Fundamental Principles Of Optical Lithography The Science Of Microfabrication By Mack Chris 2007 Paperback

This new edition of the bestselling Microlithography: Science and Technology provides a balanced treatment of theoretical and operational considerations, from elementary concepts to advanced aspects of modern submicron microlithography. Each chapter reflects the current research and practices from the world's leading academic and industrial laboratories detailed by a stellar panel of international experts. New in the Second Edition In addition to updated information on existing material, this new edition features coverage of technologies developed over the last decade since the first edition appeared, including: Immersion Lithography 157nm Lithography Electron Projection Lithography (EPL) Extreme Ultraviolet (EUV) Lithography Imprint Lithography Photoresists for 193nm and Immersion Lithography Scatterometry Microlithography: Science and Technology, Second Edition authoritatively covers the physics, chemistry, optics, metrology tools and techniques, resist processing and materials, and fabrication methods involved in the latest generations of microlithography such as immersion lithography and extreme ultraviolet (EUV) lithography. It also looks ahead to the possible future systems and technologies that will bring the next generations to fruition. Loaded with illustrations, equations, tables, and time-saving references to the most current literature, this book is the most comprehensive and reliable source for anyone, from student to seasoned professional, looking to achieve robust, accurate, and cost-effective microlithography processes and systems.

The merging of metasurface and holography brings about unprecedented opportunities for versatile manipulation of light in terms of both far-field wavefront and near-field profile. In this book, a brief evolving history from surface plasmon polariton holography to metamaterial holography and finally to metasurface holography is introduced at first. Basic physical mechanisms that govern the phase modulation rules behind metasurface holography design are discussed later. Next, extended functionalities such as arbitrary polarization holography, vectorial holography, full-color holography, and hybrid holography achieved in the metasurface platform are presented. Surface wave and metagrating holography that bridges the on-chip surface wave and free-space wave is also introduced. In the end, we envisage practical applications of high-fidelity 3D holographic display, high-secure encryption, and high capacity digital encoding and also indicate remaining challenges based on metasurface holography.

Considered a major field of photonics, plasmonics offers the potential to confine and guide light below the diffraction limit and promises a new generation of highly miniaturized photonic devices. This book combines a comprehensive introduction with an extensive overview of the current state of the art. Coverage includes plasmon waveguides, cavities for field-enhancement, nonlinear processes and the emerging field of active plasmonics studying interactions of surface plasmons with active media.

Fundamentals and Applications of Nanophotonics includes a comprehensive discussion of the field of nanophotonics, including key enabling technologies that have the potential to drive economic growth and impact numerous application domains such as ICT, the environment, healthcare, military, transport, manufacturing, and energy. This book gives readers the theoretical underpinnings needed to understand the latest advances in the field. After an introduction to the area, chapters two and three cover the essential topics of electrodynamics, quantum mechanics, and computation as they relate to nanophotonics. Subsequent chapters explore materials for nanophotonics, including nanoparticles, photonic crystals, nanosilicon, nanocarbon, III-V, and II-VI semiconductors. In addition, fabrication and characterization techniques are addressed, along with the importance of plasmonics, and the applications of nanophotonics in devices such as lasers, LEDs, and photodetectors. Covers electrodynamics, quantum mechanics and computation as these relate to nanophotonics Reviews materials, fabrication and characterization techniques for nanophotonics Describes applications of the technology such as lasers, LEDs and photodetectors

Nanofabrication

Computational Lithography

Principles, Practices, and Materials

Principles of Lithography

Tiger Technology

Microlithography Fundamentals in Semiconductor Devices and Fabrication Technology

