim to generate interest in these subjects while also serving as a motivating primer and supporting companion for studying more detailed and advanced textbooks in solid-state physics. The book is also suitable as a quick refresher for students preparing for examinations. The third edition features many extensions, including an up-to-date discussion of topological materials, a rapidly developing area at the forefront of solid-state physics. Primarily concentrating on the electric and magnetic properties of materials, the book will benefit undergraduate students in the fields of physics, materials science, and electrical engineering.

Essentials of Semiconductor Device Physics

John Wiley & Sons ESSENTIALS OF SEMICONDUCTOR DEVICE PHYSICS An introductory semiconductor device physics textbook that is accessible to readers without a background in statistical physics The subject of this book is the physics of semiconductor devices, which is an important topic in engineering and physics because it forms the background for electronic and optoelectronic devices, including solar cells. The author aims to provide students and teachers with a concise text that focuses on semiconductor devices and covers the necessary background in statistical physics. This text introduces the key prerequisite knowledge in a simple, clear, and friendly manner. It distills the key concepts of semiconductor devices down to their essentials, enabling students to master this key subject in engineering, physics, and materials. The subject matter treated in this book is directly connected to the physics of p-n junctions and solar cells, which has become a topic of intense interest in the last decade. Sample topics covered within the text include: Chemical potential, Fermi level, Fermi-Dirac distribution, drift current and diffusion current. The physics of semiconductors, band theory and intuitive derivations of the concentration of charge carriers. The p-n junction, with qualitative analysis preceding the mathematical descriptions. A derivation of the current vs voltage relation in p-n junctions (Shockley equation). Important applications of p-n junctions, including solar cells The two main types of transistors: Bipolar Junction Transistors (BJT) and Metal Oxide Semiconductor Field Effect Transistors (MOSFET) For students and instructors, it may be used as a primary textbook for an introductory semiconductor device physics course and is suitable for a course of approximately 30-50 hours. Scientists

studying and researching semiconductor devices in general, and solar cells in particular, will also benefit from the clear and intuitive explanations found in this book.

High Magnetic Fields in Semiconductor Physics II

Transport and Optics, Proceedings of the International Conference, Würzburg, Fed. Rep. of Germany, August 22–26, 1988

Springer Science & Business Media This volume contains contributions presented at the International Conference "The Application of High Magnetic Fields in Semiconductor Physics", which was held at the University of Wiirzburg from August 22 to 26, 1988. In the tradition of previous Wiirzburg meetings on the subject - the first conference was held in 1972 - only invited papers were presented orally. All 42 lecturers were asked to review their subject to some extent so that this book gives a good overview of the present state of the respective topic. A look at the contents shows that the subjects which have been treated at previous conferences have not lost their relevance. On the contrary, the application of high magnetic fields to semiconductors has grown substantially during the recent past. For the elucidation of the electronic band structure of semicon ductors high magnetic fields are still an indispensable tool. The investigation of two-dimensional electronic systems especially is frequently connected with the use of high magnetic fields. The reason for this is that a high B-field adds angular momentum quantization to the boundary quantization present in het erostructures and superlattices. A glance at the contributions shows that the majority deal with 2D properties. Special emphasis was on the integral and fractional quantum Hall effect. Very recent results related to the observation of a fraction with an even denbminator were presented. It became obvious that the polarization of the different fractional Landau levels is more complicated than originally anticipated.

