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Self-Assembled InGaAs/GaAs  
Quantum Dots  
Semiconductors and Semimetals  
Volume 60

Mitsuru Sugawara



# Self Assembled Ingaas Gaas Quantum Dots

**Todd D. Steiner**



## **Self Assembled Ingaas Gaas Quantum Dots:**

**Self-Assembled InGaAs/GaAs Quantum Dots**, 1999-03-29 This volume is concerned with the crystal growth optical properties and optical device application of the self formed quantum dot which is one of the major current subjects in the semiconductor research field The atom like density of states in quantum dots is expected to drastically improve semiconductor laser performance and to develop new optical devices However since the first theoretical prediction for its great possibilities was presented in 1982 due to the difficulty of their fabrication process Recently the advent of self organized quantum dots has made it possible to apply the results in important optical devices and further progress is expected in the near future The authors working for Fujitsu Laboratories are leading this quantum dot research field In this volume they describe the state of the art in the entire field with particular emphasis on practical applications

*Self-Assembled InGaAs/GaAs Quantum Dots*, 1999-04-05 This volume is concerned with the crystal growth optical properties and optical device application of the self formed quantum dot which is one of the major current subjects in the semiconductor research field The atom like density of states in quantum dots is expected to drastically improve semiconductor laser performance and to develop new optical devices However since the first theoretical prediction for its great possibilities was presented in 1982 due to the difficulty of their fabrication process Recently the advent of self organized quantum dots has made it possible to apply the results in important optical devices and further progress is expected in the near future The authors working for Fujitsu Laboratories are leading this quantum dot research field In this volume they describe the state of the art in the entire field with particular emphasis on practical applications

*Self-Assembled Quantum Dots* Zhiming M Wang, 2007-11-29 This multidisciplinary book provides up to date coverage of carrier and spin dynamics and energy transfer and structural interaction among nanostructures Coverage also includes current device applications such as quantum dot lasers and detectors as well as future applications to quantum information processing The book will serve as a reference for anyone working with or planning to work with quantum dots *Optical Spectroscopy of Single Self-assembled InGaAs/GaAs Quantum Dots* Ruth Oulton, University of Sheffield, 2003

Semiconductors and Semimetals Robert K. Willardson, Albert C. Beer, 1999 **Picosecond Coherent Control of Single Self-Assembled InGaAs GaAs Quantum Dots** Stephen James Boyle, 2010 Optical Spectroscopy of InGaAs GaAs Self

Assembled Quantum Dots Paul William Fry, 2001 Quaternary Capped In(Ga)As/GaAs Quantum Dot Infrared Photodetectors Sourav Adhikary, Subhananda Chakrabarti, 2017-09-06 This book introduces some alternative methods for enhancing the performance of In Ga As GaAs based quantum dot infrared photodetectors QDIPs In Ga As GaAs based QDIPs and focal plane array FPA cameras have wide application in fields such as military and space science The core of the study uses a combination of quaternary In<sub>0.21</sub>Al<sub>0.21</sub>Ga<sub>0.58</sub>As and GaAs spacer as a capping layer on In Ga As GaAs quantum dots in the active region of the detector structure For the purposes of optimization three types of samples growths are considered

with different capping thicknesses The results presented include TEM XRD and photoluminescence studies that compare combination barrier thickness and its effect on structural and optical properties Compressive strain within the heterostructure thermal stability in high temperature annealing spectral response shifts in PL peaks peak and responsivity and detectivity are all considered The results also present a narrow spectral width that was obtained by using InAs QDs which is very useful for third generation FPA camera application The book details effect of post growth rapid thermal annealing on device characteristics and methods to enhance responsivity and peak detectivity The contents of this book will be useful to researchers and professionals alike

**Spintronics** Tomasz Dietl, David D. Awschalom, Maria Kaminska, Hideo Ohno, 2009-02-12 This new volume focuses on a new exciting field of research Spintronics the area also known as spin based electronics The ultimate aim of researchers in this area is to develop new devices that exploit the spin of an electron instead of or in addition to its electronic charge In recent years many groups worldwide have devoted huge efforts to research of spintronic materials from their technology through characterization to modeling The resultant explosion of papers in this field and the solid scientific results achieved justify the publication of this volume Its goal is to summarize the current level of understanding and to highlight some key results and milestones that have been achieved to date Semiconductor spintronics is expected to lead to a new generation of transistors lasers and integrated magnetic sensors that can be used to create ultra low power high speed memory logic and photonic devices In addition development of novel devices such as spin polarized light emitters spin field effect transistors integrated sensors and high temperature electronics is anticipated Spintronics has emerged as one of the fastest growing areas of research This text presents an in depth examination of the most recent technological spintronic developments Includes contributions from leading scholars and industry experts

