High Mobility And Quantum Well Transistors Design And Tcad Simulation Springer Series In Advanced Microelectronics

Nanotechnology for Microelectronics and Photonics
Gas Source Molecular Beam Epitaxy
High Speed Heterostructure Devices
Physics Of Semiconductors - Proceedings Of The 20th International Conference (In 3 Volumes)
The Physics of Low-dimensional Structures
Intersubband Transitions in Quantum Wells
Recent Trends in Thermoelectric Materials Research III
Physics and Applications of Quantum Wells and Superlattices
Selected Works of Professor Herbert Kroemer

Interfaces, Quantum Wells, and Superlattices
High Mobility and Quantum Well Transistors
Optical Phenomena in Semiconductor Structures of Reduced Dimensions
Impurities Confined in Quantum Structures
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Spintronics Handbook, Second Edition: Spin Transport and Magnetism
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Nanotechnology for Microelectronics and

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This volume comprises select papers from the

International Conference on Microelectronics, Computing & Communication Systems(MCCS 2015). Electrical, Electronics, Computer, Communication and Information Technology and their applications in business, academic, industry and other allied areas. The main aim of this volume is to bring together content from international scientists, researchers, engineers from both academia and the industry. The contents of this volume will prove useful to researchers, professionals, and students alike.

Gas Source Molecular Beam Epitaxy Springer Science & Business Media Quantum Heterostructures provides a detailed description of the key physical and engineering principles of quantum semiconductor heterostructures. Blending important concepts from physics, materials science, and electrical engineering, it also explains clearly the behavior and operating features of modern microelectronic and optoelectronic devices. The authors begin by outlining the trends that have driven development in this field, most importantly the need for high-performance devices in computer, information, and communications technologies. They then describe the basics of quantum nanoelectronics, including various transport mechanisms. In the latter part of the book, they cover novel microelectronic devices, and optical devices based on quantum

heterostructures. The book contains many homework problems and is suitable as a textbook for undergraduate and graduate courses in electrical engineering, physics, or materials science. It will also be of great interest to those involved in research or development in microelectronic or optoelectronic devices.

High Speed Heterostructure Devices IET

High Mobility Materials for CMOS Applications provides a comprehensive overview of recent developments in the field of (Si)Ge and III-V materials and their integration on Si. The book covers material growth and integration on Si, going all the way from device to circuit design. While the book's focus is on digital applications, a number of chapters also address the use of III-V for RF and analog applications, and in optoelectronics. With CMOS technology moving to the 10nm node and beyond, however, severe concerns with power dissipation and performance are arising, hence the need for this timely work on the advantages and challenges of the technology. Addresses each of the challenges of utilizing high mobility materials for CMOS applications, presenting possible solutions and the latest innovations Covers the latest advances in research on heterogeneous integration, gate stack, device design and scalability Provides a broad overview of the

topic, from materials integration to circuits *Physics Of Semiconductors - Proceedings Of The 20th International Conference (In 3 Volumes)* Springer Science & Business Media Nano particles have created a high interest in recent years by virtue of their unusual mechanical, electrical, optical and magnetic properties and find wide applications in all fields of engineering. This edited volume aims to present the latest trends and updates in nanogenerators, thin film solar cells and green synthesis of metallic nanoparticles with a focus on nanostructured semiconductor devices. Exclusive chapter on electrical transport of nanostructure explains device physics for material properties for reduced dimensions. Additionally, the text describes the functionality of metallic nanoparticles and their application in molecular imaging and optical metamaterials. Piezoelectric nanogenerators has been touched upon from the energy perspective as well. Key Features: • Organized contents on Nanogenerators, VOC sensing, nanoelectronics, and NEMS. • Discusses eco-friendly green synthesis methods for metallic nanoparticles. • Touches upon low power nano devices (e.g. nanogenerators) for energy harvesting with quantum mechanical study. • Thin film/heterojunction based high efficiency solar cell addressed aimed at reducing global energy consumption.

