Semiconductor Materials And Process Technology Handbook

The drive toward new semiconductor technologies is intricately related to market demands for cheaper, smaller, faster, and more reliable circuits with lower power consumption. The development of new processing tools and technologies is aimed at optimizing one or more of these requirements. This goal can, however, only be achieved by a concerted effort between scientists, engineers, technicians, and operators in research, development, and manufac turing. It is therefore important that experts in specific disciplines, such as device and circuit design, understand the principle, capabil ities, and limitations of tools and processing technologies. It is also important that those working on specific unit processes, such as lithography or hot processes, be familiar with other unit processes used to manufacture the product. Several excellent books have been published on the subject of process technologies. These texts, however, cover subjects in too much detail, or do not cover topics important to modem tech nologies. This book is written with the need for a "bridge" between different disciplines in mind. It is intended to present to engineers and scientists those parts of modem processing technologies that are of greatest importance to the design and manufacture of semi conductor circuits. The material is presented with sufficient detail to understand and analyze interactions between processing and other semiconductor disciplines, such as design of devices and cir cuits, their electrical parameters, reliability, and yield.
Proceedings of the Ninth International Vacuum Metallurgy Conference on Special Melting, San Diego, CA, April 1988. A hefty volume composed of 73 contributions discussing various aspects of melting and remelting processing technologies. No index. Annotation copyright Book News, Inc. Portland, Or.
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 completely revised edition remains the only comprehensive treatise on polymer coatings for electronics. Since the original edition, the applications of coatings for the environmental protection of electronic systems have greatly increased, largely driven by the competitive need to reduce costs, weight and volume. The demands for high-speed circuits for the rapid processing of signals and data, high-density circuits for the storage and retrieval of megabits of memory, and the improved reliability required of electronics for guiding and controlling weapons and space vehicles have triggered the development of many new and improved coating polymers and formulations. Both the theoretical aspects of coatings (molecular structure of polymer types and their correlation with electrical and physical properties) and applied aspects (functions, deposition processes, applications, testing) are covered in the book. Over 100 proprietary coating formulations were reviewed, their properties collated, and tables of comparative properties prepared. This book is useful as both a primer and as a handbook for collecting properties data.

Methods of Measurement for Semiconductor Materials, Process Control, and Devices

quarterly report

Molecular Beam Epitaxy

Handbook of 3D Integration, Volume 3

Handbook of Polymer Coatings for Electronics

Microlithography Fundamentals in Semiconductor Devices and Fabrication Technology

Edited by key figures in 3D integration and written by top authors from high-tech companies and renowned research institutions, this book covers the intricate details of 3D process technology. As such, the main focus is on silicon via formation, bonding and debonding, thinning, via reveal and backside processing, both from a technological and a materials science perspective. The last part of the book is concerned with assessing and enhancing the reliability of the 3D integrated devices, which is a prerequisite for the large-scale implementation of this emerging technology. Invaluable reading for materials scientists, semiconductor physicists, and those working in the semiconductor industry, as well as IT and electrical engineers.

CMP and polishing are the most precise processes used to finish the surfaces of mechanical and electronic or semiconductor components. Advances in CMP/Polishing Technologies for Manufacture of Electronic Devices presents the latest developments and technological innovations in the field - making cutting-edge R&D accessible to the wider engineering community. Most of the applications of these processes are kept as confidential as possible (proprietary information), and specific details are not seen in professional or technical journals and magazines. This book makes these processes and applications accessible to a wider industrial and academic audience. Building on the fundamentals of tribology - the science of friction, wear and lubrication - the authors explore the practical applications of CMP and polishing across various market sectors. Due to the high pace of development of the electronics and semiconductors industry, many of the presented processes and applications come from these industries. Demystifies scientific developments and technological innovations, opening them up for new applications and process improvements in the semiconductor industry and other areas of precision engineering Explores stock removal mechanisms in CMP and polishing, and the challenges involved in predicting the outcomes of abrasive processes in high-precision

environments The authors bring together the latest innovations and research from the USA and Japan

The development of semiconductor devices began a little more than a century ago, with the discovery of the electrical conductivity of ionic solids. Today, solid state technologies form the background of the society in which we live. The aim of this book is threefold: to present the background physical chemistry on which the technology of solid state devices is based; secondly, to describe specific issues such as the role of defects on the properties of solids, and the crucial influence of surface properties; and ultimately, to look at the physics and chemistry of growth processes, both at the bulk and thin–film level, together with some issues relating to the properties of nano–devices. Divided into five chapters, it covers: Thermodynamics of solids, including phases and their properties and structural order Point defects in semiconductors Extended defects in semiconductors and their interactions with point defects and impurities Growth of semiconductor materials Physical chemistry of semiconductor materials processing With applications across all solid state technologies,the book is useful for advanced students and researchers in materials science, physics, chemistry, electrical and electronic engineering. It is also useful for those in the semiconductor industry.

