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Gas Source Molecular Beam Epitaxy-Morton B. Panish 2013-03-07 The first book to present a unified treatment of hybrid source MBE and metalorganic MBE. Since metalorganic MBE permits selective area growth, the latest information on its application to the INP/GaInAs(P) system is presented. This system has been highlighted because it is one of rising importance, vital to optical communications systems, and has great potential for future ultra-highspeed electronics. The use of such analytical methods as high resolution x-ray diffraction, secondary ion mass spectroscopy, several photoluminescence methods, and the use of active devices for materials evaluation is shown in detail.
Gas Source Molecular Beam Epitaxy Deposition of Device Quality Gallium Nitride-Hadis Morkoc 1989 Deposition of the first layers of gallium nitride will occur by the end of February. We have spent the last six months assembling our experimental equipment which includes selecting and ordering a plasma activated nitrogen source, building a nitrogen delivery system and bringing up our gas source MBE. A brief report of our research goals for GaN is given. (rh).
Molecular Beam Epitaxy-Robin F.C. Farrow 1995-12-31 In this volume, the editor and contributors describe the use of molecular beam epitaxy (MBE) for a range of key materials systems that are of interest for both technological and fundamental reasons. Prior books on MBE have provided an introduction to the basic concepts and techniques of MBE and emphasize growth and characterization of GaAs-based structures. The aim in this book is somewhat different; it is to demonstrate the versatility of the technique by showing how it can be utilized to prepare and explore a range of distinct and diverse materials. For each of these materials systems MBE has played a key role both in their development and application to devices.
Molecular Beam Epitaxy-John Orton 2015-06-25 The book is a history of Molecular Beam Epitaxy (MBE) as applied to the growth of semiconductor thin films (note that it does not cover the subject of metal thin films). It begins by examining the origins of MBE, first of all looking at the nature of molecular beams and considering their application to fundamental physics, to the development of nuclear magnetic resonance and to the invention of the microwave MASER. It shows how molecular beams of silane (SiH4) were used to study the nucleation of silicon films on a silicon substrate and how such studies were extended to compound semiconductors such as GaAs. From such surface studies in ultra-high vacuum the technique developed into a method of growing high quality single crystal films of a wide range of semiconductors. Comparing this with earlier evaporation methods of deposition and with other epitaxial deposition methods such as liquid phase and vapour phase epitaxy (LPE and VPE). The text describes the development of MBE machines from the early âhome-madeâ variety to that of commercial equipment and show how MBE was gradually refined to produce high quality films with atomic dimensions. This was much aided by the use of various in-situ surface analysis techniques, such as reflection high energy electron diffraction (RHEED) and mass spectrometry, a feature unique to MBE. It looks at various modified versions of the basic MBE process, then proceed to describe their application to the growth of so-called âlow-dimensional structuresâ (LDS) based on ultra-thin heterostructure films with thickness of order a few molecular monolayers. Further chapters cover the growth of a wide range of different compounds and describe their application to fundamental physics and to the fabrication of electronic and opto-electronic devices. The authors study the historical development of all these aspects and emphasise both the (often unexpected) manner of their discovery and development and the unique features which MBE brings to the growth of extremely complex structures with monolayer accuracy.
Molecular Beam Epitaxy-Mohamed Henini 2012-12-31 This multi-contributor handbook discusses Molecular Beam Epitaxy (MBE), an epitaxial deposition technique which involves laying down layers of materials with atomic thicknesses on to substrates. It summarizes MBE research and application in epitaxial growth with close discussion and a ‘how to’ on processing molecular or atomic beams that occur on a surface of a heated crystalline substrate in a vacuum. MBE has expanded in importance over the past thirty years (in terms of unique authors, papers and conferences) from a pure research domain into commercial applications (prototype device structures and more at the advanced research stage). MBE is important because it enables new device phenomena and facilitates the production of multiple layered structures with extremely fine dimensional and compositional control. The techniques can be deployed wherever precise thin-film devices with enhanced and unique properties for computing, optics or photonics are required. This book covers the advances made by MBE both in research and mass production of electronic and optoelectronic devices. It includes new semiconductor materials, new device structures which are commercially available, and many more which are at the advanced research stage. Condenses 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 Coverage of MBE as mass production epitaxial technology enhances processing efficiency and throughput for semiconductor industry and nanostructured semiconductor materials research community
Molecular Beam Epitaxy-Robin F.C. Farrow 1995-12-31 In this volume, the editor and contributors describe the use of molecular beam epitaxy (MBE) for a range of key materials systems that are of interest for both technological and fundamental reasons. Prior books on MBE have provided an introduction to the basic concepts and techniques of MBE and emphasize growth and characterization of GaAs-based structures. The aim in this book is somewhat different; it is to demonstrate the versatility of the technique by showing how it can be utilized to prepare and explore a range of distinct and diverse materials. For each of these materials systems MBE has played a key role both in their development and application to devices.
