GRADUATE TEXTS IN PHYSICS

Peter Y. Yu Manuel Cardona

Fundamentals of Semiconductors

Physics and Materials Properties

Fourth Edition



<u>Fundamentals Of Semiconductors Physics And Materials</u> <u>Properties</u>

KJ Lindholm-Leary

Fundamentals Of Semiconductors Physics And Materials Properties:

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Semiconductor Peter Yu, Manuel Cardona, 2014-01-15 Fundamentals Of Semiconductors: Physics And Materials Properties, 3E Y. Yu Peter, Manuel Cardona, 2007-03-01 Fundamentals of Semiconductors Peter Y. Yu, Manuel

Physics of Semiconductors Aditya Saxena, 2025-02-20 Physics of Semiconductors Core Principles Cardona, 2010-09-13 is a comprehensive guide that demystifies how semiconductors function from the fundamental physics to the devices we use daily We cater to a general audience with a focus on readers in the United States We begin with the basics of quantum mechanics and solid state physics before diving into how these principles apply to semiconductors like silicon and gallium arsenide We explain crucial concepts such as band theory the flow of electricity through semiconductors and their use in devices like transistors and solar cells Additionally we discuss the manufacturing processes of semiconductors and highlight the advancements scientists are making in developing new and improved semiconductors Physics of Semiconductors Core Principles is an excellent resource for anyone eager to understand the intricacies of this essential technology Physics of Semiconductor Materials and Devices Debdeep Jena, 2022-05-16 Quantum Phenomena do not occur in a Hilbert space They occur in a laboratory Asher Peres Semiconductor physics is a laboratory to learn and discover the concepts of quantum mechanics and thermodynamics condensed matter physics and materials science and the payoffs are almost immediate in the form of useful semiconductor devices Debdeep Jena has had the opportunity to work on both sides of the fence on the fundamental materials science and quantum physics of semiconductors and in their applications in semiconductor electronic and photonic devices In Quantum Physics of Semiconductors and Nanostructures Jena uses this experience to make each topic as tangible and accessible as possible to students at all levels Consider the simplest physical processes that occur in semiconductors electron or hole transport in bands and over barriers collision of electrons with the atoms in the crystal or when electrons and holes annihilate each other to produce a photon The correct explanation of these processes require a quantum mechanical treatment Any shortcuts lead to misconceptions that can take years to dispel and sometimes become roadblocks towards a deeper understanding and appreciation of the richness of the subject A typical introductory course on semiconductor physics would then require prerequisites of quantum mechanics statistical physics and thermodynamics materials science and electromagnetism Rarely would a student have all this background when s he takes a course of this nature in most universities Jena s work fills in these gaps and gives students the background and deeper understanding of the quantum physics of semiconductors and nanostructures **Fundamentals Of Semiconductors** Physics And Materials Properties M. Cardona, Semiconductor Materials B.G. Yacobi, 2006-04-18 The technological progress is closely related to the developments of various materials and tools made of those materials Even the different ages have been defined in relation to the materials used Some of the major attributes of the present day age i e the electronic materials age are such common tools as computers and fiber optic telecommunication systems in which semiconductor materials provide vital components for various mic electronic and optoelectronic devices in applications such as computing

memory storage and communication The field of semiconductors encompasses a variety of disciplines This book is not intended to provide a comprehensive description of a wide range of semiconductor properties or of a continually increasing number of the semiconductor device applications Rather the main purpose of this book is to provide an introductory perspective on the basic principles of semiconductor materials and their applications that are described in a relatively concise format in a single volume Thus this book should especially be suitable as an introductory text for a single course on semiconductor materials that may be taken by both undergraduate and graduate engineering students This book should also be useful as a concise reference on semiconductor materials for researchers working in a wide variety of fields in physical and engineering sciences Basic Semiconductor Physics Chihiro Hamaguchi, 2017-11-27 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 <u>II-VI Semiconductor Materials and their Applications</u> MariaC. Tamargo, 2018-05-04 II VI Semiconductor Materials and Their Applications deals with II VI compound semiconductors and the status of the two areas of current optoelectronics applications blue green emitters and IR detectors Specifically the growth charactrization materials and device issues for these two applications are described Emphasis is placed on the wide

