# LONG-WAYELENGTH SEMICONDUCTOR LASERS

G.P. AGRAWAL N.K. DUTTA

## **Long Wavelength Semiconductor Lasers**

**Chaoyuan Jin** 

#### **Long Wavelength Semiconductor Lasers:**

Long-Wavelength Semiconductor Lasers Govind Agrawal, Niloy K. Dutta, 1986-12-31 Since its invention in 1962 the semiconductor laser has come a long way Advances in material purity and epitaxial growth techniques have led to a variety of semiconductor lasers covering a wide wavelength range of 0 3 100 ILm The development during the 1970s of GaAs semiconductor lasers emitting in the near infrared region of 0 8 0 9 ILm resulted in their use for the first generation of optical fiber communication systems However to take advantage of low losses in silica fibers occurring around 1 3 and 1 55 ILm the emphasis soon shifted toward long wavelength semiconductor lasers. The material system of choice in this wavelength range has been the quaternary alloy InGaAsP During the last five years or so the intense development effort devoted to InGaAsP lasers has resulted in a technology mature enough that lightwave transmission systems using InGaAsP lasers are currently being deployed throughout the world This book is intended to provide a comprehensive account of long wave length semiconductor lasers Particular attention is paid to InGaAsP lasers although we also consider semiconductor lasers operating at longer wave lengths The objective is to provide an up to date understanding of semicon ductor lasers while incorporating recent research results that are not yet available in the book form Although InGaAsP lasers are often used as an example the basic concepts discussed in this text apply to all semiconductor lasers irrespective of their Long-Wavelength Semiconductor Lasers Govind Agrawal, 2014-09-12 Since its invention in 1962 the wavelengths semiconductor laser has come a long way Advances in material purity and epitaxial growth techniques have led to a variety of semiconductor lasers covering a wide wavelength range of 0 3 100 ILm The development during the 1970s of GaAs semiconductor lasers emitting in the near infrared region of 0 8 0 9 ILm resulted in their use for the first generation of optical fiber communication systems However to take advantage of low losses in silica fibers occurring around 1 3 and 1 55 ILm the emphasis soon shifted toward long wavelength semiconductor lasers The material system of choice in this wavelength range has been the quaternary alloy InGaAsP During the last five years or so the intense development effort devoted to InGaAsP lasers has resulted in a technology mature enough that lightwave transmission systems using InGaAsP lasers are currently being deployed throughout the world This book is intended to provide a comprehensive account of long wave length semiconductor lasers Particular attention is paid to InGaAsP lasers although we also consider semiconductor lasers operating at longer wave lengths The objective is to provide an up to date understanding of semicon ductor lasers while incorporating recent research results that are not yet available in the book form Although InGaAsP lasers are often used as an example the basic concepts discussed in this text apply to all semiconductor lasers irrespective of their wavelengths Semiconductor Lasers Govind P. Agrawal, Niloy K. Dutta, 2013-11-27 Since its invention in 1962 the semiconductor laser has come a long way Advances in material purity and epitaxial growth techniques have led to a variety of semiconductor lasers covering a wide wavelength range of 0 3 100 m The development during the 1970s of GaAs

semiconductor lasers emitting in the near infrared region of 0 8 0 9 m resulted in their use for the first generation of optical fiber communication systems However to take advantage oflow losses in silica fibers occurring around 1 3 and 1 55 m the emphasis soon shifted toward long wavelength semiconductor lasers. The material system of choice in this wavelength range has been the quaternary alloy InGaAsP During the last five years or so the intense development effort devoted to InGaAsP lasers has resulted in a technology mature enough that lightwave transmission systems using InGaAsP lasers are currently being deployed throughout the world. This book is intended to provide a comprehensive account of long wave length semiconductor lasers Particular attention is paid to InGaAsP lasers although we also consider semiconductor lasers operating at longer wave lengths. The objective is to provide an up to date understanding of semicon ductor lasers while incorporating recent research results that are not yet available in the book form Although InGaAsP lasers are often used as an example the basic concepts discussed in this text apply to all semiconductor lasers irrespective of their wavelengths