Fundamentals and Applications of Nano Silicon in Plasmonics and Fullerines: Current and Future Trends addresses current and future trends in the application and commercialization of nanosilicon. The book presents current, innovative and prospective applications and products based on nanosilicon and their binary system in the fields of energy harvesting and storage, lighting (solar cells and nano-capacitor and fuel cell devices and nanoLEDs), electronics (nanotransistors and nanomemory, quantum computing, photodetectors for space applications; biomedicine (substance detection, plasmonic treatment of disease, skin and hair care, implantable glucose sensor, capsules for drug delivery and underground water and oil exploration), and art (glass and pottery). Moreover, the book includes material on the use of advanced laser and proximal probes for imaging and manipulation of nanoparticles and atoms. In addition, coverage is given to carbon and how it contrasts and integrates with silicon with additional related applications. This is a valuable resource to all those seeking to learn more about the commercialization of nanosilicon, and to researchers wanting to learn more about emerging nanosilicon applications. Features a variety of designs and operation of nano-devices, helping engineers to make the best use of nanosilicon Contains underlying principles of how nanomaterials work and the variety of applications they provide, giving those new to nanosilicon a fundamental understanding Assesses the viability of various nanosilicon devices for mass production and commercialization, thereby providing an important source of information for engineers

SERS was discovered in the 1970s and has since grown enormously in breadth, depth, and understanding. One of the major characteristics of SERS is its interdisciplinary nature: it lies at the boundary between physics, chemistry, colloid science, plasmonics, nanotechnology, and biology. By their very nature, it is impossible to find a textbook that will summarize the principles needed for SERS of these rather dissimilar and disconnected topics. Although a basic understanding of these topics is necessary for research projects in SERS with all its many aspects and applications, they are seldom touched upon as a coherent unit during most undergraduate studies in physics or chemistry. This book intends to fill this existing gap in the literature. It provides an overview of the underlying principles of SERS, from the fundamental understanding of the effect to its potential applications. It is aimed primarily at newcomers to the field, graduate students, researchers or scientists, attracted by the many applications of SERS and plasmonics or its basic science. The emphasis is on concepts and background material for SERS, such as Raman spectroscopy, the physics of plasmons, or colloid science, all of them introduced within the context of SERS, and from where the more specialized literature can be followed. Represents one of very few books fully dedicated to the topic of surface-enhanced Raman spectroscopy (SERS) Gives a comprehensive summary of the underlying physical concepts around SERS Provides a detailed analysis of plasmons and plasmonics

The three volumes in the PRINCIPLES OF ELECTRON OPTICS Series constitute the first comprehensive treatment of electron optics in over forty years. While Volumes 1 and 2 are devoted to geometrical optics, Volume 3 is concerned with wave optics and effects due to wave length. Subjects covered include: Derivation of the laws of electron propagation from SchrÜdinger's equation Image formation and the notion of resolution The interaction between specimens and electrons Image processing Electron holography and interference Coherence, brightness, and the spectral function

Together, these works comprise a unique and informative treatment of the subject. Volume 3, like its predecessors, will provide readers with both a textbook and an invaluable reference source.

Advanced lithography grows up to several fields such as nano-lithography, micro electro-mechanical system (MEMS) and nano-phonics, etc. Nano-lithography reaches to 20 nm size in advanced electron device. Consequently, we have to study and develop true single nanometer size lithography. One of the solutions is to study a fusion of top down and bottom up technologies such as EB drawing and self-assembly with block copolymer. In MEMS and nano-photonics, 3 dimensional structures are needed to achieve some functions in the devices for the applications. Their formation are done by several methods such as colloid lithography, stereo-lithography, dry etching, sputtering, deposition, etc. This book covers a wide area regarding nano-lithography, nano structure and 3-dimensional structure, and introduces readers to the methods, methodology and its applications.

