

Advances In Chemical Mechanical Planarization Cmp Woodhead Publishing Series In Electronic And Optical Materials

Advances and Challenges in Chemical Mechanical Planarization
 Research on Chemical Mechanical Polishing Mechanism of Novel Diffusion Barrier Ru for Cu Interconnect
 Science and Technology of Chemical Mechanical Planarization (CMP):
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 Advances in Abrasive Based Machining and Finishing Processes
 Abrasive Technology
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 Advances and Challenges in Chemical Mechanical Planarization:
 Semiconductor Manufacturing Technology
 Wafer Bonding
 Atomic Layer Deposition for Semiconductors
 Chemical-Mechanical Planarization:
 Chemical Mechanical Planarization of Microelectronic Materials
 Novel Aspects of Diamond
 Ultrananocrystalline Diamond
 Advances in Chemical-Mechanical Polishing: Volume 816
 Synthesis, Properties and Applications
 Emerging Contaminants
 Chemical-Mechanical Planarization: Volume 867
 Wafer Manufacturing: Shaping of Single Crystal Silicon Wafers
 Materials Science and Technology of Optical Fabrication
 Advances in Chemical-mechanical Planarization
 Semiconductor Manufacturing Technology
 Characteristics and Applications
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 Advanced Interconnects for ULSI Technology
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KELLEY MAYRA

Advances and Challenges in Chemical Mechanical Planarization Springer Science & Business Media

The role that friction and contact play in the processes of wear and planarization on material surfaces is central to the understanding of Chemical-Mechanical planarization (CMP) technology, particularly when applied to nanosurfaces. Tribology in Chemical-Mechanical Planarization presents a detailed account of the CMP process in a language that is suitable for tribology professionals as well as chemists, materials scientists, physicists, and other applied scientists and engineers in fields of semiconductors and microelectronics. The first half of the book is devoted to CMP, while the other focuses on the fundamentals of tribology. As the first source to integrate CMP and tribology, the book illustrates the important role that these fields play in manufacturing and technological development. It follows with an examination of tribological principles and their applications in CMP, including integrated circuits, basic concepts in surfaces of contacts, and common defects. Other topics covered in depth include basics of friction, flash temperature, lubrication fundamentals, basics of wear, polishing particles, and pad wear. The book concludes its focus with CMP practices, discussing mechanical aspects, pad materials, elastic modulus, and cell buckling. Expanding upon the science and technology of tribology to improve the reliability, maintenance, and wear of technical equipment and other material applications, Tribology in Chemical-Mechanical Planarization provides scientists and engineers with clear foresight to the future of this technology.

Research on Chemical Mechanical Polishing Mechanism of Novel Diffusion Barrier Ru for Cu Interconnect John Wiley & Sons

Chemical-mechanical planarization (CMP) has emerged as a critical fabrication technology for advanced integrated circuits. Even as the applications of CMP have diversified and we have begun to understand aspects of the physics and chemistry of the process, a new generation of CMP innovations is unfolding. New slurries and consumables are under development. New applications to novel devices continue to appear. This book, the most recent in a successful series on CMP, offers a review of the advances to date and provides a comprehensive discussion of the future challenges that must be overcome. Presentations from academia, government labs and industry are featured. Topics include; CMP modeling; CMP science; CMP slurries and particles for planarization of copper, oxide, and other materials; planarization applications including shallow trench isolation (STI), copper damascene, and novel devices and CMP integration.

Science and Technology of Chemical Mechanical Planarization (CMP): Cambridge University Press

