# **CONTENTS OF VOLUMES IN THIS SERIES**

# Volume 1 Physics of III-V Compounds

- C. Hilsum, Some Key Features of III-V Compounds
- F. Bassani, Methods of Band Calculations Applicable to III-V Compounds
- E. O. Kane, The k-p Method
- V. L. Bonch-Bruevich, Effect of Heavy Doping on the Semiconductor Band Structure
- D. Long, Energy Band Structures of Mixed Crystals of III-V Compounds
- L. M. Roth and P. N. Argyres, Magnetic Quantum Effects
- S. M. Puri and T. H. Geballe, Thermomagnetic Effects in the Quantum Region
- W. M. Becker, Band Characteristics near Principal Minima from Magnetoresistance
- E. H. Putley, Freeze-Out Effects, Hot Electron Effects, and Submillimeter Photoconductivity in InSb
- H. Weiss, Magnetoresistance
- B. Ancker-Johnson, Plasma in Semiconductors and Semimetals

### Volume 2 Physics of III-V Compounds

- M. G. Holland, Thermal Conductivity
- S. I. Novkova, Thermal Expansion
- U. Piesbergen, Heat Capacity and Debye Temperatures
- G. Giesecke, Lattice Constants
- J. R. Drabble, Elastic Properties
- A. U. Mac Rae and G. W. Gobeli, Low Energy Electron Diffraction Studies
- R. Lee Mieher, Nuclear Magnetic Resonance
- B. Goldstein, Electron Paramagnetic Resonance
- T. S. Moss, Photoconduction in III-V Compounds
- E. Antoncik and J. Tauc, Quantum Efficiency of the Internal Photoelectric Effect in InSb
- G. W. Gobeli and I. G. Allen, Photoelectric Threshold and Work Function
- P. S. Pershan, Nonlinear Optics in III-V Compounds
- M. Gershenzon, Radiative Recombination in the III-V Compounds
- F. Stern, Stimulated Emission in Semiconductors

## Volume 3 Optical Properties of III-V Compounds

- M. Hass. Lattice Reflection
- W. G. Spitzer, Multiphonon Lattice Absorption
- D. L. Stierwalt and R. F. Potter, Emittance Studies
- H. R. Philipp and H. Ehrenveich, Ultraviolet Optical Properties
- M. Cardona, Optical Absorption Above the Fundamental Edge
- E. J. Johnson, Absorption Near the Fundamental Edge
- J. O. Dimmock, Introduction to the Theory of Exciton States in Semiconductors

- B. Lax and J. G. Mavroides, Interband Magnetooptical Effects
- H. Y. Fan, Effects of Free Carries on Optical Properties
- E. D. Palik and G. B. Wright, Free-Carrier Magnetooptical Effects
- R. H. Bube, Photoelectronic Analysis
- B. O. Seraphin and H. E. Benett, Optical Constants

## Volume 4 Physics of III-V Compounds

- N. A. Goryunova, A. S. Borchevskii and D. N. Tretiakov, Hardness
- N. N. Sirota, Heats of Formation and Temperatures and Heats of Fusion of Compounds of A<sup>III</sup>B<sup>V</sup>
- D. L. Kendall, Diffusion
- A. G. Chynoweth, Charge Multiplication Phenomena
- R. W. Keyes, The Effects of Hydrostatic Pressure on the Properties of III-V Semiconductors
- L. W. Aukerman, Radiation Effects
- N. A. Goryunova, F. P. Kesamanly, and D. N. Nasledov, Phenomena in Solid Solutions
- R. T. Bate, Electrical Properties of Nonuniform Crystals

### Volume 5 Infrared Detectors

- H. Levinstein, Characterization of Infrared Detectors
- P. W. Kruse, Indium Antimonide Photoconductive and Photoelectromagnetic Detectors
- M. B. Prince, Narrowband Self-Filtering Detectors
- I. Melngalis and T. C. Hannan, Single-Crystal Lead-Tin Chalcogenides
- D. Long and J. L. Schmidt, Mercury-Cadmium Telluride and Closely Related Alloys
- E. H. Putley, The Pyroelectric Detector
- N. B. Stevens, Radiation Thermopiles
- R. J. Keyes and T. M. Quist, Low Level Coherent and Incoherent Detection in the Infrared
- M. C. Teich, Coherent Detection in the Infrared
- F. R. Arams, E. W. Sard, B. J. Peyton and F. P. Pace, Infrared Heterodyne Detection with Gigahertz IF Response
- H. S. Sommers, Jr., Macrowave-Based Photoconductive Detector
- R. Sehr and R. Zuleeg, Imaging and Display

## Volume 6 Injection Phenomena

- M. A. Lampert and R. B. Schilling, Current Injection in Solids: The Regional Approximation Method
- R. Williams, Injection by Internal Photoemission
- A. M. Barnett, Current Filament Formation
- R. Baron and J. W. Mayer, Double Injection in Semiconductors
- W. Ruppel, The Photoconductor-Metal Contact

## Volume 7 Application and Devices

### Part A

- J. A. Copeland and S. Knight, Applications Utilizing Bulk Negative Resistance
- F. A. Padovani, The Voltage-Current Characteristics of Metal-Semiconductor Contacts
- P. L. Hower, W. W. Hooper, B. R. Cairns, R. D. Fairman, and D. A. Tremere, The GaAs Field-Effect Transistor
- M. H. White, MOS Transistors
- G. R. Antell, Gallium Arsenide Transistors
- T. L. Tansley, Heterojunction Properties

#### Part B

- T. Misawa, IMPATT Diodes
- H. C. Okean, Tunnel Diodes
- R. B. Campbell and Hung-Chi Chang, Silicon Junction Carbide Devices
- R. E. Enstrom, H. Kressel, and L. Krassner, High-Temperature Power Rectifiers of GaAs<sub>1-x</sub>P<sub>x</sub>

## Volume 8 Transport and Optical Phenomena

- R. J. Stim, Band Structure and Galvanomagnetic Effects in III-V Compounds with Indirect Band Gaps
- R. W. Ure, Jr., Thermoelectric Effects in III-V Compounds
- H. Piller, Faraday Rotation
- H. Barry Bebb and E. W. Williams, Photoluminescence I: Theory
- E. W. Williams and H. Barry Bebb, Photoluminescence II: Gallium Arsenide

# Volume 9 Modulation Techniques

- B. O. Seraphin, Electroreflectance
- R. L. Aggarwal, Modulated Interband Magnetooptics
- D. F. Blossey and Paul Handler, Electroabsorption
- B. Batz, Thermal and Wavelength Modulation Spectroscopy
- I. Balslev, Piezooptical Effects
- D. E. Aspnes and N. Bottka, Electric-Field Effects on the Dielectric Function of Semiconductors and Insulators

## Volume 10 Transport Phenomena

- R. L. Rhode, Low-Field Electron Transport
- J. D. Wiley, Mobility of Holes in III-V Compounds
- C. M. Wolfe and G. E. Stillman, Apparent Mobility Enhancement in Inhomogeneous Crystals
- R. L. Petersen, The Magnetophonon Effect

### Volume 11 Solar Cells

H. J. Hovel, Introduction; Carrier Collection, Spectral Response, and Photocurrent; Solar Cell Electrical Characteristics; Efficiency; Thickness; Other Solar Cell Devices; Radiation Effects; Temperature and Intensity; Solar Cell Technology

### Volume 12 Infrared Detectors (II)

- W. L. Eiseman, J. D. Merriam, and R. F. Potter, Operational Characteristics of Infrared Photodetectors
- P. R. Bratt, Impurity Germanium and Silicon Infrared Detectors
- E. H. Putley, InSb Submillimeter Photoconductive Detectors
- G. E. Stillman, C. M. Wolfe, and J. O. Dimmock, Far-Infrared Photoconductivity in High Purity GaAs
- G. E. Stillman and C. M. Wolfe, Avalanche Photodiodes
- P. L. Richards, The Josephson Junction as a Detector of Microwave and Far-Infrared Radiation
- E. H. Putley, The Pyroelectric Detector An Update

### Volume 13 Cadmium Telluride

K. Zanio, Materials Preparations; Physics; Defects; Applications

## Volume 14 Lasers, Junctions, Transport

- N. Holonyak, Jr., and M. H. Lee, Photopumped III-V Semiconductor Lasers
- H. Kressel and J. K. Butler, Heterojunction Laser Diodes
- A. Van der Ziel, Space-Charge-Limited Solid-State Diodes
- P. J. Price, Monte Carlo Calculation of Electron Transport in Solids

## Volume 15 Contacts, Junctions, Emitters

- B. L. Sharma, Ohmic Contacts to III-V Compounds Semiconductors
- A. Nussbaum, The Theory of Semiconducting Junctions
- J. S. Escher, NEA Semiconductor Photoemitters

## Volume 16 Defects, (HgCd)Se, (HgCd)Te

- H. Kressel, The Effect of Crystal Defects on Optoelectronic Devices
- C. R. Whitsett, J. G. Broerman, and C. J. Summers, Crystal Growth and Properties of  $Hg_{1-x}$  Cd<sub>x</sub> Se Alloys
- M. H. Weiler, Magnetooptical Properties of  $Hg_{1-x}$   $Cd_x$  Te Alloys
- P. W. Kruse and J. G. Ready, Nonlinear Optical Effects in  $Hg_{1-x}$   $Cd_x$  Te

