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Rapid Thermal Processing for Future Semiconductor Devices Rapid Thermal and Other Short-time Processing Technologies II Rapid Thermal and Other Short-time Processing Technologies Rapid Thermal Processing Rapid Thermal and Integrated Processing VII: Volume 525 Rapid Thermal and Integrated Processing Rapid Thermal and Integrated Processing IV: Rapid Thermal and Integrated Processing III: Volume 342 Rapid Thermal and Other Short-time Processing Technologies III Rapid Thermal Processing and beyond: Applications in Semiconductor Processing Rapid Thermal Processing of Electronic Materials: Volume 92 Rapid Thermal and Integrated Processing IV: Rapid Thermal Processing: Volume 52 Rapid Thermal Annealing/Chemical Vapor Deposition and Integrated Processing: Volume 146 Rapid Thermal Processing Rapid Thermal Processing and Beyond Rapid Thermal Processing of Semiconductors Advances in Rapid Thermal and Integrated Processing Rapid Thermal Processing of Crystalline Silicon Materials and Solar Cells Advances in Rapid Thermal and Integrated Processing Rapid Thermal Processing of Silicon Solar Cells Bonding of Silicon to Steel Via Low Temperature Rapid Thermal Annealing Diffusion of Gold in Silicon with the Rapid Thermal Processing for High Speed Bipolar Switching Transistors Rapid Thermal Processing of Semiconductors Rapid Thermal and Related Processing Techniques MEMS Packaging by Rapid Thermal Processing Subsecond Annealing of Advanced Materials Shallow Diffusion of GeSe in GaAs Using Rapid Thermal Annealing to Form Non-alloyed Ohmic Contacts Rapid Thermal Processing for Integrated-circuit Applications Solder Reflow Bonding Using Rapid Thermal Processing for MEMS Packaging Using Modern System Theory in Semiconductor Manufacturing to Enhance Productivity and Flexibility on the Example of Rapid Thermal Processing Rapid Thermal Processing for Integrated-circuit Applications Rapid Thermal Analysis Technique for Aggregates in Portland Cement Concrete Superalloys 2020 Flash Lamp Annealing Advances in Rapid Thermal Processing Thermal Processing of Food Recent Advances in Sliding Modes: From Control to Intelligent Mechatronics Mechanics of Thermal Contraction Cracks and Ice-Wedge Polygons in Permafrost Control System Applications

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Rapid thermal and integrated processing is an emerging single-wafer technology in ULSI semiconductor manufacturing, electrical engineering, applied physics and materials science. Here, the physics and engineering of this technology are discussed at the graduate level. Three interrelated areas are covered. First, the thermophysics of photon-induced annealing of semiconductor and related materials, including fundamental pyrometry and emissivity issues, the modelling of reactor designs and processes, and their relation to temperature uniformity. Second, process integration, treating the advances in basic equipment design, scale-up, integrated cluster-tool equipment, including wafer cleaning and integrated processing. Third, the deposition and processing of thin epitaxial, dielectric and metal films, covering selective deposition and epitaxy, integrated processing of layer stacks, and new areas of potential application, such as the processing of III-V semiconductor structures and thin- film head processing for high-density magnetic data storage. Rapid thermal and integrated processing is an emerging single-wafer technology in ULSI semiconductor manufacturing, electrical engineering, applied physics and materials science. Here, the physics and engineering of this technology are discussed at the graduate level. Three interrelated areas are covered. First, the thermophysics of photon-induced annealing of semiconductor and related materials, including fundamental pyrometry and emissivity issues, the modelling of reactor designs and processes, and their relation to temperature uniformity. Second, process integration, treating the advances in basic equipment design, scale-up, integrated cluster-tool equipment, including wafer cleaning and integrated processing. Third, the deposition and processing of thin epitaxial, dielectric and metal films, covering selective deposition and epitaxy, integrated processing of layer stacks, and new areas of potential application, such as the processing of III-V semiconductor structures and thin- film head processing for high-density magnetic data storage. Rapid Thermal Processing (RTP) is a well established single-wafer technology in USLI semiconductor manufacturing and electrical engineering, as well as in materials science. The biggest advantage of RTP is that it eliminates the long-ramp-up and ramp-down times associated with furnaces, enabling a significant reduction in the thermal budget. Today, RTP is in production use for source/drain implant annealing, contact alloying, formation of refractory nitrides and silicides and thin gate dielectric (oxide) formation. The aim of Symposium I was to provide an overview of the latest information on research and development in the different topics cited above. The potential applications of RTP in new areas like large area devices such as flat planel displays and solar cells has to be investigated. About 30 papers were presented in this symposium. The contributions of most interest involved modelling and control, junctions formation and thermal oxidation, deposition and recrystallisation and silicide formations. However, the range of topics and the intent to focus on underlying, fundamental issues like dopant diffusion in silicon from solid sources, strain relaxation and photonic effects, nucleation as well as applications to magnetic films and solar cells devices. The MRS proceedings series on rapid thermal processing (RTP) has become the