Microelectronic Packaging analyzes the massive impact of electrochemical technologies on various levels of microelectronic packaging. Traditionally, interconnections within a chip were considered outside the realm of packaging technologies, but this book emphasizes the importance of chip wiring as a key aspect of microelectronic packaging, and focuses on electrochemical processing as an enabler of advanced chip metallization. Divided into five parts, the book begins by outlining the basics of electrochemical processing, defining the microelectronic packaging hierarchy, and emphasizing the impact of electrochemical technology on packaging. The second part discusses chip metallization topics including the development of robust barrier layers and alternative metallization materials. Part III explores key aspects of chip-package interconnect technologies, followed by Part IV's analysis of packages, boards, and connectors which covers materials development, technology

trends in ceramic packages and multi-chip modules, and electroplated contact materials. Illustrating the importance of processing tools in enabling technology development, the book concludes with chapters on chemical mechanical planarization, electroplating, and wet etching/cleaning tools. Experts from industry, universities, and national laboratories submitted reviews on each of these subjects, capturing the technological advances made in each area. A detailed examination of how packaging responds to the challenges of Moore's law, this book serves as a timely and valuable reference for microelectronic packaging and processing professionals and other industrial technologists.

Science and Technology of Chemical Mechanical Planarization (CMP): BoD - Books on Demand
 Advances in Chemical Mechanical Planarization (CMP) Woodhead Publishing

Advances in Abrasive Based Machining and Finishing Processes Cambridge University Press
 Finding new materials for copper/low-k interconnects is critical to the continuing development of computer chips. While copper/low-k interconnects have served well, allowing for the creation of Ultra Large Scale Integration (ULSI) devices which combine over a billion transistors onto a single chip, the increased resistance and RC-delay at the smaller scale has become a significant factor affecting chip performance. Advanced Interconnects for ULSI Technology is dedicated to the materials and methods which might be suitable replacements. It covers a broad range of topics, from physical principles to design, fabrication, characterization, and application of new materials for nano-interconnects, and discusses: Interconnect functions, characterisations, electrical properties and wiring requirements Low-k materials: fundamentals, advances and mechanical properties Conductive layers and barriers Integration and reliability including mechanical reliability, electromigration and electrical breakdown New approaches including 3D, optical, wireless interchip, and carbon-based interconnects Intended for postgraduate students and researchers, in academia and industry, this book provides a critical overview of the enabling technology at the heart of the future development of computer chips.

Abrasive Technology Springer Science & Business Media

Technology requirements associated with the progressive scaling of devices for future technology nodes, coupled with the aggressive introduction of new materials, places tremendous demands on chemical-mechanical polishing. The goal of this 2005 book, which is part of a popular series from MRS, is to bring together experts from a broad spectrum of research and technology groups currently working on CMP, to review advances made, and to offer a comprehensive discussion of future challenges that must be overcome. The book shows trends in the development of consumables, process modules, tool designs, process integration, modeling, defect characterization, and metrology. Topics include: planarization processes and applications; consumables -CMP pads and slurries; CMP equipment and metrology; and CMP modeling and simulation.

Advances in Chemical Mechanical Planarization (CMP) John Wiley & Sons

This book presents the advances in abrasive based machining and finishing in broad sense. Specifically, the book covers the novel machining and finishing strategies implemented in various advanced machining processes for improving machining accuracy and overall quality of the product. This book presents the capability of advanced machining processes using abrasive grain. It also covers ways for enhancing the production rate as well as quality. It fulfills the gap between the production of any complicated components and successful machining with abrasive particles.
Advances and Challenges in Chemical Mechanical Planarization: Springer Science & Business Media
 A practical guide to semiconductor manufacturing from process control to yield modeling and experimental design Fundamentals of Semiconductor Manufacturing and Process Control covers all issues involved in manufacturing microelectronic devices and circuits, including fabrication

sequences, process control, experimental design, process modeling, yield modeling, and CIM/CAM systems. Readers are introduced to both the theory and practice of all basic manufacturing concepts. Following an overview of manufacturing and technology, the text explores process monitoring methods, including those that focus on product wafers and those that focus on the equipment used to produce wafers. Next, the text sets forth some fundamentals of statistics and yield modeling, which set the foundation for a detailed discussion of how statistical process control is used to analyze quality and improve yields. The discussion of statistical experimental design offers readers a powerful approach for systematically varying controllable process conditions and determining their impact on output parameters that measure quality. The authors introduce process modeling concepts, including several advanced process control topics such as run-by-run, supervisory control, and process and equipment diagnosis. Critical coverage includes the following: * Combines process control and semiconductor manufacturing * Unique treatment of system and software technology and management of overall manufacturing systems * Chapters include case studies, sample problems, and suggested exercises * Instructor support includes electronic copies of the figures and an instructor's manual Graduate-level students and industrial practitioners will benefit from the detailed examination of how electronic materials and supplies are converted into finished integrated circuits and electronic products in a high-volume manufacturing environment. An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department. An Instructor Support FTP site is also available.