Plasmonics: Fundamentals and Applications

Fundamentals of Semiconductor Manufacturing and Process Control

Fundamentals of Microfabrication and Nanotechnology, Three-Volume Set

and Related Plasmonic Effects

Fundamentals and Applications of Nano Silicon in Plasmonics and Fullerines

Optical Measurements for Scientists and Engineers

Containing more than 300 equations and nearly 500 drawings, photographs, and micrographs, this reference surveys key areas such as optical measurements and in-line calibration methods. It describes cleanroom-based measurement technology used during the manufacture of silicon integrated circuits and covers model-based, critical dimension, overlay

Applied Photometry, Radiometry, and Measurements of Optical Losses reviews and analyzes physical concepts of radiation transfer, providing quantitative foundation for the means of measurements of optical losses, which affect propagation and distribution of light waves in various media and in diverse optical systems and components. The comprehensive analysis of advanced methodologies for low-loss detection is outlined in comparison with the classic photometric and radiometric observations, having a broad range of techniques examined and summarized: from interferometric and calorimetric, resonator and polarization, phase-shift and ring-down decay, wavelength and frequency modulation to pulse separation and resonant, acousto-optic and emissive - subsequently compared to direct and balancing methods for studying free-space and polarization optics, fibers and waveguides. The material is focused on applying optical methods and procedures for evaluation of transparent, reflecting, scattering, absorbing, and aggregated objects, and for determination of power and energy parameters of radiation and color properties of light.

A practical guide to semiconductor manufacturing from processcontrol to yield modeling and experimental design Fundamentals of Semiconductor Manufacturing and Process Controlcovers all issues involved in manufacturing microelectronic devicesand circuits, including fabrication sequences, process control,experimental design, process modeling, yield modeling, and CIM/CAMsystems. Readers are introduced to both the theory and practice ofall basic manufacturing concepts. Following an overview of manufacturing and technology, the textexplores process monitoring methods, including those that focus onproduct wafers and those that focus on the equipment used toproduce wafers. Next, the text sets forth some fundamentals ofstatistics and yield modeling, which set the foundation for adetailed discussion of how statistical process control is used toanalyze quality and improve yields. The discussion of statistical experimental design offers readers apowerful approach for systematically varying controllable processconditions and determining their impact on output parameters thatmeasure quality. The authors introduce process modeling concepts,including several advanced process control topics such asrun-by-run, supervisory control, and process and equipmentdiagnosis. Critical coverage includes the following: * Combines process control and semiconductor manufacturing * Unique treatment of system and software technology and managementof overall manufacturing systems * Chapters include case studies, sample problems, and suggestedexercises * Instructor support includes electronic copies of the figures andan instructor's manual Graduate-level students and industrial practitioners will benefitfrom the detailed exami?nation of how electronic materials andsupplies are converted into finished integrated circuits andelectronic products in a high-volume manufacturingenvironment. An Instructor's Manual presenting detailed solutions to all theproblems in the book is available from the Wiley editorialdepartment. An Instructor Support FTP site is also available.

This Field Guide distills the material written by Chris Mack over the past 20 years, including notes from his graduate-level lithography course at the University of Texas at Austin. It details the lithography process, image formation, imaging onto a photoresist, photoresist chemistry, and lithography control and optimization. An introduction to next-generation lithographic technologies is also included, as well as an extensive lithography glossary and a summation of salient equations critical to anyone involved in the lithography industry.

Fundamental Principles of Polymeric Materials

Fundamentals and Devices

Principles of Electron Optics

Chemistry and Lithography

The Science of Microfabrication

A Modeling Perspective

Fundamentals of Nanoparticles: Classifications, Synthesis Methods, Properties and Characterization explores the nanoparticles and architecture of nanostructured materials being used today in a comprehensive, detailed manner. This book focuses primarily on the characterization, properties and synthesis of nanoscale materials, and is divided into three major parts. This is a valuable reference for materials scientists, and chemical and mechanical engineers working in R&D and academia, who want to learn more about how nanoparticles and nanomaterials are characterized and engineered. Part one covers nanoparticles formation, self-assembly in the architecture nanostructures, types and classifications of nanoparticles, and signature physical and chemical properties, toxicity and regulations. Part two presents different ways to form nanometer particles, including bottom-up and top-down approaches, the classical and non-classical theories of nanoparticles formation and self-assembly, surface functionalization and other surface treatments to allow practical use. Part three covers characterization of nanoparticles and nanostructured materials, including the determination of size and shape, in addition to atomic and electronic structures and other important properties. Includes new physical and chemical techniques for the synthesis of nanoparticles and architecture nanostructures Features an in-depth treatment of nanoparticles and nanostructures, including their characterization and chemical and physical properties Explores the unusual properties of materials that are developed by modifying their shape and composition and by manipulating the arrangement of atoms and molecules Explains important techniques for the synthesis, fabrication and the characterization of complex nano-architectures