bandgap emitters where much progress has occurred recently The book also presents new directions that have potential future applications in optoelectronics for II VI materials In particular it discusses the status of dilute magnetic semiconductors for mango optical and electromagnetic devices nonlinear optical properties photorefractive effects and new materials and physics phenomena such as self organized low dimensional structures II VI Semiconductor Materials and Their Applications is a valuable reference book for researchers in the field as well as a textbook for materials science and applied Optik und Photonik Bahaa E. A. Saleh, Malvin Carl Teich, 2020-04-30 Vollst ndig berarbeitete Neuauflage des ma geblichen Grundlagen Lehrbuchs zur Optik und Photonik umfassend berarbeitet und mit einem neuen Kapitel zur Metamaterialoptik erweitert Die Optik ist eines der Itesten und faszinierendsten Teilgebiete der Physik und fest in den Curricula des Physikstudiums verankert Sie besch ftigt sich mit der Ausbreitung von Licht und Ph nomenen wie Interferenz Brechung Beugung und optischen Abbildungen Die Photonik umfasst optische Ph nomene die prim r auf der Wechselwirkung von quantisiertem Licht und Materie beruhen und befasst sich mit dem Verst ndnis und der Entwicklung optischer Bauteile und Systeme wie etwa Lasern LEDs und photonischen Kristallen In bew hrter Weise gibt die vollst ndig berarbeitete und erweiterte Neuauflage des Saleh Teich eine Einf hrung in die Grundlagen der Optik und Photonik fr Studierende der Physik und verwandter Wissenschaften Ausf hrliche Erkl rungen rund 1000 Abbildungen und die zur guantitativen Durchdringung notwendige Mathematik erm glichen ein tiefes Verst ndnis aller Teilgebiete der klassischen und modernen Optik Umfassend und verst ndlich s mtliche Grundlagen der Optik und Photonik in einem Werk vereint Geschrieben von hervorragenden Didaktikern mit langer Lehrerfahrung optische Ph nomene und deren Physik stehen im Vordergrund der notwendige mathematische Apparat wird behutsam entwickelt berarbeitet und erweitert alle Kapitel wurden mit Blick auf noch bessere Verst ndlichkeit kritisch gepr ft und aktualisiert Komplett neu umfangreiches Kapitel zu Metamaterialoptik Optik und Photonik richtet sich an Bachelor und Master Studierende der Physik Materialwissenschaften und Ingenieurwissenschaften

Semiconductor Research Amalia Patane, Naci Balkan, 2012-04-12 The book describes the fundamentals latest developments and use of key experimental techniques for semiconductor research It explains the application potential of various analytical methods and discusses the opportunities to apply particular analytical techniques to study novel semiconductor compounds such as dilute nitride alloys The emphasis is on the technique rather than on the particular system studied Comprehensive Semiconductor Science and Technology ,2024-11-28 Semiconductors are at the heart of modern living Almost everything we do be it work travel communication or entertainment all depend on some feature of semiconductor technology Comprehensive Semiconductor Science and Technology Second Edition Three Volume Set captures the breadth of this important field and presents it in a single source to the large audience who study make and use semiconductor devices Written and edited by a truly international team of experts and newly updated to capture key advancements in the field this work delivers an objective yet cohesive review of the semiconductor world The work is divided

into three sections fully updated and expanded from the first edition The first section is concerned with the fundamental physics of semiconductors showing how the electronic features and the lattice dynamics change drastically when systems vary from bulk to a low dimensional structure and further to a nanometer size Throughout this section there is an emphasis on the full understanding of the underlying physics especially quantum phenomena The second section deals largely with the transformation of the conceptual framework of solid state physics into devices and systems which require the growth of high purity or doped bulk and epitaxial materials with low defect density and well controlled electrical and optical properties The third section is devoted to design fabrication and assessment of discrete and integrated semiconductor devices It will cover the entire spectrum of devices we see all around us for telecommunications computing automation displays illumination and consumer electronics Provides a comprehensive global picture of the semiconductor world Written and Edited by an international team of experts Compiles the most important semiconductor knowledge into one comprehensive resource Moves from fundamentals and theory to more advanced knowledge such as applications allowing readers to gain a deeper understanding of the field Strukturuntersuchungen an epitaktisch abgeschiedenen SiC-Schichten Hans-Peter Lang, 1998