Fundamentals of Semiconductor Physics and Devices

World Scientific This book is an introduction to the principles of semiconductor physics, linking its scientific aspects with practical applications. It is addressed to both readers who wish to learn semiconductor physics and those seeking to understand semiconductor devices. It is particularly well suited for those who want to do both.Intended as a teaching vehicle, the book is written in an expository manner aimed at conveying a deep and coherent understanding of the field. It provides clear and complete derivations of the basic concepts of modern semiconductor physics. The mathematical arguments and physical interpretations are well balanced: they are presented in a measure designed to ensure the integrity of the delivery of the subject matter in a fully comprehensible form. Experimental procedures and measured data are included as well. The reader is generally not expected to have background in quantum mechanics and solid state physics beyond the most elementary level. Nonetheless, the presentation of this book is planned to bring the student to the point of research/design capability as a scientist or engineer. Moreover, it is sufficiently well endowed with detailed knowledge of the field, including recent developments bearing on submicron semiconductor structures, that the book also constitutes a valuable reference resource.In Chapter 1, basic features of the atomic structures, chemical nature and the macroscopic properties of semiconductors are discussed. The band structure of ideal semiconductor crystals is treated in Chapter 2, together with the underlying one-electron picture and other fundamental concepts. Chapter 2 also provides the requisite background of the tight binding method and the k.p-method, which are later used extensively. The electron states of shallow and deep centers, clean semiconductor surfaces, quantum wells and superlattices, as well as the effects of external electric and magnetic fields, are treated in Chapter 3. The one- or multi-band effective mass theory is used wherever this method is applicable. A summary of group theory for application in semiconductor physics is given in an Appendix. Chapter 4 deals with the statistical distribution of charge carriers over the band and localized states in thermodynamic equilibrium. Non-equilibrium processes in semiconductors are treated in Chapter 5. The physics of semiconductor junctions (pn-, hetero-, metal-, and insulator-) is developed in Chapter 6 under conditions of thermodynamic equilibrium, and in Chapter 7 under non-equilibrium conditions. On this basis, the most important electronic and opto-electronic semiconductor devices are treated, among them uni- and bi-polar transistors, photodetectors, solar cells, and injection lasers. A summary of group theory for applications in semiconductors is given in an Appendix.

The Physics of Semiconductors

An Introduction Including Devices and Nanophysics

Springer Science & Business Media Brings the reader to an overview of the subject as a whole and to the point where they can specialize and enter supervised laboratory research Provides a balance between aspects of solid state and semiconductor physics and the concepts of various semiconductor devices and their applications in electric and photonic devices. Proffers explicit formulas (with the help of Mathematica) for as many as possible results, going beyond current textbook equations, thus makes easier to understand for undergrads.

Semiconductor Nanostructures

Quantum States and Electronic Transport

Oxford University Press This introduction to the physics of semiconductor nanostructures and their transport properties emphasizes five fundamental transport phenomena: quantized conductance, tunnelling transport, the Aharonov-Bohm effect, the quantum Hall effect and the Coulomb blockade effect.

Modern Semiconductor Physics and Device Applications

"This textbook provides a theoretical background for contemporary trends in solid state theory and semiconductor device physics. It discusses advanced methods of quantum mechanics and field theory and is therefore primarily intended for graduate students in theoretical and experimental physics who have already studied electrodynamics, statistical physics, and quantum mechanics. It also relates solid-state physics fundamentals to semiconductor device applications and includes auxiliary results from mathematics and quantum mechanics, making the book useful also for graduate students in electrical engineering and material science. Key Features: Explores concepts common in textbooks on semiconductors, in addition to topics not included in similar books currently available on the market, such as the topology of Hilbert space in crystals Contains the latest research and developments in the field Written in an accessible yet rigorous manner"--

Advanced Physics of Electron Transport in Semiconductors and Nanostructures

Springer This textbook is aimed at second-year graduate students in Physics, Electrical Engineering, or Materials Science. It presents a rigorous introduction to electronic transport in solids, especially at the nanometer scale.Understanding electronic transport in solids requires some basic knowledge of Hamiltonian Classical Mechanics, Quantum Mechanics, Condensed Matter Theory, and Statistical Mechanics. Hence, this book discusses those sub-topics which are required to deal with electronic transport in a single, self-contained course. This will be useful for students who intend to work in academia or the nano/ micro-electronics industry.Further topics covered include: the theory of energy bands in crystals, of second quantization and elementary excitations in solids, of the dielectric properties of semiconductors with an emphasis on dielectric screening and coupled interfacial modes, of electron scattering with phonons, plasmons, electrons and photons, of the derivation of transport equations in semiconductors and semiconductor nanostructures somewhat at the quantum level, but mainly at the semi-classical level. The text presents examples relevant to current research, thus not only about Si, but also about III-V compound semiconductors, nanowires, graphene and graphene nanoribbons. In particular, the text gives major emphasis to plane-wave methods applied to the electronic structure of solids, both DFT and empirical pseudopotentials, always paying attention to their effects on electronic transport and its numerical treatment. The core of the text is electronic transport, with ample discussions of the transport equations derived both in the quantum picture (the Liouville-von Neumann equation) and semi-classically (the Boltzmann transport equation, BTE). An advanced chapter, Chapter 18, is strictly related to the ‘tricky’ transition from the time-reversible Liouville-von Neumann equation to the time-irreversible Green’s functions, to the density-matrix formalism and, classically, to the Boltzmann transport equation. Finally, several methods for solving the BTE are also reviewed, including the method of moments, iterative methods, direct matrix inversion, Cellular Automata and Monte Carlo. Four appendices complete the text.