The Physics of Low-dimensional Structures CRC Press
This volume forms a solid presentation in several important areas of NGS research, including materials, growth and characterization, fundamental physical phenomena, and devices and applications. It examines the novel material of InAs and its related alloys, heterostructures, and nanostructures as well as more traditional NGS materials such as InSb, PbTe, and HgCdTe. Several chapters cover carbon nanotubes and spintronics, along with spin-orbit coupling, nonparabolicity, and large g-factors. The book also deals with the physics and applications of low-energy phenomena at the infrared and terahertz ranges.
Intersubband Transitions in Quantum Wells CRC Press
Remarkable advances in semiconductor growth and processing technologies continue to have a profound impact on condensed-matter physics and to stimulate the invention of novel optoelectronic effects. Intensive research on the behaviors of free carriers has been carried out in the two-dimensional systems of semiconductor heterostructures and in the one and zero-dimensional systems of nanostructures created by the state-of-the-art fabrication methods. These studies have uncovered unexpected quantum mechanical correlations that arise because of the combined effects of strong electron-

electron interactions and wave function confinement associated with reduced dimensionality. The investigations of these phenomena are currently at the frontiers of condensed-matter physics. They include areas like the fractional quantum Hall effect, the dynamics of electrons on an ultra short (femtosecond) time scale, electron behavior in quantum wires and dots, and studies of electron tunneling phenomena in ultra small semiconductor structures. Optical techniques have made important contributions to these fields in recent years, but there has been no coherent review of this work until now. The book provides an overview of these recent developments that will be of interest to semiconductor materials scientists in university, government and industrial laboratories.

Recent Trends in Thermoelectric Materials Research III Gulf Professional Publishing

The second edition of Nanotechnology for Microelectronics and Photonics has been thoroughly revised, expanded, and updated. The aim of the book is to present the most recent advances in the field of nanomaterials, as well as the devices being developed for novel nanoelectronics and nanophotonic systems. It covers the many novel nanoscale applications in microelectronics and photonics that have been developed in recent years. Looking to the future, the book suggests

what other applications are currently in development and may become feasible within the next few decades based on novel materials such as graphene, nanotubes, and organic semiconductors. In addition, the inclusion of new chapters and new sections to keep up with the latest developments in this rapidly-evolving field makes Nanotechnology for Microelectronics and Photonics, Second Edition an invaluable reference to research and industrial scientists looking for a guide on how nanostructured materials and nanoscale devices are used in microelectronics, optoelectronics, and photonics today and in future developments. Presents the fundamental scientific principles that explain the novel properties and applications of nanostructured materials in the quantum frontier. Offers clear and concise coverage of how nanotechnology is currently used in the areas of microelectronics, optoelectronics, and photonics, as well as future proposed devices. Includes nearly a hundred problems along with helpful hints and full solutions for more than half of them.

Physics and Applications of Quantum Wells and Superlattices Elsevier

A textbook about Electrical Engineering.

Selected Works of Professor Herbert Kroemer Woodhead Publishing

The 20th century has been the century of

unparalleled scientific advances fuelled primarily by discoveries made by physicists. The century also represents the life span of the American Physical Society, not coincidentally, and to celebrate both its own centennial and this remarkable century, the APS has prepared this book highlighting the seminal discoveries of the 20th century, with invited articles by the world's most eminent living physicists, including 12 physics Nobel Prize winners. Some 40 chapters cover a broad range of topics in physics written in an engaging and personal style. While the technical level is high, these are not review articles, but rather perspectives on discoveries written by those scientists most closely associated with the original work, as well as future directions of research.