Long-Wavelength Infrared Semiconductor Lasers Hong K. Choi, 2004-03-18 Long wavelength Infrared Semiconductor Lasers provides a comprehensive review of the current status of semiconductor coherent sources emitting in the mid to far infrared spectrum and their applications It includes three topics not covered in any previous book far infrared emission from photo mixers as well as from hot hole lasers and InP based lasers emitting beyond two micrometers Semiconductor lasers emitting at more than two micrometers have many applications such as in trace gas analysis environmental monitoring and industrial process control Because of very rapid progress in recent years until this book no **Design and Fabrication of High** comprehensive information beyond scattered journal articles is available at present **Speed, Long Wavelength, Semiconductor Lasers** John Gilmary Wasserbauer,1994 Semiconductor Lasers for Long-wavelength Optical-fibre Communications Systems M. J. Adams, 1987 Using Band-filling to Understand Long-wavelength Semiconductor Lasers and Q-switching of Solid-state Lasers Yi-jen Tsou, 1993 InGaAsNSb Xiaoping Yang, 2002 Long-Wavelength Infrared Semiconductor Lasers Hong K Choi, 2004 Long Wavelength Semiconductor Lasers Development for Infrared Heterodyne Applications National Aeronautics and Space Adm Nasa, 2018-12-29 PbSnTe single crystals were grown in a new 3 zone furnace Molecular beam epitaxy MBE growth parameters have been established including beam flux vs temperature and growth rates and dopant vs PbTe flux ratios for the various effusion sources involved Lattice matching studies were conducted and doping studies were completed Broad area Pb 1 x Sn x Te double heterostructure lasers were fabricated with active layer compositions up to x equals 0 04 at percent Sn in the active layers Electrical and optical test data are presented Feit Zeev and Kostyk Douglas NASA CR 189243 NAS 1 26 189243 NAS5 30445 Long Wavelength Infrared Emitters Based on Quantum Wells and Superlattices Manfred Helm, 2000-10-31 This book offers a thorough survey of long wavelength infrared semiconductor emitters based primarily on quantum wells and superlattices Featuring contributions from the most prominent researchers in the field this volume allows readers to compare different types of lasers as well as examine investigations of potential far infrared terrahertz sources This is an essential reference for researchers engineers and graduate students who wish to obtain comprehensive knowledge about infrared semiconductor sources and recent developments in this field **Process Technology for Semiconductor** Lasers Kenichi Iga, Susumu Kinoshita, 2013-03-07 Process Technology for Semiconductor Lasers describes the design principles of semiconductor lasers mainly from the fabrication point of view A review is given of the history of semiconductor laser development and applications and of the materials used in lasing at short to long wavelengths. The basic design principles for semiconductor laser devices and the epitaxy for laser production are discussed An entire chapter is devoted to the technology of liquid phase epitaxy and another one to vapor phase and beam epitaxies The characterizations of laser materials and the fabrication and characteristics of semiconductor lasers are treated Mode control techniques are presented and surface emitting lasers are introduced in the final chapter Semiconductor Lasers II Eli Kapon, 1999-01-14 Judging from the impact it has on our everyday lives the semiconductor laser has emerged as perhaps the most important laser device currently in use This volume presents information on recent advances in materials and structures Performance of Long-wavelength Semiconductor Disk Lasers Hans Lindberg, 2004 Fundamentals of Semiconductor Lasers Takahiro Numai, 2006-05-10 Fundamentals of Semiconductor Lasers explains the physics and fundamental characteristics of semiconductor lasers with regard to systems applications. The detailed and comprehensive presentation is unique in that it encourages the reader to consider different semiconductor lasers from different angles Emphasis is placed on recognizing common concepts such operating principles and structure and solving problems based on individual situations The treatment is enhanced by an historical account of advances in semiconductor lasers over the years discussing both those ideas that have persisted over the years and those that have faded out The first four chapters cover the basics of semiconductors including band structures optical transitions optical waveguides and optical resonators The remaining chapters discuss operating principles and basic characteristics of semiconductor lasers and advanced topics including dynamic single mode lasers quantum well lasers and control of spontaneous emission. The reader need only be familiar with undergraduate level electromagnetism and quantum mechanics After reading this book the student will be able to think critically about semiconductor lasers and be able to read and understand journal papers in the field This book will be essential to any advanced undergraduate or graduate student of semiconductor lasers and any professional physicist or engineer looking for a good overview of the subject Long Wavelength GaInAsP/InP Semiconductor Lasers for Optical Communications Pei-Chuang Chen, California Institute of Technology. Division of Engineering and Applied Science, 1982 GaAs-based Long-wavelength Semiconductor Diode Lasers for Optical Fibre Communication Chaoyuan Jin, 2008 Investigation of Long Wavelength GaAs-based Semiconductor Lasers Grown by MOVPE [17], 2009 *Principles* of Lasers Orazio Svelto, 2010-03-16 This fifth edition of Principles of Lasers includes corrections to the previous edition as

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#### **Table of Contents Long Wavelength Semiconductor Lasers**

- 1. Understanding the eBook Long Wavelength Semiconductor Lasers
  - The Rise of Digital Reading Long Wavelength Semiconductor Lasers
  - Advantages of eBooks Over Traditional Books
- 2. Identifying Long Wavelength Semiconductor Lasers
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
- 3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Long Wavelength Semiconductor Lasers
  - User-Friendly Interface
- 4. Exploring eBook Recommendations from Long Wavelength Semiconductor Lasers
  - Personalized Recommendations
  - $\circ\,$  Long Wavelength Semiconductor Lasers User Reviews and Ratings
  - Long Wavelength Semiconductor Lasers and Bestseller Lists
- 5. Accessing Long Wavelength Semiconductor Lasers Free and Paid eBooks
  - Long Wavelength Semiconductor Lasers Public Domain eBooks
  - Long Wavelength Semiconductor Lasers eBook Subscription Services
  - Long Wavelength Semiconductor Lasers Budget-Friendly Options

- 6. Navigating Long Wavelength Semiconductor Lasers eBook Formats
  - o ePub, PDF, MOBI, and More
  - Long Wavelength Semiconductor Lasers Compatibility with Devices
  - Long Wavelength Semiconductor Lasers Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Long Wavelength Semiconductor Lasers
  - Highlighting and Note-Taking Long Wavelength Semiconductor Lasers
  - Interactive Elements Long Wavelength Semiconductor Lasers
- 8. Staying Engaged with Long Wavelength Semiconductor Lasers
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Long Wavelength Semiconductor Lasers
- 9. Balancing eBooks and Physical Books Long Wavelength Semiconductor Lasers
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Long Wavelength Semiconductor Lasers
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Long Wavelength Semiconductor Lasers
  - Setting Reading Goals Long Wavelength Semiconductor Lasers
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Long Wavelength Semiconductor Lasers
  - Fact-Checking eBook Content of Long Wavelength Semiconductor Lasers
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements

• Interactive and Gamified eBooks

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