

Reliability and Degradation of Semiconductor Lasers and LEDs

Mitsuo Fukuda

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EDFAS Desk Reference Committee



Reliability And Degradation Of Semiconductor Lasers And Leds:

Reliability and Degradation of Semiconductor Lasers and LEDs Mitsuo Fukuda, 1991-01-01 This comparative tutorial describes the reasons behind device failures and provides practical information on what can be done to minimize failure prone designs and enhance device reliability The text demonstrates how with such advantages as smaller size low cost and simple operation LEDs are well suited for a wide range of applications especially in the field of optical fibre communication This book should prove of interest to engineers and scientists in research design manufacturing and development of semiconductor lasers LEDs and optical transmission systems

Semiconductor Laser Engineering, Reliability and Diagnostics Peter W. Epperlein, 2013-01-25 This reference book provides a fully integrated novel approach to the development of high power single transverse mode edge emitting diode lasers by addressing the complementary topics of device engineering reliability engineering and device diagnostics in the same book and thus closes the gap in the current book literature Diode laser fundamentals are discussed followed by an elaborate discussion of problem oriented design guidelines and techniques and by a systematic treatment of the origins of laser degradation and a thorough exploration of the engineering means to enhance the optical strength of the laser Stability criteria of critical laser characteristics and key laser robustness factors are discussed along with clear design considerations in the context of reliability engineering approaches and models and typical programs for reliability tests and laser product qualifications Novel advanced diagnostic methods are reviewed to discuss for the first time in detail in book literature performance and reliability impacting factors such as temperature stress and material instabilities Further key features include practical design guidelines that consider also reliability related effects key laser robustness factors basic laser fabrication and packaging issues detailed discussion of diagnostic investigations of diode lasers the fundamentals of the applied approaches and techniques many of them pioneered by the author to be fit for purpose and novel in the application systematic insight into laser degradation modes such as catastrophic optical damage and a wide range of technologies to increase the optical strength of diode lasers coverage of basic concepts and techniques of laser reliability engineering with details on a standard commercial high power laser reliability test program Semiconductor Laser Engineering Reliability and Diagnostics reflects the extensive expertise of the author in the diode laser field both as a top scientific researcher as well as a key developer of high power highly reliable devices With invaluable practical advice this new reference book is suited to practising researchers in diode laser technologies and to postgraduate engineering students

Reliability Characterisation of Electrical and Electronic Systems, 2014-12-24 This book takes a holistic approach to reliability engineering for electrical and electronic systems by looking at the failure mechanisms testing methods failure analysis characterisation techniques and prediction models that can be used to increase reliability for a range of devices The text describes the reliability behavior of electrical and electronic systems It takes an empirical scientific approach to reliability engineering to facilitate a greater understanding of operating

conditions failure mechanisms and the need for testing for a more realistic characterisation After introducing the fundamentals and background to reliability theory the text moves on to describe the methods of reliability analysis and characterisation across a wide range of applications Takes a holistic approach to reliability engineering Looks at the failure mechanisms testing methods failure analysis characterisation techniques and prediction models that can be used to increase reliability Facilitates a greater understanding of operating conditions failure mechanisms and the need for testing for a more realistic characterisation

Reliability of Semiconductor Lasers and Optoelectronic Devices Robert Herrick, Osamu Ueda, 2021-03-11 Front Cover Reliability of Semiconductor Lasers and Optoelectronic Devices Copyright Page Dedication Contents List of contributors Preface Acknowledgments 1 Introduction to optoelectronic devices 1 1 Introduction 1 2 Optoelectronic applications 1 2 1 InGaN based light emitting diodes for high efficiency lighting 1 2 2 Lasers for sensing arrays 1 2 3 Lasers for data and telecommunications 1 2 4 The history of the laser 1 3 Principles of operation for optoelectronic components 1 3 1 Light emission 1 3 1 1 Light emission in gas plasmas a review 1 3 1 2 Stimulated emission in gas lasers 1 3 1 3 Spontaneous and stimulated emission from semiconductors 1 3 2 Light emitting diodes 1 3 2 1 Carrier confinement 1 3 2 2 Light extraction 1 3 2 3 Heat extraction 1 3 2 4 Rollover or droop 1 3 2 5 The green gap 1 3 3 Lasers 1 3 3 1 What additional design features exist with lasers that are not present with an light emitting diode Adding a population inversion Adding waveguiding Adding mirrors 1 3 3 2 Vertical cavity surface emitting lasers 1 3 3 3 Direct modulation 1 3 4 Modulators 1 3 5 Photodetectors 1 3 5 1 Photodiodes 1 3 5 2 Avalanche photodiodes 1 4 Method of fabrication 1 4 1 Epitaxial growth 1 4 2 Wafer fabrication 1 4 3 Wafer test 1 4 4 Singulation and packaging 1 4 5 Burn in 1 5 Critical metrics 1 5 1 Beam divergence 1 5 2 Single mode versus multimode 1 5 3 Coherence length 1 5 4 Power 1 5 5 Modulation rate 1 6 Laser and light emitting diode reliability 1 6 1 Reliability qualification 1 6 2 Quality control 1 7 New technology developments 1 7 1 Fiber optics 1 7 2 The future of optoelectronic devices 1 7 2 1 Photonic integrated circuits 1 7 2 2 LiDAR