predominant international forum for research in this exciting and fast-growing field. In particular, this book in the series clearly indicates that the science of RTP is increasingly better understood and that equipment simulation and engineering have matured. With the so-called 'second generation' equipment vendors are providing useful and production-worthy solutions to the most pertinent problems within RTP - temperature measurement and reproducability. For that reason, the issues of temperature calibration and metrology, along with the International Temperature Scale, are featured. The evaluation and modelling of furnace, mini-bath and single-wafer RTP furnaces as the thermal method of choice are also addressed. Interesting developments are reported in the processing of dielectrics. Applications outside the field of silicon semiconductors are also presented. Topics include: measurement; RTCVD; modelling and manufacturing; integrated processing; silicides; annealing and defects; dielectrics; and RTP of III-V materials and other novel applications. The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners. "Electronics, Dielectric Science and Technology, and High Temperature Materials Divisions." The thermal processing of materials ranges from few fem to seconds by Swift Heavy Ion Implantation to about one second using advanced Rapid Thermal Annealing. This book offers after an historical excursus selected contributions on fundamental and applied aspects of thermal processing of classical elemental semiconductors and other advanced materials including nanostructures with novel optoelectronic, magnetic, and superconducting properties. Special emphasis is given on the diffusion and segregation of impurity atoms during thermal treatment. A broad range of examples describes the solid phase and/or liquid phase processing of elemental and compound semiconductors, dielectric composites and organic materials. Rapid thermal processing has contributed to the development of single wafer cluster processing tools and other innovations in integrated circuit manufacturing environments. Borisenko and Hesketh review theoretical and experimental progress in the field, discussing a wide range of materials, processes, and conditions. They thoroughly cover the work of international investigators in the field. Heat-treatment and thermal annealing are very common processing steps which have been employed during semiconductor manufacturing right from the beginning of integrated circuit technology. In order to minimize undesired diffusion, and other thermal budget-dependent effects, the trend has been to reduce the annealing time sharply by switching from standard furnace batch-processing (involving several hours or even days), to rapid thermal processing involving soaking times of just a few seconds. This transition from thermal equilibrium, to highly non-equilibrium, processing was very challenging and is still a field ripe for further development. This book provides a comprehensive survey of the technology of flash lamp annealing (FLA) for thermal processing of semiconductors. It gives a detailed introduction to the FLA technology and its physical background. Advantages, drawbacks and process issues are addressed in detail and allow the reader to properly plan and perform their own thermal processing. Moreover, this books gives a broad overview of the applications of flash lamp annealing, including a comprehensive literature survey. Several case studies of simulated temperature profiles in real material systems give the reader the necessary insight into the underlying physics and simulations. This book is a valuable reference work for both novice and advanced users. The fourth in a continuing series on rapid thermal processing (RTP), this volume addresses work in traditional RTP processes such as dielectric growth, annealing and silicides, as well as developments in integrated processes. The primary focus, however, is the manufacturing aspects of RTP and the successful integration of RTP into production semiconductor fabs. Emphasis is placed on process and equipment modelling and the critical aspects of RTP, such as temperature measurement, uniformity and control. Topics include: modelling, sensors and control; integrated processing and manufacturing; dielectrics; epitaxy, polysilicon and devices; and junctions, metallization and contacts. The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners. The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners. Rapid thermal processing has contributed to the development of single wafer cluster processing tools and other innovations in integrated circuit manufacturing environments. Borisenko and Hesketh review theoretical and experimental progress in the field, discussing a wide range of materials, processes, and conditions. They thoroughly cover the work of international investigators in the field. These proceedings from the April 1998 symposium illustrate how the range of rapid thermal processing (RTP) applications in silicon device manufacturing is expanding and how mature the technology has become. The 51 contributions are grouped under six headings--RTP equipment modeling and new concepts, temperature measurement and control in RTP equipment, MOSGET gate stack engineering, MOSFET channel and source/drain engineering, silicides, and new applications for rapid thermal processing. Annotation copyrighted by Book News, Inc., Portland, OR The proceedings from this May 2000 symposium illustrate the range of applications in Rapid Thermal Processing (RTP). The refereed papers cover a variety of issues, such as ultra-shallow junctions; contacts for nanoscale CMOS; gate stacks; new applications of RTP, such as for the enhanced crystalization of amorphous silicon thin films; and advances on RTP systems and process monitoring, including optimizing and controlling gas flows in an RTCVD reactor. Most presentations are supported by charts and other graphical data. c. Book News Inc. Durability of course aggregate has a major impact on the durability of Portland