# Volume 17 CW Processing of Silicon and Other Semiconductors

- J. F. Gibbons, Beam Processing of Silicon
- A. Lietoila, R. B. Gold, J. F. Gibbons, and L. A. Christel, Temperature Distributions and Solid Phase Reaction Rates Produced by Scanning CW Beams

- A. Leitoila and J. F. Gibbons, Applications of CW Beam Processing to Ion Implanted Crystalline Silicon
- N. M. Johnson, Electronic Defects in CW Transient Thermal Processed Silicon
- K. F. Lee, T. J. Stultz, and J. F. Gibbons, Beam Recrystallized Polycrystalline Silicon: Properties, Applications, and Techniques
- T. Shibata, A. Wakita, T. W. Sigmon and J. F. Gibbons, Metal-Silicon Reactions and Silicide
- Y. I. Nissim and J. F. Gibbons, CW Beam Processing of Gallium Arsenide

## Volume 18 Mercury Cadmium Telluride

- P. W. Kruse, The Emergence of  $(Hg_{1-x} Cd_x)$  Te as a Modern Infrared Sensitive Material
- H. E. Hirsch, S. C. Liang, and A. G. White, Preparation of High-Purity Cadmium, Mercury, and Tellurium
- W. F. H. Micklethwaite, The Crystal Growth of Cadmium Mercury Telluride
- P. E. Petersen, Auger Recombination in Mercury Cadmium Telluride
- R. M. Broudy and V. J. Mazurczyck, (HgCd) Te Photoconductive Detectors
- M. B. Reine, A. K. Soad, and T. J. Tredwell, Photovoltaic Infrared Detectors
- M. A. Kinch, Metal-Insulator-Semiconductor Infrared Detectors

## Volume 19 Deep Levels, GaAs, Alloys, Photochemistry

- G. F. Neumark and K. Kosai, Deep Levels in Wide Band-Gap III-V Semiconductors
- D. C. Look, The Electrical and Photoelectronic Properties of Semi-Insulating GaAs
- R. F. Brebrick, Ching-Hua Su, and Pok-Kai Liao, Associated Solution Model for Ga-In-Sb and Hg-Cd-Te
- Y. Ya. Gurevich and Y. V. Pleskon, Photoelectrochemistry of Semiconductors

# Volume 20 Semi-Insulating GaAs

- R. N. Thomas, H. M. Hobgood, G. W. Eldridge, D. L. Barrett, T. T. Braggins, L. B. Ta, and S. K. Wang, High-Purity LEC Growth and Direct Implantation of GaAs for Monolithic Microwave Circuits
- C. A. Stolte, Ion Implantation and Materials for GaAs Integrated Circuits
- C. G. Kirkpatrick, R. T. Chen, D. E. Holmes, P. M. Asbeck, K. R. Elliott, R. D. Fairman, and J. R. Oliver, LEC GaAs for Integrated Circuit Applications
- J. S. Blakemore and S. Rahimi, Models for Mid-Gap Centers in Gallium Arsenide

### Volume 21 **Hydrogenated Amorphous Silicon**

### Part A

- J. I. Pankove, Introduction
- M. Hirose, Glow Discharge; Chemical Vapor Deposition
- Y. Uchida, di Glow Discharge
- T. D. Moustakas, Sputtering
- I. Yamada, Ionized-Cluster Beam Deposition
- B. A. Scott, Homogeneous Chemical Vapor Deposition

- F. J. Kampas, Chemical Reactions in Plasma Deposition
- P. A. Longeway, Plasma Kinetics
- H. A. Weakliem, Diagnostics of Silane Glow Discharges Using Probes and Mass Spectroscopy
- L. Gluttman, Relation between the Atomic and the Electronic Structures
- A. Chenevas-Paule, Experiment Determination of Structure
- S. Minomura, Pressure Effects on the Local Atomic Structure
- D. Adler, Defects and Density of Localized States

#### Part B

- J. I. Pankove, Introduction
- G. D. Cody, The Optical Absorption Edge of a-Si: H
- N. M. Amer and W. B. Jackson, Optical Properties of Defect States in a-Si: H
- P. J. Zanzucchi, The Vibrational Spectra of a-Si: H
- Y. Hamakawa, Electroreflectance and Electroabsorption
- J. S. Lannin, Raman Scattering of Amorphous Si, Ge, and Their Alloys
- R. A. Street, Luminescence in a-Si: H
- R. S. Crandall, Photoconductivity
- J. Tauc, Time-Resolved Spectroscopy of Electronic Relaxation Processes
- P. E. Vanier, IR-Induced Quenching and Enhancement of Photoconductivity and Photoluminescence
- H. Schade, Irradiation-Induced Metastable Effects
- L. Ley, Photoelectron Emission Studies

### Part C

- J. I. Pankove, Introduction
- J. D. Cohen, Density of States from Junction Measurements in Hydrogenated Amorphous Silicon
- P. C. Taylor, Magnetic Resonance Measurements in a-Si: H
- K. Morigaki, Optically Detected Magnetic Resonance
- J. Dresner, Carrier Mobility in a-Si: H
- T. Tiedje, Information About Band-Tail States from Time-of-Flight Experiments
- A. R. Moore, Diffusion Length in Undoped a-S: H
- W. Beyer and J. Overhof, Doping Effects in a-Si: H
- H. Fritzche, Electronic Properties of Surfaces in a-Si: H
- C. R. Wronski, The Staebler-Wronski Effect
- R. J. Nemanich, Schottky Barriers on a-Si: H
- B. Abeles and T. Tiedje, Amorphous Semiconductor Superlattices

### Part D

- J. I. Pankove, Introduction
- D. E. Carlson, Solar Cells
- G. A. Swartz, Closed-Form Solution of I-V Characteristic for a s-Si: H Solar Cells
- I. Shimizu, Electrophotography
- S. Ishioka, Image Pickup Tubes
- P. G. Lecomber and W. E. Spear, The Development of the a-Si: H Field-Effect Transistor and its Possible Applications

- D. G. Ast, a-Si: H FET-Addressed LCD Panel
- S. Kaneko, Solid-State Image Sensor
- M. Matsumura, Charge-Coupled Devices
- M. A. Bosch, Optical Recording
- A. D'Amico and G. Fortunato, Ambient Sensors
- H. Kulkimoto, Amorphous Light-Emitting Devices
- R. J. Phelan, Jr., Fast Decorators and Modulators
- J. I. Pankove, Hybrid Structures
- P. G. LeComber, A. E. Owen, W. E. Spear, J. Hajto, and W. K. Choi, Electronic Switching in Amorphous Silicon Junction Devices

# Volume 22 Lightwave Communications Technology

### Part A

- K. Nakajima, The Liquid-Phase Epitaxial Growth of InGaAsP
- W. T. Tsang, Molecular Beam Epitaxy for III-V Compound Semiconductors
- G. B. Stringfellow, Organometallic Vapor-Phase Epitaxial Growth of III-V Semiconductors
- G. Beuchet, Halide and Chloride Transport Vapor-Phase Deposition of InGaAsP and GaAs
- M. Razeghi, Low-Pressure, Metallo-Organic Chemical Vapor Deposition of Ga<sub>x</sub>In<sub>1-x</sub>AsP<sub>1-y</sub> Alloys
- P. M. Petroff, Defects in III-V Compound Semiconductors

### Part B

- J. P. van der Ziel, Mode Locking of Semiconductor Lasers
- K. Y. Lau and A. Yariv, High-Frequency Current Modulation of Semiconductor Injection Lasers
- C. H. Henry, Special Properties of Semi Conductor Lasers
- Y. Suematsu, K. Kishino, S. Arai, and F. Koyama, Dynamic Single-Mode Semiconductor Lasers with a Distributed Reflector
- W. T. Tsang, The Cleaved-Coupled-Cavity (C3) Laser

### Part C

- R. J. Nelson and N. K. Dutta, Review of InGaAsP InP Laser Structures and Comparison of Their Performance
- N. Chinone and M. Nakamura, Mode-Stabilized Semiconductor Lasers for 0.7–0.8- and 1.1–1.6- $\mu$ m Regions
- Y. Horikoshi, Semiconductor Lasers with Wavelengths Exceeding 2 µm
- B. A. Dean and M. Dixon, The Functional Reliability of Semiconductor Lasers as Optical Transmitters
- R. H. Saul, T. P. Lee, and C. A. Burus, Light-Emitting Device Design
- C. L. Zipfel, Light-Emitting Diode-Reliability
- T. P. Lee and T. Li, LED-Based Multimode Lightwave Systems
- K. Ogawa, Semiconductor Noise-Mode Partition Noise

#### Part D

- F. Capasso, The Physics of Avalanche Photodiodes
- T. P. Pearsall and M. A. Pollack, Compound Semiconductor Photodiodes

- T. Kaneda, Silicon and Germanium Avalanche Photodiodes
- S. R. Forrest, Sensitivity of Avalanche Photodetector Receivers for High-Bit-Rate Long-Wavelength Optical Communication Systems
- J. C. Campbell, Phototransistors for Lightwave Communications

### Part E

- S. Wang, Principles and Characteristics of Integrable Active and Passive Optical Devices
- S. Margalit and A. Yariv, Integrated Electronic and Photonic Devices
- T. Mukai, A. Yamamoto, and T. Kimura, Optical Amplification by Semiconductor Lasers

