Semiconductor Optoelectronic Devices Bhattacharya

Semiconductor Nanolasers
Semiconductor Optoelectronic Devices
Introduction to Physics and Simulation
A Practical Approach to High Power and Single Mode Devices
Thermoelectric Power in Nanostructured Materials
Optoelectronic Devices
High-Speed Electronics and Optoelectronics
Stability, Instability and Chaos
Semiconductor Materials for Solar Photovoltaic Cells
Properties of III-V Quantum Wells and Superlattices
Quantum Dot Optoelectronic Devices
Electronic Devices and Circuits
Semiconductor Lasers
Chemical Solution Synthesis for Materials Design and Thin Film Device Applications
Optoelectronics

Advances in Semiconductor Lasers and Applications to Optoelectronics
Principles and Applications of Optical Communications
Physics and Technology
Semiconductor Optoelectronic Devices
Nitride Semiconductors
Digitally-Assisted Analog and Analog-Assisted Digital IC Design
An Introduction
Solid State Electronic Devices
Complete Guide to Semiconductor Devices
Introduction to Semiconductor Lasers for Optical Communications
Semiconductor Optoelectronic Devices
Electronic and Optoelectronic Properties of Semiconductor Structures
Semiconductor Laser Engineering, Reliability and Diagnostics
Optical Semiconductor Devices
Devices and Applications
Synthesis, Characterization and Potential Applications
Semiconductors Optoelectronic Device 2/ed
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MALAKI GUADALUPE

Semiconductor Nanolasers Cambridge University Press Discover cutting-edge techniques for next-generation integrated circuit design, and learn how to deliver improved speed, density, power, and cost.

Semiconductor Optoelectronic Devices Cambridge University Press Optoelectronics has become an important part of our lives. Wherever light is used to transmit information, tiny semiconductor devices are needed to transfer electrical current into optical signals and vice versa. Examples include light emitting diodes in radios and other appliances, photodetectors in elevator doors and digital cameras, and laser diodes that transmit phone calls through glass fibers. Such optoelectronic devices take advantage of sophisticated interactions between electrons and light. Nanometer scale semiconductor structures are often at the heart of modern optoelectronic

devices. Their shrinking size and increasing complexity make computer simulation an important tool to design better devices that meet ever rising perfomance requirements. The current need to apply advanced design software in optoelectronics follows the trend observed in the 1980's with simulation software for silicon devices. Today, software for technology computer-aided design (TCAD) and electronic design automation (EDA) represents a fundamental part of the silicon industry. In optoelectronics, advanced commercial device software has emerged recently and it is expected to play an increasingly important role in the near future. This book will enable students, device engineers, and researchers to more effectively use advanced design software in optoelectronics. Provides fundamental knowledge in semiconductor physics and in electromagnetics, while helping to understand and use advanced device simulation software Demonstrates the combination of measurements and simulations in order to obtain realistic results and provides data on all required material parameters Gives deep insight into the physics of state-of-the-art devices and helps to design and analyze of modern optoelectronic devices

Introduction to Physics and Simulation Elsevier

There are only a few discoveries and new technologies in materials

science that have the potential to dramatically alter and revolutionize our material world. Discovery of two-dimensional (2D) materials, the thinnest form of materials to ever occur in nature, is one of them. After isolation of graphene from graphite in 2004, a whole other class of atomically thin materials, dominated by surface effects and showing completely unexpected and extraordinary properties, has been created. This book provides a comprehensive view and state-of-the-art knowledge about 2D materials such as graphene, hexagonal boron nitride (h-BN), transition metal dichalcogenides (TMD) and so on. It consists of 11 chapters contributed by a team of experts in this exciting field and provides latest synthesis techniques of 2D materials, characterization and their potential applications in energy conservation, electronics, optoelectronics and biotechnology.

A Practical Approach to High Power and Single Mode Devices Springer Science & Business Media
Basic Electrical and Electronics Engineering provides an overview of the basics of electrical and electronic engineering that are required at the undergraduate level. The book allows students outside electrical and electronics engineering to easily
Thermoelectric Power in Nanostructured Materials Cambridge University Press

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

academic departments of many institutes and universities.

