

MICRODEVICES  
Physics and Fabrication Technologies

# Semiconductor Materials

An Introduction to  
Basic Principles

B. G. Yacobi

# Semiconductor Materials An Introduction To Basic Principles

**TD Snyder**



## **Semiconductor Materials An Introduction To Basic Principles:**

*Semiconductor Materials* B.G. Yacobi, 2003-01-31 The main objective of this book is to provide an introductory perspective of the basic principles of semiconductors being an integrated overview of the basic properties applications and characterization of semiconductors in a single volume This book is suitable for both undergraduate and graduate students and for researchers working in a wide variety of fields in physical and engineering sciences who require an introductory and concise description of the field of semiconductors

**Semiconductor Devices** Jasprit Singh, 2000-08-03 This introductory text designed for the first course in semiconductor physics presents a well balanced coverage of semiconductor physics and device operation and shows how devices are optimized for applications The text begins with an exploration of the basic physical processes upon which all semiconductor devices diodes transistor light emitters and detectors are based Topics such as bandstructure effective masses holes doping carrier transport and lifetimes are discussed Next the author focuses on the operation of the important semiconductor devices along with issues relating to the optimization of device performance Issues such as how doping device dimensions and parasitic effects influence device operation are also included The book is appropriate for the following courses Device Physics Semiconductor Devices Device Electronics Physics of Semiconductor Devices Integrated Circuit Devices Device Electronics Solid State Devices

*Handbook of Semiconductors* Ram K. Gupta, 2024-07-10 This book provides readers with state of the art knowledge of established and emerging semiconducting materials their processing and the fabrication of chips and microprocessors In addition to covering the fundamentals of these materials it details the basics and workings of many semiconducting devices and their role in modern electronics and explores emerging semiconductors and their importance in future devices Provides readers with latest advances in semiconductors Covers diodes transistors and other devices using semiconducting materials Covers advances and challenges in semiconductors and their technological applications Discusses fundamentals and characteristics of emerging semiconductors for chip manufacturing This book provides directions to scientists engineers and researchers in materials engineering and related disciplines to help them better understand the physics characteristics and applications of modern semiconductors

**Semiconductor Materials** Lev I. Berger, 2020-12-17 *Semiconductor Materials* presents physico chemical electronic electrical elastic mechanical magnetic optical and other properties of a vast group of elemental binary and ternary inorganic semiconductors and their solid solutions It also discusses the properties of organic semiconductors Descriptions are given of the most commonly used semiconductor devices charge coupled devices field effect transistors unijunction transistors thyristors Zener and avalanche diodes and photodiodes and lasers The current trend of transitioning from silicon technology to gallium arsenide technology in field effect based electronic devices is a special feature that is also covered More than 300 figures and 100 tables highlight discussions in the text and more than 2 000 references guide you to further sources on specific topics *Semiconductor Materials* is a relatively compact book containing vast information on

semiconductor material properties Readers can compare results of the property measurements that have been reported by different authors and critically compare the data using the reference information contained in the book Engineers who design and improve semiconductor devices researchers in physics and chemistry and students of materials science and electronics will find this a valuable guide

**Physics and Properties of Narrow Gap Semiconductors** Junhao Chu, Arden Sher, 2007-11-21 Narrow gap semiconductors obey the general rules of semiconductor science but often exhibit extreme features of these rules because of the same properties that produce their narrow gaps Consequently these materials provide sensitive tests of theory and the opportunity for the design of innovative devices For example narrow gap semiconductors are the most important materials for the preparation of advanced modern infrared systems In this book the authors offer clear descriptions of crystal growth and the fundamental structure and properties of these unique materials Topics covered include band structure optical and transport properties and lattice vibrations and spectra A thorough treatment of the properties of low dimensional systems and their relation to infrared applications is provided In addition to covering the technology of photoconductive detectors photovoltaic detectors metal insulator semiconductor devices quantum well infrared photodetectors infrared lasers and single photon detectors *Physics and Properties of Narrow Gap Semiconductors* helps readers to understand semiconductor physics and related areas of materials science and how they relate to advanced optoelectronic devices

*A Practical Guide to Experimental Geometrical Optics* Yuriy A. Garbovskiy, Anatoliy V. Glushchenko, 2017-12-28 A concise yet deep introduction to experimental geometrical optics this book begins with fundamental concepts and then develops the practical skills and research techniques routinely used in modern laboratories Suitable for students researchers and optical engineers this accessible text teaches readers how to build their own optical laboratory and to design and perform optical experiments It uses a hands on approach which fills a gap between theory based textbooks and laboratory manuals allowing the reader to develop their practical skills in this interdisciplinary field and also explores the ways in which this knowledge can be applied to the design and production of commercial optical devices Including supplementary online resources to help readers track and evaluate their experimental results this text is the ideal companion for anyone with a practical interest in experimental geometrical optics