# Volume 23 Pulsed Laser Processing of Semiconductors

- R. F. Wood, C. W. White and R. T. Young, Laser Processing of Semiconductors: An Overview
- C. W. White, Segregation, Solute Trapping and Supersaturated Alloys
- G. E. Jellison, Jr., Optical and Electrical Properties of Pulsed Laser-Annealed Silicon
- R. F. Wood and G. E. Jellison, Jr., Melting Model of Pulsed Laser Processing
- R. F. Wood and F. W. Young, Jr., Nonequilibrium Solidification Following Pulsed Laser Melting
- D. H. Lawndes and G. E. Jellison, Jr., Time-Resolved Measurement During Pulsed Laser Irradiation of Silicon
- D. M. Zebner, Surface Studies of Pulsed Laser Irradiated Semiconductors
- D. H. Lowndes, Pulsed Beam Processing of Gallium Arsenide
- R. B. James, Pulsed CO<sub>2</sub> Laser Annealing of Semiconductors
- R. T. Young and R. F. Wood, Applications of Pulsed Laser Processing

# Volume 24 Applications of Multiquantum Wells, Selective Doping, and Superlattices

- C. Weisbuch, Fundamental Properties of III–V Semiconductor Two-Dimensional Quantized Structures: The Basis for Optical and Electronic Device Applications
- H. Morkoç and H. Unlu, Factors Affecting the Performance of (Al,Ga)As/GaAs and (Al,Ga)As/InGaAs Modulation-Doped Field-Effect Transistors: Microwave and Digital Applications
- N. T. Linh, Two-Dimensional Electron Gas FETs: Microwave Applications
- M. Abe et al., Ultra-High-Speed HEMT Integrated Circuits
- D. S. Chemla, D. A. B. Miller and P. W. Smith, Nonlinear Optical Properties of Multiple Quantum Well Structures for Optical Signal Processing
- F. Capasso, Graded-Gap and Superlattice Devices by Band-Gap Engineering
- W. T. Tsang, Quantum Confinement Heterostructure Semiconductor Lasers
- G. C. Osbourn et al., Principles and Applications of Semiconductor Strained-Layer Superlattices

### Volume 25 **Diluted Magnetic Semiconductors**

W. Giriat and J. K. Furdyna, Crystal Structure, Composition, and Materials Preparation of Diluted Magnetic Semiconductors

- W.~M.~Becker, Band Structure and Optical Properties of Wide-Gap  $A_{1-x}^{II}Mn_xB_{IV}$  Alloys at Zero Magnetic Field
- S. Oseroff and P. H. Keesom, Magnetic Properties: Macroscopic Studies
- T. Giebultowicz and T. M. Holden, Neutron Scattering Studies of the Magnetic Structure and Dynamics of Diluted Magnetic Semiconductors
- J. Kossut, Band Structure and Quantum Transport Phenomena in Narrow-Gap Diluted Magnetic Semiconductors
- C. Riquaux, Magnetooptical Properties of Large-Gap Diluted Magnetic Semiconductors
- J. A. Gaj, Magnetooptical Properties of Large-Gap Diluted Magnetic Semiconductors
- J. Mycielski, Shallow Acceptors in Diluted Magnetic Semiconductors: Splitting, Boil-off, Giant Negative Magnetoresistance
- A. K. Ramadas and R. Rodriquez, Raman Scattering in Diluted Magnetic Semiconductors
- P. A. Wolff, Theory of Bound Magnetic Polarons in Semimagnetic Semiconductors

# Volume 26 III-V Compound Semiconductors and Semiconductor Properties of Superionic Materials

- Z. Yuanxi, III-V Compounds
- H. V. Winston, A. T. Hunter, H. Kimura, and R. E. Lee, InAs-Alloyed GaAs Substrates for Direct Implantation
- P. K. Bhattacharya and S. Dhar, Deep Levels in III-V Compound Semiconductors Grown by MBE
- Y. Ya. Gurevich and A. K. Ivanov-Shits, Semiconductor Properties of Supersonic Materials

## Volume 27 High Conducting Quasi-One-Dimensional Organic Crystals

- E. M. Conwell, Introduction to Highly Conducting Quasi-One-Dimensional Organic Crystals
- I. A. Howard, A Reference Guide to the Conducting Quasi-One-Dimensional Organic Molecular Crystals
- J. P. Pouquet, Structural Instabilities
- E. M. Conwell, Transport Properties
- C. S. Jacobsen, Optical Properties
- J. C. Scolt, Magnetic Properties
- L. Zuppiroli, Irradiation Effects: Perfect Crystals and Real Crystals

### Volume 28 Measurement of High-Speed Signals in Solid State Devices

- J. Frey and D. Ioannou, Materials and Devices for High-Speed and Optoelectronic Applications
- H. Schumacher and E. Strid, Electronic Wafer Probing Techniques
- D. H. Auston, Picosecond Photoconductivity: High-Speed Measurements of Devices and Materials
- J. A. Valdmanis, Electro-Optic Measurement Techniques for Picosecond Materials, Devices and Integrated Circuits
- J. M. Wiesenfeld and R. K. Jain, Direct Optical Probing of Integrated Circuits and High-Speed Devices
- G. Plows, Electron-Beam Probing
- A. M. Weiner and R. B. Marcus, Photoemissive Probing

## Volume 29 Very High Speed Integrated Circuits: Gallium Arsenide LSI

- M. Kuzuhara and T. Nazaki, Active Layer Formation by Ion Implantation
- H. Hasimoto, Focused Ion Beam Implantation Technology
- T. Nozaki and A. Higashisaka, Device Fabrication Process Technology
- M. Ino and T. Takada, GaAs LSI Circuit Design
- M. Hirayama, M. Ohmori, and K. Yamasaki, GaAs LSI Fabrication and Performance

### Volume 30 Very High Speed Integrated Circuits: Heterostructure

- H. Watanabe, T. Mizutani, and A. Usui, Fundamentals of Epitaxial Growth and Atomic Layer Epitaxy
- S. Hiyamizu, Characteristics of Two-Dimensional Electron Gas in III-V Compound Heterostructures Grown by MBE
- T. Nakanisi, Metalorganic Vapor Phase Epitaxy for High-Quality Active Layers
- T. Nimura, High Electron Mobility Transistor and LSI Applications
- T. Sugeta and T. Ishibashi, Hetero-Bipolar Transistor and LSI Application
- H. Matsuedo, T. Tanaka, and M. Nakamura, Optoelectronic Integrated Circuits

### Volume 31 Indium Phosphide: Crystal Growth and Characterization

- J. P. Farges, Growth of Discoloration-Free InP
- M. J. McCollum and G. E. Stillman, High Purity InP Grown by Hydride Vapor Phase Epitaxy
- I. Inada and T. Fukuda, Direct Synthesis and Growth of Indium Phosphide by the Liquid Phosphorous Encapsulated Czochralski Method
- O. Oda, K. Katagiri, K. Shinohara, S. Katsura, Y. Takahashi, K. Kainosho, K. Kohiro, and R. Hirano, InP Crystal Growth, Substrate Preparation and Evaluation
- K. Tada, M. Tatsumi, M. Morioka, T. Araki, and T. Kawase, InP Substrates: Production and Quality Control
- M. Razeghi, LP-MOCVD Growth, Characterization, and Application of InP Material
- T. A. Kennedy and P. J. Lin-Chung, Stoichiometric Defects in InP

### Volume 32 Strained-Layer Superlattices: Physics

- T. P. Pearsall, Strained-Layer Superlattices
- F. H. Pollack, Effects of Homogeneous Strain on the Electronic and Vibrational Levels in Semiconductors
- J. Y. Marzin, J. M. Gerárd, P. Voisin, and J. A. Brum, Optical Studies of Strained III-V Heterolayers
- R. People and S. A. Jackson, Structurally Induced States from Strain and Confinement
- M. Jaros, Microscopic Phenomena in Ordered Superlattices

# Volume 33 Strained-Layer Superlattices: Material Science and Technology

R. Hull and J. C. Bean, Principles and Concepts of Strained-Layer Epitaxy

- W. J. Shaff, P. J. Tasker, M. C. Foisy, and L. F. Eastman, Device Applications of Strained-Layer Epitaxy
- S. T. Picraux, B. L. Doyle, and J. Y. Tsao, Structure and Characterization of Strained-Layer Superlattices
- E. Kasper and F. Schaffer, Group IV Compounds
- D. L. Martin, Molecular Beam Epitaxy of IV-VI Compounds Heterojunction
- R. L. Gunshor, L. A. Kolodziejski, A. V. Nurmikko, and N. Otsuka, Molecular Beam Epitaxy of I-VI Semiconductor Microstructures

## Volume 34 Hydrogen in Semiconductors

- J. I. Pankove and N. M. Johnson, Introduction to Hydrogen in Semiconductors
- C. H. Seager, Hydrogenation Methods
- J. I. Pankove, Hydrogenation of Defects in Crystalline Silicon
- J. W. Corbett, P. Déak, U. V. Desnica, and S. J. Pearton, Hydrogen Passivation of Damage Centers in Semiconductors
- S. J. Pearton, Neutralization of Deep Levels in Silicon
- J. I. Pankove, Neutralization of Shallow Acceptors in Silicon
- N. M. Johnson, Neutralization of Donor Dopants and Formation of Hydrogen-Induced Defects in n-Type Silicon
- M. Stavola and S. J. Pearton, Vibrational Spectroscopy of Hydrogen-Related Defects in Silicon
- A. D. Marwick, Hydrogen in Semiconductors: Ion Beam Techniques
- C. Herring and N. M. Johnson, Hydrogen Migration and Solubility in Silicon
- E. E. Haller, Hydrogen-Related Phenomena in Crystalline Germanium
- J. Kakalios, Hydrogen Diffusion in Amorphous Silicon
- J. Chevalier, B. Clerjaud, and B. Pajot, Neutralization of Defects and Dopants in III-V Semiconductors
- G. G. DeLeo and W. B. Fowler, Computational Studies of Hydrogen-Containing Complexes in Semiconductors
- R. F. Kiefl and T. L. Estle, Muonium in Semiconductors
- C. G. Van de Walle, Theory of Isolated Interstitial Hydrogen and Muonium in Crystalline Semiconductors

