



Microelectronic Materials

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Microelectronic Materials:

Microelectronic Materials C.R.M. Grovenor, 2017-10-05 This practical book shows how an understanding of structure thermodynamics and electrical properties can explain some of the choices of materials used in microelectronics and can assist in the design of new materials for specific applications It emphasizes the importance of the phase chemistry of semiconductor and metal systems for ensuring the long term stability of new devices The book discusses single crystal and polycrystalline silicon aluminium and gold based metallisation schemes packaging semiconductor devices failure analysis and the suitability of various materials for optoelectronic devices and solar cells It has been designed for senior undergraduates graduates and researchers in physics electronic engineering and materials science

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Microelectronic Materials and Processes R.A. Levy, 2012-12-06 The primary thrust of very large scale integration VLS is the miniaturization of devices to increase packing density achieve higher speed and consume lower power The fabrication of integrated circuits containing in excess of four million components per chip with design rules in the submicron range has now been made possible by the introduction of innovative circuit designs and the development of new microelectronic materials and processes This book addresses the latter challenge by assessing the current status of the science and technology associated with the production of VLSI silicon circuits It represents the cumulative effort of experts from academia and industry who have come together to blend their expertise into a tutorial overview and cohesive update of this rapidly expanding field A balance of fundamental and applied contributions cover the basics of microelectronics materials and process engineering Subjects in materials science include silicon silicides resists dielectrics and interconnect metallization Subjects in process engineering include crystal growth epitaxy oxidation thin film deposition fine line lithography dry etching ion implantation and diffusion Other related topics such as process simulation defects phenomena and diagnostic techniques are also included This book is the result of a NATO sponsored Advanced Study Institute AS held in Castelvechio Pascoli Italy Invited speakers at this institute provided manuscripts which were edited updated and integrated with other contributions solicited from non participants to this AS

Chemical Mechanical Planarization of Microelectronic Materials Joseph M. Steigerwald, Shyam P. Murarka, Ronald J. Gutmann, 1997 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 Microelectronic Materials C. Grovenor, Institute of Physics (Great Britain), 1994

Microelectronic Materials and Processes Roland Levy, 1989-01-31

The primary thrust of very large scale integration VLS is the miniaturization of devices to increase packing density achieve higher speed and consume lower power The fabrication of integrated circuits containing in excess of four million components per chip with design rules in the submicron range has now been made possible by the introduction of innovative circuit designs and the development of new microelectronic materials and processes This book addresses the latter challenge by assessing the current status of the science and technology associated with the production of VLSI silicon circuits It represents the cumulative effort of experts from academia and industry who have come together to blend their expertise into a tutorial overview and cohesive update of this rapidly expanding field A balance of fundamental and applied contributions cover the basics of microelectronics materials and process engineering Subjects in materials science include silicon silicides resists dielectrics and interconnect metallization Subjects in process engineering include crystal growth epitaxy oxidation thin film deposition fine line lithography dry etching ion implantation and diffusion Other related topics such as process simulation defects phenomena and diagnostic techniques are also included This book is the result of a NATO sponsored Advanced Study Institute AS held in Castelvechio Pascoli Italy Invited speakers at this institute provided manuscripts which were edited updated and integrated with other contributions solicited from non participants to this AS Defects in Microelectronic Materials and Devices Daniel M Fleetwood, Ronald D. Schrimpf, 2019-08-30

Uncover the Defects that Compromise Performance and Reliability As microelectronics features and devices become smaller and more complex it is critical that engineers and technologists completely understand how components can be damaged during the increasingly complicated fabrication processes required to produce them A comprehensive survey of defects that occur in silicon based metal oxide semiconductor field effect transistor MOSFET technologies this book also discusses flaws in linear bipolar technologies silicon carbide based devices and gallium arsenide materials and devices These defects can profoundly affect the yield performance long term reliability and radiation response of microelectronic devices and integrated circuits ICs Organizing the material to build understanding of the problems and provide a quick reference for scientists engineers and technologists this text reviews yield and performance limiting defects and impurities in the device silicon layer in the gate insulator and or at the critical Si SiO₂ interface It then examines defects that impact production yield and long term reliability including Vacancies interstitials and impurities especially hydrogen Negative bias temperature instabilities Defects in ultrathin oxides SiO₂ and silicon oxynitride Take A Proactive Approach The authors condense decades of experience and perspectives of noted experimentalists and theorists to characterize defect properties and their impact on microelectronic