Photomasks, the printing masters for the fabrication of integrated circuits, have become a necessity of modern semiconductor manufacturing. This book details the science and technology of industrial photo mask production, including fundamental principles, industrial production flows, and technological evolution.

The fabrication of an integrated circuit requires a variety of physical and chemical processes to be performed on a semiconductor substrate. In general, these processes fall into three categories: film deposition, patterning, and semiconductor doping. Films of both conductors and insulators are used to connect and isolate transistors and their components. By creating structures of these various components millions of transistors can be built and wired together to form the complex circuitry of modern microelectronic devices. Fundamental to all of these processes is lithography, ie, the formation of three-dimensional relief images on the substrate for subsequent transfer of the pattern to the substrate. This book presents a complete theoretical and practical treatment of the topic of lithography for both students and researchers. It comprises ten detailed chapters plus three appendices with problems provided at the end of each chapter. Additional Information: Visiting http://www.lithoguru.com/textbook/index.html enhances the reader's understanding as the website supplies information on how you can download a free laboratory manual, Optical Lithography Modelling with MATLAB®, to accompany the textbook. You can also contact the author and find help for instructors.

Now in its third edition, Fundamentals of Microfabrication and Nanotechnology continues to provide the most complete MEMS coverage available. Thoroughly revised and updated the new edition of this perennial bestseller has been expanded to three volumes, reflecting the substantial growth of this field. It includes a wealth of theoretical and practical information on nanotechnology and NEMS and offers background and comprehensive information on materials, processes, and manufacturing options. The first volume offers a rigorous theoretical treatment of micro- and nanosciences, and includes sections on solid-state physics, quantum mechanics, crystallography, and fluidics. The second volume presents a very large set of manufacturing techniques for micro- and nanofabrication and covers different forms of lithography, material removal processes, and additive technologies. The third volume focuses on manufacturing techniques and applications of Bio-MEMS and Bio-NEMS. Illustrated in color throughout, this seminal work is a cogent instructional text, providing classroom and self-learners with worked-out examples and end-of-chapter problems. The author characterizes and defines major research areas and illustrates them with examples pulled from the most recent literature and from his own work.

Semiconductor Dry Etching Technology

Metasurface Holography

Atomic Layer Processing

Harnessing Light

Fundamentals and Applications

Current and Future Trends

Optical science and engineering affect almost every aspect of our lives. Millions of miles of optical fiber carry voice and data signals around the world. Lasers are used in surgery of the retina, kidneys, and heart. New high-efficiency light sources promise dramatic reductions in electricity consumption. Night-vision equipment and satellite surveillance are changing how wars are fought. Industry uses optical methods in everything from the production of computer chips to the construction of tunnels. Harnessing Light surveys this multitude of applications, as well as the status of the optics industry and of research and education in optics, and identifies actions that could enhance the field's contributions to society and facilitate its continued technical development.