### Volume 35 Nanostructured Systems

- M. Reed, Introduction
- H. van Houten, C. W. J. Beenakker, and B. J. Wees, Quantum Point Contacts
- G. Timp, When Does a Wire Become an Electron Waveguide?
- M. Búttiker, The Quantum Hall Effects in Open Conductors
- W. Hansen, J. P. Kotthaus, and U. Merkt, Electrons in Laterally Periodic Nanostructures

### Volume 36 The Spectroscopy of Semiconductors

- D. Heiman, Spectroscopy of Semiconductors at Low Temperatures and High Magnetic Fields
- A. V. Nurmikko, Transient Spectroscopy by Ultrashort Laser Pulse Techniques

- A. K. Ramdas and S. Rodriguez, Piezospectroscopy of Semiconductors
- O. J. Glembocki and B. V. Shanabrook, Photoreflectance Spectroscopy of Microstructures
- D. G. Seiler, C. L. Littler, and M. H. Wiler, One- and Two-Photon Magneto-Optical Spectroscopy of InSb and  $Hg_{1-x}Cd_x$  Te

### Volume 37 The Mechanical Properties of Semiconductors

- A.-B. Chen, A. Sher, and W. T. Yost, Elastic Constants and Related Properties of Semiconductor Compounds and Their Alloys
- D. R. Clarke, Fracture of Silicon and Other Semiconductors
- H. Siethoff, The Plasticity of Elemental and Compound Semiconductors
- S. Guruswamy, K. T. Faber, and J. P. Hirth, Mechanical Behavior of Compound Semiconductors
- S. Mahajan, Deformation Behavior of Compound Semiconductors
- J. P. Hirth, Injection of Dislocations into Strained Multilayer Structures
- D. Kendall, C. B. Fleddermann, and K. J. Malloy, Critical Technologies for the Micromatching of Silicon
- J. Matsuba and K. Mokuya, Processing and Semiconductor Thermoelastic Behavior

### Volume 38 Imperfections in III/V Materials

- U. Scherz and M. Scheffler, Density-Functional Theory of sp-Bonded Defects in III/V Semiconductors
- M. Kaminska and E. R. Weber, E12 Defect in GaAs
- D. C. Look, Defects Relevant for Compensation in Semi-Insulating GaAs
- R. C. Newman, Local Vibrational Mode Spectroscopy of Defects in III/V Compounds
- A. M. Hennel, Transition Metals in III/V Compounds
- K. J. Malloy and K. Khachaturyan, DX and Related Defects in Semiconductors
- V. Swaminathan and A. S. Jordan, Dislocations in III/V Compounds
- K. W. Nauka, Deep Level Defects in the Epitaxial III/V Materials

# Volume 39 Minority Carriers in III-V Semiconductors: Physics and Applications

- N. K. Dutta, Radiative Transition in GaAs and Other III-V Compounds
- R. K. Ahrenkiel, Minority-Carrier Lifetime in III-V Semiconductors
- T. Furuta, High Field Minority Electron Transport in p-GaAs
- M. S. Lundstrom, Minority-Carrier Transport in III-V Semiconductors
- R. A. Abram, Effects of Heavy Doping and High Excitation on the Band Structure of GaAs
- D. Yevick and W. Bardyszewski, An Introduction to Non-Equilibrium Many-Body Analyses of Optical Processes in III–V Semiconductors

## Volume 40 Epitaxial Microstructures

- E. F. Schubert, Delta-Doping of Semiconductors: Electronic, Optical and Structural Properties of Materials and Devices
- A. Gossard, M. Sundaram, and P. Hopkins, Wide Graded Potential Wells

- P. Petroff, Direct Growth of Nanometer-Size Quantum Wire Superlattices
- E. Kapon, Lateral Patterning of Quantum Well Heterostructures by Growth of Nonplanar Substrates
- H. Temkin, D. Gershoni, and M. Panish, Optical Properties of Ga<sub>1-x</sub>In<sub>x</sub>As/InP Quantum Wells

## Volume 41 High Speed Heterostructure Devices

- F. Capasso, F. Beltram, S. Sen, A. Pahlevi, and A. Y. Cho, Quantum Electron Devices: Physics and Applications
- P. Solomon, D. J. Frank, S. L. Wright and F. Canora, GaAs-Gate Semiconductor-Insulator-Semiconductor FET
- M. H. Hashemi and U. K. Mishra, Unipolar InP-Based Transistors
- R. Kiehl, Complementary Heterostructure FET Integrated Circuits
- T. Ishibashi, GaAs-Based and InP-Based Heterostructure Bipolar-Transistors
- H. C. Liu and T. C. L. G. Sollner, High-Frequency-Tunneling Devices
- H. Ohnishi, T. More, M. Takatsu, K. Imamura, and N. Yokoyama, Resonant-Tunneling Hot-Electron Transistors and Circuits

# Volume 42 Oxygen in Silicon

- F. Shimura, Introduction to Oxygen in Silicon
- W. Lin, The Incorporation of Oxygen into Silicon Crystals
- T. J. Schaffner and D. K. Schroder, Characterization Techniques for Oxygen in Silicon
- W. M. Bullis, Oxygen Concentration Measurement
- S. M. Hu, Intrinsic Point Defects in Silicon
- B. Pajot, Some Atomic Configuration of Oxygen
- J. Michel and L. C. Kimerling, Electrical Properties of Oxygen in Silicon
- R. C. Newman and R. Jones, Diffusion of Oxygen in Silicon
- T. Y. Tan and W. J. Taylor, Mechanisms of Oxygen Precipitation: Some Quantitative Aspects
- M. Schrems, Simulation of Oxygen Precipitation
- K. Simino and I. Yonenaga, Oxygen Effect on Mechanical Properties
- W. Bergholz, Grown-in and Process-Induced Effects
- F. Shimura, Intrinsic/Internal Gettering
- H. Tsuya, Oxygen Effect on Electronic Device Performance

# Volume 43 Semiconductors for Room Temperature Nuclear Detector Applications

- R. B. James and T. E. Schlesinger, Introduction and Overview
- L. S. Darken and C. E. Cox, High-Purity Germanium Detectors
- A. Burger, D. Nason, L. Van den Berg, and M. Schieber, Growth of Mercuric Iodide
- X. J. Bao, T. E. Schlesinger, and R. B. James, Electrical Properties of Mercuric Iodide
- X. J. Bao, R. B. James, and T. E. Schlesinger, Optical Properties of Red Mercuric Iodide
- M. Hage-Ali and P. Siffert, Growth Methods of CdTe Nuclear Detector Materials
- M. Hage-Ali and P. Siffert, Characterization of CdTe Nuclear Detector Materials

- M. Hage-Ali and P. Siffert, CdTe Nuclear Detectors and Applications
- R. B. James, T. E. Schlesinger, J. Lund, and M. Schieber,  $Cd_{1-x} Zn_x Te$  Spectrometers for Gamma and X-Ray Applications
- D. S. McGregor, J. E. Kammeraad, Gallium Arsenide Radiation Detectors and Spectrometers
- J. C. Lund, F. Olschner, and A. Burger, Lead Iodide
- M. R. Squillante and K. S. Shah, Other Materials: Status and Prospects
- V. M. Gerrish, Characterization and Quantification of Detector Performance
- J. S. Iwanczyk and B. E. Patt, Electronics for X-ray and Gamma Ray Spectrometers
- M. Schieber, R. B. James and T. E. Schlesinger, Summary and Remaining Issues for Room Temperature Radiation Spectrometers

# Volume 44 II-IV Blue/Green Light Emitters: Device Physics and Epitaxial Growth

- J. Han and R. L. Gunshor, MBE Growth and Electrical Properties of Wide Bandgap ZnSe-based II–VI Semiconductors
- S. Fujita and S. Fujita, Growth and Characterization of ZnSe-based II-VI Semiconductors by MOVPE
- E. Ho and L. A. Kolodziejski, Gaseous Source UHV Epitaxy Technologies for Wide Bandgap II–VI Semiconductors
- C. G. Van de Walle, Doping of Wide-Band-Gap II-VI Compounds Theory
- R. Cingolani, Optical Properties of Excitons in ZnSe-Based Quantum Well Heterostructures
- A. Ishibashi and A. V. Nurmikko, II-VI Diode Lasers: A Current View of Device Performance and Issues
- S. Guha and J. Petruzello, Defects and Degradation in Wide-Gap II–VI-based Structure and Light Emitting Devices

# Volume 45 Effect of Disorder and Defects in Ion-Implanted Semiconductors: Electrical and Physiochemical Characterization