**Semiconducting Fibers** Ram K. Gupta, 2024-08-23 *Semiconducting Fibers Preparation Advances and Applications* is a comprehensive study of the properties and emerging applications of semiconducting fibers These nanomaterials have unique optoelectronic properties they are flexible one dimensional and lightweight and can grow in bulk thin films and nano dimensions 0D 1D 2D 3D Written by experts from around the world this book covers the fundamentals of semiconducting fibers their fabrication and emerging applications in electronics optoelectronics energy and healthcare Various approaches to fabricating semiconducting fibers their characteristics and the working principles of nano dimensional devices are covered Key features Expert scientists across the world present state of the art progress on semiconducting fibers for emerging applications including flexible and

wearable electronics Provides details of novel methods and advanced technologies used in energy applications of semiconducting fibers Provides fundamentals of electrochemical behavior and their understanding of optoelectronics photovoltaics batteries fuel cells sensors and supercapacitors Presents fabrication characterization and applications of semiconducting fibers for energy conversion and storage This book will be a key resource for students academics and industry professionals interested in the fabrication device technologies and applications of semiconducting fibers

Nanosilicon Anatoly A. Ischenko, Gennady V. Fetisov, Leonid A. Aslalnov, 2014-07-23 Nanosilicon Properties Synthesis Applications Methods of Analysis and Control examines the latest developments on the physics and chemistry of nanosilicon The book focuses on methods for producing nanosilicon its electronic and optical properties research methods to characterize its spectral and structural properties and its possible applications The first part of the book covers the basic properties of semiconductors including causes of the size dependence of the properties structural and electronic properties and physical characteristics of the various forms of silicon It presents theoretical and experimental research results as well as examples of porous silicon and quantum dots The second part discusses the synthesis of nanosilicon modification of the surface of nanoparticles and properties of the resulting particles The authors give special attention to the photoluminescence of silicon nanoparticles The third part describes methods used for studying and controlling the structure and properties of nanocrystalline silicon These methods include standard ones such as electron microscopy spectroscopy and diffraction as well as novel techniques such as femtosecond spectroscopy ultrafast electron nanocrystallography and dynamic transmission electron microscopy The fourth part details some of the practical applications of nanocrystalline silicon including the use of nanoparticles as additives absorbers of UV radiation in sunscreens Incorporating much of the authors own extensive research results this book provides a systematic account of the scientific problems of nanosilicon and its potential practical applications It will help readers understand current and emerging applications and research methods of this unique material

Development of Advanced Nano-Optics A. Guillermo Bracamonte, 2025-03-26 This book discusses advanced nano optics from proof of concepts to real applications in devices and miniaturized instrumentation It covers various themes and topics within nanochemistry and physics that produce enhanced optical and smart responsive materials Development of Advanced Nano Optics is about the development of nano optics with advanced nanochemistry control in order to adjust physical phenomena towards new advanced and enhanced properties and related applications It explores the development of various physical phenomena such as the generation of high frequency electromagnetic fields in the near field show that have an effect in the far field The author discusses nano optoelectronics light scattering nano optics quantum nano optics and advances in nanospectroscopy He also presents proof of concepts from nanochemistry and nano optics towards advanced applications in nanotechnology and the life sciences Nano optical materials in microdevices and miniaturized instrumentation are also presented and discussed This book is written for a wide range of readers from undergraduate students to advanced

researchers academics and practising engineers in industry working in the fields of optics miniaturized instrumentation and materials

**Growth And Characterization Of Semiconductor Nanostructure For Device Applications** Dr. Jehova Jire L. Hmar, 2023-03-04 This book is intended to provide knowledge for students and learners in the field of nanoscale science and nanotechnology Nanotechnology is design fabrication and application of nanostructures or nanomaterials and the fundamental understanding of the relationships between physical properties or phenomena and material dimensions Nanotechnology deals with materials or structures in nanometer scales typically ranging from subnanometers to several hundred nanometers Nanotechnology is a new field or a new scientific domain Similar to quantum mechanics on nanometer scale materials or structures may possess new physical properties or exhibit new physical phenomena Nanotechnology has an extremely broad range of potential applications from nanoscale electronics and optics and therefore it requires formation of and contribution from multidisciplinary teams of physicists chemists materials scientists and engineers The aim of this book Growth and Characterization of Semiconductor Nanostructure for Device Applications is to summarize the fundamentals and established techniques of synthesis fabrication characterization and applications of nanomaterials and nanostructures so as to provide readers a systematic and coherent picture about synthesis fabrication and characterization of nanomaterials