devices They identify the defects offering solutions to avoid them and methods to detect them These include the use of 3 D imaging as well as electrical analytical computational spectroscopic and state of the art microscopic methods This book is a valuable look at challenges to come from emerging Microelectronics to Nanoelectronics Anupama B. Kaul,2017-12-19 Composed of contributions from top experts Microelectronics to Nanoelectronics Materials Devices and Manufacturability offers a detailed overview of important recent scientific and technological developments in the rapidly evolving nanoelectronics arena Under the editorial guidance and technical expertise of noted materials scientist Anupama B Kaul of California Institute of Technology s Jet Propulsion Lab this book captures the ascent of microelectronics into the nanoscale realm It addresses a wide variety of important scientific and technological issues in nanoelectronics research and development The book also showcases some key application areas of micro electro mechanical systems MEMS that have reached the commercial realm Capitalizing on Dr Kaul s considerable technical experience with micro and nanotechnologies and her extensive research in prestigious academic and industrial labs the book offers a fresh perspective on application driven research in micro and nanoelectronics including MEMS Chapters explore how rapid developments in this area are transitioning from the lab to the market where new and exciting materials devices and manufacturing technologies are revolutionizing the electronics industry Although many micro and nanotechnologies still face major scientific and technological challenges and remain within the realm of academic research labs rapid advances in this area have led to the recent emergence of new applications and markets This handbook encapsulates that exciting recent progress by providing high quality content contributed by international experts from academia leading industrial institutions such as Hewlett Packard and government laboratories including the U S Department of Energy s Sandia National Laboratory Offering something for everyone from students to scientists to entrepreneurs this book showcases the broad spectrum of cutting edge technologies that show significant promise for electronics and related applications in which nanotechnology plays a key role

Defects in Microelectronic Materials and Devices Daniel M. Fleetwood,Ronald D. Schrimpf,2008-11-19 Uncover the Defects that Compromise Performance and ReliabilityAs microelectronics features and devices become smaller and more complex it is critical that engineers and technologists completely understand how components can be damaged during the increasingly complicated fabrication processes required to produce them A comprehensive survey of defe **Analysis of Microelectronic Materials and Devices** M. Grasserbauer,H. W. Werner,1995-05-03 This book presents for the first time a comprehensive survey of analytical techniques currently used in support of all stages of microelectronic materials and device processing The diversity of topics covered in this book has been achieved by bringing together an international field of authors contributing specialized individual chapters This has ensured that each technique is discussed in detail giving in depth treatments of the subject matter A particularly helpful feature in this book is the concise technical summary given at the end of each section Four major areas are considered in this volume Bulk analysis of microelectronic materials Analysis of surfaces

interfaces and thin films Structure analysis on an atomic scale Characterization of physical electrical and topographic features Complete with over 400 illustrations this volume is an indispensable guide to analytical support for the microelectronic industry

Robust Design of Microelectronics Assemblies Against Mechanical Shock, Temperature and Moisture E-H Wong, Y.-W. Mai, 2015-05-23 Robust Design of Microelectronics Assemblies Against Mechanical Shock Temperature and Moisture discusses how the reliability of packaging components is a prime concern to electronics manufacturers The text presents a thorough review of this important field of research providing users with a practical guide that discusses theoretical aspects experimental results and modeling techniques The authors use their extensive experience to produce detailed chapters covering temperature moisture and mechanical shock induced failure adhesive interconnects and viscoelasticity Useful program files and macros are also included Discusses how the reliability of packaging components is a prime concern to electronics manufacturers Presents a thorough review of this important field of research providing users with a practical guide that discusses theoretical aspects experimental results and modeling techniques Includes program files and macros for additional study