- H. Ryssel, Ion Implantation into Semiconductors: Historical Perspectives
- You-Nian Wang and Teng-Cai Ma, Electronic Stopping Power for Energetic Ions in Solids
- S. T. Nakagawa, Solid Effect on the Electronic Stopping of Crystalline Target and Application to Range Estimation
- G. Miller, S. Kalbitzer, and G. N. Greaves, Ion Beams in Amorphous Semiconductor Research
- J. Boussey-Said, Sheet and Spreading Resistance Analysis of Ion Implanted and Annealed Semiconductors
- M. L. Polignano and G. Queirolo, Studies of the Stripping Hall Effect in Ion-Implanted Silicon
- J. Sroemenos, Transmission Electron Microscopy Analyses
- R. Nipoti and M. Servidori, Rutherford Backscattering Studies of Ion Implanted Semiconductors
- P. Zaumseil, X-ray Diffraction Techniques

# Volume 46 Effect of Disorder and Defects in Ion-Implanted Semiconductors: Optical and Photothermal Characterization

- M. Fried, T. Lohner, and J. Gyulai, Ellipsometric Analysis
- A. Seas and C. Christofides, Transmission and Reflection Spectroscopy on Ion Implanted Semiconductors

- A. Othonos and C. Christofides, Photoluminescence and Raman Scattering of Ion Implanted Semiconductors. Influence of Annealing
- C. Christofides, Photomodulated Thermoreflectance Investigation of Implanted Wafers. Annealing Kinetics of Defects
- U. Zammit, Photothermal Deflection Spectroscopy Characterization of Ion-Implanted and Annealed Silicon Films
- A. Mandelis, A. Budiman, and M. Vargas, Photothermal Deep-Level Transient Spectroscopy of Impurities and Defects in Semiconductors
- R. Kalish and S. Charbonneau, Ion Implantation into Quantum-Well Structures
- A. M. Myasnikov and N. N. Gerasimenko, Ion Implantation and Thermal Annealing of III–V Compound Semiconducting Systems: Some Problems of III–V Narrow Gap Semiconductors

# Volume 47 Uncooled Infrared Imaging Arrays and Systems

- R. G. Buser and M. P. Tompsett, Historical Overview
- P. W. Kruse, Principles of Uncooled Infrared Focal Plane Arrays
- R. A. Wood, Monolithic Silicon Microbolometer Arrays
- C. M. Hanson, Hybrid Pyroelectric-Ferroelectric Bolometer Arrays
- D. L. Polla and J. R. Choi, Monolithic Pyroelectric Bolometer Arrays
- N. Teranishi, Thermoelectric Uncooled Infrared Focal Plane Arrays
- M. F. Tompsett, Pyroelectric Vidicon
- T. W. Kenny, Tunneling Infrared Sensors
- J. R. Vig, R. L Filler, and Y. Kim, Application of Quartz Microresonators to Uncooled Infrared Imaging Arrays
- P. W. Kruse, Application of Uncooled Monolithic Thermoelectric Linear Arrays to Imaging Radiometers

## Volume 48 High Brightness Light Emitting Diodes

- G. B. Stringfellow, Materials Issues in High-Brightness Light-Emitting Diodes
- M. G. Craford, Overview of Device Issues in High-Brightness Light-Emitting Diodes
- F. M. Steranka, AlGaAs Red Light Emitting Diodes
- C. H. Chen, S. A. Stockman, M. J. Peanasky, and C. P. Kuo, OMVPE Growth of AlGaInP for High Efficiency Visible Light-Emitting Diodes
- F. A. Kish and R. M. Fletcher, AlGaInP Light-Emitting Diodes
- M. W. Hodapp, Applications for High Brightness Light-Emitting Diodes
- J. Akasaki and H. Amano, Organometallic Vapor Epitaxy of GaN for High Brightness Blue Light Emitting Diodes
- S. Nakamura, Group III–V Nitride Based Ultraviolet-Blue-Green-Yellow Light-Emitting Diodes and Laser Diodes

### Volume 49 Light Emission in Silicon: from Physics to Devices

- D. J. Lockwood, Light Emission in Silicon
- G. Abstreiter, Band Gaps and Light Emission in Si/SiGe Atomic Layer Structures

- T. G. Brown and D. G. Hall, Radiative Isoelectronic Impurities in Silicon and Silicon-Germanium Alloys and Superlattices
- J. Michel, L. V. C. Assali, M. T. Morse, and L. C. Kimerling, Erbium in Silicon
- Y. Kanemitsu, Silicon and Germanium Nanoparticles
- P. M. Fauchet, Porous Silicon: Photoluminescence and Electroluminescent Devices
- C. Delerue, G. Allan, and M. Lannoo, Theory of Radiative and Nonradiative Processes in Silicon Nanocrystallites
- L. Brus, Silicon Polymers and Nanocrystals

## Volume 50 Gallium Nitride (GaN)

- J. I. Pankove and T. D. Moustakas, Introduction
- S. P. DenBaars and S. Keller, Metalorganic Chemical Vapor Deposition (MOCVD) of Group III Nitrides
- W. A. Bryden and T. J. Kistenmacher, Growth of Group III-A Nitrides by Reactive Sputtering
- N. Newman, Thermochemistry of III-N Semiconductors
- S. J. Pearton and R. J. Shul, Etching of III Nitrides
- S. M. Bedair, Indium-based Nitride Compounds
- A. Trampert, O. Brandt, and K. H. Ploog, Crystal Structure of Group III Nitrides
- H. Morkoς, F. Hamdani, and A. Salvador, Electronic and Optical Properties of III–V Nitride based Quantum Wells and Superlattices
- K. Doverspike and J. I. Pankove, Doping in the III-Nitrides
- T. Suski and P. Perlin, High Pressure Studies of Defects and Impurities in Gallium Nitride
- B. Monemar, Optical Properties of GaN
- W. R. L. Lambrecht, Band Structure of the Group III Nitrides
- N. E. Christensen and P. Perlin, Phonons and Phase Transitions in GaN
- S. Nakamura, Applications of LEDs and LDs
- I. Akasaki and H. Amano, Lasers
- J. A. Cooper, Jr., Nonvolatile Random Access Memories in Wide Bandgap Semiconductors

### Volume 51A Identification of Defects in Semiconductors

- G. D. Watkins, EPR and ENDOR Studies of Defects in Semiconductors
- J.-M. Spaeth, Magneto-Optical and Electrical Detection of Paramagnetic Resonance in Semiconductors
- T. A. Kennedy and E. R. Claser, Magnetic Resonance of Epitaxial Layers Detected by Photoluminescence
- K. H. Chow, B. Hitti, and R. F. Kiefl, µSR on Muonium in Semiconductors and Its Relation to Hydrogen
- K. Saarinen, P. Hautojärvi, and C. Corbel, Positron Annihilation Spectroscopy of Defects in Semiconductors
- R. Jones and P. R. Briddon, The Ab Initio Cluster Method and the Dynamics of Defects in Semiconductors

### Volume 51B Identification Defects in Semiconductors

- G. Davies, Optical Measurements of Point Defects
- P. M. Mooney, Defect Identification Using Capacitance Spectroscopy

- M. Stavola, Vibrational Spectroscopy of Light Element Impurities in Semiconductors
- P. Schwander, W. D. Rau, C. Kisielowski, M. Gribelyuk, and A. Ourmazd, Defect Processes in Semiconductors Studied at the Atomic Level by Transmission Electron Microscopy
- N. D. Jager and E. R. Weber, Scanning Tunneling Microscopy of Defects in Semiconductors

### Volume 52 SiC Materials and Devices

- K. Järrendahl and R. F. Davis, Materials Properties and Characterization of SiC
- V. A. Dmitiriev and M. G. Spencer, SiC Fabrication Technology: Growth and Doping
- V. Saxena and A. J. Steckl, Building Blocks for SiC Devices: Ohmic Contacts, Schottky Contacts, and p-n Junctions
- M. S. Shur, SiC Transistors
- C. D. Brandt, R. C. Clarke, R. R. Siergiej, J. B. Casady, A. W. Morse, S. Sriram, and A. K. Agarwal, SiC for Applications in High-Power Electronics
- R. J. Trew, SiC Microwave Devices
- J. Edmond, H. Kong, G. Negley, M. Leonard, K. Doverspike, W. Weeks, A. Suvorov, D. Waltz, and C. Carter, Jr., SiC-Based UV Photodiodes and Light-Emitting Diodes
- H. Morkoç, Beyond Silicon Carbide! III-V Nitride-Based Heterostructures and Devices

# Volume 53 Cumulative Subjects and Author Index Including Tables of Contents for Volumes 1-50

### Volume 54 High Pressure in Semiconductor Physics I

- W. Paul, High Pressure in Semiconductor Physics: A Historical Overview
- N. E. Christensen, Electronic Structure Calculations for Semiconductors Under Pressure
- R. J. Neimes and M. I. McMahon, Structural Transitions in the Group IV, III–V and II–VI Semiconductors Under Pressure
- A. R. Goni and K. Syassen, Optical Properties of Semiconductors Under Pressure
- P. Trautman, M. Baj, and J. M. Baranowski, Hydrostatic Pressure and Uniaxial Stress in Investigations of the EL2 Defect in GaAs
- M. Li and P. Y. Yu, High-Pressure Study of DX Centers Using Capacitance Techniques
- T. Suski, Spatial Correlations of Impurity Charges in Doped Semiconductors
- N. Kuroda, Pressure Effects on the Electronic Properties of Diluted Magnetic Semiconductors

### Volume 55 High Pressure in Semiconductor Physics II

- D. K. Maude and J. C. Portal, Parallel Transport in Low-Dimensional Semiconductor Structures
- P. C. Klipstein, Tunneling Under Pressure: High-Pressure Studies of Vertical Transport in Semiconductor Heterostructures
- E. Anastassakis and M. Cardona, Phonons, Strains, and Pressure in Semiconductors