Introduction to Nitride Semiconductor Blue Lasers and Light Emitting Diodes Shuji Nakamura, Shigefusa F. Chichibu, 2000-03-09 The blue laser is an exciting new device used in physics The potential is now being recognized for its development into a commercial lighting system using about a tenth of the power and with a thousand times the operating lifetime of a comparable conventional system This comprehensive work introduces the subject at a level suitable for graduate students It covers the basics physics of light emitting diodes LEDs and laser diodes LDs based on gallium nitride and related nitride semiconductors and gives an outline of their structural transport and optical properties and the relevant device physics It begins with the fundamentals and covers both theory and experiment as well as an examination of actual and potential device applications Shuji Nakamura and Nichia Chemicals Industries made the initial breakthroughs in the field and these have revealed that LEDs and LDs are a sophisticated physical phenomenon and a commercial reality

Semiconductor Lasers and Heterojunction LEDs Henry Kressel, 2012-12-02 Semiconductor Lasers and Heterojunction LEDs presents an

introduction to the subject of semiconductor lasers and heterojunction LEDs The book reviews relevant basic solid state and electromagnetic principles the relevant concepts in solid state physics and the p n junctions and heterojunctions The text also describes stimulated emission and gain the relevant concepts in electromagnetic field theory and the modes in laser structures The relation between electrical and optical properties of laser diodes epitaxial technology binary III V compounds and diode fabrication are also considered The book further tackles the heterojunction devices of alloys other than GaAs AlAs the devices for special applications distributed feedback lasers and the transient effects in laser diodes Students taking courses in semiconductor lasers and heterojunction LEDs will find the book useful **Microelectronics Failure Analysis**

EDFAS Desk Reference Committee,2011 Includes bibliographical references and index *Optical Semiconductor Devices* Mitsuo Fukuda,1998-12-24 This book is devoted to optical semiconductor devices and their numerous applications in telecommunications optoelectronics and consumer electronics areas where signal processing or the transmission of signals across fiber optic cables is paramount It introduces a new generation of devices that includes optical modulators quantum well QW lasers and photodiodes and explores new applications of more established devices such as semiconductor lasers light emitting diodes and photodiodes Mitsuo Fukuda examines the material properties operation principles fabrication packaging reliability and applications of each device and offers a unique industrial perspective discussing everything engineers and scientists need to know at different phases of research development and production This guide to the state of the art of optical semiconductor devices Helps you choose the right device for a given application Covers important performance data such as temperature and optical feedback noise in lasers Highlights epitaxial growth techniques and fabrication for each device Features one hundred figures and an extensive bibliography Provides a clear and concise treatment unencumbered by excessive theory *Optical Semiconductor Devices* is an essential resource for engineers and researchers in telecommunications and optoelectronics equipment designers and manufacturers and graduate students and scholars interested in this rapidly evolving field *Defect Recognition and Image Processing in Semiconductors* 1997 J.