Microelectronic Test Structures for CMOS Technology Manjul Bhushan, Mark B. Ketchen, 2011-08-26 Microelectronic Test Structures for CMOS Technology and Products addresses the basic concepts of the design of test structures for incorporation within test vehicles scribe lines and CMOS products The role of test structures in the development and monitoring of CMOS technologies and products has become ever more important with the increased cost and complexity of development and manufacturing In this timely volume IBM scientists Manjul Bhushan and Mark Ketchen emphasize high speed characterization techniques for digital CMOS circuit applications and bridging between circuit performance and characteristics of MOSFETs and other circuit elements Detailed examples are presented throughout many of which are equally applicable to other microelectronic technologies as well The authors overarching goal is to provide students and technology practitioners alike a practical guide to the disciplined design and use of test structures that give unambiguous information on the parametrics and performance of digital CMOS technology

Integrated Microelectronic Devices Jesús A. del Alamo, 2018 The central goal of this book is to present the fundamentals of semiconductor device operation with relevance to modern integrated microelectronics as opposed to say photonics energy conversion devices or power electronics This means that no optical devices nor power devices of any kind are described In contrast emphasis is devoted to frequency response layout geometrical effects parasitic issues and modeling in integrated microelectronics devices transistors and diodes In spite of this focus the concepts learned here are highly applicable in other device contexts This book should be a great resource for a broad range of students with a diverse set of interests

Microelectronic Applications of Chemical Mechanical Planarization Yuzhuo Li, 2008 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

Microelectronic Materials C. R. M. Grovenor, 1989 This practical book shows how an understanding of structure thermodynamics and electrical properties can explain some of the choices of materials used in microelectronics and can assist in the design of new materials for specific applications It emphasizes the importance of the phase chemistry of semiconductor and metal systems for ensuring the long term stability of new devices The book discusses single crystal and polycrystalline silicon aluminium and gold based metallisation schemes packaging semiconductor devices failure analysis and the suitability of various materials for optoelectronic devices and solar cells It has been designed for senior undergraduates graduates and researchers in physics electronic engineering and materials science

Microelectronic Packaging M. Datta, Tetsuya Osaka, J. Walter Schultze, 2004-12-20 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

Microelectronic Materials C. R. M. Grovenor,1998 This practical book shows how an understanding of structure thermodynamics and electrical properties can explain some of the choices of materials used in microelectronics and can assist in the design of new materials for specific applications It emphasizes the importance of the phase chemistry of semiconductor and metal systems for ensuring the long term stability of new devices The book discusses single crystal and polycrystalline silicon aluminium and gold based metallisation schemes packaging semiconductor devices failure analysis and the suitability of various materials for optoelectronic devices and solar cells It has been designed for senior undergraduates graduates and researchers in physics electronic engineering and materials science Provided by publisher

Plasma Electronics Toshiaki Makabe,Zoran Lj. Petrovic,2006-03-27 Without plasma processing techniques recent advances in microelectronics fabrication would not have been possible But beyond simply enabling new capabilities plasma based techniques hold the potential to enhance and improve many processes and applications They are viable over a wide range of size and time scales and can be used for deposition

Dielectric Films for Advanced Microelectronics Mikhail Baklanov,Karen Maex,Martin Green,2007-04-04 The topic of thin films is an area of increasing importance in materials science electrical engineering and applied solid state physics with both research and industrial applications in microelectronics computer manufacturing and physical devices Advanced high performance computers high definition TV broadband imaging systems flat panel displays robotic systems and medical electronics and diagnostics are a few examples of the miniaturized device technologies that depend on the utilization of thin film materials This book presents an in depth overview of the novel developments made by the scientific leaders in the area of modern dielectric films for advanced microelectronic applications It contains clear concise explanations of material science of dielectric films and their problem for device operation including high k low k medium k dielectric films and also specific features and requirements for dielectric films used in the packaging technology A broad range of related topics are covered from physical principles to design fabrication characterization and applications of novel dielectric films

The Enigmatic Realm of **Microelectronic Materials**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing short of extraordinary. Within the captivating pages of **Microelectronic Materials** a literary masterpiece penned by way of a renowned author, readers embark on a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book's core themes, assess its distinct writing style, and delve into its lasting impact on the hearts and minds of people who partake in its reading experience.

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