

Y. Tanabe (Ed.)

**Macro-  
molecular  
Science  
and  
Engineering**  
New Aspects



Springer

# Macromolecular Science And Engineering New Aspects

**Jarek Dabrowski, Eicke R. Weber**



## **Macromolecular Science And Engineering New Aspects:**

**Macromolecular Science and Engineering** Yoshikazu Tanabe, 1999 1 Introduction 2 Metallocene Catalyzed Polymerization of Methylmethacrylate 3 Radical Isomerization Polymerization 4 High Pressure Solid State Polymerization 5 Biodegradable Polymers 6 Polymer Objects Towards New Polymer Architectures 7 Thermo Responsive Polymer Gels 8 Biomimetic Membranes 9 Polymeric Membranes for Separation 10 Metal Clusters Dispersed in Organic Materials 11 Organic Magnetic Materials 12 Nonlinear Optical Materials 13 Laser Processing of Polymers 14 Solid Phase Forming and Mechanical Properties of Polymers 15 Precise Measurement of Molecular Weight 16 Surface Forces in Polymeric Systems 17 Structure of Organic Thin Films 18 Molecular Motions in Bulk Polymers 19 Computer Simulation of Polymers 20 Morphology Development during Melt Processing of Immiscible Polymer Blends 21 Electronic Structure of Conductive and Conjugated Polymers 22 Organic Electroluminescent Devices 23 Optical and Electrical Properties of C60 C70 Nanotubes and Endohedral Fullerenes

**Macromolecular Science and Engineering** Yoshikazu Tanabe, 2013-03-07 The explosion in the scale of production of polymers has made our daily life more convenient during the past several decades and caused serious discussion on recycling and safety During this time many polymer researchers who have constructed new industries and new fields of science changed their interests to specialty polymers and some have moved to bioscience On the other hand the expected limitations of silicon devices which are fundamental in the present semiconductor and personal computer world have initiated much interest in the idea of molecular electronic devices Based on this idea ultrathin films with many functions were studied but it is still difficult to use them in real information systems In these studies polymer scientists and solid state physicists collaborated with each other and the new field of conjugated materials including charge transfer complexes conjugated conductive materials and fullerenes has grown Here optical properties are the main interest because new materials are necessary in the advanced information society of the twenty first century During the course of this development the boundary between polymers and small organic molecules has become blurred except for the synthetic chemists This new field of science and engineering is growing and will propose new materials and new devices The present book aims at a compact presentation of the principal concepts in current polymeric and organic materials science and engineering

**Fundamental Aspects of Silicon Oxidation** Yves J. Chabal, 2012-12-06 The idea for a book dealing specifically with elementary processes in silicon oxidation was formulated after a stimulating symposium that I organized at the American Physical Society meeting in March 1998 The symposium entitled Dynamics of silicon etching and oxidation explored the mechanisms governing silicon oxidation With three experimental talks Hines Weldon and Gibson and two theoretical presentations Pasquarello and Pantelides it provided a good cross section of the recent efforts to characterize the interfacial region of silicon oxide grown on silicon The novelty of this work comes from the present experimental and theoretical advances that allow the investigation of the formation of ultra thin silicon oxides Although structural characterization

of bulk silicon oxides and electrical characterization of thin oxides and their interfaces with silicon have produced an extensive body of work over more than forty years a mechanistic understanding of the initial oxidation processes has remained elusive In the past both the experimental and theoretical efforts have been thwarted by the complexity of dealing with the formation of a mostly amorphous oxide on a crystalline substrate In this book we present a survey of the state of the art methods both experimental and theoretical specifically dealing with the issue of amorphous dielectric growth Each chapter critically reviews and cross correlates information provided by experimental techniques such as microscopy spectroscopy or scattering with results obtained using theoretical methods such as ab initio electronic structure calculations molecular dynamics and Monte Carlo simulations