This book is a must-have reference to dry etching technology for semiconductors, which will enable engineers to develop new etching processes for further miniaturization and integration of semiconductor integrated circuits. The author describes the device manufacturing flow, and explains in which part of the flow dry etching is actually used. The content is designed as a practical guide for engineers working at chip makers, equipment suppliers and materials suppliers, and university students studying plasma, focusing on the topics they need most, such as detailed etching processes for each material (Si, SiO2, Metal etc) used in semiconductor devices, etching equipment used in manufacturing fabs, explanation of why a particular plasma source and gas chemistry are used for the etching of each material, and how to develop etching processes. The latest, key technologies are also described, such as 3D IC Etching, Dual Damascene Etching, Low-k Etching, Hi-k/Metal Gate Etching, FinFET Etching, Double Patterning etc.

Crucial Issues in Semiconductor Materials and Processing Technologies

3D Process Technology

Applications to Key Materials

Semiconductor Silicon Crystal Technology

Methods of Measurement for Semiconductor Materials, Process Control, and Devices. Quarterly Report, July 1 to September 30, 1971

Physical Chemistry of Semiconductor Materials and Processes

Encompasses the entire range of industrial refractory materials and forms: properties and their measurement, applications, manufacturing, installation and maintenance techniques, quality assurance, and statistical process control.

This textbook contains all the materials that an engineer needs to know to start a career in the semiconductor industry. It also provides readers with essential background information for semiconductor research. It is written by a professional who has been working in the field for over two decades and teaching the material to university students for the past 15 years. It includes process knowledge from raw material preparation to the passivation of chips in a modular format.

Wide bandgap semiconductors, made from such materials as GaN, SiC, diamond, and ZnSe, are undergoing a strong resurgence in recent years, principally because of their direct bandgaps, which give them a huge advantage over the indirect gap Sic As an example, more than 10 million blue LEDs using this technology are sold each month, and new, high brightness (15 lumens per watt), long-life white LEDs are under development with the potential to replace incandescent bulbs in many situations. This book provides readers with a broad overview of this rapidly expanding technology, bringing them up to speed on new discoveries and commercial applications. It provides specific technical applications of key processes such as laser diodes, LEDs, and very high temperature electronic controls on engines, focusing on doping, etching, oxidation passivation, growth techniques and more.

In semiconductor manufacturing, understanding how various materials behave and interact is critical to making a reliable and robust semiconductor package. Semiconductor Packaging: Materials Interaction and Reliability provides a fundamental understanding of the underlying physical properties of the materials used in a semiconductor package. By tying together the disparate elements essential to a semiconductor package, the authors show how all the parts fit and work together to provide durable protection for the integrated circuit chip within as well as a means for the chip to communicate with the outside world. The text also covers packaging materials for MEMS, solar technology, and LEDs and explores future trends in semiconductor packages.

Electronics Reliability and Measurement Technology

Theory, Modeling and Applications in Nanoelectronics

Fiber Reinforced Ceramic Composites

Semiconductor Materials and Process Technology Handbook

Materials, Processing and Technology

Processing of 'Wide Band Gap Semiconductors

Interest in ceramics as a high speed cutting tool material is based primarily on favorable material properties. As a class of materials, ceramics possess high melting points, excellent hardness and good wear resistance. Unlike most metals, hardness levels in ceramics generally remain high at elevated temperatures which means that cutting tip integrity is relatively unaffected at high cutting speeds. Ceramics are also chemically inert against most workmetals.

