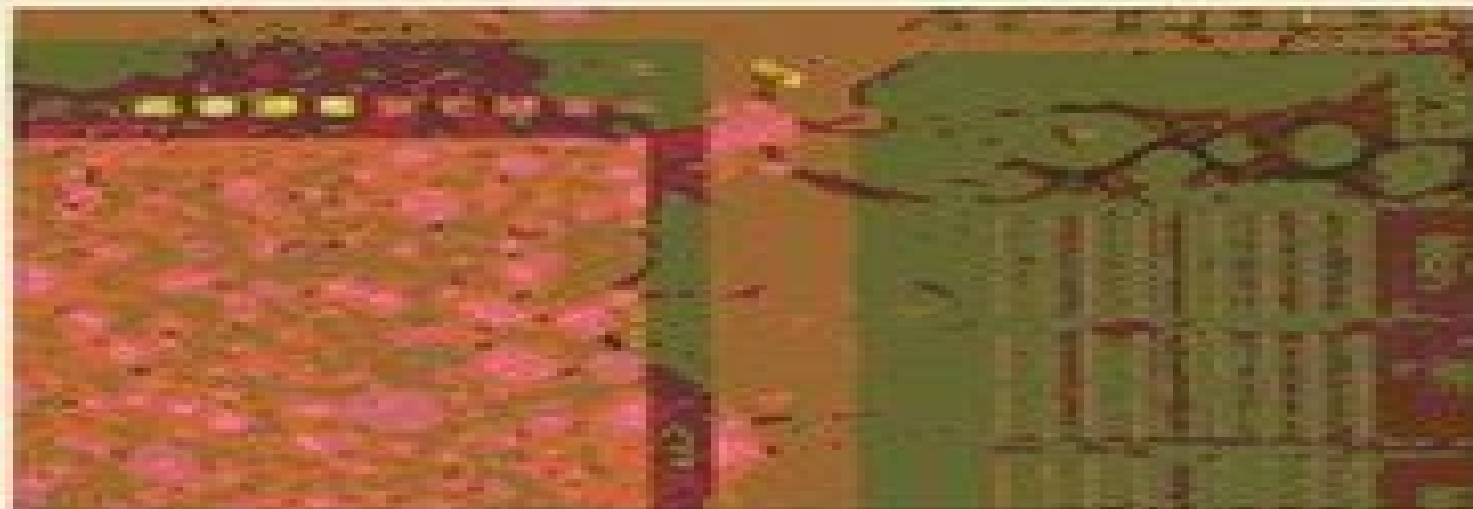


Handbook of Cleaning for Semiconductor Manufacturing

Fundamentals and Applications



Edited by Karen A. Reinhardt and Richard E. Reidy

 WILEY

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Handbook For Cleaning For Semiconductor Manufacturing Fundamentals And Applications

Yannick Le Tiec



Handbook For Cleaning For Semiconductor Manufacturing Fundamentals And Applications:

Handbook for Cleaning for Semiconductor Manufacturing Karen A. Reinhardt, Richard F. Reidy, 2011-04-12

Provides an In depth discussion of surface conditioning for semiconductor applications The Handbook of Cleaning for Semiconductor Manufacturing Fundamentals and Applications provides an in depth discussion of surface conditioning for semiconductor applications The fundamental physics and chemistry associated with wet processing is reviewed as well as surface and colloidal aspects of cleaning and etching Topics covered in this new reference include Front end line FEOL and back end of line BEOL cleaning applications such as high k metal gate post etch cleaning and pore sealing high dose implant stripping and cleaning and germanium and silicon passivation Formulation development practices methodology and a new directions are presented including chemicals used for preventing corrosion of copper lines cleaning aluminium lines reclaiming wafers and water bonding as well as the filtering and recirculating of chemicals including reuse and recycling Wetting cleaning and drying of features such as high aspect ratio features and hydrophilic surface states especially how to dry without watermarks the abilities to wet hydrophobic surfaces and to remove liquid from deep features The chemical reactions and mechanisms of silicon dioxide etching with hydrofluoric acid particle removal with ammonium hydroxide hydrogen peroxide mixture and metal removal with hydrochloric acid The Handbook of Cleaning for Semiconductor Manufacturing Fundamentals and Applications is a valuable resource for any engineer or manager associated with using or supplying cleaning and contamination free technologies for semiconductor manufacturing Engineers working for semiconductor manufacturing capital equipment chemicals or other industries that assures cleanliness of chemicals material and equipment in the manufacturing area will also find this handbook an indispensable reference