Doneker,2017-11-22 *Defect Recognition and Image Processing in Semiconductors* 1997 provides a valuable overview of current techniques used to assess monitor and characterize defects from the atomic scale to inhomogeneities in complete silicon wafers This volume addresses advances in defect analyzing techniques and instrumentation and their application to substrates epilayers and devices The book discusses the merits and limits of characterization techniques standardization correlations between defects and device performance including degradation and failure analysis and the adaptation and application of standard characterization techniques to new materials It also examines the impressive advances made possible by the increase in the number of nanoscale scanning techniques now available The book investigates defects in layers and devices and examines the problems that have arisen in characterizing gallium nitride and silicon carbide **Proceedings of the Pacific Rim Statistical Conference for Production Engineering** Dongseok Choi,Daeheung Jang,Tze Leung

Lai,Youngjo Lee,Ying Lu,Jun Ni,Peter Qian,Peihua Qiu,George Tiao,2018-03-27 This book presents the proceedings of the 2nd Pacific Rim Statistical Conference for Production Engineering Production Engineering Big Data and Statistics which took place at Seoul National University in Seoul Korea in December 2016 The papers included discuss a wide range of statistical challenges methods and applications for big data in production engineering and introduce recent advances in relevant statistical methods

Plastic Optical Fibers and Applications IGIC, Inc. Staff,John Bliss,1994

Heterogeneous Optoelectronics Integration Elias Towe,2000 Numerous efforts are directed at investigating the use of optics at short distances for example at the chip to chip and board to board levels of the interconnection hierarchy This book provides an overview of the state of the art in heterogeneous integration of electronics optoelectronics and micro optics for short distance optical interconnections

Microprobe Characterization of Optoelectronic Materials Juan Jimenez,2024-11-01 Each chapter in this book is written by a group of leading experts in one particular type of microprobe technique They emphasize the ability of that technique to provide information about small structures i e quantum dots quantum lines microscopic defects strain layer composition and its usefulness as diagnostic technique for device degradation Different types of probes are considered electrons photons and tips and different microscopies optical electron microscopy and tunneling It is an ideal reference for post graduate and experienced researchers as well as for crystal growers and optoelectronic device makers

Proceedings of the Symposium on Light Emitting Devices for Optoelectronic Applications and the Twenty-Eighth State-of-the-Art Program on Compound Semiconductors H. Q. Hou,Electrochemical Society. Luminescence and Display Materials Division,Electrochemical Society. Meeting,1998

International Lighting in Controlled Environments Workshop T. W. Tibbitts,1994

Current Trends in Vertical Cavity Surface Emitting Lasers Tien-Pei Lee,1995 With significant progress made in recent years vertical cavity surface emitting lasers VCSELs have emerged as potential lightwave sources with a variety of applications including high speed optical interconnects parallel data links optical recording 2 D scanning and optical signal processing This volume which contains a collection of articles by outstanding experts on this topic encompasses a broad discussion of the current trends in the development of VCSELs Discussions include material growths structure designs processing methods performance analysis improvement strategies and future prospects The collection provides a comprehensive overview that may help newcomers to this field as well as engineers and researchers who are engaged in the research and development of this new exciting device family

Defects in Organic Semiconductors and Devices Thien-Phap Nguyen,2023-07-27 Defects play a key role in the physical properties of semiconductors and devices and their identification is essential in assessing the reliability of electronic devices Defects in Organic Semiconductors and Devices introduces the fundamental aspects of defects in organic semiconductors and devices in relation to the structure of materials and architecture of electronic components It covers the topics of defect formation and evolution defect measurement techniques and their adaption to organic devices the effects of defects on the physical

properties of materials and their effects on the performance and lifetime of organic devices Identifying defects and determining their characteristics in the structure of organic devices such as OLEDs OFETs and OPVs make it possible to better understand degradation processes and develop solutions to improve the reliability of such devices This book is intended for researchers and students in university programs or engineering schools who are specializing in electronics energy and materials Wireless Optical Communication Systems Steve Hranilovic,2006-01-16 This volume addresses the problem of designing efficient signalling and provides a link between the areas of communication theory and modem design for amplitude constrained linear optical intensity channel It provides practical guidelines for the design of signalling sets for wireless optical intensity channels *Fiber Optics Primer* IGIC, Inc. Staff,1994 **Microelectronics Failure Analysis** ,2004-01-01 For newcomers cast into the waters to sink or swim as well as seasoned professionals who want authoritative guidance desk side this hefty volume updates the previous 1999 edition It contains the work of expert contributors who rallied to the job in response to a committee s call for help the committee was assigned to the update by the Electron

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