Learn about fundamental and advanced topics in etching with this practical guide Atomic Layer Processing: Semiconductor Dry Etching Technology delivers a hands-on, one-stop resource for understanding etching technologies and their applications. The distinguished scientist, executive, and author offers readers in-depth information on the various etching technologies used in the semiconductor industry, including thermal, isotropic atomic layer, radical, ion-assisted, and reactive ion etching. The book begins with a brief history of etching technology and the role it has played in the information technology revolution, along with a collection of commonly used terminology in the industry. It then moves on to discuss a variety of different etching techniques, before concluding with discussions of the fundamentals of etching reactor design and newly emerging topics in the field such as the role played by artificial intelligence in the technology. Atomic Layer Processing includes a wide variety of other topics as well, all of which contribute to the author's goal of providing the reader with an atomic-level understanding of dry etching technology sufficient to develop specific solutions for existing and emerging semiconductor technologies. Readers will benefit from: A complete discussion of the fundamentals of how to remove atoms from various surfaces An examination of emerging etching technologies, including laser and electron beam assisted etching A treatment of process control in etching technology and the role played by artificial intelligence Analyses of a wide variety of etching methods, including thermal or vapor etching, isotropic atomic layer etching, radical etching, directional atomic layer etching, and more Perfect for materials scientists, semiconductor physicists, and surface chemists, Atomic Layer Processing will also earn a place in the libraries of engineering scientists in industry and academia, as well as anyone involved with the manufacture of semiconductor technology. The author's close involvement with corporate research & development and academic research allows the book to offer a uniquely multifaceted approach to the subject.

Nanoscale electrochemistry has revolutionized electrochemical research and technologies and has made broad impacts in other fields, including nanotechnology and nanoscience, biology, and materials chemistry. Nanoelectrochemistry examines well-established concepts and principles and provides an updated overview of the field and its applications. This book covers three integral aspects of nanoelectrochemistry. The first two chapters contain theoretical background, which is essential for everyone working in the field—specifically, theories of electron transfer, transport, and double-layer processes at nanoscale electrochemical interfaces. The next chapters are dedicated to the electrochemical studies of nanomaterials and nanosystems, as well as the development and applications of nanoelectrochemical techniques. Each chapter is self-contained and can be read independently to provide readers with a compact, up-to-date critical review of the subfield of interest. At the same time, the presented collection of chapters serves as a serious introduction to nanoelectrochemistry for graduate students or scientists who wish to enter this emerging field. The applications discussed range from studies of biological systems to nanoparticles and from electrocatalysis to molecular electronics, nanopores, and membranes. The book demonstrates how electrochemistry has contributed to the advancement of nanotechnology and nanoscience. It also explores how electrochemistry has transformed itself by leading to the discovery of new phenomena, enabling unprecedented electrochemical measurements and creating novel electrochemical systems.

Lithography is a field in which advances proceed at a swift pace. This book was written to address several needs, and the revisions for the second edition were made with those original objectives in mind. Many new topics have been included in this text commensurate with the progress that has taken place during the past few years, and several subjects are discussed in more detail. This book is intended to serve as an introduction to the science of microlithography for people who are unfamiliar with the subject. Topics directly related to the tools used to manufacture integrated circuits are addressed in depth, including such topics as overlay, the stages of exposure, tools, and light sources. This text also contains numerous references for students who want to investigate particular topics in more detail, and they provide the experienced lithographer with lists of references by topic as well. It is expected that the reader of this book will have a foundation in basic physics and chemistry. No topics will require knowledge of mathematics beyond elementary calculus.

Diazonaphthoquinone-based Resists

Nanoelectrochemistry

Silicon Photonics

Optical Metamaterials

Optical and EUV Lithography

Optical Thin Film Design

The creation of affordable high speed optical communications using standard semiconductor manufacturing technology is a principal aim of silicon photonics research. This would involve replacing copper connections with optical fibres or waveguides, and electrons with photons. With applications such as telecommunications and information processing, light detection, spectroscopy, holography and robotics, silicon photonics has the potential to revolutionise electronic-only systems. Providing an overview of the physics, technology and device operation of photonic devices using exclusively silicon and related alloys, the book includes: Basic Properties of Silicon Quantum Wells, Wires, Dots and Superlattices Absorption Processes in Semiconductors Light Emitters in Silicon Photodetectors , Photodiodes and Phototransistors Raman Lasers including Raman Scattering Guided Lightwaves Planar Waveguide Devices Fabrication Techniques and Material Systems Silicon Photonics: Fundamentals and Devices outlines the basic principles of operation of devices, the structures of the devices, and offers an insight into state-of-the-art and future developments.