Handbook for Cleaning for Semiconductor Manufacturing Karen A. Reinhardt, Richard F. Reidy, 2011-01-11 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

Developments in

Surface Contamination and Cleaning: Methods for Surface Cleaning Rajiv Kohli, Kashmiri L. Mittal, 2016-11-04

Developments in Surface Contamination and Cleaning Methods for Surface Cleaning Volume 9 part of the Developments in Surface Contamination and Cleaning series provide a state of the art guide to the current knowledge on the behavior of film type and particulate surface contaminants and their associated cleaning methods This newest volume in the series discusses methods of surface cleaning of contaminants and the resources that are needed to deal with them Taken as a whole the series forms a unique reference for professionals and academics working in the area of surface contamination and cleaning A strong theme running through the series is that of surface contamination and cleaning at the micro and nano scales Provides a comprehensive coverage of innovations in surface cleaning Written by established experts in the surface cleaning field presenting an authoritative resource Contains a comprehensive review of the state of the art including case studies to enhance the learning process

Chemistry in Microelectronics Yannick Le Tiec, 2013-02-28 Chemistry in

Microelectronics Microelectronics is a complex world where many sciences need to collaborate to create nano objects we need expertise in electronics microelectronics physics optics and mechanics also crossing into chemistry electrochemistry as well as biology biochemistry and medicine Chemistry is involved in many fields from materials chemicals gases liquids or salts the basics of reactions and equilibrium to the optimized cleaning of surfaces and selective etching of specific layers In addition over recent decades the size of the transistors has been drastically reduced while the functionality of circuits has increased This book consists of five chapters covering the chemicals and sequences used in processing from cleaning to etching the role and impact of their purity along with the materials used in Front End Of the Line which corresponds to the heart and performance of individual transistors then moving on to the Back End Of the Line which is related to the interconnection of all the transistors Finally the need for specific functionalization also requires key knowledge on surface treatments and chemical management to allow new applications

Semiconductor Manufacturing Handbook 2E (PB)

Hwaiyu Geng, 2017-10-06 Thoroughly Revised State of the Art Semiconductor Design Manufacturing and Operations Information Written by 70 international experts and reviewed by a seasoned technical advisory board this fully updated resource clearly explains the cutting edge processes used in the design and fabrication of IC chips MEMS sensors and other electronic devices Semiconductor Manufacturing Handbook Second Edition covers the emerging technologies that enable the Internet of Things the Industrial Internet of Things data analytics artificial intelligence augmented reality and smart manufacturing You will get complete details on semiconductor fundamentals front and back end processes nanotechnology photovoltaics gases and chemicals fab yield and operations and facilities Nanotechnology and microsystems manufacturing FinFET and nanoscale silicide formation Physical design for high performance low power 3D circuits Epitaxial anneals RTP and oxidation Microlithography etching and ion implantations Physical chemical electrochemical and atomic layer vapor deposition Chemical mechanical planarization Atomic force metrology Packaging bonding and interconnects Flexible hybrid

electronics Flat panel flexible display electronics and photovoltaics Gas distribution systems Ultrapure water and filtration Process chemicals handling and abatement Chemical and slurry handling systems Yield management CIM and factory automation Manufacturing execution systems Advanced process control Airborne molecular contamination ESD controls in clean room environments Vacuum systems and RF plasma systems IC manufacturing parts cleaning technology Vibration and noise design And much more *Solar Manufacturing: Environmental Design Concepts for Solar Modules* Michelle

Poliskie,2013-07-22 Publisher's Note Products purchased from Third Party sellers are not guaranteed by the publisher for quality authenticity or access to any online entitlements included with the product THE LATEST SUSTAINABLE DESIGN TECHNIQUES FOR SOLAR MODULES Solar Manufacturing Environmental Design Concepts for Solar Modules explains the sustainable development methods used by today's leading photovoltaic companies After reviewing various photovoltaic technologies and providing an overview of sustainable development this practical guide illustrates how to apply sustainable development metrics to solar modules The book describes how metrics are included in regulations and how regulations can present barriers to market entry Innovative product development trends used to improve the environmental attributes of solar modules are discussed in this timely resource COVERAGE INCLUDES Introduction to photovoltaic technology Motivation for sustainable development initiatives in the photovoltaic industry Environmental metrics used by photovoltaic companies and example calculations Environmental regulations used as trade barriers Current trends to increase environmental sustainability A full glossary and common abbreviations used in the industry **Developments in Surface**