*Spectroscopic Properties of Rare Earths in Optical Materials* Guokui Liu, Bernard Jacquier, 2006-01-29 Aimed at researchers and graduate students this book provides up to date information about the electronic interactions that impact the optical properties of rare earth ions in solids Its goal is to establish a connection between fundamental principles and the materials properties of rare earth activated luminescent and laser optical materials The theoretical survey and introduction to spectroscopic properties covers electronic energy level structure intensities of optical transitions ion phonon interactions line broadening and energy transfer and up conversion An important aspect of the book lies in its deep and detailed discussions of materials properties and the potential of new applications such as optical storage information processing nanophotonics and molecular probes that have been identified in recent experimental studies This volume will be a valuable reference book on advanced topics of rare earth spectroscopy and materials science

**Wafer Bonding** Marin Alexe, Ulrich Gösele, 2013-03-09 During the past decade direct wafer bonding has developed into a mature materials integration technology This book presents state of the art reviews of the most important applications of wafer bonding written by experts from industry and academia The topics include bonding based fabrication methods of silicon on insulator photonic crystals VCSELs SiGe based FETs MEMS together with hybrid integration and laser lift off The non specialist will learn about the basics of wafer bonding and its various application areas while the researcher in the field will find up to date information about this fast moving area including relevant patent information

**Spirally Anisotropic Composites** Garry Efimovich Freger, V. N. Kestelman, Dmitry Garrievich Freger, 2013-03-09 It is known that composites have insufficient transversal strength and rigidity and low longitudinal shear modulus compression and shear strength This book describes methods to avoid these disadvantages by hybridization and spiral reinforcement of composites at the micro level during the production stage Mathematical models and design methods have been developed for various composites The authors discuss the technology of spiral reinforcement and fillers the structures and properties of spirally reinforced composites binders the manufacture of such composites and the application of new materials and constructions This informative text will be of interest to researchers teachers and students in academia and also to industrial scientists and engineers involved in the development and application of new materials

Transport

Processes in Ion-Irradiated Polymers Dietmar Fink, 2013-03-14 Presented in two parts this first comprehensive overview addresses all aspects of energetic ion irradiation of polymers Earlier publications and review articles concentrated on selected topics only And the need for such a work has grown with the dramatic increase of research and applications such as in photoresists waveguides and medical dosimetry during the last decade The first part Fundamentals of Ion Irradiation of Polymers covers the physical chemical and instrumental fundamentals treats the specific irradiation mechanisms of low and high energy ions including similarities and differences and details the potential for future technological application All the new findings are carefully analyzed and presented in a systematic way while open questions are identified The second volume Transport Processes in Ion Irradiated Polymers deals with transport processes in both unirradiated and irradiated polymers As both a review and a stimulus this work seeks to contribute substantially to the literature and advancement of polymeric devices from both the low and high energy regimes

#### **Impurities Confined in Quantum Structures**

Olof Holtz, Qing Xiang Zhao, 2013-04-17 The dramatic impact of low dimensional semiconductor structures on current and future device applications cannot be overstated Research over the last decade has highlighted the use of quantum engineering to achieve previously unknown limits for device performance in research laboratories The modified electronic structure of semiconductor quantum structures results in transport and optical properties which differ from those of constituent bulk materials The possibility to tailor properties such as bandgap strain band offset etc of two dimensional 2D semiconductors e.g. quantum wells for specific purposes has had an extensive impact on the electronics which has resulted in a dramatic renewal process For instance 2D structures are today used in a large number of high speed electronics and optoelectronic applications e.g. detectors light emitting diodes modulators switches and lasers and in daily life in e.g. LED based traffic lights CD players cash registers The introduction of impurities also in very small concentrations in a semiconductor can change its optical and electrical properties entirely This attribute of the semiconductor is utilized in the manifoldness of their applications This fact constitutes the principal driving force for investigation of the properties of the impurities in semiconductors While the impurities in bulk materials have been investigated for a long time and their properties are fairly well established by now the corresponding studies of impurities in quantum wells is a more recent research area

#### **Fundamentals of Ion-Irradiated Polymers**

Dietmar Fink, 2013-03-14 Presented in two parts this first comprehensive overview addresses all aspects of energetic ion irradiation of polymers Earlier publications and review articles concentrated on selected topics only And the need for such a work has grown with the dramatic increase of research and applications such as in photoresists waveguides and medical dosimetry during the last decade The first part Fundamentals of Ion Irradiated Polymers covers the physical chemical and instrumental fundamentals treats the specific irradiation mechanisms of low and high energy ions including similarities and differences and details the potential for future technological application All the new findings are carefully analyzed and presented in a systematic way while open questions are identified The second volume Transport Processes in