cement concrete. Over the past years, there has been an increasing interest in developing and improving test techniques that provide a faster accurate durability assessment which ultimately leads to a better prediction of pavement performance. Thermogravimetric analysis (TGA) is a relatively rapid technique that has shown good potential for use in the analysis of carbonate aggregates. In this work, thermogravimetric technique was used to analyze 31 limestone and two dolomite aggregates, The specimens were heated to temperatures above 1000 C (1832 F) using two rates of temperature increase. The weight loss and the change in weight loss as a function of temperature were recorded. The data was acquired by a data acquisition system and later transferred to a microcomputer for analysis. This volume is dedicated to Professor Okyay Kaynak to commemorate his life time impactful research and scholarly achievements and outstanding services to profession. The 21 invited chapters have been written by leading researchers who, in the past, have had association with Professor Kaynak as either his students and associates or colleagues and collaborators. The focal theme of the volume is the Sliding Modes covering a broad scope of topics from theoretical investigations to their significant applications from Control to Intelligent Mechatronics. Control technology permeates every aspect of our lives. We rely on them to perform a wide variety of tasks without giving much thought to the origins of the technology or how it became such an important part of our lives. Control System Applications covers the uses of control systems, both in the common and in the uncommon areas of our lives. From the everyday to the unusual, it's all here. From process control to human-in-the-loop control, this book provides illustrations and examples of how these systems are applied. Each chapter contains an introduction to the application, a section defining terms and references, and a section on further readings that help you understand and use the techniques in your work environment. Highly readable and comprehensive, Control System Applications explores the uses of control systems. It illustrates the diversity of control systems and provides examples of how the theory can be applied to specific practical problems. It contains information about aspec ts of control that are not fully captured by the theory, such as techniques for protecting against controller failure and the role of cost and complexity in specifying controller designs. This is the first definitive book on rapid thermal processing (RTP), an essential namufacturing technology for single-wafer processing in highly controlled environments. Written and edited by nine experts in the field, this book covers a range of topics for academics and engineers alike, moving from basic theory to advanced technology for wafer manufacturing. The book also provides new information on the suitability or RTP for thin film deposition, junction formation, silicides, epitaxy, and in situ processing. Complete discussions on equipment designs and comparisons between RTP and other processing approaches also make this book useful for supplemental information on silicon processing, VLSI processing, and integrated circuit engineering. The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners. The 14th International Symposium on Superalloys (Superalloys 2020) highlights technologies for lifecycle improvement of superalloys. In addition to the traditional focus areas of alloy development, processing, mechanical behavior, coatings, and environmental effects, this volume includes contributions from academia, supply chain, and product-user members of the superalloy community that highlight technologies that contribute to improving manufacturability, affordability, life prediction, and performance of superalloys. This is the latest and most authoritative documentation of current scientific knowledge regarding the health effects of thermal food processing. Authors from all over Europe and the USA provide an international perspective, weighing up the risks and benefits. In addition, the contributors outline those areas where further research is necessary. This volume is a collection of papers which were presented at the 2001 International Conference on Rapid Thermal Processing (RTP 2001) held at Ise Shima, Mie, on November 14-16, 2001. This symposium is second conference followed the previous successful first International RTP conference held at Hokkaido in 1997. The RTP 2001 covered the latest developments in RTP and other short-time processing continuously aiming to point out the future direction in the Silicon ULSI devices and II-VI, III-V compound semiconductor devices. This book covers the following areas: advanced MOS gate stack, integration technologies, advancd channel engineering including shallow junction, SiGe, hetero-structure, novel metallization, inter-connect, silicidation, low-k materials, thin dielectrics including gate dielectrics and high-k materials, thin film deposition including SiGe, SOI and SiC, process and device modelling, Laser-assisted crystallization and TFT device fabrication technologies, temperature monitoring and slip-free technologies. Heat-treatment and thermal annealing are very common processing steps which have been employed during semiconductor manufacturing right from the beginning of integrated circuit technology. In order to minimize undesired diffusion, and other thermal budget-dependent effects, the trend has been to reduce the annealing time sharply by switching from standard furnace batch-processing (involving several hours or

even days), to rapid thermal processing involving soaking times of just a few seconds. This transition from thermal equilibrium, to highly non-equilibrium, processing was very challenging and is still a field ripe for further development.

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