Interfaces, Quantum Wells, and Superlattices CRC Press This book covers the field of low dimensional structures, starting from the selectively doped double heterostructures n-A1GaAs/GaAs/n-A1GaAs, and (strained) p-Si/SiGe/p-Si (quantum wells). The behaviour of the sheet electron density, the subband populations and energies as a function of the well width, the spacer thickness and the doping concentration is analysed. The temperature dependence of the bulk electron concentration versus the quasi-2DEG are discussed. In the framework of Boltzmann's transport theory a

detailed study of the mobility is presented at low and high temperatures taking into account all the relevant scattering mechanisms. The pseudomorphic Si/SiGe undoped quantum wells are a perfect example for the study of the non-parabolicity of the hole-bands. For the first time in a book an exact solution of the multiband effective mass equation that describes the heavy, light and split-off hole valence bands is introduced, and interband transitions and selection rules are obtained. Reducing dimensionality new aspects concerning optical and transport properties of quantum wires (QWRS) is discussed. Specifically, the photoluminescence and the microphotoluminescence spectra of V-shaped QWRS is theoretically interpreted leading to a realistic cartography of the interface roughness of these systems. A computational approach for the solution of the eigenvalue problem in low-dimensional systems of complex but realistic geometry is also presented for the first time in a book, and transport theoretical considerations will lead to a systematic study of the mobility. As DNA could be considered as a one-dimensional "molecular wire" the study of carrier transport along DNA is discussed in terms of hopping transport. A computational scheme is presented which allows the study of near-field magnetoabsorpsion spectra of Quantum Dots (QD) of any given

geometry, under magnetic field of any orientation. The effect of the spatial confinement imposed by the QD dimensions and the magnetic confinement governed by the magnetic field are explored. The influence of the Coulomb interactions between electrons and holes is also discussed. The applicability of the method in actual experiments, i.e. the illumination of a nanostructure with a near-field probe in conjunction with the simultaneous application of an external magnetic field, may become a challenge to experimentalists. Finally, magnetothermoelectic transport in the fractional quantum Hall effect (FQHE) regime is discussed. The theoretical framework for the calculation of the resistivity, the thermopower and the thermal conductivity for two-dimensional electron and hole gases, at low temperatures and strong perpendicular magnetic fields is outlined. The composite fermion picture enables the use of the integer quantum Hall effect and Shubnikov - de Haas conductivity models for a quantitative comparison with experiment. A study on the validity of fundamental physical laws such as the Wiedemann-Franz law in two-dimensional structures is also presented.

High Mobility and Quantum Well Transistors World Scientific

The purpose of this workshop is to spread the

vast amount of information available on semiconductor physics to every possible field throughout the scientific community. As a result, the latest findings, research and discoveries can be quickly disseminated. This workshop provides all participating research groups with an excellent platform for interaction and collaboration with other members of their respective scientific community. This workshop's technical sessions include various current and significant topics for applications and scientific developments, including • Optoelectronics • VLSI & ULSI Technology • Photovoltaics • MEMS & Sensors • Device Modeling and Simulation • High Frequency/ Power Devices • Nanotechnology and Emerging Areas • Organic Electronics • Displays and Lighting Many eminent scientists from various national and international organizations are actively participating with their latest research works and also equally supporting this mega event by joining the various organizing committees.

Optical Phenomena in Semiconductor Structures of Reduced Dimensions

Oxford University Press

The NATO Advanced Study Institute on "Interfaces, Quantum Wells and Superlattices" was held from August 16th to 29th, 1987, in Banff, Alberta, Canada. This volume contains most of the lectures that were given at the Institute. A few of the lectures had already been

presented at an earlier meeting and appear instead in the proceedings of the NATO Advanced Study Institute on "Physics and Applications of Quantum Wells and Super lattices" held in Erice from April 21st to May 1st earlier in the year and published by Plenum Press. The study of semiconductor interfaces, quantum wells and super lattices has come to represent a substantial proportion of all work in condensed matter physics. In a sense the growth of interest in this area, which began to accelerate about 10 years ago and seems to be continuing, has been driven by technological developments. While the older generation of semiconductor devices was based on adjacent semiconductors with different properties (e. g. different doping levels) separated by interfaces, modern semiconductor devices tend to be based more and more on properties of the interfaces themselves. This has led, as an example, to the field of band-structure engineering. Improved understanding of the fundamental physics of these systems has aided technological developments and, in turn, technological developments have made available systems which exhibit novel and fascinating phYSical properties, such as the integer and fractional quantum Hall effects.