- F. H. Pollak, Effects of External Uniaxial Stress on the Optical Properties of Semiconductors and Semiconductor Microstructures
- A. R. Adams, M. Silver, and J. Allam, Semiconductor Optoelectronic Devices
- S. Porowski and I. Grzegory, The Application of High Nitrogen Pressure in the Physics and Technology of III–N Compounds
- M. Yousuf, Diamond Anvil Cells in High Pressure Studies of Semiconductors

### Volume 56 Germanium Silicon: Physics and Materials

- J. C. Bean, Growth Techniques and Procedures
- D. E. Savage, F. Liu, V. Zielasek, and M. G. Lagally, Fundamental Crystal Growth Mechanisms
- R. Hull, Misfit Strain Accommodation in SiGe Heterostructures
- M. J. Shaw and M. Jaros, Fundamental Physics of Strained Layer GeSi: Quo Vadis?
- F. Cerdeira, Optical Properties
- S. A. Ringel and P. N. Grillot, Electronic Properties and Deep Levels in Germanium-Silicon
- J. C. Campbell, Optoelectronics in Silicon and Germanium Silicon
- K. Eberl, K. Brunner, and O. G. Schmidt,  $Si_{1-y}C_y$  and  $Si_{1-x-y}Ge_2C_y$  Alloy Layers

## Volume 57 Gallium Nitride (GaN) II

- R. J. Molnar, Hydride Vapor Phase Epitaxial Growth of III-V Nitrides
- T. D. Moustakas, Growth of III-V Nitrides by Molecular Beam Epitaxy
- Z. Liliental-Weber, Defects in Bulk GaN and Homoepitaxial Layers
- C. G. Van de Walk and N. M. Johnson, Hydrogen in III-V Nitrides
- W. Götz and N. M. Johnson, Characterization of Dopants and Deep Level Defects in Gallium Nitride
- B. Gil, Stress Effects on Optical Properties
- C. Kisielowski, Strain in GaN Thin Films and Heterostructures
- J. A. Miragliotta and D. K. Wickenden, Nonlinear Optical Properties of Gallium Nitride
- B. K. Meyer, Magnetic Resonance Investigations on Group III-Nitrides
- M. S. Shur and M. Asif Khan, GaN and AIGaN Ultraviolet Detectors
- C. H. Qiu, J. I. Pankove, and C. Rossington, II-V Nitride-Based X-ray Detectors

### Volume 58 Nonlinear Optics in Semiconductors I

- A. Kost, Resonant Optical Nonlinearities in Semiconductors
- E. Garmire, Optical Nonlinearities in Semiconductors Enhanced by Carrier Transport
- D. S. Chemla, Ultrafast Transient Nonlinear Optical Processes in Semiconductors
- M. Sheik-Bahae and E. W. Van Stryland, Optical Nonlinearities in the Transparency Region of Bulk Semiconductors
- J. E. Millerd, M. Ziari, and A. Partovi, Photorefractivity in Semiconductors

## Volume 59 Nonlinear Optics in Semiconductors II

- J. B. Khurgin, Second Order Nonlinearities and Optical Rectification
- K. L. Hall, E. R. Thoen, and E. P. Ippen, Nonlinearities in Active Media
- E. Hanamura, Optical Responses of Quantum Wires/Dots and Microcavities
- U. Keller, Semiconductor Nonlinearities for Solid-State Laser Modelocking and Q-Switching
- A. Miller, Transient Grating Studies of Carrier Diffusion and Mobility in Semiconductors

## Volume 60 Self-Assembled InGaAs/GaAs Quantum Dots

Mitsuru Sugawara, Theoretical Bases of the Optical Properties of Semiconductor Quantum Nano-Structures

Yoshiaki Nakata, Yoshihiro Sugiyama, and Mitsuru Sugawara, Molecular Beam Epitaxial Growth of Self-Assembled InAs/GaAs Quantum Dots

Kohki Mukai, Mitsuru Sugawara, Mitsuru Egawa, and Nobuyuki Ohtsuka, Metalorganic Vapor Phase Epitaxial Growth of Self-Assembled InGaAs/GaAs Quantum Dots Emitting at 1.3 μm

Kohki Mukai and Mitsuru Sugawara, Optical Characterization of Quantum Dots

Kohki Mukai and Milsuru Sugawara, The Photon Bottleneck Effect in Quantum Dots

Hajime Shoji, Self-Assembled Quantum Dot Lasers

Hiroshi Ishikawa, Applications of Quantum Dot to Optical Devices

Mitsuru Sugawara, Kohki Mukai, Hiroshi Ishikawa, Koji Otsubo, and Yoshiaki Nakata, The Latest News

# Volume 61 Hydrogen in Semiconductors II

Norbert H. Nickel, Introduction to Hydrogen in Semiconductors II

Noble M. Johnson and Chris G. Van de Walle, Isolated Monatomic Hydrogen in Silicon

Yurij V. Gorelkinskii, Electron Paramagnetic Resonance Studies of Hydrogen and Hydrogen-Related Defects in Crystalline Silicon

Norbert H. Nickel, Hydrogen in Polycrystalline Silicon

Wolfhard Beyer, Hydrogen Phenomena in Hydrogenated Amorphous Silicon

Chris G. Van de Walle, Hydrogen Interactions with Polycrystalline and Amorphous Silicon-Theory

Karen M. McManus Rutledge, Hydrogen in Polycrystalline CVD Diamond

Roger L. Lichti, Dynamics of Muonium Diffusion, Site Changes and Charge-State Transitions

Matthew D. McCluskey and Eugene E. Haller, Hydrogen in III-V and II-VI Semiconductors

S. J. Pearton and J. W. Lee, The Properties of Hydrogen in GaN and Related Alloys

Jörg Neugebauer and Chris G. Van de Walle, Theory of Hydrogen in GaN

# Volume 62 Intersubband Transitions in Quantum Wells: Physics and Device Applications I

Manfred Helm, The Basic Physics of Intersubband Transitions

Jerome Faist, Carlo Sirtori, Federico Capasso, Loren N. Pfeiffer, Ken W. West, Deborah L. Sivco, and Alfred Y. Cho, Quantum Interference Effects in Intersubband Transitions

- H. C. Liu, Quantum Well Infrared Photodetector Physics and Novel Devices
- S. D. Gunapala and S. V. Bandara, Quantum Well Infrared Photodetector (QWIP) Focal Plane Arrays

## Volume 63 Chemical Mechanical Polishing in Si Processing

Frank B. Kaufman, Introduction

Thomas Bibby and Karey Holland, Equipment

John P. Bare, Facilitization

Duane S. Boning and Okumu Ouma, Modeling and Simulation

Shin Hwa Li, Bruce Tredinnick, and Mel Hoffman, Consumables I: Slurry

Lee M. Cook, CMP Consumables II: Pad

François Tardif, Post-CMP Clean

Shin Hwa Li, Tara Chhatpar, and Frederic Robert, CMP Metrology

Shin Hwa Li, Visun Bucha, and Kyle Wooldridge, Applications and CMP-Related Process Problems

### Volume 64 Electroluminescence I

M. G. Craford, S. A. Stockman, M. J. Peansky, and F. A. Kish, Visible Light-Emitting Diodes

H. Chui, N. F. Gardner, P. N. Grillot, J. W. Huang, M. R. Krames, and S. A. Maranowski, High-Efficiency AIGaInP Light-Emitting Diodes

R. S. Kern, W. Gōtz, C. H. Chen, H. Liu, R. M. Fletcher, and C. P. Kuo, High-Brightness Nitride-Based Visible-Light-Emitting Diodes

Yoshiharu Sato, Organic LED System Considerations

V. Bulović, P. E. Burrows, and S. R. Forrest, Molecular Organic Light-Emitting Devices

### Volume 65 Electroluminescence II

V. Bulović and S. R. Forrest, Polymeric and Molecular Organic Light Emitting Devices: A Comparison Regina Mueller-Mach and Gerd O. Mueller, Thin Film Electroluminescence

Markku Leskelā, Wei-Min Li, and Mikko Ritala, Materials in Thin Film Electroluminescent Devices

Kristiaan Neyts, Microcavities for Electroluminescent Devices

# Volume 66 Intersubband Transitions in Quantum Wells: Physics and Device Applications II

Jerome Faist, Federico Capasso, Carlo Sirtori, Deborah L. Sivco, and Alfred Y. Cho, Quantum Cascade Lasers Federico Capasso, Carlo Sirtori, D. L. Sivco, and A. Y. Cho, Nonlinear Optics in Coupled-Quantum-Well Quasi-Molecules

Karl Unterrainer, Photon-Assisted Tunneling in Semiconductor Quantum Structures

P. Haring Bolivar, T. Dekorsy, and H. Kurz, Optically Excited Bloch Oscillations–Fundamentals and Application Perspectives

### Volume 67 Ultrafast Physical Processes in Semiconductors

Alfred Leitenstorfer and Alfred Laubereau, Ultrafast Electron-Phonon Interactions in Semiconductors: Quantum Kinetic Memory Effects

