Fundamentals Of Semiconductor Theory And Device Physics Prentice Hall Series In Electrical And Computer Engineering

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Fundamentals Of Semiconductor Theory And Device Physics Prentice Hall Series In Electrical And Computer Engineering ***2024-01-16***

KINGSTON ANDREWS

Fundamentals of Semiconductor Physics and Devices Springer Science & Business Media
Fundamentals of III-V Semiconductor MOSFETs presents the fundamentals and current status of research of compound semiconductor metal-oxide-semiconductor field-effect transistors (MOSFETs) that are envisioned as a future replacement of silicon in digital circuits. The material covered begins with a review of specific properties of III-V semiconductors and available technologies making them attractive to MOSFET technology, such as band-engineered heterostructures, effect of strain, nanoscale control during epitaxial growth. Due to the lack of thermodynamically stable native oxides on III-V's (such as SiO2 on Si), high-k oxides are the natural choice of dielectrics for III-V MOSFETs. The key challenge of the III-V MOSFET technology is a high-quality, thermodynamically stable gate dielectric that passivates the interface states, similar to SiO2 on Si. Several chapters give a detailed description of materials science and electronic behavior of various dielectrics and related interfaces, as well as physics of fabricated devices and MOSFET fabrication technologies. Topics also include recent progress and understanding of various materials systems; specific issues for electrical measurement of gate stacks and FETs with low and wide bandgap channels and high interface trap density; possible

paths of integration of different semiconductor materials on Si platform.
Quantum Theory of the Optical and Electronic Properties of Semiconductors Prentice Hall
Introduction to Semiconductor Device Physics is a popular and established text that offers a thorough introduction to the underlying physics of semiconductor devices. It begins with a review of basic solid state physics, then goes on to describe the properties of semiconductors including energy bands, the concept of effective mass, carrier concentration, and conduction in more detail. Thereafter the book is concerned with the principles of operation of specific devices, beginning with the Gunn Diode and the p-n junction. The remaining chapters cover the on specific devices, including the LED, the bipolar transistor, the field-effect transistor, and the semiconductor laser. The book concludes with a chapter providing a brief introduction to quantum theory. Not overtly mathematical, Introduction to Semiconductor Device Physics introduces only those physical concepts required for an understanding of the semiconductor devices being considered. The author's intuitive style, coupled with an extensive set of worked problems, make this the ideal introductory text for those concerned with understanding electrical and electronic engineering, applied physics, and related subjects.
Physics and Materials Properties Wiley-IEEE Press
Well-balanced and up-to-date introduction to the field of semiconductor optics, including transport phenomena in semiconductors. Starting with the theoretical fundamentals of this field the book develops, assuming a basic knowledge of solid-state physics. The application areas of the theory covered include semiconductor lasers, detectors, electro-optic modulators, single-electron transistors, microcavities and double-barrier resonant tunneling diodes. One hundred problems with hints for solution help the readers to deepen their knowledge.
Semiconductor Fundamentals Springer
This book presents those terms, concepts, equations, and models that are routinely used in describing the operational behavior of solid state devices. The second edition provides many new problems and illustrative examples.
Fundamentals of Semiconductor Physics and Devices Fundamentals of Semiconductor Theory and Device PhysicsFundamentals of SemiconductorsPhysics and Materials Properties
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.
Fundamentals of Solid State Engineering CRC Press
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.

Fundamentals of Semiconductor Theory and Device Physics Springer Science & Business Media

Fundamentals of Semiconductor Devices is a comprehensively written text which deals with both qualitative and quantitative analysis of semiconductor theory & devices. This book is perfect for the first course on Semiconductor Physics and Devices at the UG level.

Advanced Theory of Semiconductor Devices CRC Press

Electrical Engineering Advanced Theory of Semiconductor Devices Semiconductor devices are ubiquitous in today’s world and are found increasingly in cars, kitchens and electronic door locks, attesting to their presence in our daily lives. This comprehensive book provides the fundamentals of semiconductor device theory from basic quantum physics to computer-aided design. Advanced Theory of Semiconductor Devices will improve your understanding of computer simulation of devices through a thorough discussion of basic equations, their validity, and numerical solutions as they are contained in current simulation tools. You will gain state-of-the-art knowledge of devices used in both III–V compounds and silicon technology. Specially featured are novel approaches and explanations of electronic transport, particularly in p—n junction diodes. Close attention is also given to innovative treatments of quantum-well laser diodes and hot electron effects in silicon technology. This in-depth book is written for engineers, graduate students, and research scientists in solid-state electronics who want to gain a better understanding of the principles underlying semiconductor devices.