Gas-source Molecular Beam Epitaxy of GaInNAs and Ga(In)NP for Electronic and Optoelectronic Device Applications-Huoping Xin 2000
Gas-source Molecular Beam Epitaxy Growth of GaN with a Nitrogen Radical Beam and Ammonia-William Sam Wong 1995
Nitrogen-containing Mixed Group-V Compounds Grown by Gas-source Molecular Beam Epitaxy Using a Nitrogen Radical Beam Source-Wengang Bi 1997
Molecular Beam Epitaxy-Hajime Asahi 2019-04-22 Covers both the fundamentals and the state-of-the-art technology used for MBE Written by expert researchers working on the frontlines of the field, this book covers fundamentals of Molecular Beam Epitaxy (MBE) technology and science, as well as state-of-the-art MBE technology for electronic and optoelectronic device applications. MBE applications to magnetic semiconductor materials are also included for future magnetic and spintronic device applications. Molecular Beam Epitaxy: Materials and Applications for Electronics and Optoelectronics is presented in five parts: Fundamentals of MBE; MBE technology for electronic devices application; MBE for optoelectronic devices; Magnetic semiconductors and spintronics devices; and Challenge of MBE to new materials and new researches. The book offers chapters covering the history of MBE; principles of MBE and fundamental mechanism of MBE growth; migration enhanced epitaxy and its application; quantum dot formation and selective area growth by MBE; MBE of III-nitride semiconductors for electronic devices; MBE for Tunnel-FETs; applications of III-V semiconductor quantum dots in optoelectronic devices; MBE of III-V and III-nitride heterostructures for optoelectronic devices with emission wavelengths from THz to ultraviolet; MBE of III-V semiconductors for mid-infrared photodetectors and solar cells; dilute magnetic semiconductor materials and ferromagnet/semiconductor heterostructures and their application to spintronic devices; applications of bismuth-containing III–V semiconductors in devices; MBE growth and device applications of Ga2O3; Heterovalent semiconductor structures and their device applications; and more. Includes chapters on the fundamentals of MBE Covers new challenging researches in MBE and new technologies Edited by two pioneers in the field of MBE with contributions from well-known MBE authors including three Al Cho MBE Award winners Part of the Materials for Electronic and Optoelectronic Applications series Molecular Beam Epitaxy: Materials and Applications for Electronics and Optoelectronics will

appeal to graduate students, researchers in academia and industry, and others interested in the area of epitaxial growth.
Molecular Beam Epitaxy-Marian A. Herman 2013-03-08 This first-ever monograph on molecular beam epitaxy (MBE) gives a comprehensive presentation of recent developments in MBE, as applied to crystallization of thin films and device structures of different semiconductor materials. MBE is a high-vacuum technology characterized by relatively low growth temperature, ability to cease or initiate growth abruptly, smoothing of grown surfaces and interfaces on an atomic scale, and the unique facility for in situ analysis of the structural parameters of the growing film. The excellent exploitation parameters of such MBE-produced devices as quantum-well lasers, high electron mobility transistors, and superlattice avalanche photodiodes have caused this technology to be intensively developed. The main text of the book is divided into three parts. The first presents and discusses the more important problems concerning MBE equipment. The second discusses the physico-chemical aspects of the crystallization processes of different materials (mainly semiconductors) and device structures. The third part describes the characterization methods which link the physical properties of the grown film or structures with the technological parameters of the crystallization procedure. Latest achievements in the field are emphasized, such as solid source MBE, including silicon MBE, gas source MBE, especially metalorganic MBE, phase-locked epitaxy and atomic-layer epitaxy, photoassisted molecular layer epitaxy and migration enhanced epitaxy.
Synthesis and Characterization of Highly-mismatched III-V Semiconductors by Gas-source Molecular Beam Epitaxy-Tsung-Pei Chin 1993
Proceedings of the Symposium on Large Area Wafer Growth and Processing for Electronic and Photonic Devices and the Twentieth State-of-the Art Program on Compound Semiconductors (SOTAPOCS XX)-D. N. Buckley 1995
Proceedings of the Third International Symposium on Quantum Confinement- 1996
State-of-the-Art Program on Compound Semiconductors 45 (SOTAPOCS 45) -and- Wide Bandgap Semiconductor Materials and Devices 7-F. Ren 2006-01-01 This volume contains papers from two symposia: State of the Art Program on Compound Semiconductors 45 and Wide Bandgap Semiconductor Materials and Devices VII.