Phononen in II-VI-Halbleiter-Nanostrukturen Gerwin Chilla, 2009-11-04 In dieser Arbeit werden Phononen in nasschemisch synthetisierten sph rischen Nanokristallen und Tetrapods aus II VI Verbindungshalbleitern mittels verschiedener optischer Messverfahren untersucht Ziel ist es erstens Photolumineszenz Prozesse in einzelnen Core Shell und Core Shell Shell Nanokristallen und zweitens Raman Streuprozesse in CdTe Nanopartikeln zu detektieren Den Kern der Untersuchungen bilden optische und akustische Phononen die sich auf Grund der hohen Stabilit t der hier gezeigten einzelnen CdSe Nanokristalle in den Photolumineszenz Spektren nachweisen lassen Einzelne Phononen k nnen confined akustischen Moden zugeordnet werden Die fr die Nanokristalle typischen Effekte Blinking und spektrale Diffusion werden anhand von konsekutiv aufgenommenen Photolumineszenz Spektren diskutiert Die intensit tsst rkste Linie in den Spektren der einzelnen Nanokristalle bildet die Dark State Zero Phonon Line Eine Nebenlinie kann auf Rekombinationen aus einem Bright State zur ckgef hrt werden Im Rahmen des Modells nach Lamb Lam82 werden drei sph rische akustische Moden bestimmt Sowohl das LA Phonon als auch das LO Phonon des CdSe Cores lassen sich nachweisen Zus tzlich k nnen LO Phononen der CdS und der ZnS Shell identifiziert werden Durch Polymerfilme wird eine definierte Umgebung fr die CdSe Nanokristalle auf dem Si Substrat geschaffen Es werden Photolumineszenz Messungen an einzelnen Nanokristallen gezeigt die jeweils bis zu ca 4 5 Stunden reine Beleuchtungszeit ca 2 Stunden durchgef hrt werden konnten Die verh ltnism ig intensit tsschwachen Phonon Signale der einzelnen Nanokristalle werden ber aufsummierte Einzelspektren ausgewertet Den Untersuchungen an einzelnen Nanokristallen gehen Photolumineszenz Messungen an InAs Quantenpunkten die in Heterostrukturen eingebettet sind voran In den Spektren konnten Signaturen einzelner InAs Quantenpunkte nachgewiesen werden Die Raman Spektren der CdTe Tetrapods und der sph rischen CdTe Nanokristalle zeigen ebenfalls optische

Phononen Diese Proben wurden im Ensemble gemessen Neben dem CdTe LO Phonon und seiner ersten Oberschwingung werden bei beiden Probenarten SO Phononen nachgewiesen Ferner kann eine Anregung in den Tetrapods durch einen Vergleich mit Rechnungen zu Nanowires von Mah03 als TOx Phonon interpretiert werden Die Analyse der Spektren von CdTe Tetrapods und von sph rischen CdTe Nanokristallen geben Aufschluss ber elektronische berg nge in den Nanopartikeln Demzufolge wird geschlussfolgert dass sich Raman Spektren zur Differenzierung von Tetrapods mit gut ausgebildeter geometrischer Struktur und Tetrapods mit im Verh ltnis zum Kern kurzen Armen eignen **Synthesis and Applications of Inorganic Nanostructures** Huagiang Cao, 2017-09-27 Authored by a leading figure in the field this book systematically describes all the fundamental aspects and applications of inorganic nanostructures from zero to three dimensions It not only discusses various synthesis technologies but also covers the physical properties of inorganic nanostructures such as optical electric and magnetic properties and practical applications such as energy storage including Li ion and Ni MH batteries and supercapacitors superhydrophobic and bio applications etc The focus throughout is on the synthesis structure application relationships including the growth mechanisms for the nanostrucutres Concise yet comprehensive this is indispensable reading for chemists and materials scientists Emerging Nanotechnologies for Manufacturing Wagar Ahmed, Mark J Jackson, 2014-09-15 In the second edition of Emerging Nanotechnologies for Manufacturing an unrivalled team of international experts explores existing and emerging nanotechnologies as they transform large scale manufacturing contexts in key sectors such as medicine advanced materials energy and electronics From their different perspectives the contributors explore technologies and techniques as well as applications and how they transform those sectors With updated chapters and expanded coverage the new edition of Emerging Nanotechnologies for Manufacturing reflects the latest developments in nanotechnologies for manufacturing and covers additional nanotechnologies applied in the medical fields such as drug delivery systems New chapters on graphene and smart precursors for novel nanomaterials are also added This important and in depth guide will benefit a broad readership from R D scientists and engineers to venture capitalists Covers nanotechnology for manufacturing techniques and applications across a variety of industries Explores the latest developments such as nanosuspensions and nanocarriers in drug delivery systems graphene applications and usage of smart precursors to develop nanomaterials Proven reference guide written by leading experts in the field Photovoltaics for the 21st Century II Electrochemical Society. Energy Technology Division, 2001 Presentations of the Symposium on Photovoltaics for the 21st Century II part of the 199th Meeting of the Electrochemical Society held in Washington D C in March 2001 Pref

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