- Christoph Lienau and Thomas Elsaesser, Spatially and Temporally Resolved Near-Field Scanning Optical Microscopy Studies of Semiconductor Quantum Wires
- K. T. Tsen, Ultrafast Dynamics in Wide Bandgap Wurtzite GaN
- J. Paul Callan, Albert M.-T. Kim, Christopher A. D. Roeser, and Eriz Mazur, Ultrafast Dynamics and Phase Changes in Highly Excited GaAs
- Hartmut Hang, Quantum Kinetics for Femtosecond Spectroscopy in Semiconductors
- T. Meier and S. W. Koch, Coulomb Correlation Signatures in the Excitonic Optical Nonlinearities of Semiconductors
- Roland E. Allen, Traian Dumitrică, and Ben Torralva, Electronic and Structural Response of Materials to Fast, Intense Laser Pulses
- E. Gornik and R. Kersting, Coherent THz Emission in Semiconductors

# Volume 68 Isotope Effects in Solid State Physics

Vladimir G. Plekhanov, Elastic Properties; Thermal Properties; Vibrational Properties; Raman Spectra of Isotopically Mixed Crystals; Excitons in LiH Crystals; Exciton–Phonon Interaction; Isotopic Effect in the Emission Spectrum of Polaritons; Isotopic Disordering of Crystal Lattices; Future Developments and Applications; Conclusions

### Volume 69 Recent Trends in Thermoelectric Materials Research I

- H. Julian Goldsmid, Introduction
- Terry M. Tritt and Valerie M. Browning, Overview of Measurement and Characterization Techniques for Thermoelectric Materials
- Mercouri G. Kanatzidis, The Role of Solid-State Chemistry in the Discovery of New Thermoelectric Materials
- B. Lenoir, H. Scherrer, and T. Caillat, An Overview of Recent Developments for BiSb Alloys
- Citrad Uher, Skutterudities: Prospective Novel Thermoelectrics
- George S. Nolas, Glen A. Slack, and Sandra B. Schujman, Semiconductor Clathrates: A Phonon Glass Electron Crystal Material with Potential for Thermoelectric Applications

### Volume 70 Recent Trends in Thermoelectric Materials Research II

- Brian C. Sales, David G. Mandrus, and Bryan C. Chakoumakos, Use of Atomic Displacement Parameters in Thermoelectric Materials Research
- S. Joseph Poon, Electronic and Thermoelectric Properties of Half-Heusler Alloys
- Terry M. Tritt, A. L. Pope, and J. W. Kolis, Overview of the Thermoelectric Properties of Quasicrystalline Materials and Their Potential for Thermoelectric Applications
- Alexander C. Ehrlich and Stuart A. Wolf, Military Applications of Enhanced Thermoelectrics
- David J. Singh, Theoretical and Computational Approaches for Identifying and Optimizing Novel Thermoelectric Materials
- Terry M. Tritt and R. T. Littleton, IV, Thermoelectric Properties of the Transition Metal Pentatellurides:

  Potential Low-Temperature Thermoelectric Materials

Franz Freibert, Timothy W. Darling, Albert Miglori, and Stuart A. Trugman, Thermomagnetic Effects and Measurements

M. Bartkowiak and G. D. Mahan, Heat and Electricity Transport Through Interfaces

### Volume 71 Recent Trends in Thermoelectric Materials Research III

- M. S. Dresselhaus, Y.-M. Lin, T. Koga, S. B. Cronin, O. Rabin, M. R. Black, and G. Dresselhaus, Quantum Wells and Quantum Wires for Potential Thermoelectric Applications
- D. A. Broido and T. L. Reinecke, Thermoelectric Transport in Quantum Well and Quantum Wire Superlattices
- G. D. Mahan, Thermionic Refrigeration
- Rama Venkatasubramanian, Phonon Blocking Electron Transmitting Superlattice Structures as Advanced Thin Film Thermoelectric Materials
- G. Chen, Phonon Transport in Low-Dimensional Structures

## Volume 72 Silicon Epitaxy

- S. Acerboni, ST Microelectronics, CFM-AGI Department, Agrate Brianza, Italy
- V.-M. Airaksinen, Okmetic Oyi R&D Department, Vantaa, Finland
- G. Beretta, ST Microelectronics, DSG Epitaxy Catania Department, Catania, Italy
- C. Cavallotti, Dipartimento di Chimica Fisica Applicata, Politecnico di Milano, Milano, Italy
- D. Crippa, MEMC Electronic Materials, Epitaxial and CVD Department, Operations Technology Division, Novara, Italy
- D. Dutartre, ST Microelectronics, Central R&D, Crolles, France
- Srikanth Kommu, MEMC Electronic Materials inc., EPI Technology Group, St. Peters, Missouri
- M. Masi, Dipartimento di Chimica Fisica Applicata, Politecnico di Milano, Milano, Italy
- D. J. Meyer, ASM Epitaxy, Phoenix, Arizona
- J. Murota, Research Institute of Electrical Communication, Laboratory for Electronic Intelligent Systems, Tohoku University, Sendai, Japan
- V. Pozzetti, LPE Epitaxial Technologies, Bollate, Italy
- A. M. Rinaldi, MEMC Electronic Materials, Epitaxial and CVD Department, Operations Technology Division, Novara, Italy
- Y. Shiraki, Research Center for Advanced Science and Technology (RCAST), University of Tokyo, Tokyo, Japan

## Volume 73 Processing and Properties of Compound Semiconductors

S. J. Pearton, Introduction

Eric Donkor, Gallium Arsenide Heterostructures

Annamraju Kasi Viswanatli, Growth and Optical Properties of GaN

- D. Y. C. Lie and K. L. Wang, SiGe/Si Processing
- S. Kim and M. Razeghi, Advances in Quantum Dot Structures
- Walter P. Gomes, Wet Etching of III-V Semiconductors

## Volume 74 Silicon-Germanium Strained Layers and Heterostructures

S. C. Jain and M. Willander, Introduction; Strain, Stability, Reliability and Growth; Mechanism of Strain Relaxation; Strain, Growth, and TED in SiGeC Layers; Bandstructure and Related Properties; Heterostructure Bipolar Transistors; FETs and Other Devices

## Volume 75 Laser Crystallization of Silicon

Norbert H. Nickel, Introduction to Laser Crystallization of Silicon

Costas P. Grigoropoidos, Seung-Jae Moon and Ming-Hong Lee, Heat Transfer and Phase Transformations in Laser Melting and Recrystallization of Amorphous Thin Si Films

Robert Černý and Petr Přikryl, Modeling Laser-Induced Phase-Change Processes: Theory and Computation

Paulo V. Santos, Laser Interference Crystallization of Amorphous Films

Philipp Lengsfeld and Norbert H. Nickel, Structural and Electronic Properties of Laser-Crystallized Poly-Si

### Volume 76 Thin-Film Diamond I

X. Jiang, Textured and Heteroepitaxial CVD Diamond Films

Eberhard Blank, Structural Imperfections in CVD Diamond Films

- R. Kalish, Doping Diamond by Ion-Implantation
- A. Deneuville, Boron Doping of Diamond Films from the Gas Phase
- S. Koizumi, n-Type Diamond Growth
- C. E. Nebel, Transport and Defect Properties of Intrinsic and Boron-Doped Diamond Milos Nesládek, Ken Haenen and Milan Vaněček, Optical Properties of CVD Diamond Rolf Sauer, Luminescence from Optical Defects and Impurities in CVD Diamond

### Volume 77 Thin-Film Diamond II

Jacques Chevallier, Hydrogen Diffusion and Acceptor Passivation in Diamond

Jürgen Ristein, Structural and Electronic Properties of Diamond Surfaces

John C. Angus, Yuri V. Pleskov and Sally C. Eaton, Electrochemistry of Diamond

Greg M. Swain, Electroanalytical Applications of Diamond Electrodes

Werner Haenni, Philippe Rychen, Matthyas Fryda and Christos Comninellis, Industrial Applications of Diamond Electrodes

Philippe Bergonzo and Richard B. Jackman, Diamond-Based Radiation and Photon Detectors

Hiroshi Kawarada, Diamond Field Effect Transistors Using H-Terminated Surfaces

Shinichi Shikata and Hideaki Nakahata, Diamond Surface Acoustic Wave Device

## Volume 78 Semiconducting Chalcogenide Glass I

- V. S. Minaev and S. P. Timoshenkov, Glass-Formation in Chalcogenide Systems and Periodic System
- A. Popov, Atomic Structure and Structural Modification of Glass

- V. A. Funtikov, Eutectoidal Concept of Glass Structure and Its Application in Chalcogenide Semiconductor Glasses
- V. S. Minaev, Concept of Polymeric Polymorphous-Crystalloid Structure of Glass and Chalcogenide Systems: Structure and Relaxation of Liquid and Glass

## Volume 79 Semiconducting Chalcogenide Glass II

- M. D. Bal'makov, Information Capacity of Condensed Systems
- A. Česnys, G. Juška and E. Montrimas, Charge Carrier Transfer at High Electric Fields in Noncrystalline Semiconductors
- Andrey S. Glebov, The Nature of the Current Instability in Chalcogenide Vitreous Semiconductors
- A. M. Andriesh, M. S. Iovu and S. D. Shutov, Optical and Photoelectrical Properties of Chalcogenide Glasses
- V. Val. Sobolev and V. V. Sobolev, Optical Spectra of Arsenic Chalcogenides in a Wide Energy Range of Fundamental Absorption
- Yu. S. Tver'yanovich, Magnetic Properties of Chalcogenide Glasses

## Volume 80 Semiconducting Chalcogenide Glass III

Andrey S. Glebov, Electronic Devices and Systems Based on Current Instability in Chalcogenide Semiconductors