Heteroepitaxy of Semiconductors-John E. Ayers 2016-10-03 In the past ten years, heteroepitaxy has continued to increase in importance with the explosive growth of the electronics industry and the development of a myriad of heteroepitaxial devices for solid state lighting, green energy, displays, communications, and digital computing. Our ever-growing understanding of the basic physics and chemistry underlying heteroepitaxy, especially lattice relaxation and dislocation dynamic, has enabled an ever-increasing emphasis on metamorphic devices. To reflect this focus, two all-new chapters have been included in this new edition. One chapter addresses metamorphic buffer layers, and the other covers metamorphic devices. The remaining seven chapters have been revised extensively with new material on crystal symmetry and relationships, III-nitride materials, lattice relaxation physics and models, in-situ characterization, and reciprocal space maps.
Delta-doping of Semiconductors-E. F. Schubert 1996-03-14 A comprehensive review of the theory and application of delta-doping of semiconductors.
SiGe and Ge-David Louis Harame 2006-01-01 The second International SiGe & Ge: Materials, Processing, and Devices Symposium was part of the 2006 ECS conference held in Cancun, Mexico from October 29-Nov 3, 2006. This meeting provided a forum for reviewing and discussing all materials and device related aspects of SiGe & Ge. The hardcover edition includes a bonus CD-ROM containing the PDF of the entire issue.
Technology of Quantum Devices-Manijeh Razeghi 2009-12-11 Technology of Quantum Devices offers a multi-disciplinary overview of solid state physics, photonics and semiconductor growth and fabrication. Readers will find up-to-date coverage of compound semiconductors, crystal growth techniques, silicon and compound semiconductor device technology, in addition to intersubband and semiconductor lasers. Recent findings in quantum tunneling transport, quantum well intersubband photodetectors (QWIP) and quantum dot photodetectors (QWDIP) are described, along with a thorough set of sample problems.
Molecular Beam Epitaxy 1994- 1995
SiGe, Ge, and Related Compounds 3: Materials, Processing, and Devices-David Harame 2008 Advanced semiconductor technology is depending on innovation and less on "classical" scaling. SiGe, Ge, and Related Compounds have become a key component of the arsenal in improving semiconductor performance. This issue of ECS Transactions discusses the technology to form these materials, process them, FET devices incorporating them, Surfaces and Interfaces, Optoelectronic devices, and HBT devices.
Dekker Encyclopedia of Nanoscience and Nanotechnology-James A. Schwarz 2004
Molecular Beam Epitaxy-Alfred Cho 1994 Market: Materials scientists and graduate students. This volume includes the most significant contributions of world-renowned scientists in the field of Molecular Beam Expitaxy (MBE). MBE is an extremely important technique for growing single crystals by making beams of atoms and molecules strike a crystalline substrate in a vacuum. This technique has found broad applications in modern materials science.
Physics Briefs- 1994
Structure, Morphology and Kinetics of GaN Film Growth Using Gas-source and RF Plasma-assisted Metal-organic Molecular Beam Epitaxy-Arthur Randall Woll 2000 We present real-time x-ray scattering experiments, in combination with ex situ measurements of surface morphology and film thickness, aimed at understanding the fundamental aspects of GaN growth on sapphire(0001). Concerning the earliest stages of growth, we show that GaN nucleation is highly sensitive to details of the substrate surface. Further, we demonstrate a link between the structure of the substrate surface and the structure, morphology, and kinetics of the first few GaN layers. We also study GaN growth at late times. Our results are consistent with the existence of a Ga adatom layer above the crystalline surface. The dependence of the coverage of this layer on NH3 suggests that this layer acts as a reservoir for growth. In addition, we find evidence that hydrogen plays a substantial role in GaN growth at high temperatures: namely that the Ga adatom reservoir described above is stabilized with respect to desorption by the formation of Ga-H bonds.
Gallium Oxide-Masataka Higashiwaki 2020-04-23 This book provides comprehensive coverage of the new wide-bandgap semiconductor gallium oxide (Ga_2O_3). Ga_2O_3 has been attracting much attention due to its excellent materials properties. It features an extremely large bandgap of greater than 4.5 eV and availability of large-size, high-quality native substrates produced from melt-grown bulk single crystals. Ga_2O_3 is thus a rising star among ultra-wide-bandgap semiconductors and represents a key emerging research field for the worldwide semiconductor community. Expert chapters cover physical properties, synthesis, and state-of-the-art applications, including materials properties, growth techniques of melt-grown bulk single crystals and epitaxial thin films, and many types of devices. The book is an essential resource for academic and industry readers who have an interest in, or plan to start, a new R&D project related to Ga_2O_3.