Impurities Confined in Quantum Structures

Springer Science & Business Media

This book contains the

lectures delivered at the NATO Advanced Study Institute on "Physics and Applications of Quantum Wells and Superlattices", held in Erice, Italy, on April 21-May 1, 1987. This course was the fourth one of the International School of Solid-State Device Research, which is under the auspices of the Ettore Majorana Center for Scientific Culture. In the last ten years, we have seen an enormous increase in re search in the field of Semiconductor Heterostructures, as evidenced by the large percentage of papers presented in recent international conferences on semiconductor physics. Undoubtfully, this expansion has been made possible by dramatic advances in materials preparation, mostly by molecular beam epitaxy and organometallic chemical vapor deposition. The emphasis on epitaxial growth that was prevalent at the beginning of the decade (thus, the second course of the School, held in 1983, was devoted to Molecular Beam Epitaxy and Heterostructures) has given way to a strong interest in new physical phenomena and new material structures, and to practical applications that are already emerging from them.

Negative Differential Resistance and Instabilities in 2-D Semiconductors

Springer Science & Business Media

The book deals with the physics, operating principles and characteristics of the important quantum well devices, namely, the High

Electron Mobility Transistor (HEMT), Resonant Tunneling Diode (RTD), Quantum Well Laser (QWL), Quantum Well Infrared Photodetector (QWIP), Modulator and Switch. The basic physical concepts on which these devices are based are discussed in detail with necessary diagrams and mathematical derivations. The growth of heterostructures, theories and experiments on band offset, theories and experimental results on electron states, optical interaction phenomena, and electron transport are discussed as the background material. Practical aspects and up-to-date developments and applications of the devices are also covered. This book will be of interest to researchers and specialists in the field of Solid State Technology, Optics and Optoelectronics. It can also serve as a textbook for graduate students and new entrants in the exciting field of quantum electronics. This book takes the reader from the introductory stage to the advanced level of the construction, principles of operation, and application of these devices.

Spintronics Handbook, Second Edition: Spin Transport and Magnetism
Cambridge University Press
Information technology has changed our society radically. Just as the integrated circuits have been the prime mover for electronics, high-speed transistors and semiconductor lasers based on heterostructures are now playing the same

role in modern telecommunications. Professor Kroemer's conceptual work on heterostructures began in the early 1950s as he was looking for a way to improve transistor speed and performance. In the 1960s, he applied the same principles to the development of lasers and light-emitting diodes, showing that they could achieve continuous operation at room temperature OCo something thought impossible at that time. His deep fundamental scientific work has had a profound effect on technology and society, transforming and improving our lives.This reprint collection brings together Professor Kroemer's most important papers, presenting a comprehensive perspective of the field. It covers topics ranging from substrate materials, electronic properties, process technology, and devices, to circuits and applications. This reprint collection will help the reader identify the key stages in the development of heterostructure devices and lasers from early research through to its integration in current manufacturing. Devoted to R&D engineers and scientists who are actively involved in extending the nano- and microelectronics roadmap mainly via heterostructure engineering, this volume may also serve as a reference for postgraduate and research students."