Chemistry and Lithography provides a comprehensive treatment of the chemical phenomena in lithography in a manner that is accessible to a wide readership. The book presents topics on the optical and charged particle physics practiced in lithography, with a broader view of how the marriage between chemistry and optics has made possible the print and electronic revolutions of the digital age. The related aspects of lithography are thematically presented to convey a unified view of the developments in the field over time, from the very first recorded reflections on the nature of matter to the latest developments at the frontiers of lithography science and technology. Part I presents several important chemical and physical principles involved in the invention and evolution of lithography. Part II covers the processes for the synthesis, manufacture, usage, and handling of lithographic chemicals and materials. Part III investigates several important chemical and physical principles involved in the practice of lithography. Chemistry and Lithography is a useful reference for anyone working in the semiconductor industry.

Thin-film coatings are universal on optical components such as displays, lenses, mirrors, cameras, and windows and serve a variety of functions such as antireflection, high reflection, and spectral filtering. Designs can be as simple as a single-layer dielectric for antireflection effects or very complex with hundreds of layers for producing elaborate spectral filtering effects. Starting from basic principles of electromagnetics, design techniques are progressively introduced toward more intricate optical filter designs, numerical optimization techniques, and production methods, as well as emerging areas such as phase change materials and metal film optics. Worked examples, Python computer codes, and instructor problem sets are included. Key Features: Starting from the basic principles of electromagnetics, topics are built in a pedagogic manner toward intricate filter designs, numerical optimization and production methods. Discusses thin-film applications and design from simple single-layer effects to complex several-hundred-layer spectral filtering. Includes modern topics such as phase change materials and metal film optics. Includes worked examples, problem sets, and numerical examples with Python codes.

Semiconductor lithography is one of the key steps in the manufacturing of integrated silicon-based circuits. In fabricating a semiconductor device such as a transistor, a series of hot processes consisting of vacuum film deposition, oxidations, and dopant implantation are all patterned into microscopic circuits by the wet processes of lithography. Lithography, as adopted by the semiconductor industry, is the process of drawing or printing the pattern of an integrated circuit in a resist material. The pattern is formed and overlayed to a previous circuit layer as many as 30 times in the manufacture of logic and memory devices. With the resist pattern acting as a mask, a permanent device structure is formed by subtractive (removal) etching or by additive deposition of metals or insulators. Each process step in lithography uses inorganic or organic materials to physically transform semiconductors of silicon, insulators of oxides, nitrides, and organic polymers, and metals, into useful electronic devices. All forms of electromagnetic radiation are used in the processing. Lithography is a mUltidisciplinary science of materials, processes, and equipment, interacting to produce three-dimensional structures. Many aspects of chemistry, electrical engineering, materials science, and physics are involved. The purpose of this book is to bring together the work of many scientists and engineers over the last 10 years and focus upon the basic resist materials, the lithographic processes, and the fundamental principles behind each lithographic process.