There has been a major thrust throughout the semiconductor industry to establish the capability to process Very Large Scale (VLSIC) and Ultra Large Scale (ULSIC) Integrated Circuits, as well as Very High Speed Integrated Circuits (VHSIC). The goals of these integrated circuits are a natural evolution of current IC technology since the number of devices on a simple IC have nearly doubled every year for the past two decades.This handbook is a broad review of semiconductor materials and process technology, with emphasis on very large-scale integration (VLSI) and ultra large scale integration (ULSI). The technology of integrated circuit (IC) processing is expanding so rapidly that it can be difficult for the scientist working in one area to keep abreast of developments in other areas of the field. This handbook solves this problem by bringing together snapshots of the various aspects of the technology.

Provides the first comprehensive treatment of continuous and discontinuous ceramic fiber and whisker reinforced ceramic composites, written by 29 authorities in the field.

This book examines electronics reliability and measurement technology. It identifies advances in measurement science and technology for nondestructive evaluation, and it details common measurement trouble spots.

Guide To Semiconductor Engineering

Ceramic Cutting Tools

Semiconductor Packaging

Code Compliance for Advanced Technology Facilities

Chemistry, Technology and Applications

Handbook of Semiconductor Manufacturing Technology

More than 1,100 TEM images illustrate the science of ULSI The natural outgrowth of VLSI (Very Large Scale Integration), Ultra Large Scale Integration (ULSI) refers to semiconductor chips with more than 10 million devices per chip. Written by three renowned pioneers in their field, ULSI Semiconductor Technology Atlas uses examples and TEM (Transmission Electron Microscopy) micrographs to explain and illustrate ULSI process technologies and their associated problems. The first book available on the subject to be illustrated using TEM images, ULSI Semiconductor Technology Atlas is logically divided into four parts: * Part I includes basic introductions to the ULSI process, device construction analysis, and TEM sample preparation * Part II focuses on key ULSI modules--ion implantation and defects, dielectrics and isolation structures, silicides/salicides, and metallization * Part III examines integrated devices, including complete planar DRAM, stacked cell DRAM, and trench cell DRAM, as well as SRAM as examples for process integration and development * Part IV emphasizes special applications, including TEM in advanced failure analysis, TEM in advanced packaging development and UBM (Under Bump Metallization) studies, and high-resolution TEM in microelectronics This innovative guide also provides engineers and managers in the microelectronics industry, as well as graduate students, with: * More than 1,100 TEM images to illustrate the science of ULSI * A historical introduction to the technology as well as coverage of the evolution of basic ULSI process problems and issues * Discussion of TEM in other advanced microelectronics devices and materials, such as flash memories, SOI, SiGe devices, MEMS, and CD-ROMs

Quartz, zeolites, gemstones, perovskite type oxides, ferrite, carbon allotropes, complex coordinated compounds and many moreùall products now being produced using hydrothermal technology. Handbook of Hydrothermal Technology brings together the latest techniques in this rapidly advancing field in one exceptionally useful, long-needed volume. The handbook provides a single source for understanding how aqueous solvents or mineralizers work under temperature

and pressure to dissolve and recrystallize normally insoluble materials, and decompose or recycle any waste material. The result, as the authors show in the book, is technologically the most efficient method in crystal growth, materials processing, and waste treatment. The book gives scientists and technologists an overview of the entire subject including: ò Evolution of the technology from geology to widespread industrial use. ò Descriptions of equipment used in the process and how it works. ò Problems involved with the growth of crystals, processing of technological materials, environmental and safety issues. ò Analysis of the direction of today's technology. In addition, readers get a close look at the hydrothermal synthesis of zeolites, fluorides, sulfides, tungstates, and molybdates, as well as native elements and simple oxides. Delving into the commercial production of various types, the authors clarify the effects of temperature, pressure, solvents, and various other chemical components on the hydrothermal processes.

Facilities which utilize hazardous liquids and gases represent a significant potential liability to the owner, operator, and general public in terms of personnel safety and preservation of assets. It is obvious that a catastrophic incident or loss of property or personnel is to be avoided at all costs. This book was conceived to give the reader a guide to understanding the requirements of the various codes and regulations that apply to the design, construction, and operation of facilities utilizing hazardous materials in their processes.

A broad review of semiconductor materials and process technology with emphasis on VLSI and ULSI.