Optoelectronic Devices

BoD – Books on Demand

A definitive and up-to-date handbook of semiconductor devices Semiconductor devices, the basic components of integrated circuits, are responsible for the rapid growth of the electronics industry over the past fifty years. Because there is a growing need for faster and more complex systems for the information age, existing semiconductor devices are constantly being studied for improvement, and new ones are being continually invented. As a result, a large number of types and variations of devices are available in the literature. The Second Edition of this unique engineering guide continues to be the only available complete collection of semiconductor devices, identifying 74 major devices and more than 200 variations of these devices. As in the First Edition, the value of this text lies in its comprehensive, yet highly readable presentation and its easy-to-use format, making it suitable for a wide range of audiences. Essential information is presented for a quick, balanced overview Each chapter is designed to cover only one specific device, for easy and focused reference Each device is discussed in detail, always including its history, its structure, its characteristics, and its applications The Second Edition has been significantly updated with eight new chapters, and

the material rearranged to reflect recent developments in the field. As such, it remains an ideal reference source for graduate students who want a quick survey of the field, as well as for practitioners and researchers who need quick access to basic information, and a valuable pragmatic handbook for salespeople, lawyers, and anyone associated with the semiconductor industry.
High-Speed Electronics and Optoelectronics Wiley-IEEE Press
Optoelectronics, first published in 2002, is a practical and self-contained textbook written for graduate students and engineers.
Stability, Instability and Chaos World Scientific
This book brings together two broad themes that have generated a great deal of interest and excitement in the scientific and technical community in the last 100 years or so: quantum tunnelling and nonlinear dynamical systems. It applies these themes to nanostructured solid state heterostructures operating at room temperature to gain insight into novel photonic devices, systems and applications.
Semiconductor Materials for Solar Photovoltaic Cells John Wiley & Sons
This book provides a comprehensive treatment of the design and applications of optoelectronic devices. Optoelectronic devices such as light emitting diodes (LEDs), semiconductor lasers, photodetectors, optical fibers, and solar cells, are

important components for solid state lighting systems, optical communication systems, and power generation systems. Optical fiber amplifiers and fiber lasers are also important for high power industrial applications and sensors. The applications of optoelectronic devices were first studied in the 1970's. Since then, the diversity and scope of optoelectronic device research and applications have been steadily growing. Optoelectronic Devices is self-contained and unified in presentation. It can be used as an advanced textbook by graduate students and practicing engineers. It is also suitable for non-experts who wish to have an overview of optoelectronic devices and systems. The treatments in the book are detailed enough to capture the interest of the curious reader and complete enough to provide the necessary background to explore the subject further.

Properties of III-V Quantum Wells and Superlattices Cambridge University Press

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 captures the breadth of this important field, and presents it in a single source to the large audience who study, make, and exploit

semiconductors. Previous attempts at this achievement have been abbreviated, and have omitted important topics. Written and Edited by a truly international team of experts, this work delivers an objective yet cohesive global review of the semiconductor world. The work is divided into three sections. 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. 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 extremely high purity, nearly defect-free bulk and epitaxial materials. The last section is devoted to exploitation of the knowledge described in the previous sections to highlight the spectrum of devices we see all around us. Provides a comprehensive global picture of the semiconductor world Each of the work's three sections presents a complete description of one aspect of the whole Written and Edited by a truly international team of experts

Quantum Dot Optoelectronic Devices

Elsevier

Semiconductor Opto-Electronics focuses on

opto-electronics, covering the basic physical phenomena and device behavior that arise from the interaction between electromagnetic radiation and electrons in a solid. The first nine chapters of this book are devoted to theoretical topics, discussing the interaction of electromagnetic waves with solids, dispersion theory and absorption processes, magneto-optical effects, and non-linear phenomena. Theories of photo-effects and photo-detectors are treated in detail, including the theories of radiation generation and the behavior of semiconductor lasers and lamps. The rest of this text deals with the group IV elements, III-V compounds, and selection of the most important chalcogenides. This publication is intended primarily for physicists engaged in academic research or commercial device development and for honors students specializing in solid-state physics.

Electronic Devices and Circuits Springer

This unique resource explains the fundamental physics of semiconductor nanolasers, and provides detailed insights into their design, fabrication, characterization, and applications. Topics covered range from the theoretical treatment of the underlying physics of nanoscale phenomena, such as temperature dependent quantum effects and active medium selection, to practical design aspects, including the multi-physics cavity design that extends beyond pure

electromagnetic consideration, thermal management and performance optimization, and nanoscale device fabrication and characterization techniques. The authors also discuss technological applications of semiconductor nanolasers in areas such as photonic integrated circuits and sensing. Providing a comprehensive overview of the field, detailed design and analysis procedures, a thorough investigation of important applications, and insights into future trends, this is essential reading for graduate students, researchers, and professionals in optoelectronics, applied photonics, physics, nanotechnology, and materials science.