Compound Semiconductors John Wiley & Sons

Strain Effect in Semiconductors: Theory and Device Applications presents the fundamentals and applications of strain in semiconductors and semiconductor devices that is relevant for strain-enhanced advanced CMOS technology and strain-based piezoresistive MEMS transducers. Discusses relevant applications of strain while also focusing on the fundamental physics pertaining to bulk, planar, and scaled nano-devices. Hence, this book is relevant for current strained Si logic technology as well as for understanding the physics and scaling for future strained nano-scale devices.

Theory and Device Applications World Scientific

A practical guide to semiconductor manufacturing from processcontrol to yield modeling and experimental design Fundamentals of Semiconductor Manufacturing and Process Controlcovers all issues involved in manufacturing microelectronic devicesand circuits, including fabrication

sequences, process control,experimental design, process modeling, yield modeling, and CIM/CAMsystems. Readers are introduced to both the theory and practice ofall basic manufacturing concepts. Following an overview of manufacturing and technology, the textexplores process monitoring methods, including those that focus onproduct wafers and those that focus on the equipment used toproduce wafers. Next, the text sets forth some fundamentals ofstatistics and yield modeling, which set the foundation for adetailed discussion of how statistical process control is used toanalyze quality and improve yields. The discussion of statistical experimental design offers readers apowerful approach for systematically varying controllable processconditions and determining their impact on output parameters thatmeasure quality. The authors introduce process modeling concepts,including several advanced process control topics such asrun-by-run, supervisory control, and process and equipmentdiagnosis. Critical coverage includes the following: * Combines process control and semiconductor manufacturing * Unique treatment of system and software technology and managementof overall manufacturing systems * Chapters include case studies, sample problems, and suggestedexercises * Instructor support includes electronic copies of the figures andan instructor's manual Graduate-level students and industrial practitioners will benefitfrom the detailed exami?nation of how electronic materials andsupplies are converted into finished integrated circuits andelectronic products in a high-volume manufacturingenvironment. An Instructor's Manual presenting detailed solutions to all theproblems in the book is available from the Wiley editorialdepartment. An Instructor Support FTP site is also available.

A Qualitative, Non-mathematical Explanation of How Semiconductors Work and How They are Used CRC Press

"Explores the science and technology of lithographic processes and resist materials and summarizes the most recent innovations in semiconductor manufacturing. Considers future trends in lithography and resist material technology. Reviews the interaction of light, electron beams, and X-rays with resist materials."

Fundamentals of Semiconductor Devices Elsevier

Solid-State Devices and Applications is an introduction to the solid-state theory and its devices and applications. The book also presents a summary of all major solid-state devices available, their theory, manufacture, and main applications. The text is divided into three sections. The first part deals with the semiconductor theory and discusses the fundamentals of semiconductors; the kinds of diodes and techniques in their manufacture; the types and modes of operation of bipolar transistors; and the basic principles of unipolar transistors and their difference with bipolar transistors. The second part talks about the kinds of integrated circuits and their future developments; amplifiers, including their fundamentals and different types; and the principles and categories of oscillators. The third part discusses the applications of solid-state devices; transistor parameters and equivalent circuits; and the fundamentals and applications of Boolean-algebra. The book is a good read for technicians and students who

are about to enter or are currently in their final stages of their course, as well as those who have recently finished and would like to have their knowledge refreshed.

Fundamentals of Semiconductor Manufacturing and Process Control Anchor Academic Publishing (aap_verlag)

The Third Edition of the standard textbook and reference in the field of semiconductor devices This classic book has set the standard for advanced study and reference in the semiconductor device field. Now completely updated and reorganized to reflect the tremendous advances in device concepts and performance, this Third Edition remains the most detailed and exhaustive single source of information on the most important semiconductor devices. It gives readers immediate access to detailed descriptions of the underlying physics and performance characteristics of all major bipolar, field-effect, microwave, photonic, and sensor devices. Designed for graduate textbook adoptions and reference needs, this new edition includes: A complete update of the latest developments New devices such as three-dimensional MOSFETs, MODFETs, resonant-tunneling diodes, semiconductor sensors, quantum-cascade lasers, single-electron transistors, real-space transfer devices, and more Materials completely reorganized Problem sets at the end of each chapter All figures reproduced at the highest quality Physics of Semiconductor Devices, Third Edition offers engineers, research scientists, faculty, and students a practical basis for understanding the most important devices in use today and for evaluating future device performance and limitations. A Solutions Manual is available from the editorial department.

