

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

Finishing is the final operation after a part is sized and shaped. Currently in high tech industries, there is a demand for nano level surface finishing of components. This process is done to improve the surface finish, to remove the recast layer, or to remove surface and sub-surface defects. The result is low friction, longer product life, and low power requirements. Equally important is the aesthetic aspect of the product. This subject is growing very fast from the technology as well as a science point of view. Books on this subject are very limited, particularly those ones that deal with both the science as well as the technology aspects. 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.

Advances in Chemical Mechanical Planarization (CMP) Woodhead Publishing  
Chemical mechanical planarization (CMP) has been a leading-edge technology in semiconductor processing for the past 15-20 years. A successful CMP process is based in fundamental science across the disciplines of mechanical engineering, chemical engineering, colloid science, materials science and chemistry. Traditionally, the MRS Spring Meeting serves as a nexus for multidisciplinary interaction and discussion between CMP researchers in both industry and academia. The papers in this book are from the 2007 MRS Spring Meeting and address the fluid and wear mechanics that occur when using CMP tools and pad/slurry consumables, as well as the surface mechanisms required for effective post-CMP cleaning. It also focuses on new successes and challenges in technologies such as electrochemical mechanical planarization (eCMP), three-dimensional integration and advanced CMP process modeling and control strategies.

The subject matter of this book is the information on the abrasive technology methods, the characteristics of the methods (for example, the technological parameters, tools, and machines), innovative methods, characteristics of surface structure and surface properties after this type of mechanical process, and application in various industrial branches and other technical and technological domains. Abrasive technology is very important, for example, in precision component manufacturing and nano-technology devices. The aim of this book is to present information on the characteristics and applications of abrasive technology, abrasive tools, tests, and also the innovative methods of this

technology. This information enables scientists, engineers, and designers to ensure the soundness and integrity of the fabricated components and to develop new techniques effectively.

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.

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. 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. Tribocorrosion causes the degradation or alteration of materials through the combined action of corrosion and wear. It limits the performance and life-time of installations, machines and devices with moving parts, and controls certain manufacturing processes such as chemical-mechanical polishing. The effects of tribocorrosion are most pronounced on passive metals which owe their corrosion resistance to a thin protecting oxide film. Most corrosion-resistant engineering alloys belong to this category. This book provides an introduction to the developing field of tribocorrosion and an overview of the latest research. Part one reviews basic notions of corrosion and tribology, before presenting the most recent results on the growth and structure of passive oxide films. Tribocorrosion mechanisms under fretting, sliding and erosion conditions, respectively, are then discussed. Part two focuses on methods for measuring and preventing tribocorrosion. It includes chapters on electrochemical techniques, the design of tribocorrosion test equipment, data evaluation and the optimisation of materials'

properties for tribocorrosion systems. Part three presents a selection of tribocorrosion problems in engineering and medicine. Three chapters address the tribocorrosion of medical implants including test methods and clinical implications. Other chapters examine tribocorrosion issues in nuclear power plants, marine environments, automotive cooling circuits, elevated-temperature metal working and chemical–mechanical polishing. With its distinguished editors and international team of expert contributors Tribocorrosion of passive metals and coatings is an invaluable reference tool for engineers and researchers in industry and academia confronted with tribocorrosion problems.

Comprehensively reviews current research on the tribocorrosion of passive metals and coatings, with particular reference to the design of tribocorrosion test equipment, data evaluation and the optimisation of materials' properties for tribocorrosion systems Chapters discuss tribocorrosion mechanisms under fretting, sliding and erosion conditions before focussing on methods for measuring and preventing tribocorrosion Includes a comprehensive selection of tribocorrosion problems in engineering and medicine, such as the tribocorrosion of medical implants, and tribocorrosion issues in nuclear power plants, marine environments, automotive cooling circuits and elevated-temperature metal working

The first comprehensive guide to the chemicals and gases used in semiconductor manufacturing The fabrication of semiconductor devices involves a series of complex chemical processes such as photolithography, etching, cleaning, thin film deposition, and polishing. Until now, there has been no convenient source of information on the properties, applications, and health and safety considerations of the chemicals used in these processes. The Handbook of Chemicals and Gases for the Semiconductor Industry meets this need. Each of the Handbook's eight chapters is related to a specific area of semiconductor processing. The authors provide a brief overview of each step in the process, followed by tables containing physical properties, handling, safety, and other pertinent information on chemicals and gases typically used in these processes. The 270 chemical and gas entries include data on physical properties, emergency treatment procedures, waste disposal, and incompatible materials, as well as descriptions of applications, chemical mechanisms involved, and references to the literature. Appendices cross-reference entries by process, chemical name, and CAS number. The Handbook's eight chapters are: Thin Film Deposition Materials Wafer Cleaning Materials Photolithography Materials Wet and Dry Etching Materials Chemical Mechanical Planarizing Methods Carrier Gases Uncategorized Materials Semiconductor Chemicals Analysis No other single source brings together these useful and important data on chemicals and gases used in the manufacture of semiconductor devices. The Handbook of Chemicals and Gases for the Semiconductor Industry will be a valuable reference for process engineers, scientists, suppliers to the semiconductor industry, microelectronics researchers, and students.