Morgan & Claypool Publishers

This book reviews the current status of semiconductor materials for conversion of sunlight to electricity, and highlights advances in both basic science and manufacturing. Photovoltaic (PV) solar electric technology will be a significant contributor to world energy supplies when reliable, efficient PV power products are manufactured in large volumes at low cost. Expert chapters cover the full range of semiconductor materials for solar-to-electricity conversion, from crystalline silicon and amorphous silicon to cadmium telluride, copper indium gallium sulfide selenides, dye sensitized solar cells, organic solar cells, and environmentally friendly copper zinc tin

sulfide selenides. The latest methods for synthesis and characterization of solar cell materials are described, together with techniques for measuring solar cell efficiency. Semiconductor Materials for Solar Photovoltaic Cells presents the current state of the art as well as key details about future strategies to increase the efficiency and reduce costs, with particular focus on how to reduce the gap between laboratory scale efficiency and commercial module efficiency. This book will aid materials scientists and engineers in identifying research priorities to fulfill energy needs, and will also enable researchers to understand novel semiconductor materials that are emerging in the solar market. This integrated approach also gives science and engineering students a sense of the excitement and relevance of materials science in the development of novel semiconductor materials. · Provides a comprehensive introduction to solar PV cell materials · Reviews current and future status of solar cells with respect to cost and efficiency · Covers the full range of solar cell materials, from silicon and thin films to dye sensitized and organic solar cells · Offers an in-depth account of the semiconductor material strategies and directions for further research · Features detailed tables on the world leaders in efficiency demonstrations · Edited by scientists with experience in both

research and industry
Semiconductor Lasers
Academic Press
Integrated optoelectronics is becoming ever more important to communications, computer, and consumer industries. It is the enabling technology in a variety of systems, ranging from low-cost, robust optical componentsin consumer electronics to high-performance broadband information networks capable of supporting video and multimedia conferencing. The requirements for producing low-cost, highly reliable components for deployment in these new systems have created a technology challenge. Integrated optoelectronics promises to meet the performance and cost objectives of these applications by integrating both optical and electronic components in a highly functional chip. This book provides an overview of this exciting newtechnology. Integrated Optoelectronics brings together a group of acknowledged experts from both universities and industry around the world to focus on a common theme of integration. These experts have reported not only on the state-of-the-art, but also on the physics and design experience that goes into implementing integrated chips and modules. This book is a cohesive series of articles that includes a discussion of the intimate trade-offs between materials, processes, devices, functional blocks, packaging,and systems

requirements in a truly integrated technology. This integration encompasses electrical, optoelectronic, and optical devices onto monolithic or hybrid chips, and into multichip modules. This volume surveys state-of-the-art research activities in integrated optoelectronics and gathers most of the important references into a single place. It outlines the major issues involved in integrating both optical and electronic components, provides an overview of design and fabrication concepts, and discusses the issues involved in bringing these new chips to the marketplace. This exciting new book: Provides a broad overview of the optoelectronic field, including materials processing, devices, and systems applications Features authors who are acknowledged research experts in this field, from both industry and universities around the world Includes new information on device fabrication, including the latest epitaxial growth and lift-off techniques to permit the mixing of dissimilar materials onto single chips Covers planar processed laser fabrication leading to wafer level automated testing Discusses optimization of devices for integration, including a detailed treatment of the vertical emitting laser and theoretical and experimental coverage of optimization of photodetectors for integration into receiver chips Describes design approaches for multifunctional chips,

including photonic circuits for all-optical networks and the design of integrated optoelectronic chips with lasers, photodiodes, and electronic ICs Covers the infrastructure needed to support an integrated technology, including automated design systems which treat both optical and electrical circuits, and multichip packaging approaches for both optical and IC chips *Chemical Solution Synthesis for Materials Design and Thin Film Device Applications* McGraw-Hill College Chemical Solution Synthesis for Materials Design and Thin Film Device Applications presents current research on wet chemical techniques for thin-film based devices. Sections cover the quality of thin films, types of common films used in devices, various thermodynamic properties, thin film patterning, device configuration and applications. As a whole, these topics create a roadmap for developing new materials and incorporating the results in device fabrication. This book is suitable for graduate, undergraduate, doctoral students, and researchers looking for quick guidance on material synthesis and device fabrication through wet chemical routes. Provides the different wet chemical routes for materials synthesis, along with the most relevant thin film structured materials for device applications Discusses patterning and solution processing of inorganic thin films, along with

solvent-based processing techniques Includes an overview of key processes and methods in thin film synthesis, processing and device fabrication, such as nucleation, lithography and solution processing