Semiconductor Optics

Springer Science & Business Media The updated and enlarged new edition of this book provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV. It includes coverage of linear and nonlinear optical properties, dynamics, magneto- and electrooptics, high-excitation effects, some applications, experimental techniques and group theory. The mathematics

is kept as elementary as possible. The subjects covered extend from physics to materials science and optoelectronics. New or updated chapters add coverage of current topics, while the chapters on bulk materials have been revised and updated.

Fundamentals of Semiconductor Physics and Devices

World Scientific This book is an introduction to the principles of semiconductor physics, linking its scientific aspects with practical applications. It is addressed to both readers who wish to learn semiconductor physics and those seeking to understand semiconductor devices. It is particularly well suited for those who want to do both. Intended as a teaching vehicle, the book is written in an expository manner aimed at conveying a deep and coherent understanding of the field. It provides clear and complete derivations of the basic concepts of modern semiconductor physics. The mathematical arguments and physical interpretations are well balanced: they are presented in a measure designed to ensure the integrity of the delivery of the subject matter in a fully comprehensible form. Experimental procedures and measured data are included as well. The reader is generally not expected to have background in quantum mechanics and solid state physics beyond the most elementary level. Nonetheless, the presentation of this book is planned to bring the student to the point of research/design capability as a scientist or engineer. Moreover, it is sufficiently well endowed with detailed knowledge of the field, including recent developments bearing on submicron semiconductor structures, that the book also constitutes a valuable reference resource. In Chapter 1, basic features of the atomic structures, chemical nature and the macroscopic properties of semiconductors are discussed. The band structure of ideal semiconductor crystals is treated in Chapter 2, together with the underlying one-electron picture and other fundamental concepts. Chapter 2 also provides the requisite background of the tight binding method and the k.p-method, which are later used extensively. The electron states of shallow and deep centers, clean semiconductor surfaces, quantum wells and superlattices, as well as the effects of external electric and magnetic fields, are treated in Chapter 3. The one- or multi-band effective mass theory is used wherever this method is applicable. A summary of group theory for application in semiconductor physics is given in an Appendix. Chapter 4 deals with the statistical distribution of charge carriers over the band and localized states in thermodynamic equilibrium. Non-equilibrium processes in semiconductors are treated in Chapter 5. The physics of semiconductor junctions (pn-, hetero-, metal-, and insulator-) is developed in Chapter 6 under conditions of thermodynamic equilibrium, and in Chapter 7 under non-equilibrium conditions. On this basis, the most important electronic and opto-electronic semiconductor devices are treated, among them uni- and bi-polar transistors, photodetectors, solar cells, and injection lasers. A summary of group theory for applications in semiconductors is given in an Appendix. Contents:Characterization of SemiconductorsElectronic Structure of Ideal CrystalsElectronic Structure of Semiconductor Crystals with PerturbationsElectron System in Thermodynamic EquilibriumNon-Equilibrium Processes in SemiconductorsSemiconductor Junctions in Thermodynamic EquilibriumSemiconductor Junctions Under Non-Equilibrium Conditions Readership: Undergraduates, graduates and researchers in the fields of physics and engineering. keywords:Semiconductors;Transistor;Devices;Heterojunctions;Microstructures;Band-Structure;Luttinger-Kohn-Model;Kane-Model;Deep-Levels;Transport;Semiconductor Physics;Fundamental Physical Phenomena;General Backround;Characterization of Semiconductor;Electronic Structur of Semiconductors;Semiconductor Junctions the Thermodynamic Equilibrium;Semiconductor Junctions Under Non-Equilibrium Conductions; “... The reader who has only a first acquaintance with semiconductor physics will find that this book has fully detailed explanations of the fundamental physical phenomena, providing a good general background ... A brilliant discussion of artifical atomic superstructures of nanometer length scale establishes a link to the most active field of semiconductor physics ... In my opinion the book of R Enderlein and N J M Horing Fundamentals of Semiconductor Physics and Devices is a valuable contribution to the modern didactic literature on the physics of semiconductors. Morever, it is of considerable value as a reference for specialists as well.” J T Devreese Professor at the Physics Department University of Antwerpen, Belgium “In Fundamentals of Semiconductor Physics and Devices, R Enderiein and N J M Horing have provided a very extensive and detailed text on the physics underlying semiconductor devices. More so than any other current text, this book provides a greatly expanded discussion of modern tight-binding methods, helping the students to understand these aspects of electronic structure in clear, simple terms. In connection with this the authors offer a very detailed discussion of deep levels in semiconductors, which are so important to semiconducting properties. Also, in the discussion of transport properties, the book goes into much greater depth about nonlinear and nonequilibrium processes than is usual. It is quite a unique contribution, containing the basic physics which tends to be missing from device-oriented books, but going much further into the essentials needed for device development than any solid-state-physics text.” Walter A Harrison Professor of Applied Physics Stanford University, USA