Run-to-run (R2R) control is cutting-edge technology that allows modification of a product recipe between machine "runs," thereby minimizing process drift, shift, and variability-and with them, costs. Its effectiveness has been demonstrated in a variety of processes, such as vapor phase epitaxy, lithography, and chemical mechanical planarization. The only barrier to the semiconductor industry's widespread adoption of this highly effective process control is a lack of understanding of the technology. Run to Run Control in Semiconductor Manufacturing overcomes that barrier by offering in-depth analyses of R2R control.

In the development of next-generation nanoscale devices, higher speed and lower power operation is the name of the game. Increasing reliance on mobile computers, mobile phone, and other electronic devices demands a greater degree of speed and power. As chemical mechanical planarization (CMP) progressively becomes perceived less as black art and more as a cutting-edge technology, it is emerging as the technology for achieving higher performance devices. Nanoparticle Engineering for Chemical-Mechanical Planarization explains the physicochemical properties of nanoparticles according to each step in the CMP process, including dielectric CMP, shallow trench isolation CMP, metal CMP, poly isolation CMP, and noble metal CMP. The authors provide a detailed guide to nanoparticle engineering of novel CMP slurry for next-generation nanoscale devices below the 60nm design rule. They present design techniques using polymeric additives to improve CMP performance. The final chapter focuses on novel CMP slurry for the application to memory devices beyond 50nm technology. Most books published on CMP focus on the polishing process, equipment, and cleaning. Even though some of these books may touch on CMP slurries, the methods they cover are confined to conventional slurries and none cover them with the detail required for the development of next-generation devices. With its coverage of fundamental concepts and novel technologies, this book delivers expert insight into CMP for all current and next-generation systems. 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

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.

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.

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

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.

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. 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 diamond disc pad conditioning, the use of FTIR spectroscopy for characterization of surface processes, and approaches for deflection characterization, mitigation, and reduction. The second edition includes coverage of post-CMP cleaning challenges and tribology of CMP.

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

The latest knowledge on mineral ore genesis and the exploration of ore deposits Global demand for metals has risen considerably over the past decade. Geologists are developing new approaches for studying ore deposits and discovering new sources.

Ore Deposits: Origin, Exploration, and Exploitation is a compilation of diverse case studies on new prospects in ore deposit geology including atypical examples of mineral deposits and new methods for ore exploration. Volume highlights include: Presentation of the latest research on a range of ore deposit types Application of ore deposits to multiple areas of geology and geophysical exploration Emphasis on diverse methods and tools for the study of ore deposits Useful case studies for geologists in both academia and industry Ore Deposits: Origin, Exploration, and Exploitation is a valuable resource for economic geologists, mineralogists, petrologists, geochemists, mining engineers, research professionals, and advanced students in relevant areas of academic study.

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

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 defection 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

The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners. This volume was first published in 2001. Microfabrication is the key technology behind integrated circuits, microsensors, photonic crystals, ink jet printers, solar cells and flat panel displays. Microsystems can be complex, but the basic microstructures and processes of microfabrication are fairly simple. Introduction to Microfabrication shows how the common microfabrication concepts can be applied over and over again to create devices with a wide variety of structures and functions. Featuring:

- \* A comprehensive presentation of basic fabrication processes
- \* An emphasis on materials and microstructures, rather than device physics
- \* In-depth discussion on process integration showing how processes, materials and devices interact
- \* A wealth of examples of both conceptual and real devices

Introduction to Microfabrication includes 250 homework problems for students to familiarise themselves with micro-scale materials, dimensions, measurements, costs and scaling trends. Both research and manufacturing topics are covered, with an emphasis on silicon, which is the workhorse of microfabrication. This book will serve as an excellent first text for electrical engineers, chemists, physicists and materials scientists who wish to learn about microstructures and microfabrication techniques, whether in MEMS, microelectronics or emerging applications.

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.

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.