Papers from the 16th North American Conference on Molecular Beam Epitaxy-Keith R. Evans 1998
State-of-the-Art Program on Compound Semiconductors XXXVI, and Wide Bandgap Semiconductors for Photonic and Electronic Devices and Sensors II-Electrochemical Society. Electronics Division 2002
Compound Semiconductor Power Transistors and-Electrochemical Society. Electronics Division 1998
Proceedings of the Twenty-sixth State-of-the-Art Program on Compound Semiconductors (SOTAPOCS XXVI)-D. N. Buckley 1997
III-V Integrated Circuit Fabrication Technology-Shiban Tiku 2016-04-27 GaAs processing has reached a mature stage. New semiconductor compounds are emerging that will dominate future materials and device research, although the processing techniques used for GaAs will still remain relevant. This book covers all aspects of the current state of the art of III–V processing, with emphasis on HBTs. It is aimed at practicing engineers and graduate students and engineers new to the field of III–V semiconductor IC processing. The book’s primary purpose is to discuss all aspects of processing of active and passive devices, from crystal growth to backside processing, including lithography, etching, and film deposition.
Beam Technologies for Integrated Processing-National Research Council 1992-02-01 Beam technologies play an important role in microelectronic component fabrication and offer opportunities for application in other manufacturing schemes. Emerging beam technologies that incorporate potential for sensors, control, and information processing have created new opportunities for integrated processing of materials and components. This volume identifies various beam technologies and their applications in electronics and other potential manufacturing processes. Recommendations for research and development to enhance the understanding, capabilities, and applications of beam technologies are presented.
Surface Diffusion-M.C. Tringides 1997-12-31 The interest in the problem of surface diffusion has been steadily growing over the last fifteen years. This is clearly evident from the increase in the number of papers dealing with the problem, the development of new experimental techniques, and the specialized sessions focusing on diffusion in national and international meetings. Part of the driving force behind this increasing activity is our recently acquired ability to observe and possibly control atomic scale phenomena. It is now possible to look selectively at individual atomistic processes and to determine their relative importance during growth and reactions at surfaces. The number of researchers interested in this problem also has been growing steadily which generates the need for a good reference source to farniliarize newcomers to the problem. While the recent emphasis is on the role of diffusion during growth, there is also continuing progress on the more traditional aspects of the problem describing mass transport in an ensemble of particles. Such a description is based on the statistical mechanical analysis of a collection of particles that mutually interact and develop correlations. An average over the multitude of atomistic processes that operate under these conditions is necessary to fully describe the dynamics in the system.

Growth and Optical Properties of (100) and (111)B InAsP/InP Strained Quantum Wells-Hong Qi Hou 1993
Proceedings of the Twenty-Seventh State-of-the-Art Program on Compound Semiconductors (SOTAPOCS XXVII)-S. N. G. Chu 1997
Vertical-Cavity Surface-Emitting Lasers-Carl W. Wilmsen 2001-11-12 This book, first published in 1999, provides a comprehensive description of the physics, design, fabrication, characterization, and applications of vertical-cavity surface-emitting lasers.
Femtosecond Technology-Takeshi Kamiya 1999 The new femtosecond technology is the basis for fast transmission of large volumes of information. This book gives a comprehensive introduction to the fundamentals, explains the realisation of this concept and gives guidance to the user in optical data transmission. It should appeals to researchers, process engineers and advanced students.
First International Conference on Indium Phosphide and Related Materials for Advanced Electronic and Optical Devices-Rajendra Singh 1989
Bismuth-Containing Alloys and Nanostructures-Shumin Wang 2019-07-03 This book focuses on novel bismuth-containing alloys and nanostructures, covering a wide range of materials from semiconductors, topological insulators, silica optical fibers and to multiferroic materials. It provides a timely overview of bismuth alloys and nanostructures, from material synthesis and physical properties to device applications and also includes the latest research findings. Bismuth is considered to be a sustainable and environmentally friendly element, and has received increasing attention in a variety of innovative research areas in recent years. The book is intended as a reference resource and textbook for graduate students and researchers working in these fields.
Semiconductor Materials Analysis and Fabrication Process Control-G.M. Crean 2012-12-02 There is a growing awareness that the successful implementation of novel material systems and technology steps in the fabrication of microelectronic and optoelectronic devices, is critically dependent on the understanding and control of the materials, the process steps and their interactions. The contributions in this volume demonstrate that characterisation and analysis techniques are an essential support mechanism for research in these fields. Current major research themes are reviewed both in the development and application of diagnostic techniques for advanced materials analysis and fabrication process control. Two distinct trends are elucidated: the emergence and evaluation of sophisticated in situ optical diagnostic techniques such as photoreflectance and spectroellipsometry and the industrial application of ultra-high sensitivity chemical analysis techniques for contamination monitoring. The volume will serve as a useful and timely overview of this increasingly important field.

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