Semiconductor Manufacturing Technology Springer Science & Business Media

In this book, Quirk and Serda introduce the terminology, concepts, processes, products, and equipment commonly used in the manufacture of ultra large scale integrated (ULSI) semiconductors. The book provides helpful, up-to-date technical information about semiconductor manufacturing and strikes an effective balance between the process and equipment technology found in wafer fabrications. Topics include copper interconnect; dual damascene additive process for metallization; deep UV sub-micron photolithography (.18 micron and below); low-k dielectric processing; chemical mechanical planarization; a comprehensive model of manufacturing process; chemical-mechanical polish (CMP); and maintenance and troubleshooting. For practicing semiconductor manufacturing technicians or those interested in semiconductor manufacturing technology and processes.

Wafer Bonding William Andrew

Covers the fundamental science of grinding and polishing by examining the chemical and mechanical interactions over many scale lengths Manufacturing next generation optics has been, and will continue to be, enablers for enhancing the performance of advanced laser, imaging, and spectroscopy systems. This book reexamines the age-old field of optical fabrication from a materials-science perspective, specifically the multiple, complex interactions between the workpiece (optic), slurry, and lap. It also describes novel characterization and fabrication techniques to improve and better understand the optical fabrication process, ultimately leading to higher quality optics with higher yield. Materials Science and Technology of Optical Fabrication is divided into two major parts. The first part describes the phenomena and corresponding process parameters affecting both the grinding and polishing processes during optical fabrication. It then relates them to the critical resulting properties of the optic (surface quality, surface figure, surface roughness, and material removal rate). The second part of the book covers a number of related topics including: developed forensic tools used to increase yield of optics with respect to surface quality (scratch/dig) and fracture loss; novel characterization and fabrication techniques used to understand/quantify the fundamental phenomena described in the first part of the book; novel and recent optical fabrication processes and their connection with the fundamental interactions; and finally, special techniques utilized to fabricate optics with high damage resistance. Focuses on the fundamentals of grinding and polishing, from a materials science viewpoint, by studying the chemical and mechanical interactions/phenomena over many scale lengths between the workpiece, slurry, and lap Explains how these phenomena affect the major characteristics of the optic workpiece—namely surface figure, surface quality, surface roughness, and material removal rate Describes methods to improve the major characteristics of the workpiece as well as improve process yield, such as through fractography and scratch forensics Covers novel characterization and fabrication techniques used to understand and quantify the fundamental phenomena of various aspects of the workpiece or fabrication process Details novel and recent optical fabrication processes and their connection with the fundamental interactions Materials Science and Technology of Optical Fabrication is an excellent guidebook for process engineers, fabrication engineers, manufacturing engineers, optical scientists, and opticians in the optical fabrication industry. It will also be helpful for students studying material science and applied optics/ photonics.

Atomic Layer Deposition for Semiconductors Springer Science & Business Media

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.

Chemical-Mechanical Planarization: Pearson College Division

First introduced about a decade ago, the first edition of the Handbook of Semiconductor Interconnection Technology became widely popular for its thorough, integrated treatment of interconnect technologies and its forward-looking perspective. The field has grown tremendously in the interim and many of the "likely directions" outlined in the first ed