Quarterly Report. July 1 - September 30, 1972

Materials Interaction and Reliability

Handbook of Industrial Refractories Technology

Handbook of Semiconductor Silicon Technology

Fundamentals of Semiconductor Processing Technology

Special Melting and Processing Technologies

In this volume, the editor and contributors describe the use of molecular beam epitaxy (MBE) for a range of key materials systems that are of interest for both technological and fundamental reasons. Prior books on MBE have provided an introduction to the basic concepts and techniques of MBE and emphasize growth and characterization of GaAs-based structures. The aim in this book is somewhat different; it is to demonstrate the versatility of the technique by showing how it can be utilized to prepare and explore a range of distinct and diverse materials. For each of these materials systems MBE has played a key role both in their development and application to devices.

Retaining the comprehensive and in-depth approach that cemented the bestselling first edition's place as a standard reference in the field, the Handbook of Semiconductor Manufacturing Technology, Second Edition features new and updated material that keeps it at the vanguard of today's most dynamic and rapidly growing field. Iconic experts Robert Doering and Yoshio Nishi have again assembled a team of the world's leading specialists in every area of semiconductor manufacturing to provide the most reliable, authoritative, and industry-leading information available. Stay Current with the Latest Technologies In addition to updates to nearly every existing chapter, this edition features five entirely new contributions on... Silicon-on-insulator (SOI) materials and devices Supercritical CO2 in semiconductor cleaning Low-κ dielectrics Atomic-layer deposition Damascene copper electroplating Effects of terrestrial radiation on integrated circuits (ICs) Reflecting rapid progress in many areas, several chapters were heavily revised and updated, and in some cases, rewritten to reflect rapid advances in such areas as interconnect technologies, gate dielectrics, photomask fabrication, IC packaging, and 300 mm wafer fabrication. While no book can be up-to-the-minute with the advances in the semiconductor field, the Handbook of Semiconductor Manufacturing Technology keeps the most important data, methods, tools, and techniques close at hand.

This book contains a comprehensive review of CMP (Chemical-Mechanical Planarization) technology, one of the most exciting areas in the field of semiconductor technology. It contains detailed discussions of all aspects of the technology, for both dielectrics and metals. The state of polishing models and their relation to experimental results are covered. Polishing tools and consumables are also covered. The leading edge issues of damascene and new dielectrics as well as slurryless technology are discussed.

The Guide to Semiconductor Engineering is concerned with semiconductor materials, devices and process technologies which in combination constitute an enabling force behind the growth of our technical civilization. This book was conceived and written keeping in mind those who need to learn about semiconductors, who are professionally associated with select aspects of this technical domain and want to see it in a broader context, or for those who are simply interested in state-of-the-art semiconductor engineering. In its coverage of semiconductor properties, materials, devices, manufacturing technology, and characterization methods, this Guide departs from textbook-style, monothematic in-depth discussions of each topic. Instead, it considers the entire broad field of semiconductor technology and identifies synergistic interactions within various areas in one concise volume. It is a holistic approach to the coverage of semiconductor engineering which distinguishes this Guide among other books concerned with semiconductors related issues.

Materials, Development and Performance

Proceedings of the Ninth International Vacuum Metallurgy Conference on Special Melting, San Diego, California, April 11-15, 1988

Dry Etching Technology for Semiconductors

Chemical-Mechanical Planarization of Semiconductor Materials

Handbook of Compound Semiconductors

Introduction to Semiconductor Manufacturing Technology

Handbook of Chemical Vapor Deposition: Principles, Technology and Applications provides information pertinent to the fundamental aspects of chemical vapor deposition. This book discusses the applications of chemical vapor deposition, which is a

relatively flexible technology that can accommodate many variations. Organized into 12 chapters, this book begins with an overview of the theoretical examination of the chemical vapor deposition process. This text then describes the major chemical reactions and reviews the chemical vapor deposition systems and equipment used in research and production. Other chapters consider the materials deposited by chemical vapor deposition. This book discusses as well the potential applications of chemical vapor deposition in semiconductors and electronics. The final chapter deals with ion implantation as a major process in the fabrication of semiconductors. This book is a valuable resource for scientists, engineers, and students. Production and marketing managers and suppliers of equipment, materials, and services will also find this book useful.