**CRC Concise Encyclopedia of Nanotechnology** Boris Ildusovich Kharisov, Oxana Vasilievna Kharissova, Ubaldo Ortiz-Mendez, 2016-01-06 The CRC Concise Encyclopedia of Nanotechnology sets the standard against which all other references of this nature are measured As such it is a major resource for both skilled professionals and novices to nanotechnology The book examines the design application and utilization of devices techniques and technologies critical to research at the

**Optoelectronics: A Formula Handbook** N.B. Singh, Optoelectronics A Formula Handbook is a concise and indispensable guide that compiles essential formulas and concepts in the field of optoelectronics Covering topics such as semiconductor physics optical devices light matter interactions and photonic systems this handbook provides quick access to key equations and principles needed for understanding and designing optoelectronic devices and systems Whether you re a student researcher or industry professional this book serves as a valuable reference for navigating the complexities of optoelectronics and harnessing light based technologies for various applications

**Nanostructured Materials** Zesheng Li, Changlin Yu, 2023-08-31 Nanostructured Materials Physicochemical Chemistry Fundamentals for Energy and Environmental Applications summarizes research knowledge and helps advanced students researchers and industrial technicians understand specific applications of nanomaterials in energy and the environment Sections bring a strong foundational focus on the physicochemical basis of nanomaterials for these applications the basic theory and physicochemical basis of nanomaterials an energy and environment applications examination of typical cases and progress This book will appeal to researchers in the chemical sciences inorganic and physical chemistry coordination chemistry molecular dynamics electrochemistry photocatalysis thermocatalysis thermodynamics etc nanoscience graphene carbon nanotubes nanocrystals

nano catalysis energy and environment nano science and more Efficient use of energy eco friendly environmental systems and technologies play an important role in global sustainable development Multifunctional nanocomposites have excellent properties and can meet the practical needs of energy development and environmental treatment They have been gradually applied in chemical materials energy preparation pollution control and other fields and have achieved impressive development Provides a unified overview of a large variety of different applications on the design and synthesis of nanomaterials with potential applications in various conventional and new energy and environmental technologies Provides a strong foundational focus on the analysis of the structure of nanomaterials the basic principles of design nanomaterial structure activity relationship and the theoretical basis of physical chemistry theoretical basis of nanomaterial design and applications Meets a need to summarize and examine ongoing research and advances in a rapidly developing field

**Semiconductor Devices, 2nd Edition** John Sparkes, 1994-07-28 Since its inception the Tutorial Guides in Electronic Engineering series has met with great success among both instructors and students Designed for first and second year undergraduate courses each text provides a concise list of objectives at the beginning of every chapter key definitions and formulas highlighted in margin notes and references to other texts in the series Semiconductor Devices begins with a review of the necessary basic background in semiconductor materials and what semiconductor devices are expected to do that is their typical applications Then the author explains in order of increasing complexity the main semiconductor devices in use today beginning with p n junctions in their various forms and ending with integrated circuits In doing so he presents both the band model and the bond model of semiconductors since neither one on its own can account for all device behavior The final chapter introduces more recently developed technologies particularly the use of compound instead of silicon semiconductors and the improvement in device performance these materials make possible True to the Tutorial Guides in Electronic Engineering series standards Semiconductor Devices offers a clear presentation a multitude of illustrations and fully worked examples supported by end of chapter exercises and suggestions for further reading This book provides an ideal introduction to the fundamental theoretical principles underlying the operation of semiconductor devices and to their simple and effective mathematical modelling

**Technology for Advanced Focal Plane Arrays of HgCdTe and AlGaIn** Li He, Dingjiang Yang, Guoqiang Ni, 2016-07-15 This book introduces the basic framework of advanced focal plane technology based on the third generation infrared focal plane concept The essential concept research advances and future trends in advanced sensor arrays are comprehensively reviewed Moreover the book summarizes recent research advances in HgCdTe AlGaIn detectors for the infrared ultraviolet waveband with a particular focus on the numerical method of detector design material epitaxial growth and processing as well as Complementary Metal Oxide Semiconductor Transistor readout circuits The book offers a unique resource for all graduate students and researchers interested in the technologies of focal plane arrays or electro optical imaging sensors