The Physics of Semiconductors

With Applications to Optoelectronic Devices

Cambridge University Press Graduate text with comprehensive treatment of semiconductor device physics and engineering, and descriptions of real optoelectronic devices.

Physics of Semiconductor Devices

Springer This textbook describes the basic physics of semiconductors, including the hierarchy of transport models, and connects the theory with the functioning of actual semiconductor devices. Details are worked out carefully and derived from the basic physical concepts, while keeping the internal coherence of the analysis and explaining the different levels of approximation. Coverage includes the main steps used in the fabrication process of integrated circuits: diffusion, thermal oxidation, epitaxy, and ion implantation. Examples are based on silicon due to its industrial importance. Several chapters are included that provide the reader with the quantum-mechanical concepts necessary for understanding the transport properties of crystals. The behavior of crystals incorporating a position-dependent impurity distribution is described, and the different hierarchical transport models for semiconductor devices are derived (from the Boltzmann transport equation to the hydrodynamic and drift-diffusion models). The transport models are then applied to a detailed description of the main semiconductor-device architectures (bipolar, MOS, CMOS), including a number of solid-state sensors. The final chapters are devoted to the measuring methods for semiconductor-device parameters, and to a brief illustration of the scaling rules and numerical methods applied to the design of semiconductor devices.

Ultrafast Spectroscopy of Semiconductors and Semiconductor Nanostructures

Springer Science & Business Media

Epitaxy of Semiconductors

Physics and Fabrication of Heterostructures

Springer Nature The extended and revised edition of this textbook provides essential information for a comprehensive upper-level graduate course on the crystalline growth of semiconductor heterostructures. Heteroepitaxy is the basis of today’s advanced electronic and optoelectronic devices, and it is considered one of the most important fields in materials research and nanotechnology. The book discusses the structural and electronic properties of strained epitaxial layers, the thermodynamics and kinetics of layer growth, and it describes the major growth techniques: metalorganic vapor-phase epitaxy, molecular-beam epitaxy, and liquid-phase epitaxy. It also examines in detail cubic and hexagonal semiconductors, strain relaxation by misfit dislocations, strain and confinement effects on electronic states, surface structures, and processes during nucleation and growth. Requiring only minimal knowledge of solid-state physics, it provides natural sciences, materials science and electrical engineering students and their lecturers elementary introductions to the theory and practice of epitaxial growth, supported by references and over 300 detailed illustrations. In this second edition, many topics have been extended and treated in more detail, e.g. in situ growth monitoring, application of surfactants, properties of dislocations and defects in organic crystals, and special growth techniques like vapor-liquid-solid growth of nanowires and selective-area epitaxy.

Semiconductor Radiation Detectors

Device Physics

Springer Starting from basic principles, this book describes the rapidly growing field of modern semiconductor detectors used for energy and position measurement radiation. The author, whose own contributions to these developments have been significant, explains the working principles of semiconductor radiation detectors in an intuitive way. Broad coverage is also given to electronic signal readout and to the subject of radiation damage.