Chemical Mechanical Planarization of Microelectronic Materials Cambridge University Press
Advances in Chemical Mechanical Planarization (CMP), Second Edition provides the latest information on a mainstream process that is critical for high-volume, high-yield semiconductor manufacturing, and even more so as device dimensions continue to shrink. The second edition includes the recent advances of CMP and its emerging materials, methods, and applications, including coverage of post-CMP cleaning challenges and tribology of CMP. This important book offers a systematic review of fundamentals and advances in the area. Part one covers CMP of dielectric and metal films, with chapters focusing on the use of current and emerging techniques and processes and on CMP of various materials, including ultra low-k materials and high-mobility channel materials, and ending with a chapter reviewing the environmental impacts of CMP processes. New content addressed includes CMP challenges with tungsten, cobalt, and ruthenium as interconnect and barrier films, consumables for ultralow topography and CMP for memory devices. Part two addresses consumables and process control for improved CMP and includes chapters on CMP pads, diamond disc pad conditioning, the use of FTIR spectroscopy for characterization of surface processes and approaches for defect characterization, mitigation, and reduction. Advances in Chemical Mechanical Planarization (CMP), Second Edition is an invaluable resource and key reference for materials scientists and engineers in academia and R&D. Reviews the most relevant techniques and processes for CMP of dielectric and metal films Includes chapters devoted to CMP for current and emerging materials Addresses consumables and process control for improved CMP, including post-CMP

Novel Aspects of Diamond CRC Press

Ultrananocrystalline Diamond: Synthesis, Properties, and Applications is a unique practical reference handbook. Written by the leading experts worldwide it introduces the science of UNCD for both the R&D community and applications developers using UNCD in a diverse range of applications from macro to nanodevices, such as energy-saving ultra-low friction and wear coatings for mechanical pump seals and tools, high-performance MEMS/NEMS-based systems (e.g. in telecommunications), the next generation of high-definition flat panel displays, in-vivo biomedical implants, and biosensors. This work brings together the basic science of nanoscale diamond structures, with detailed information on ultra-nanodiamond synthesis, properties, and applications. The book offers discussion on UNCD in its two forms, as a powder and as a chemical vapor deposited film. Also discussed are the superior mechanical, tribological, transport, electrochemical, and electron emission properties of UNCD for a wide range of applications including MEMS/ NEMS, surface acoustic wave (SAW) devices, electrochemical sensors, coatings for field emission arrays, photonic and RF switching, biosensors, and neural prostheses, etc. Ultrananocrystalline Diamond summarises the most recent developments in the nanodiamond field, and presents them in a way that will be useful to the R&D community in both academic and corporate sectors. Coverage of both nanodiamond particles and films make this a valuable resource for both the nanotechnology community and the field of thin films / vacuum deposition. Written by the world's leading experts in nanodiamond, this second edition builds on its predecessor's reputation as the most up-to-date resource in the field.

Ultrananocrystalline Diamond World Scientific

The topics include bonding-based fabrication methods of silicon-on-insulator, photonic crystals, VCSELs, SiGe-based FETs, MEMS together with hybrid integration and laser lift-off. The non-specialist will learn about the basics of wafer bonding and its various application areas, while the researcher in the field will find up-to-date information about this fast-moving area, including relevant patent information.

Advances in Chemical-Mechanical Polishing: Volume 816 John Wiley & Sons

Advances in Chemical Mechanical Planarization (CMP) provides the latest information on a mainstream process that is critical for high-volume, high-yield semiconductor manufacturing, and even more so as device dimensions continue to shrink. The technology has grown to encompass the removal and planarization of multiple metal and dielectric materials and layers both at the device and the metallization levels, using different tools and parameters, requiring improvements in the control of topography and defects. This important book offers a systematic review of fundamentals and advances in the area. Part One covers CMP of dielectric and metal films, with chapters focusing on the use of particular techniques and processes, and on CMP of particular various materials, including ultra low-k materials and high-mobility channel materials, and ending with a chapter reviewing the environmental impacts of CMP processes. Part Two addresses consumables and process control for improved CMP, and includes chapters on the preparation and characterization of slurry, diamond disc pad conditioning, the use of FTIR spectroscopy for characterization of surface processes, and approaches for defect characterization, mitigation, and reduction. Considers techniques and processes for CMP of dielectric and metal films Includes chapters devoted to CMP for particular materials Addresses consumables and process control for improved CMP

Synthesis, Properties and Applications CRC Press

Emerging Contaminants presents the reader with information on classification, recent studies, and adverse effects on the environment and human health of the main classes of contaminants. Emerging contaminants are synthetic or natural compounds and microorganisms produced and used by humans that cause adverse ecological and human health effects when they reach the environment. This book is organized into four sections that cover the classification of contaminants and the instrumental techniques used to quantify them, recent studies on pesticides, antibiotics as an important group of emerging contaminants, and studies of different classes of emerging contaminants such as polybrominated diphenyl ethers (PBDEs), microplastics, and others.