**Thermoelectrics Handbook** D.M. Rowe, 2018-10-03 Ten years ago D M Rowe introduced the

bestselling CRC Handbook of Thermoelectrics to wide acclaim Since then increasing environmental concerns desire for long life electrical power sources and continued progress in miniaturization of electronics has led to a substantial increase in research activity involving thermoelectrics Reflecting the latest trends and developments the Thermoelectrics Handbook Macro to Nano is an extension of the earlier work and covers the entire range of thermoelectrics disciplines Serving as a convenient reference as well as a thorough introduction to thermoelectrics this book includes contributions from 99 leading authorities from around the world Its coverage spans from general principles and theoretical concepts to material preparation and measurements thermoelectric materials thermoelements modules and devices and thermoelectric systems and applications Reflecting the enormous impact of nanotechnology on the field as the thermoelectric properties of nanostructured materials far surpass the performance of conventional materials each section progresses systematically from macro scale to micro nano scale topics In addition the book contains an appendix listing major manufacturers and suppliers of thermoelectric modules There is no longer any need to spend hours plodding through the journal literature for information The Thermoelectrics Handbook Macro to Nano offers a timely comprehensive treatment of all areas of thermoelectrics in a single unified reference

*Nanometer CMOS ICs* Harry J.M. Veendrick, 2017-04-28 This textbook provides a comprehensive fully updated introduction to the essentials of nanometer CMOS integrated circuits It includes aspects of scaling to even beyond 12nm CMOS technologies and designs It clearly describes the fundamental CMOS operating principles and presents substantial insight into the various aspects of design implementation and application Coverage includes all associated disciplines of nanometer CMOS ICs including physics lithography technology design memories VLSI power consumption variability reliability and signal integrity testing yield failure analysis packaging scaling trends and road blocks The text is based upon in house Philips NXP Semiconductors Applied Materials ASML IMEC ST Ericsson TSMC etc courseware which to date has been completed by more than 4500 engineers working in a large variety of related disciplines architecture design test fabrication process packaging failure analysis and software

**Encyclopedia of Renewable Energy, Sustainability and the Environment**, 2024-08-09 Encyclopedia of Renewable Energy Sustainability and the Environment Four Volume Set comprehensively covers all renewable energy resources including wind solar hydro biomass geothermal energy and nuclear power to name a few In addition to covering the breadth of renewable energy resources at a fundamental level this encyclopedia delves into the utilization and ideal applications of each resource and assesses them from environmental economic and policy standpoints This book will serve as an ideal introduction to any renewable energy source for students while also allowing them to learn about a topic in more depth and explore related topics all in a single resource Instructors researchers and industry professionals will also benefit from this comprehensive reference Covers all renewable energy technologies in one comprehensive resource Details renewable energies processes from production to utilization in a single encyclopedia Organizes topics into concise consistently formatted chapters perfect for readers who are new to the field



Assesses economic challenges faced to implement each type of renewable energy Addresses the challenges of replacing fossil fuels with renewables and covers the environmental impacts of each renewable energy      Fundamentals Of Solar Cells Alan Fahrenbruch, Richard Bube, 2012-12-02 Fundamentals of Solar Cells Photovoltaic Solar Energy Conversion provides an introduction to the fundamental physical principles of solar cells It aims to promote the expansion of solar photovoltaics from relatively small and specialized use to a large scale contribution to energy supply The book begins with a review of basic concepts such as the source of energy the role of photovoltaic conversion the development of photovoltaic cells and sequence of phenomena involved in solar power generation This is followed by separate chapters on each of the processes that take place in solar cell These include solar input properties of semiconductors recombination and the flow of photogenerated carriers charge separation and the characteristics of junction barriers and calculation of solar efficiency Subsequent chapters deal with the operation of specific solar cell devices such as a single crystal homojunction Si a single crystal heterojunction buried homojunction AlGaAs GaAs and a polycrystalline thin film cell Cu<sub>2</sub>S CdS This book is intended for upper level graduate students who have a reasonably good understanding of solid state physics and for scientists and engineers involved in research and development of solar cells      Electronic Materials L.S. Miller, J.B. Mullin, 2012-12-06 Electronic materials are a dominant factor in many areas of modern technology The need to understand them is paramount this book addresses that need The main aim of this volume is to provide a broad unified view of electronic materials including key aspects of their science and technology and also in many cases their commercial implications It was considered important that much of the contents of such an overview should be intelligible by a broad audience of graduates and industrial scientists and relevant to advanced undergraduate studies It should also be up to date and even looking forward to the future Although more extensive and written specifically as a text the resulting book has much in common with a short course of the same name given at Coventry Polytechnic The interpretation of the term electronic materials used in this volume is a very broad one in line with the initial aim The principal restriction is that with one or two minor exceptions relating to aspects of device processing for example the materials dealt with are all active materials Materials such as simple insulators or simple conductors playing only a passive role are not singled out for consideration Active materials might be defined as those involved in the processing of signals in a way that depends crucially on some specific property of those materials and the immediate question then concerns the types of signals that might be considered

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