Electron Spectrum of Gapless Semiconductors

Springer Science & Business Media A presentation of the peculiarities of the physical properties of a comparatively new class of solids. GSs are of practical interest since they are very sensitive to impurities, and to the influence of light, magnetic and electric fields, and to pressure.

Compound Semiconductor Device Physics

Academic Press This book provides one of the most rigorous treatments of compound semiconductor device physics yet published. A complete understanding of modern devices requires a working knowledge of low-dimensional physics, the use of statistical methods, and the use of one-, two-, and three-dimensional analytical and numerical analysis techniques. With its systematic and detailed**discussion of these topics, this book is ideal for both the researcher and the student. Although the emphasis of this text is on compound semiconductor devices, many of the principles discussed will also be useful to those interested in silicon devices. Each chapter ends with exercises that have been designed to reinforce concepts, to complement arguments or derivations, and to emphasize the nature of approximations by critically evaluating realistic conditions. One of the most rigorous treatments of compound semiconductor device physics yet published**Essential reading for a complete understanding of modern devices**Includes chapter-ending exercises to facilitate understanding

Physical Limitations of Semiconductor Devices

Springer Providing an important link between the theoretical knowledge in the field of non-linier physics and practical application problems in microelectronics, the purpose of the book is popularization of the physical approach for reliability assurance. Another unique aspect of the book is the coverage given to the role of local structural defects, their mathematical description, and their impact on the reliability of the semiconductor devices.

Physics of Semiconductor Devices

Springer Science & Business Media Physics of Semiconductor Devices covers both basic classic topics such as energy band theory and the gradual-channel model of the MOSFET as well as advanced concepts and devices such as MOSFET short-channel effects, low-dimensional devices and single-electron transistors. Concepts are introduced to the reader in a simple way, often using comparisons to everyday-life experiences such as simple fluid mechanics. They are then explained in depth and mathematical developments are fully described. Physics of Semiconductor Devices contains a list of problems that can be used as homework assignments or can be solved in class to exemplify the theory. Many of these problems make use of Matlab and are aimed at illustrating theoretical concepts in a graphical manner.

The Story of Semiconductors

OUP Oxford 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.

Quantum Theory of the Optical and Electronic Properties of Semiconductors

World Scientific This invaluable textbook presents the basic elements needed to understand and research into semiconductor physics. It deals with elementary excitations in bulk and low-dimensional semiconductors, including quantum wells, quantum wires and quantum dots. The basic principles underlying optical nonlinearities are developed, including excitonic and many-body plasma effects. Fundamentals of optical bistability, semiconductor lasers, femtosecond excitation, the optical Stark effect, the semiconductor photon echo, magneto-optic effects, as well as bulk and quantum-confined Franz-Keldysh effects, are covered. The material is presented in sufficient detail for graduate students and researchers with a general background in quantum mechanics.

Excitons in Low-Dimensional Semiconductors

Theory Numerical Methods Applications

Springer Science & Business Media The author develops the effective-mass theory of excitons in low-dimensional semiconductors and describes numerical methods for calculating the optical absorption including Coulomb interaction, geometry, and external fields. The theory is applied to Fano resonances in low-dimensional semiconductors and the Zener breakdown in superlattices. Comparing theoretical results with experiments, the book is essentially self-contained; it is a hands-on approach with detailed derivations, worked examples, illustrative figures, and computer programs. The book is clearly structured and will be valuable as an advanced-level self-study or course book for graduate students, lecturers, and researchers.

Optics of Semiconductors and Their Nanostructures

Springer Science & Business Media In recent years the field of semiconductor optics has been pushed to several extremes. The size of semiconductor structures has shrunk to dimensions of a few nanometers, the semiconductor-light interaction is studied on timescales as fast as a few femtoseconds, and transport properties on a length scale far below the wavelength of light have been revealed. These advances were driven by rapid improvements in both semiconductor and optical technologies and were further facilitated by progress in the theoretical description of optical excitations in semiconductors. This book, written by leading experts in the field, provides an up-to-date introduction to the optics of semiconductors and their nanostructures so as to help the reader understand these exciting new developments. It also discusses recently established applications, such as blue-light emitters, as well as the quest for future applications in areas such as spintronics, quantum information processing, and third-generation solar cells.