Ion Irradiated Polymers deals with transport processes in both unirradiated and irradiated polymers As both a review and a stimulus this work seeks to contribute substantially to the literature and advancement of polymeric devices from both the low and high energy regimes

*Diffraction Analysis of the Microstructure of Materials* Eric J. Mittemeijer, Paolo Scardi, 2013-11-21 Diffraction Analysis of the Microstructure of Materials provides an overview of diffraction methods applied to the analysis of the microstructure of materials Since crystallite size and the presence of lattice defects have a decisive influence on the properties of many engineering materials information about this microstructure is of vital importance in developing and assessing materials for practical applications The most powerful and usually non destructive evaluation techniques available are X ray and neutron diffraction The book details among other things diffraction line broadening methods for determining crystallite size and atomic scale strain due e g to dislocations and methods for the analysis of residual macroscale stress The book assumes only a basic knowledge of solid state physics and supplies readers sufficient information to apply the methods themselves

*Predictive Simulation of Semiconductor Processing* Jarek Dabrowski, Eicke R. Weber, 2013-03-09 Predictive Simulation of Semiconductor Processing enables researchers and developers to extend the scaling range of semiconductor devices beyond the parameter range of empirical research It requires a thorough understanding of the basic mechanisms employed in device fabrication such as diffusion ion implantation epitaxy defect formation and annealing and contamination This book presents an in depth discussion of our current understanding of key processes and identifies areas that require further work in order to achieve the goal of a comprehensive predictive process simulation tool

**Chemical-Mechanical Planarization of Semiconductor Materials** M.R. Oliver, 2013-03-14 Chemical Mechanical Planarization CMP has emerged in the last two decades and grown rapidly as a basic technology widely used in semiconductor device fabrication As a semiconductor processing step it was developed at IBM in the mid 1980s From this beginning the technology has been widely adopted throughout the semiconductor industry As basic CMP technology has been understood and accepted throughout the semiconductor industry its uses in different parts of the semiconductor process have multiplied This includes special steps for some special processing flows such as for DRAM technology In addition the availability of CMP technology has enabled the implementation of new technologies with the best example being copper interconnect technology Copper could not be practically implemented into semiconductor process flows until the advent of CMP Unfortunately the rapid acceptance and implementation of CMP technology in wafer fabrication has occurred without a corresponding rate of advance in the underlying science Progress is being made in understanding the underlying CMP mechanisms but in general it is slow and uneven The most noteworthy exception to this trend is the science of metal CMP reactions where the scientific understanding is actually driving much of the advance of the technology There has been no corresponding progress in other CMP areas however

*Multiphased Ceramic Materials* Wei-Hsing Tuan, Jin-Kun Guo, 2004-06-14 Summary of the recent progress in ceramics research Several novel concepts for materials selection and

microstructural design are presented as are experimental results that substantiate the ideas

**Applications of NMR Spectroscopy** Atta-ur-Rahman, M. Iqbal Choudhary, 2016-11-22 Applications of NMR Spectroscopy is a book series devoted to publishing the latest advances in the applications of nuclear magnetic resonance NMR spectroscopy in various fields of organic chemistry biochemistry health and agriculture The fifth volume of the series features several reviews focusing on NMR spectroscopic techniques for identifying natural and synthetic compounds polymer and peptide characterization GABA in tinnitus affected mice medical diagnosis and therapy gliomas and food analysis The spectroscopic methods highlighted in this volume include high resolution proton magnetic resonance spectroscopy and solid state NMR

**Computational Materials Design** Tetsuya Saito, 2013-04-17 Computational Materials Design consists of ten chapters outlining a wide range of materials design technologies from first principle calculations to continuum mechanics with successful applications to materials design and development Each theory is explained from the point of view of a relevant technology Thus the reader can understand the outline of each theory and the effectiveness of computational approaches in terms of materials phenomena as well as materials design and development