Semiconductor Silicon Crystal Technology provides information pertinent to silicon, which is the dominant material in the semiconductor industry. This book discusses the technology of integrated circuits (ICs) in electronic materials manufacturer. Comprised of eight chapters, this book provides an overview of the basic science, silicon materials, IC device fabrication processes, and their interaction for enhancing both the processes and materials. This text then proceeds with a discussion of the atomic structure and bonding mechanisms in order to understand the nature and formation of crystal structures, which are the fundamentals of material science. Other chapters consider the technological crystallography and classify natural crystal morphologies based on observation. The final chapter deals with the interrelationships among silicon material characteristics, circuit design, and IC fabrication in order to ensure the fabrication of very-large-scale-integration/ultra-large-scale-integration circuits. This book is a valuable resource for graduate students, physicists, engineers, materials scientists, and professionals involved in semiconductor industry.

For courses in Semiconductor Manufacturing Technology, IC Fabrication Technology, and Devices: Conventional Flow. This up-to-date text on semiconductor manufacturing processes takes into consideration the rapid development of the industry's technology. It thoroughly describes the complicated and new IC chip fabrication processes in detail with minimum mathematics, physics, and chemistry. Advanced technologies are covered along with older ones to assist students in understanding the development processes from a historic point of view.

Laser Annealing Processes in Semiconductor Technology: Theory, Modeling and Applications in Nanoelectronics synthesizes the scientific and technological advances of laser annealing processes for current and emerging nanotechnologies. The book provides an overview of the laser-matter interactions of materials and recent advances in modeling of laser-related phenomena, with the bulk of the book focusing on current and emerging (beyond-CMOS) applications. Reviewed applications include laser annealing of CMOS, group IV semiconductors, superconducting materials, photonic materials, 2D materials. This comprehensive book is ideal for post-graduate students, new entrants, and experienced researchers in academia, research and development in materials science, physics and engineering. Introduces the fundamentals of laser materials and device fabrication methods, including laser-matter interactions and laser-related phenomena Addresses advances in physical modeling and in predictive simulations of laser annealing processes such as atomistic modeling and TCAD simulations Reviews current and emerging applications of laser annealing processes such as CMOS technology and group IV semiconductors

Growth, Processing, Characterization, and Devices

Proceedings of the Symposium on Materials and New Processing Technologies for Photovoltaics

Fundamentals of Semiconductor Manufacturing and Process Control
Handbook of Chemical Vapor Deposition
A Comprehensive Guide for Semiconductor and other Hazardous Occupancies
Laser Annealing Processes in Semiconductor Technology

"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."

A summary of the science, technology, and manufacturing of semiconductor silicon materials. Properties of silicon are detailed, and a set of silicon binary phase diagrams is included. Other aspects such as materials handling, safety, impurity, and defect reduction are also discussed.

Semiconductors lie at the heart of some of the most important industries and technologies of the twentieth century. The complexity of silicon integrated circuits is increasing considerably because of the continuous dimensional shrinkage to improve efficiency and functionality. This evolution in design rules poses real challenges for the materials scientists and processing engineers. Materials, defects and processing now have to be understood in their totality. World experts discuss, in this volume, the crucial issues facing lithography, ion implication and plasma processing, metallization and insulating layer quality, and crystal growth. Particular emphasis is placed upon silicon, but compound semiconductors and photonic materials are also highlighted. The fundamental concepts of phase stability, interfaces and defects play a key role in understanding these crucial issues. These concepts are reviewed in a crucial fashion.

A description of the design principles, seen mainly from the fabrication point of view. Following a review of the historical development and of the materials used in lasing at short to long wavelengths, the book goes on to discuss the basic design principles for semiconductor-laser devices and the epitaxy for laser production. One entire chapter is devoted to the technology of liquid-phase epitaxy, while another treats vapor-phase and beam epitaxies. The whole is rounded off with mode-control techniques and an introduction to surface-emitting lasers.

Principles, Types, Properties and Applications

Guide to Semiconductor Engineering

ULSI Semiconductor Technology Atlas

Semiconductor Manufacturing Technology

Nondestructive Evaluation

Advances in CMP/polishing Technologies for the Manufacture of Electronic Devices

This book reviews the recent advances and current technologies used to produce microelectronic and optoelectronic devices from compound semiconductors. It provides a complete overview of the technologies necessary to grow bulk single-crystal substrates, grow hetero-or homoepitaxial films, and process advanced devices such as HBT's, QW diode lasers, etc.

Crystal Growth and Microprocesses
Handbook of Hydrothermal Technology
Principles, Technology and Applications

Process Technology for Semiconductor Lasers