Silicon-Germanium (SiGe) Nanostructures CRC Press

Instabilities associated

with hot electrons in semiconductors have been investigated from the beginning of transistor physics in the 194Os. The study of NDR and impact ionization in bulk material led to devices like the Gunn diode and the avalanche-photo-diode. In layered semiconductors domain formation in HEMTs can lead to excess gate leakage and to excess noise. The studies of hot electron transport parallel to the layers in heterostructures, single and multiple, have shown abundant evidence of electrical instability and there has been no shortage of suggestions concerning novel NDR mechanisms, such as real space transfer, scattering induced NDR, inter-sub band transfer, percolation effects etc. Real space transfer has been exploited in negative-resistance PETs (NERFETs) and in the charge-injection transistor (CHINT) and in light emitting logic devices, but far too little is known and understood about other NDR mechanisms with which quantum well material appears to be particularly well-endowed, for these to be similarly exploited. The aim of this book is therefore to collate what is known and what is not known about NDR instabilities, and to identify promising approaches and techniques which will increase our understanding of the origin of these instabilities which have been observed during the last decade of investigations into high-field longitudinal transport in layered semiconductors. The book

covers the fundamental properties of hot carrier transport and the associated instabilities and light emission in 2-dimensional semiconductors dealing with both theory and experiment.

Physics of Quantum Well Devices Springer Science & Business Media

For many decades, the semiconductor industry has miniaturized transistors, delivering increased computing power to consumers at decreased cost. However, mere transistor downsizing does no longer provide the same improvements. One interesting option to further improve transistor characteristics is to use high mobility materials such as germanium and III-V materials. However, transistors have to be redesigned in order to fully benefit from these alternative materials. High Mobility and Quantum Well Transistors: Design and TCAD Simulation investigates planar bulk Germanium pFET technology in chapters 2-4, focusing on both the fabrication of such a technology and on the process and electrical TCAD simulation. Furthermore, this book shows that Quantum Well based transistors can leverage the benefits of these alternative materials, since they confine the charge carriers to the high-mobility material using a heterostructure. The design and fabrication of one particular transistor structure - the SiGe Implant-Free Quantum Well pFET – is discussed. Electrical testing shows

remarkable short-channel performance and prototypes are found to be competitive with a state-of-the-art planar strained-silicon technology. High mobility channels, providing high drive current, and heterostructure confinement, providing good short-channel control, make a promising combination for future technology nodes. *Strain-Induced Effects in Advanced MOSFETs* John Wiley & Sons
This book summarizes most of the fundamental physical phenomena which semiconductors and their modulated structures exhibit in high magnetic fields. Readers can learn not only the basic theoretical background but also the present state of the art from the most advanced data in this rapidly growing research area. *Compound Semiconductors 1996, Proceedings of the Twenty-Third INT Symposium on Compound Semiconductors held in St Petersburg, Russia, 23-27 September 1996* Springer Science & Business Media
Providing a comprehensive overview of developments to both the academic and industrial communities, Compound Semiconductors 1996 covers all types of compound semiconducting materials and devices. The book includes results on blue and green lasers, heterostructure devices, nanoelectronics, and novel wide band gap semiconductors. With invited review papers and research results in current

topics of interest, this volume is part of a well-known series of conferences for the dissemination of research results in the field.

Compound Semiconductors 1998

World Scientific

This book contains the lectures delivered at the NATO Advanced Research Workshop on the "Intersubband Transistions in Quantum Wells" held in Cargese, France, between the t 9 h and the 14th of September 1991. The urge for this Workshop was justified by the impressive growth of work dealing with this subject during the last two or three years. Indeed, thanks to recent progresses of epitaxial growth techniques, such as Molecular Beam Epitaxy, it is now possible to realize semiconductor layers (e.g. GaAs) with thicknesses controlled within one atomic layer, sandwiched between insulating layers (e.g. AlGaAs). When the semiconducting layer is very thin, i.e. less than 15 nm, the energy of the carriers corresponding to their motion perpendicular to these layers is quantized, forming subbands of allowed energies. Because of the low effective masses in these semiconducting materials, the oscillator strengths corresponding to intersubband transitions are extremely large and quantum optical effects become giant in the 5 - 20 ~ range: photoionization, optical nonlinearities, ... Moreover, a great theoretical surprise is that - thanks to the robustness

of the effective mass theory - these quantum wells are a real life materialization of our old text book one-dimensional quantum well ideal. Complex physical phenomena may then be investigated on a simple model system.

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