Emerging Contaminants National Academies Press

Chemical Mechanical Planarization (CMP) plays an important role in today's microelectronics industry. With its ability to achieve global planarization, its universality (material insensitivity), its applicability to multimaterial surfaces, and its relative cost-effectiveness, CMP is the ideal planarizing medium for the interlayered dielectrics and metal films used in silicon integrated circuit fabrication. But although the past decade has seen unprecedented research and development into CMP, there has been no single-source reference to this rapidly emerging technology-until now. Chemical Mechanical Planarization of Microelectronic Materials provides engineers and scientists working in the microelectronics industry with unified coverage of both the fundamental mechanisms and engineering applications of CMP. Authors Steigerwald, Murarka, and Gutmann—all leading CMP pioneers—provide a historical overview of CMP, explain the various chemical and mechanical concepts involved, describe CMP materials and processes, review the latest scientific data on CMP worldwide, and offer examples of its uses in the microelectronics industry. They provide detailed coverage of the CMP of various materials used in the making of microcircuitry: tungsten, aluminum, copper, polysilicon, and various dielectric materials, including polymers. The concluding chapter describes post-CMP cleaning techniques, and most chapters feature problem sets to assist readers in developing a more practical understanding of CMP. The only comprehensive reference to one of the fastest growing integrated circuit manufacturing technologies, Chemical Mechanical Planarization of Microelectronic Materials is an important resource for research scientists and engineers working in the microelectronics industry. An indispensable resource for scientists and engineers working in the microelectronics industry Chemical Mechanical Planarization of Microelectronic Materials is the only comprehensive single-source reference to one of the fastest growing integrated circuit manufacturing technologies. It provides engineers and scientists who work in the microelectronics industry with unified coverage of both the fundamental mechanisms and engineering applications of CMP, including: * The history of CMP * Chemical and mechanical underpinnings of CMP * CMP materials and processes * Applications of CMP in the microelectronics industry * The CMP of tungsten, aluminum, copper, polysilicon, and various dielectrics, including polymers used in integrated circuit fabrication * Post-CMP cleaning techniques * Chapter-end problem sets are also included to assist readers in developing a practical understanding of CMP.

Chemical-Mechanical Planarization: Volume 867 Cambridge University Press

The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners. This book, first published in 2004, presents advances in fundamental understanding, development, and applications of chemical-mechanical polishing (CMP).

Wafer Manufacturing: Shaping of Single Crystal Silicon Wafers John Wiley & Sons

This comprehensive volume provides an in-depth discussion of the fundamentals of cleaning and surface conditioning of semiconductor applications such as high-k/metal gate cleaning, copper/low-k cleaning, high dose implant stripping, and silicon and SiGe passivation. The theory and fundamental physics associated with wet etching and wet cleaning is reviewed, plus the surface and colloidal aspects of wet processing. Formulation development practices and methodology are presented along with the applications for preventing copper corrosion, cleaning aluminum lines, and other sensitive layers. This is a must-have reference for any engineer or manager associated with using or supplying cleaning and contamination free technologies for semiconductor manufacturing. From the

Reviews... "This handbook will be a valuable resource for many academic libraries. Many engineering librarians who work with a variety of programs (including, but not limited to Materials Engineering) should include this work in their collection. My recommendation is to add this work to

any collection that serves a campus with a materials/manufacturing/electrical/computer engineering programs and campuses with departments of physics and/or chemistry with large graduate-level enrollment." —Randy Wallace, Department Head, Discovery Park Library, University of North Texas

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