Contamination and Cleaning - Vol 5 Rajiv Kohli,Kashmiri L. Mittal,2012-12-31 In this series Rajiv Kohli and Kash Mittal have brought together the work of experts from different industry sectors and backgrounds to provide a state of the art survey and best practice guidance for scientists and engineers engaged in surface cleaning or dealing with the consequences of surface contamination This volume complements Volumes 3 and 4 of this series which focused largely on particulate contaminants The expert contributions in this volume cover methods for removal of non particulate contaminants such as metallic and non metallic thin films hydrocarbons toxic and hazardous chemicals and microbiological substances as well as contamination monitoring in pharmaceutical manufacturing and an innovative method for characterization at the nanoscale Comprehensive coverage of innovations in surface contamination and cleaning Written by established experts in the contamination and cleaning field Each chapter is a comprehensive review of the state of the art Case studies included

Particle Adhesion and Removal K. L. Mittal,Ravi Jaiswal,2015-02-02 The book provides a comprehensive and easily accessible reference source covering all important aspects of particle adhesion and removal The core objective is to cover both fundamental and applied aspects of particle adhesion and removal with emphasis on recent developments Among the topics to be covered include 1 Fundamentals of surface forces in particle adhesion and removal 2 Mechanisms of particle adhesion and removal 3 Experimental methods e g AFM SFA SFM IFM etc to understand particle particle and particle

substrate interactions 4 Mechanics of adhesion of micro and nanoscale particles 5 Various factors affecting particle adhesion to a variety of substrates 6 Surface modification techniques to modulate particle adhesion 7 Various cleaning methods both wet dry for particle removal 8 Relevance of particle adhesion in a host of technologies ranging from simple to ultra sophisticated

Semiconductor Manufacturing Handbook Hwaiyu Geng, 2005-05-18 This handbook will provide engineers with the principles applications and solutions needed to design and manage semiconductor manufacturing operations Consolidating the many complex fields of semiconductor fundamentals and manufacturing into one volume by deploying a team of world class specialists it allows the quick look up of specific manufacturing reference data across many subdisciplines

Handbook of Semiconductor Wafer Cleaning Technology Werner Kern, 1993-12-31 Discusses semiconductor wafer cleaning and the scientific and technical disciplines associated directly or indirectly with this subject Intended to serve as a handbook for practitioners and professionals in the field

Cleaning Technology in Semiconductor Device Manufacturing ..., 2002 **Advanced Laser Processing of Materials: Volume 397** Jeff

Cheung, Lucien Laude, Jagdish Narayan, David Norton, Rajiv Singh, 1996-09-09 Laser processing has been used in a wide variety of applications and materials such as semiconductors superconductors ceramics polymers and metals Lasers provide a controlled source of atomic and electronic excitations involving nonequilibrium phenomena that lend themselves to processing of novel materials and structures The range of laser solid interactions involving electronic excitation melting and evaporation result in the formation of novel phases selective gas excitations surface modification and low temperature thin film deposition This book from MRS focuses on the use of lasers in both the fundamental understanding and applied aspects of laser solid and laser gas interactions relevant to materials processing Applications featured include thin film transistors formed by laser induced crystallization of amorphous silicon diamond coatings and micromachining Topics include fundamentals of laser solid interactions fundamentals of pulsed laser ablation pulsed laser deposition novel applications of laser processing laser driven formation of nanocrystals laser annealing surface modification and etching and laser assisted chemical vapor deposition