**Nitride Semiconductors and Devices** Hadis Morkoç, 2013-03-08 A View of the Past and a Look into the Future by a Pioneer By Jacques I Pankove This forward will be a brief review of important developments in the early and recent history of gallium nitride and also a perspective on the current and future evolution of this exciting field Gallium nitride GaN was synthesized more than 50 years ago by Johnson et al 1 in 1932 and also by Juza and Hahn 2 in 1938 who passed ammonia over hot gallium This method produced small needles and platelets The purpose of Juza and Hahn was to investigate the crystal structure and lattice constant of GaN as part of a systematic study of many compounds Two decades later Grim 3 in 1959 employed the same technique to produce small crystals of GaN for the purpose of measuring their photoluminescence spectra Another decade later Maruska and Tietjen 4 in 1969 used a chloride transport vapor technique to make a large area layer of GaN on sapphire All of the GaN made at that time was very conducting n type even when not deliberately doped The donors were believed to be nitrogen vacancies Later this model was questioned by Seifert et al 5 in 1983 and oxygen was proposed as the donor Oxygen with its 6 valence electrons on a N site N has 5 valence electrons would be a single donor

**Technology and Applications of Amorphous Silicon** Robert A. Street, 2013-06-29 Amorphous silicon has enabled a new technology for large area electronics with major applications in liquid crystal displays image sensing and solar power conversion This book presents a broad description of the current technology and its future potential so that the reader can understand how the particular properties of amorphous silicon lead to unique applications Topics covered include the design of the amorphous silicon transistor and sensor devices the range of matrix addressed arrays and other systems that can be fabricated and the performance of the various application areas

**The Elements of Polymer Science and Engineering** Alfred Rudin, 2012-12-02 This introductory text is intended as the basis for a two or three semester course in synthetic macromolecules It can also serve as

a self instruction guide for engineers and scientists without formal training in the subject who find themselves working with polymers For this reason the material covered begins with basic concepts and proceeds to current practice where appropriate Serves as both a textbook and an introduction for scientists in the field Problems accompany each chapter

**Semiconducting Silicides** Victor E. Borisenko, 2013-03-07 Semiconductors are well known as the main materials of modern solid state electronics They have held the attention of researchers and engineers since the brilliant invention of the semiconductor transistor by Bardeen Brattain and v V Shockley in the middle of the 20th century Silicon germanium AlIIB and AlIB compounds have been widely used in discrete semiconductor devices and microelectronic and nanoelectronic integrated systems Each of these materials has separately met specific physical and technological requirements to provide formation of solid state structures with the best electronic or optical performance However attempts to combine them within integrated circuit appear to be ineffective or even technologically impossible Thus material and related technological compatibilities are important for further progress particularly in microelectronics optoelectronics and nanoelectronics This stimulates an increasing interest in silicides and silicon germanium alloys which provide new prospects for silicon based integration Elements from the Periodic Table form more than 180 silicides which are chemical compounds of silicon with different metals Most of them except the silicides of lanthanides and actinides are shown in Table 1 Along with appropriate compatibility with silicon and easy formation by silicidation in a metal silicon couple silicides are characterized by high thermal stability and resistance to oxidation The majority of them are metallic and have low resistivity Exactly metallic silicides were first employed for interconnections gates in MOS structures ohmic contacts and Schottky barriers in silicon integrated circuits For a comprehensive overview of their properties and general features of the formation technology the reader may address the books and reviews 1 10 Metal Impurities in Silicon-Device Fabrication Klaus Graff, 2013-03-07 Metal Impurities in Silicon Device Fabrication treats the transition metal impurities generated during the fabrication of silicon samples and devices The different mechanisms responsible for contamination are discussed and a survey is given of their impact on device performance The specific properties of the main and rare impurities in silicon are examined as well as the detection methods and requirements in modern technology Finally impurity gettering is studied along with modern techniques to determine the gettering efficiency In all of these subjects reliable and up to date data are presented This monograph provides a thorough review of the results of recent scientific investigations as well as the relevant data and properties of the various metal impurities in silicon The new edition includes important recent data and a number of new tables



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