Dumitru Tsiulyanu, Heterostructures on Chalcogenide Glass and Their Applications

E. Bychkov, Yu. Tveryanovich and Yu. Vlasov, Ion Conductivity and Sensors

Yu. S. Tver'yanovich and A. Tverjanovich, Rare-earth Doped Chalcogenide Glass

M. F. Churbanov and V. G. Plotnichenko, Optical Fibers from High-purity Arsenic Chalcogenide Glasses

# Volume 81 Conducting Organic Materials and Devices

Suresh C. Jain, Magnus Willander and Vikram Kumar, Introduction; Polyacetylene; Optical and Transport Properties; Light Emitting Diodes and Lasers; Solar Cells; Transistors

### Volume 82 Semiconductors and Semimetals

Maiken H. Mikkelsen, Roberto C. Myers, Gregory D. Fuchs, and David D. Awschalom, Single Spin Coherence in Semiconductors

Jairo Sinova and A. H. MacDonald, Theory of Spin-Orbit Effects in Semiconductors

- K. M. Yu, T. Wojtowicz, W. Walukiewicz, X. Liu, and J. K. Furdyna, Fermi Level Effects on Mn Incorporation in III–Mn–V Ferromagnetic Semiconductors
- T. Jungwirth, B. L. Gallagher, and J. Wunderlich, Transport Properties of Ferromagnetic Semiconductors
- F. Matsukura, D. Chiba, and H. Ohno, Spintronic Properties of Ferromagnetic Semiconductors
- C. Gould, G. Schmidt, and L. W. Molenkamp, Spintronic Nanodevices

- J. Cibert, L. Besombes, D. Ferrand, and H. Mariette, Quantum Structures of II–VI Diluted Magnetic Semiconductors
- Agnieszka Wolos and Maria Kaminska, Magnetic Impurities in Wide Band-gap III-V Semiconductors
- Tomasz Dietl, Exchange Interactions and Nanoscale Phase Separations in Magnetically Doped Semiconductors
- Hiroshi Katayama-Yoshida, Kazunori Sato, Tetsuya Fukushima, Masayuki Toyoda, Hidetoshi Kizaki, and An van Dinh, Computational Nano-Materials Design for the Wide Band-Gap and High-TC Semiconductor Spintronics
- Masaaki Tanaka, Masafumi Yokoyama, Pham Nam Hai, and Shinobu Ohya, Properties and Functionalities of MnAs/III–V Hybrid and Composite Structures

#### Volume 83 Semiconductors and Semimetals

- T. Scholak, F. Mintert, T. Wellens, and A. Buchleitner, Transport and Entanglement
- P. Nalbach and M. Thorwart, Quantum Coherence and Entanglement in Photosynthetic Light-Harvesting Complexes
- Richard J. Cogdell and Jürgen Köhler, Sunlight, Purple Bacteria, and Quantum Mechanics: How Purple Bacteria Harness Quantum Mechanics for Efficient Light Harvesting

#### Volume 84 Semiconductors and Semimetals

- David Z.-Y. Ting, Alexander Soibel, Linda Höglund, Jean Nguyen, Cory J. Hill, Arezou Khoshakhlagh, and Sarath D. Gunapala, Type-II Superlattice Infrared Detectors
- S. D. Gunapala, S. V. Bandara, S. B. Rafol, and D. Z. Ting, QuantumWell Infrared Photodetectors
- Ajit V. Barve and Sanjay Krishna, Quantum Dot Infrared Photodetectors

J. C. Cao and H. C. Liu, Terahertz Semiconductor Quantum Well Photodetectors

- A. G. U. Perera, Homo- and Heterojunction Interfacial Workfunction Internal Photo-Emission Detectors from UV to IR
- David R. Rhiger, HgCdTe Long-Wave Infrared Detectors

### Volume 85 Semiconductors and Semimetals

- Darius Abramavicius, Vytautas Butkus, and Leonas Valkunas, Interplay of Exciton Coherence and Dissipation in Molecular Aggregates
- Oliver Kühn and Stefan Lochbrunner, Quantum Dynamics and Spectroscopy of Excitons in Molecular Aggregates
- Carsten Olbrich and Ulrich Kleinekathöfer, From Atomistic Modeling to Electronic Properties of Light-Harvesting Systems
- Alex W. Chin, Susana F. Huelga, and Martin B. Plenio, Chain Representations of Open Quantum Systems and Their Numerical Simulation with Time-Adaptive Density Matrix Renormalisation Group Methods
- Avinash Kolli and Alexandra Olaya-Castro, Electronic Excitation Dynamics in a Framework of Shifted Oscillators

E. Lifshitz, R. Vaxenburg, G. I. Maikov, D. Yanover, A. Brusilovski, J. Tilchin, and A. Sashchiuk, The Significance of Alloy Colloidal Quantum Dots

Elizabeth von Hauff, The Role of Molecular Structure and Conformation in Polymer Electronics

Koen Vandewal, Kristofer Tvingstedt, and Olle Inganäs, Charge Transfer States in Organic Donor–Acceptor Solar Cells

Carsten Deibel, Photocurrent Generation in Organic Solar Cells

### Volume 86 Advances in Semiconductor Lasers

- Joseph P. Donnelly, Paul W. Juodawlkis, Robin Huang, Jason J. Plant, Gary M. Smith, Leo J. Missaggia, William Loh, Shawn M. Redmond, Bien Chann, Michael K. Connors, Reuel B. Swint, and George W. Turner, High-Power Slab-Coupled Optical Waveguide Lasers and Amplifiers
- P. Crump, O. Brox, F. Bugge, J. Fricke, C. Schultz, M. Spreemann, B. Sumpf, H. Wenzel, and G. Erbert, High-Power, High-Efficiency Monolithic Edge-Emitting GaAs-Based Lasers with Narrow Spectral Widths
- E. A. Avrutin and E. U. Rafailov, Advances in Mode-Locked Semiconductor Lasers
- K. M. Kelchner, S. P. DenBaars, and J. S. Speck, GaN Laser Diodes on Nonpolar and Semipolar Planes

Eric Tournié and Alexei N. Baranov, Mid-Infrared Semiconductor Lasers: A Review

Dominic F. Siriani and Kent D. Choquette, Coherent Coupling of Vertical-Cavity Surface-Emitting Laser Arrays

Anne C. Tropper, Adrian H. Quarterman, and Keith G. Wilcox, Ultrafast Vertical-External-Cavity Surface-Emitting Semiconductor Lasers

Soon-Hong Kwon, Hong-Gyu Park, and Yong-Hee Lee, Photonic Crystal Lasers

Martin T. Hill, Metallic and Plasmonic Nanolasers

Mark T. Crowley, Nader A. Naderi, Hui Su, Frederic Grillot, and Luke F. Lester, GaAs-Based Quantum Dot Lasers

Philip Poole, InP-Based Quantum Dot Lasers

C. Z. Ning, Semiconductor Nanowire Lasers

### Volume 87 Advances in Photovoltaics: Volume 1

Hans-Josef Fell, Foreword

Eicke R. Weber and Gerhard P. Willeke, Introduction

Gerhard P. Willeke and Armin Räuber, On The History of Terrestrial PV Development: With a Focus on Germany

Paula Mints, Overview of Photovoltaic Production, Markets, and Perspectives

Gregory F. Nemet and Diana Husmann, PV Learning Curves and Cost Dynamics

Martin A. Green, Photovoltaic Material Resources

Laszlo Fabry and Karl Hesse, Crystalline Silicon Feedstock Preparation and Analysis

### Volume 88 Oxide Semiconductors

John L. Lyons, Anderson Janotti, and Chris G. Van de Walle, Theory and Modeling of Oxide Semiconductors Filip Tuomisto, Open Volume Defects: Positron Annihilation Spectroscopy

Lasse Vines and Andrej Kuznetsov, Bulk Growth and Impurities

Leonard J. Brillson, Surfaces and Interfaces of Zinc Oxide

Tadatsugu Minami, Transparent Conductive Oxides for Transparent Electrode Applications

Bruno K. Meyer, Angelika Polity, Daniel Reppin, Martin Becker, Philipp Hering, Benedikt Kramm, Peter J. Klar, Thomas Sander, Christian Reindl, Christian Heiliger, Markus Heinemann, Christian Müller, and Carsten Ronning, The Physics of Copper Oxide (Cu<sub>2</sub>O)

Cheng Song and Feng Pan, Transition Metal-Doped Magnetic Oxides

Katharina Grossmann, Udo Weimar, and Nicolae Barsan, Semiconducting Metal Oxides Based Gas Sensors John F. Wager and Bao Yeh, Oxide Thin-Film Transistors: Device Physics

### Volume 89 Advances in Photovoltaics: Part 2

Otwin Breitenstein, The Physics of Industrial Crystalline Silicon Solar Cells

Matthias Heuer, Metallurgical Grade and Metallurgically Refined Silicon for Photovoltaics

Harry Wirth, Crystalline Silicon PV Module Technology

Ulf Blieske and Gunther Stollwerck, Glass and Other Encapsulation Materials

Karsten Bothe and David Hinken, Quantitative Luminescence Characterization of Crystalline Silicon Solar Cells

### Volume 90 Advances in Photovoltaics: Part 3

Giso Hahn and Sebastian Joos, State-of-the-Art Industrial Crystalline Silicon Solar Cells

Christophe Ballif, Stefaan De Wolf, Antoine Descoeudres, and Zachary C. Holman, Amorphous

Silicon/Crystalline Silicon Heterojunction Solar Cells

Bernhard Dimmler, Overview of Thin-Film Solar Cell Technologies