Handbook of Silicon Wafer Cleaning Technology Karen Reinhardt, Werner Kern, 2018-03-16 Handbook of Silicon Wafer Cleaning Technology Third Edition provides an in depth discussion of cleaning etching and surface conditioning for semiconductor applications The fundamental physics and chemistry associated with wet and plasma processing are reviewed including surface and colloidal aspects This revised edition includes the developments of the last ten years to accommodate a continually involving industry addressing new technologies and materials such as germanium and III V compound semiconductors and reviewing the various techniques and methods for cleaning and surface conditioning Chapters include numerous examples of cleaning technique and their results The book helps the reader understand the process they are using for their cleaning application and why the selected process works For example discussion of the mechanism and physics of contamination metal particle and organic includes information on particle removal metal

passivation hydrogen terminated silicon and other processes that engineers experience in their working environment In addition the handbook assists the reader in understanding analytical methods for evaluating contamination The book is arranged in an order that segments the various cleaning techniques aqueous and dry processing Sections include theory chemistry and physics first then go into detail for the various methods of cleaning specifically particle removal and metal removal amongst others Focuses on cleaning techniques including wet plasma and other surface conditioning techniques used to manufacture integrated circuits Reliable reference for anyone that manufactures integrated circuits or supplies the semiconductor and microelectronics industries Covers processes and equipment as well as new materials and changes required for the surface conditioning process *Semiconductor Manufacturing Handbook* Hwaiyu Geng,2005-05-18 WORLD CLASS SEMICONDUCTOR MANUFACTURING EXPERTISE AT YOUR FINGERTIPS This is a comprehensive reference to the semiconductor manufacturing process and ancillary facilities from raw material preparation to packaging and testing applying basics to emerging technologies Readers charged with optimizing the design and performance of manufacturing processes will find all the information necessary to produce the highest quality chips at the lowest price in the shortest time possible The Semiconductor Manufacturing Handbook provides leading edge information on semiconductor wafer processes MEMS nanotechnology and FPD plus the latest manufacturing and automation technologies including Yield Management Automated Material Handling System Fab and Cleanroom Design and Operation Gas Abatement and Waste Treatment Management And much more Written by 60 international experts and peer reviewed by a seasoned advisory board this handbook covers the fundamentals of relevant technology and its real life application and operational considerations for planning implementing and controlling manufacturing processes It includes hundreds of detailed illustrations and a list of relevant books technical papers and websites for further research This inclusive wide ranging coverage makes the Semiconductor Manufacturing Handbook the most comprehensive single volume reference ever published in the field STATE OF THE ART SEMICONDUCTOR TECHNOLOGIES AND MANUFACTURING PROCESSES SEMICONDUCTOR FUNDAMENTALS How Chips Are Designed and Made Substrates Copper and Low k Dielectrics Silicide Formation Plasma Vacuum Photomask WAFER PROCESSING TECHNOLOGIES Microlithography Ion Implantation Etch PVD ALD CVD ECD Epitaxy CMP Wet Cleaning FINAL MANUFACTURING Packaging Grinding Stress Relief Dicing Inspection Measurement and Testing NANOTECHNOLOGY MEMS AND FPD GAS AND CHEMICALS Specialty Gas System and DCA Gas Abatement Systems Chemical and Slurries Delivery System Ultra Pure Water FAB YIELD OPERATIONS AND FACILITIES Yield Management Automated Materials Handling System Metrology Six Sigma Advanced Process Control EHS Fab Design and Construction Cleanroom Vibration and Acoustic Control ESD Airborne Molecular Control Particle Monitoring Wastewater Neutralization Systems **Subject Guide to Books in Print** ,1993 [Handbook for Critical Cleaning: Applications, processes, and controls](#) Barbara Kanegsberg,Ed Kanegsberg,Edward Kanegsberg,2011 Nearly all companies which

manufacture or fabricate high value physical objects components parts assemblies perform critical cleaning at one or more stages These range from the giants of the semiconductor aerospace and biomedical world to a host of small to medium to large companies producing a dizzying array of components *The Cumulative Book Index* ,1997 A world list of books in the English language **Lithography for Semiconductor Manufacturing** ,2001 *Encyclopedia of Physical Science and Technology* ,2002 Of the Encyclopedia of Physical Science and Technology Has been completely updated with no less than 90% revised material and 50% new content throughout the volumes Presents eighteen volumes nearly 800 authoritative articles and 14 500 pages Is lavishly illustrated with over 7 000 photographs illustrations and tables Presents an increased emphasis on the hottest topics such as information processing environmental science biotechnology and biomedicine Includes a final Index Volume containing Thematic Relational and Subject indexes *Index of Conference Proceedings* ,1990

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