Photomask Fabrication Technology

Updates in Advanced Lithography

Manufacturing Techniques for Microfabrication and Nanotechnology

Integrated Photonics

Fundamentals and Applications of Nanophotonics

A Practical Guide

A Unified Summary of the Models and Optimization Methods Used in Computational Lithography Optical lithography is one of the most challenging areas of current integrated circuit manufacturing technology. The semiconductor industry is relying more on resolution enhancement techniques (RETs), since their implementation does not require significant changes in fabrication infrastructure. Computational Lithography is the first book to address the computational optimization of RETs in optical lithography, providing an in-depth discussion of optimal optical proximity correction (OPC), phase shifting mask (PSM), and off-axis illumination (OAI) RET tools that use model-based mathematical optimization approaches. The book starts with an introduction to optical lithography systems, electric magnetic field principles, and the fundamentals of optimization from a mathematical point of view. It goes on to describe in detail different types of optimization algorithms to implement RETs. Most of the algorithms developed are based on the application of the OPC, PSM, and OAI approaches and their combinations. Algorithms for coherent illumination as well as partially coherent illumination systems are described, and numerous simulations are offered to illustrate the effectiveness of the algorithms. In addition, mathematical derivations of all optimization frameworks are presented. The accompanying MATLAB® software files for all the RET methods described in the book make it easy for readers to run and investigate the codes in order to understand and apply the optimization algorithms, as well as to design a set of optimal lithography masks. The codes may also be used by readers for their research and development activities in their academic or industrial organizations. An accompanying MATLAB® software guide is also included. An accompanying MATLAB® software guide is included, and readers can download the software to use with the guide at ftp://ftp.wiley.com/public/sci_tech_med/computational_lithography. Tailored for both entry-level and experienced readers, Computational Lithography is meant for faculty, graduate students, and researchers, as well as scientists and engineers in industrial organizations whose research or career field is semiconductor IC fabrication, optical lithography, and RETs. Computational lithography draws from the rich theory of inverse problems, optics, optimization, and computational imaging; as such, the book is also directed to researchers and practitioners in these fields.

An accessible, introductory text explaining how to select, set up and use optical spectroscopy and optical microscopy techniques.

Metamaterials—artificially structured materials with engineered electromagnetic properties—have enabled unprecedented flexibility in manipulating electromagnetic waves and producing new functionalities. This book details recent advances in the study of optical metamaterials, ranging from fundamental aspects to up-to-date implementations, in one unified treatment. Important recent developments and applications such as superlens and cloaking devices are also treated in detail and made understandable. The planned monograph can serve as a very timely book for both newcomers and advanced researchers in this extremely rapid evolving field.

This book elucidates the reasons underlying the lasting success of DNQ/N resist systems by examining the correlation between the chemical structure of the components and the photoresist performance. The basic chemistry of both DNQ sensitizers and novolak resins are explored. Focus also is placed on the chemical basis of application-related facets of the lithographic process. Methods of increasing process performance, such as image reversal, top layer imaging, antireflection layers, and phase shift technology are treated.

Microlithography

EUV Lithography

Optical Science and Engineering for the 21st Century

Semiconductor Lithography

Fundamentals of Nanoparticles

Fundamental Principles of Optical Lithography

Editorial Review Dr. Bakshi has compiled a thorough, clear reference text covering the important fields of EUV lithography for high-volume manufacturing. This book has resulted from his many years of experience in EUVL development and from teaching this subject to future specialists. The book proceeds from an historical perspective of EUV lithography, through source technology, optics, projection system design, mask, resist, and patterning performance, to cost of ownership. Each section contains worked examples, a comprehensive review of challenges, and relevant citations for those who wish to further investigate the subject matter. Dr. Bakshi succeeds in presenting sometimes unfamiliar material in a very clear manner. This book is also valuable as a teaching tool. It has become an instant classic and far surpasses others in the EUVL field. -- Dr. Akira Endo, Chief Development Manager, Gigaphoton Inc. Description Extreme ultraviolet lithography (EUVL) is the principal lithography technology aiming to manufacture computer chips beyond the current 193-nm-based optical lithography, and recent progress has been made on several fronts: EUV light sources, optics, optics metrology, contamination control, masks and mask handling, and resists. This comprehensive volume is comprised of contributions from the world's leading EUVL researchers and provides all of the critical information needed by practitioners and those wanting an introduction to the field. Interest in EUVL technology continues to increase, and this volume provides the foundation required for understanding and applying this exciting technology. About the editor of EUV Lithography Dr. Vivek Bakshi previously served as a senior member of the technical staff at SEMATECH; he is now president of EUV Litho, Inc., in Austin, Texas.