An authoritative, systematic, and comprehensive description of current CMP technology Chemical Mechanical Planarization (CMP) provides the greatest degree of planarization of any known technique. The current standard for integrated circuit (IC) planarization, CMP is playing an increasingly important role in other related applications such as microelectromechanical systems (MEMS) and computer hard drive manufacturing. This reference focuses on the chemical aspects of the technology and includes contributions from the foremost experts on specific applications. After a detailed overview of the fundamentals and basic science of CMP, Microelectronic Applications of Chemical Mechanical Planarization:

- \* Provides in-depth coverage of a wide range of state-of-the-art technologies and applications
- \* Presents information on new designs, capabilities, and emerging technologies, including topics like CMP with nanomaterials and 3D chips
- \* Discusses different types of CMP tools, pads for IC CMP, modeling, and the applicability of tribometry to various aspects of CMP
- \* Covers nanotopography, CMP performance and defect profiles, CMP waste treatment, and the chemistry and colloidal properties of the slurries used in CMP
- \* Provides a perspective on the opportunities and challenges of the next fifteen years

Complete with case studies, this is a valuable, hands-on resource for professionals, including process engineers, equipment engineers, formulation chemists, IC manufacturers, and others. With systematic organization and questions at the end of each chapter to facilitate learning, it is an ideal introduction to CMP and an excellent text for students in advanced graduate courses that cover CMP or related semiconductor manufacturing processes.

This thesis addresses selected unsolved problems in the chemical mechanical polishing process (CMP) for integrated circuits using ruthenium (Ru) as a novel barrier layer material. Pursuing a systematic approach to resolve the remaining critical issues in the CMP, it first investigates the tribocorrosion properties and the material removal mechanisms of copper (Cu) and Ru in KIO<sub>4</sub>-based slurry. The thesis subsequently studies Cu/Ru galvanic corrosion from a new micro and in-situ perspective, and on this basis, seeks ways to mitigate corrosion using different slurry additives. The findings presented here constitute a significant advance in fundamental and technical investigations into the CMP, while also laying the groundwork for future research.

In Advanced ULSI interconnects – fundamentals and applications we bring a comprehensive description of copper-based interconnect technology for ultra-large scale integration (ULSI) technology for integrated circuit (IC) application. Integrated circuit technology is the base for all modern electronics systems. You can find electronics systems today everywhere: from toys and home appliances to airplanes and space

shuttles. Electronics systems form the hardware that together with software are the bases of the modern information society. The rapid growth and vast exploitation of modern electronics system create a strong demand for new and improved electronic circuits as demonstrated by the amazing progress in the field of ULSI technology. This progress is well described by the famous "Moore's law" which states, in its most general form, that all the metrics that describe integrated circuit performance (e. g. , speed, number of devices, chip area) improve exponentially as a function of time. For example, the number of components per chip doubles every 18 months and the critical dimension on a chip has shrunk by 50% every 2 years on average in the last 30 years. This rapid growth in integrated circuits technology results in highly complex integrated circuits with an increasing number of interconnects on chips and between the chip and its package. The complexity of the interconnect network on chips involves an increasing number of metal lines per interconnect level, more interconnect levels, and at the same time a reduction in the interconnect line critical dimensions.

Lapping and polishing are currently the most precise surface finishing processes for mechanical and electronic components. Unfortunately, most improvements in either methods or understanding of the physical processes involved are closely guarded as proprietary information. The Handbook of Lapping and Polishing is the first source in English to bring to the light of day the physical fundamentals and advanced technologies at the leading edge of modern lapping and polishing practice. Collecting decisive work contributed by industrial and academic experts from the USA, Germany, and Japan, this authoritative resource presents the latest lapping and polishing technologies along with case studies that illustrate their value. After a brief introduction, the book explains the fundamental concepts and major types of lapping and polishing processes. The discussion then turns to lapping of ductile and brittle materials followed by an in-depth look at lapping machines and equipment. Rounding out the presentation, the final chapters discuss polishing technologies and equipment as well as the latest on chemical-mechanical polishing (CMP) and its applications in the semiconductor industry. Offering an integrated approach to both theory and practical applications under a single cover, the Handbook of Lapping and Polishing supplies a definitive survey of the most advanced surface finishing technologies available.

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 deflection 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

While now in widespread use in integrated circuit fabrication, chemical-mechanical polishing (CMP) is also starting to appear in a surprisingly wide range of applications, with a growing variety of processes and technologies. This book, first published in 2004, presents advances in fundamental understanding, development, and applications of CMP. CMP of both conventional and nonconventional materials are discussed. Conventional materials polished using CMP include silicon, oxides and nitrides, polysilicon, and other insulating films, as well as copper, tungsten, barrier films, and other metal films. Nonconventional materials include those of increasing importance in advanced semiconductor, MEMS, and nanotechnologies, such as low-k dielectrics and polymer, nickel, and ruthenium films. CMP in IC fabrication continues to pose substantial problems - for virgin silicon wafer preparation, shallow-trench isolation (STI) structures, and poly or other deep-trench structure formation, as well as copper and low-k metal interconnect. New developments in CMP pads and slurries are presented. Novel polishing methods and are described. Advances in CMP process understanding and modeling are also highlighted.

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