Fundamentals of Semiconductor Fabrication Springer Science & Business Media

"This dynamic text applies physics concepts and equations to practical, real-world applications of semiconductor device theory"--

Fundamentals of Semiconductors Tata McGraw-Hill Education

Provides a multidisciplinary introduction to quantum mechanics, solid state physics, advanced devices, and fabrication Covers wide range of topics in the same style and in the same notation Most up to date developments in semiconductor physics and nano-engineering Mathematical derivations are carried through in detail with emphasis on clarity Timely application areas such as biophotonics , bioelectronics

Semiconductor Devices World Scientific

An accessible guide to how semiconductor electronics work and how they are manufactured, for professionals and interested readers with no electronics engineering background Semiconductor Basics is an accessible guide to how semiconductors work. It is written for readers without an electronic engineering background. Semiconductors are the basis for almost all modern electronic devices. The author—an expert on the topic—explores the fundamental concepts of what a semiconductor is, the different types in use, and how they are different from conductors and insulators. The book has a large number of helpful and illustrative drawings, photos, and figures. The author uses only simple arithmetic to help understand the device operation and applications. The book reviews the key devices that can be constructed using semiconductor materials such as

diodes and transistors and all the large electronic systems based on these two component such as computers, memories, LCDs and related technology like Lasers LEDs and infrared detectors. The text also explores integrated circuits and explains how they are fabricated. The author concludes with some projections about what can be expected in the future. This important book: Offers an accessible guide to semiconductors using qualitative explanations and analogies, with minimal mathematics and equations Presents the material in a well-structured and logical format Explores topics from device physics fundamentals to transistor formation and fabrication and the operation of the circuits to build electronic devices and systems Includes information on practical applications of p-n junctions, transistors, and integrated circuits to link theory and practice Written for anyone interested in the technology, working in semiconductor labs or in the semiconductor industry, Semiconductor Basics offers clear explanations about how semiconductors work and its manufacturing process.

Physics of Semiconductor 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

Fundamentals of Semiconductor Theory and Device Physics World Scientific Publishing Company

Bridging the gap between a general solid-state physics textbook and research articles, the renowned authors provide detailed explanations of the electronic, vibrational, transport, and optical properties of semiconductors. Their approach is a physical and intuitive one, rather than formal and pedantic. This textbook has been written with both students and researchers in mind, and the authors therefore present theories to explain experimental results. Throughout, the emphasis is on understanding the physical properties of Si, and similar tetrahedrally coordinated semiconductors, with explanations based on physical insights. Each chapter is enriched by an extensive collection of tables of material parameters, figures and problems -- many of the latter 'lead students by the hand' to arrive at the results.

Modern Semiconductor Physics and Device Applications John Wiley & Sons

This book provides an overview of compound semiconductor materials and their technology. After presenting a theoretical background, it describes the relevant material preparation technologies for bulk and thin-layer epitaxial growth. It then briefly discusses the electrical, optical, and structural properties of semiconductors, complemented by a description of the most popular characterization tools, before more complex hetero- and low-dimensional structures are discussed. A special chapter is devoted to GaN and related materials, owing to their huge importance in modern optoelectronic and electronic devices, on the one hand, and their particular properties compared to other compound semiconductors, on the other. In the last part of the book, the physics and functionality of optoelectronic and electronic device structures (LEDs, laser diodes, solar cells, field-effect and heterojunction bipolar transistors) are discussed on the basis of the specific properties of compound semiconductors presented in the preceding chapters of the book. Compound semiconductors form the back-bone of all opto-electronic and electronic devices besides the classical Si electronics. Currently the most important field is solid state lighting with highly efficient LEDs emitting visible light. Also laser diodes of all wavelength ranges between mid-infrared and near ultraviolet have been the enabler for a huge number of unprecedented applications like CDs and DVDs for entertainment and data storage, not to speak about the internet, which would be impossible without optical data communications with infrared laser diodes as key elements. This book provides a concise overview over this class of materials, including the most important technological aspects for their fabrication and characterisation, also covering the most relevant devices based on compound semiconductors. It presents therefore an excellent introduction into this subject not only for students, but also for engineers and scientist who intend to put their focus on this field of science.

John Wiley & Sons

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.