Optoelectronics

Cambridge University Press

The characterization and precisely controlled building of atomic-scale mutilayers have been the subject of intensive R&D worldwide. Nanometric structures based on III-V semiconductors have attracted particular attention. Since 1970, around 15,000 papers have been published in all, of which 10,000 have appeared in the last 6 years. The resulting improved materials control is enabling engineers to achieve major improvements in the performance of microelectronic and optoelectronic devices such as QW lasers, tunnelling devices, modulators, switches and photodetectors. In this book, the large volume of research results which have accumulated is evaluated and distilled down to a useful, manageable concentration of up-to-date knowledge for electronic engineers and solid-state physicists. This has been carried out by an invited international team of over 50 specialists under the editorship of Professor Bhattacharya with support from INSPEC, who also compiled the subject index. There are 40 individually-written, self-contained modules ("Datareviews"), each specially commissioned to

fit into a pre-determined structure. Subjects reviewed in depth include historical perspective, theory, epitaxial growth and doping, structure (e.g. X-ray diffraction), electronic properties, optical properties, modulation doping and devices. Each Datareview comprises tables, text, figures and expert guidance to the literature, as appropriate. Properties of III-V quantum wells and superlattices is intended both as a look-up source of evaluated data and as a finely-structured state-of-the-art review for academic and industrial R&D workers.

Advances in Semiconductor Lasers and Applications to Optoelectronics Pearson Education India

As we approach the end of the present century, the elementary particles of light (photons) are seen to be competing increasingly with the elementary particles of charge (electrons/holes) in the task of transmitting and processing the insatiable amounts of infonnation needed by society. The massive enhancements in electronic signal processing that have taken place since the discovery of the transistor, elegantly demonstrate how we have learned to make use of the strong interactions that exist between assemblages of electrons and holes, disposed in suitably designed geometries, and replicated on an increasingly fine scale. On the other hand, photons interact extremely weakly amongst themselves and

all-photonic active circuit elements, where photons control photons, are presently very difficult to realise, particularly in small volumes. Fortunately rapid developments in the design and understanding of semiconductor injection lasers coupled with newly recognized quantum phenomena, that arise when device dimensions become comparable with electronic wavelengths, have clearly demonstrated how efficient and fast the interaction between electrons and photons can be. This latter situation has therefore provided a strong incentive to devise and study monolithic integrated circuits which involve both electrons and photons in their operation. As chapter I notes, it is barely fifteen years ago since the first demonstration of simple optoelectronic integrated circuits were realised using m-V compound semiconductors; these combined either a laser/driver or photodetector/preamplifie r combination.

Principles and Applications of Optical Communications Prentice Hall

Optoelectronics has become an important part of our lives. Wherever light is used to transmit information, tiny semiconductor devices are needed to transfer electrical current into optical signals and vice versa. Examples include light emitting diodes in radios and other appliances, photodetectors in elevator doors and digital cameras, and laser diodes that

transmit phone calls through glass fibers. Such optoelectronic devices take advantage of sophisticated interactions between electrons and light. Nanometer scale semiconductor structures are often at the heart of modern optoelectronic devices. Their shrinking size and increasing complexity make computer simulation an important tool to design better devices that meet ever rising perfomance requirements. The current need to apply advanced design software in optoelectronics follows the trend observed in the 1980's with simulation software for silicon devices. Today, software for technology computer-aided design (TCAD) and electronic design automation (EDA) represents a fundamental part of the silicon industry. In optoelectronics, advanced commercial device software has emerged recently and it is expected to play an increasingly important role in the near future. This book will enable students, device engineers, and researchers to more effectively use advanced design software in optoelectronics. * Provides fundamental knowledge in semiconductor physics and in electromagnetics, while helping to understand and use advanced device simulation software * Demonstrates the combination of measurements and simulations in order to obtain realistic results and provides data on all required material

parameters * Gives deep insight into the physics of state-of-the-art devices and helps to design and analyze of modern optoelectronic devices
Physics and Technology
Springer Nature
A graduate textbook presenting the underlying physics behind devices that drive today's technologies. The book covers important details of structural properties, bandstructure, transport, optical and magnetic properties of semiconductor structures. Effects of low-dimensional physics and strain - two important driving forces in modern device technology - are also discussed. In addition to conventional semiconductor physics the book discusses self-assembled structures, mesoscopic structures and the developing field of spintronics. The book utilizes carefully chosen solved examples to convey important concepts and has over 250 figures and 200 homework exercises. Real-world applications are highlighted throughout the book, stressing the links between physical principles and actual devices. Electronic and Optoelectronic Properties of Semiconductor Structures provides engineering and physics students and practitioners with complete and coherent coverage of key modern semiconductor concepts. A solutions manual and set of viewgraphs for use in lectures are available for instructors, from solutions@cambridge.org.
Semiconductor Optoelectronic Devices

Newnes
The Third Edition of this best-selling textbook continues the successful approach adopted by previous editions - It is an introduction to optoelectronics for all students, undergraduate or postgraduate, and practicing engineers requiring a treatment that is not too advanced but gives a good introduction to the quantitative aspects of the subject. The book aims to put special emphasis on the fundamental principles which underlie the operation of devices and systems. Readers will then be able to appreciate the operation of devices not covered in the book and to understand future developments within the subject. All the material in this edition has been fully updated.

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