*Impact of Ion Implantation on Quantum Dot Heterostructures and Devices* Arjun Mandal, Subhananda Chakrabarti, 2017-06-02 This book looks at the effects of ion implantation as an effective post growth technique to improve the material properties and ultimately the device performance of In Ga As GaAs quantum dot QD heterostructures Over the past two decades In Ga As GaAs based QD heterostructures have marked their superiority particularly for application in lasers and photodetectors Several in situ and ex situ techniques that improve material quality and device performance have already been reported These techniques are necessary to maintain dot density and dot size uniformity in QD heterostructures and also to improve the material quality of heterostructures by removing defects from the system While rapid thermal annealing pulsed laser annealing and the hydrogen passivation technique have been popular as post growth methods ion implantation had not been explored largely as a post growth method for improving the material properties of In Ga As GaAs QD heterostructures This work attempts to remedy this gap in the literature The work also looks at introduction of a capping layer of quaternary alloy InAlGaAs over these In Ga As GaAs QDs to achieve better QD characteristics The contents of this volume will prove useful to researchers and professionals involved in the study of QDs and QD based devices

**Dekker Encyclopedia of**

**Nanoscience and Nanotechnology** James A. Schwarz, Cristian I. Contescu, Karol Putyera, 2004      **Low Dimensional Structures Prepared by Epitaxial Growth or Regrowth on Patterned Substrates** K. Eberl, Pierre M. Petroff, Piet Demeester, 2012-12-06 Proceedings of the NATO Advanced Research Workshop Ringberg in Rottach Egern Germany February 20 24 1995      **Semiconductor Nanostructures for Optoelectronic Applications** Todd D. Steiner, 2004 Annotation Tiny structures measurable on the nanometer scale one billionth of a meter are known as nanostructures and nanotechnology is the emerging application of these nanostructures into useful nanoscale devices As we enter the 21st century more and more professional are using nanotechnology to create semiconductors for a variety of applications including communications information technology medical and transportation devices Written by today's best researchers of semiconductor nanostructures this cutting edge resource provides a snapshot of this exciting and fast changing field The book covers the latest advances in nanotechnology and discusses the applications of nanostructures to optoelectronics photonics and electronics      *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      **Molecular Beam Epitaxy** Mohamed Henini, 2018-06-27 Molecular Beam Epitaxy MBE From Research to Mass Production Second Edition provides a comprehensive overview of the latest MBE research and applications in epitaxial growth along with a detailed discussion and how to on processing molecular or atomic beams that occur on the

surface of a heated crystalline substrate in a vacuum The techniques addressed in the book can be deployed wherever precise thin film devices with enhanced and unique properties for computing optics or photonics are required It includes new semiconductor materials new device structures that are commercially available and many that are at the advanced research stage This second edition covers the advances made by MBE both in research and in the mass production of electronic and optoelectronic devices Enhancements include new chapters on MBE growth of 2D materials Si Ge materials AlN and GaN materials and hybrid ferromagnet and semiconductor structures Condenses the fundamental science of MBE into a modern reference speeding up literature review Discusses new materials novel applications and new device structures grounding current commercial applications with modern understanding in industry and research Includes coverage of MBE as mass production epitaxial technology and how it enhances processing efficiency and throughput for the semiconductor industry and nanostructured semiconductor materials research community

*Quantum-Dot-Based Semiconductor Optical Amplifiers for O-Band Optical Communication* Holger Schmeckebeier, 2016-10-21 This thesis examines the unique properties of gallium arsenide GaAs based quantum dot semiconductor optical amplifiers for optical communication networks introducing readers to their fundamentals basic parameters and manifold applications The static and dynamic properties of these amplifiers are discussed extensively in comparison to conventional non quantum dot based amplifiers and their unique advantages are elaborated on such as the fast carrier dynamics and the decoupling of gain and phase dynamics In addition to diverse amplification scenarios involving single and multiple high symbol rate amplitude and phase coded data signals wide range wavelength conversion as a key functionality for optical signal processing is investigated and discussed in detail Furthermore two novel device concepts are developed and demonstrated that have the potential to significantly simplify network architectures reducing the investment and maintenance costs as well as the energy consumption of future networks