The creation of high technology industries in East Asia, such as the semiconductor industry, has been achieved in the face of enormous obstacles. The countries concerned, such as Korea, Taiwan, Singapore and Malaysia, industrialized through labor-intensive, low-cost industries. But knowledge-intensive industries such as semiconductors are much more demanding. The book develops a plausible account of this industrial transformation, based on the central notion of "technology leverage" and the distinctive institutions established to facilitate the process. It concludes that management of technology diffusion is as important a form of wealth creation as management of innovation.

"Explores the science and technology of lithographic processes and resist materials and summarizes the most recent innovations in semiconductor manufacturing. Considers future trends in lithography and resist material technology. Reviews the interaction of light, electron beams, and X-rays with resist materials."

Aims to provide a solid overall background in fibre optic sensors and discusses mechanisms and configurations for a wide range of applications for measurement and analysis. The author also discusses both sides of the case for fibre optic sensors, including sensitivity and dynamic response.

Laser Fundamentals

Applied Photometry, Radiometry, and Measurements of Optical Losses

Classifications, Synthesis Methods, Properties and Characterization

Wave Optics

Fiber Optic Sensors

Handbook of Silicon Semiconductor Metrology

Laser Fundamentals provides a clear and comprehensive introduction to the physical and engineering principles of laser operation and design. Simple explanations, based throughout on key underlying concepts, lead the reader logically from the basics of laser action to advanced topics in laser physics and engineering. Much new material has been added to this second edition, especially in the areas of solid-state lasers, semiconductor lasers, and laser cavities. This 2004 edition contains a new chapter on laser operation above threshold, including extensive discussion of laser amplifiers. The clear explanations, worked examples, and many homework problems will make this book invaluable to undergraduate and first-year graduate students in science and engineering taking courses on lasers. The summaries of key types of lasers, the use of many unique theoretical descriptions, and the extensive bibliography will also make this a valuable reference work for researchers.

Intended to update scientists and engineers on the current state of the art in a variety of key techniques used extensively in the fabrication of structures at the nanoscale. The present work covers the essential technologies for creating sub 25 nm features lithographically, depositing layers with nanometer control, and etching patterns and structures at the nanoscale. A distinguishing feature of this book is a focus not on extension of microelectronics fabrication, but rather on techniques applicable for building NEMS, biosensors, nanomaterials, photonic crystals, and other novel devices and structures that will revolutionize society in the coming years.

Designed for science and engineering students, this text focuses on emerging trends in processes for fabricating MEMS and NEMS devices. The book reviews different forms of lithography, subtractive material removal processes, and additive technologies. Both top-down and bottom-up fabrication processes are exhaustively covered and the merits of the different approaches are compared. Students can use this color volume as a guide to help establish the appropriate fabrication technique for any type of micro- or nano-machine.

Expanded discussion of extended-chain crystals and their commercial developments; phase behavior in polymer-solvent systems; and three-dimensional stress and strain introduction to the Flory-Huggins theory; the "modified Cross" model; and Tobolsky's "Procedure X" for extracting discrete relaxation times and moduli from data. New sections on scaleup calculations for the laminar flow of non-Newtonian fluids; liquid-crystal polymers; and group-transfer polymerization, including a quantitative treatment of Ziegler-Natta polymerization with worked-out examples. All kinetic expressions are written in terms of conversions (rather than monomer concentration) for greater generality and ease of application. Kinetic expressions incorporate the possibility of a variable-volume reaction mass, and feature new examples to illustrate the effects of variable volume.

Science and Technology, Second Edition

Principles of Surface-Enhanced Raman Spectroscopy
Field Guide to Optical Lithography
The Creation of a Semiconductor Industry in East Asia
Techniques and Principles