Advances In Semiconductor Lasers And Applications To Optoelectronics (Ijhses Vol. 9 No. 4) Mitra Dutta, Michael A Strosio, 2000-06-21 Foreword by Charles H Townes This volume includes highlights of the theories underlying the essential phenomena occurring in novel semiconductor lasers as well as the principles of operation of selected heterostructure lasers To understand scattering processes in heterostructure lasers and related optoelectronic devices it is essential to consider the role of dimensional confinement of charge carriers as well as acoustical and optical phonons in quantum structures Indeed it is important to consider the confinement of both phonons and carriers in the design and modeling of novel semiconductor lasers such as the tunnel injection laser quantum well intersubband lasers and quantum dot lasers The full exploitation of dimensional confinement leads to the exciting new capability of scattering time engineering in novel semiconductor lasers As a result of continuing advances in techniques for growing quantum heterostructures recent developments are likely to be followed in coming years by many more advances in semiconductor lasers and optoelectronics As our understanding of these devices and the ability to fabricate them grow so does our need for more sophisticated theories and simulation methods

bridging the gap between quantum and classical transport      **VLSI Micro- and Nanophotonics** El-Hang Lee, Louay Eldada, Manijeh Razeghi, Chennupati Jagadish, 2018-09-03 Addressing the growing demand for larger capacity in information technology VLSI Micro and Nanophotonics Science Technology and Applications explores issues of science and technology of micro nano scale photonics and integration for broad scale and chip scale Very Large Scale Integration photonics This book is a game changer in the sense that it is quite possibly the first to focus on VLSI Photonics Very little effort has been made to develop integration technologies for micro nanoscale photonic devices and applications so this reference is an important and necessary early stage perspective on this field New demand for VLSI photonics brings into play various technological and scientific issues as well as evolutionary and revolutionary challenges all of which are discussed in this book These include topics such as miniaturization interconnection and integration of photonic devices at micron submicron and nanometer scales With its disruptive creativity and unparalleled coverage of the photonics revolution in information technology this book should greatly impact the future of micro nano photonics and IT as a whole It offers a comprehensive overview of the science and engineering of micro nanophotonics and photonic integration Many books on micro nanophotonics focus on understanding the properties of individual devices and their related characteristics However this book offers a full perspective from the point of view of integration covering all aspects of benefits and advantages of VLSI scale photonic integration the key technical concept in developing a platform to make individual devices and components useful and practical for various applications      Advanced Semiconductor Heterostructures Mitra Dutta, Michael A. Stroscio, 2003 Novel heterostructure devices Electron phonon interactions in intersubband laser heterostructures M V Kisin M Dutta and M A Stroscio Quantum dot infrared detectors and sources P Bhattacharya et al Generation of terahertz emission based on intersubband transitions Q Hu Mid infrared GaSb based lasers with Type I heterointerfaces D V Donetsky R U Martinelli and G L Belenky Advances in quantum dot research and technology the path to applications in biology M A Stroscio and M Dutta Potential device applications and basic properties High field electron transport controlled by optical phonon emission in nitrides S M Komirenko et al Cooling by inverse Nottingham effect with resonant tunneling Y Yu R F Greene and R Tsu The physics of single electron transistors M A Kastner Carrier capture and transport within tunnel injection lasers a quantum transport analysis L F Register et al The influence of environmental effects on the acoustic phonon spectra in quantum dot heterostructures S Rufo M Dutta and M A Stroscio Quantum devices with multipole electrode heterojunctions hybrid structures R Tsu      Encyclopedia of Optical and Photonic Engineering (Print) - Five Volume Set Craig Hoffman, Ronald Driggers, 2015-09-22 The first edition of the Encyclopedia of Optical and Photonic Engineering provided a valuable reference concerning devices or systems that generate transmit measure or detect light and to a lesser degree the basic interaction of light and matter This Second Edition not only reflects the changes in optical and photonic engineering that have occurred since the first edition was published but also Boasts a wealth of new material expanding the encyclopedia s length by 25

percent Contains extensive updates with significant revisions made throughout the text Features contributions from engineers and scientists leading the fields of optics and photonics today With the addition of a second editor the Encyclopedia of Optical and Photonic Engineering Second Edition offers a balanced and up to date look at the fundamentals of a diverse portfolio of technologies and discoveries in areas ranging from x ray optics to photon entanglement and beyond This edition s release corresponds nicely with the United Nations General Assembly s declaration of 2015 as the International Year of Light working in tandem to raise awareness about light s important role in the modern world Also Available Online This Taylor E mail e reference taylorandfrancis com International Tel 44 0 20 7017 6062 E mail online sales tandf co uk

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