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The proceedings of the Fourth Electronic Materials and Processing Conference, held in Montreal in 1991, cover the latest developments in multichip modules, surface mount technology, microelectronic interconnections, electronic and fiber optic connectors, and microelectronic corrosion in 53 papers. l

This book explores the role of surface effects in optical phenomena in nanoscience, from two different perspectives. When systems are reduced in volume, the ratio of surface versus volume increases. At the level of single nanostructures this translates into an enhanced role of interfacial chemistry and thermodynamics. At the level of systems of nanostructures, it translates into larger density on interfaces, which in turn leads to such intriguing collective effects as plasmonics or multiple reflection and refraction phenomena. The book highlights both perspectives presenting sample applications. Without claiming to be exhaustive, the book aims to stimulate readers in this potentially rewarding field.

This two-volume work covers ultrafast structural and electronic dynamics of elementary processes at solid surfaces and interfaces, presenting the current status of photoinduced processes. Providing valuable introductory information for newcomers to this booming field of research, it investigates concepts and experiments, femtosecond and attosecond time-resolved methods, as well as frequency domain techniques. The whole is rounded off by a look at future developments.

This handbook brings together, under a single cover, all aspects of the chemistry, physics, and engineering of surfaces and interfaces of materials currently studied in academic and industrial research. It covers different experimental and theoretical aspects of surfaces and interfaces, their physical properties, and spectroscopic techniques that have been applied to a wide class of inorganic, organic, polymer, and biological materials. The diversified technological areas of surface science reflect the explosion of scientific information on surfaces and interfaces of materials and their spectroscopic characterization. The

large volume of experimental data on chemistry, physics, and engineering aspects of materials surfaces and interfaces remains scattered in so many different periodicals, therefore this handbook compilation is needed. The information presented in this multivolume reference draws on two decades of pioneering research on the surfaces and interfaces of materials to offer a complete perspective on the topic. These five volumes-Surface and Interface Phenomena; Surface Characterization and Properties; Nanostructures, Micelles, and Colloids; Thin Films and Layers; Biointerfaces and Applications-provide multidisciplinary review chapters and summarize the current status of the field covering important scientific and technological developments made over past decades in surfaces and interfaces of materials and spectroscopic techniques with contributions from internationally recognized experts from all over the world. Fully cross-referenced, this book has clear, precise, and wide appeal as an essential reference source long due for the scientific community. The complete reference on the topic of surfaces and interfaces of materials The information presented in this multivolume reference draws on two decades of pioneering research Provides multidisciplinary review chapters and summarizes the current status of the field Covers important scientific and technological developments made over past decades in surfaces and interfaces of materials and spectroscopic techniques Contributions from internationally recognized experts from all over the world

Moisture Sensitivity of Plastic Packages of IC Devices provides information on the state-of-the-art techniques and methodologies related to moisture issues in plastic packages. The most updated, in-depth and systematic technical and theoretical approaches are addressed in the book. Numerous industrial applications are provided, along with the results of the most recent research and development efforts, including, but not limited to: thorough exploration of moisture's effects based on lectures and tutorials by the authors, consistent focus on solution-based approaches and methodologies for improved reliability in plastic packaging, emerging theories and cutting-edge industiral applications presented by the leading professionals in the field. Moisture plays a key role in the reliability of plastic packages of IC devices, and moisture-induced failures have become an increasing concern with the development of advanced IC devices. This second volume in the Micro- and Opto--Electronic Materials, Structures, and Systems series is a must-read for researchers and engineers alike.

Issues relating to the high--K gate dielectric are among the greatest challenges for the evolving International Technology Roadmap for Semiconductors (ITRS). More than just an historical overview, this book will assess previous and present approaches related to scaling the gate dielectric and their impact, along with the creative directions and forthcoming challenges that will define the future of gate dielectric scaling technology.

According to Bernie Meyerson, IBM's chief technology of?cer, the traditional sc- ing of semiconductor manufacturing processes died somewhere between the 1- and 90-nanometer nodes. One of the prime reasons is the low dielectric constant of SiO — the-

choice dielectricof all modern electronics. This book presents materials 2 fundamentals of the novel gate dielectrics that are being introduced into semic- ductor manufacturing to ensure the Moore's law scaling of CMOS devices. This is a very rapidly evolving?eld of research and we try to focus on the basicundersta- ing of structure, thermodynamics, and electronic properties of these materials that determine their performance in the device applications. Thevolume was conceivedin 2001 afteraSymposium on Alternative Gate - electrics we had at the American Physical Society March Meeting in Seattle, upon the suggestion of the Kluwer editor Sabine Freisem. After several discussions we decided that such a bookindeed would be useful as long as we could focus on the fundamental side of the problem and keep the level of the discussion accessible to graduate students andavariety of professionals from different ?elds. The problem of?nding a replacement for SiO asa gate dielectric bringstogether inaunique way 2 many fundamental disciplines. At the same time this problem is truly applied and practical. It looked unlikelythat the perfect new material would be foundfast; rather there would be a series of evolving candidate materialsand approaches.

Metal-dielectric interfaces are ubiquitous in modern electronics. As advanced gigascale electronic devices continue to shrink, the stability of these interfaces is becoming an increasingly important issue that has a profound impact on the operational reliability of these devices. In this book, the authors present the basic science underlying the thermal and electrical stability of metal-dielectric interfaces and its relationship to the operation of advanced interconnect systems in gigascale electronics. Interface phenomena, including chemical reactions between metals and dielectrics, metallic-atom diffusion, and ion drift, are discussed based on fundamental physical and chemical principles. Schematic diagrams are provided throughout the book to illustrate interface phenomena and the principles that govern them. Metal-Dielectric Interfaces in Gigascale Electronics provides a unifying approach to the diverse and sometimes contradictory test results that are reported in the literature on metal-dielectric interfaces. The goal is to provide readers with a clear account of the relationship between interface science and its applications in interconnect structures. The material presented here will also be of interest to those engaged in field-effect transistor and memristor device research, as well as university researchers and industrial scientists working in the areas of electronic materials processing, semiconductor manufacturing, memory chips, and IC design.

The original campus of the University of Michigan was nearly a perfect square about a half-mile along a side. A street--sized walk, appropriately called the Diag, runs diagonally across this square, connecting its southeast and northwest corners. In 1904 a new engineering building was either started or finished (I do not remember which) to house classrooms. When another engineering building was built on the expanded campus across the street from it many years later, the old building came to be known as West Engine, to distinguish it from the new East Engine. Old West Engine is (or maybe by now, was) a four-story, L-shaped structure that

stood at the southeast corner of the original campus. It was built with an arch in it to straddle the Diag at the apex of the L. You walked over the Engineering Arch to get from one leg of the L to the other if you were inside the building, and you walked under it when you entered the campus from the southeast corner. Affixed to the masonry wall of the arch was a plaque I often noted in passing. It bore a quote attributed to Horace Greeley (1811-1872), who I did not know at the time was the founder, editor, and publisher of the New York Tribune. It said, simply, Young man, when theory and practice differ, use your horse sense. The suggestion seems worthy of an exclamation point instead of a period, but I do not remember if it had one.

Provides a detailed and systematic description of the Method of Moments (Boundary Element Method) for electromagnetic modeling at low frequencies and includes hands-on, application-based MATLAB® modules with user-friendly and intuitive GUI and a highly visualized interactive output. Includes a full-body computational human phantom with over 120 triangular surface meshes extracted from the Visible Human Project® Female dataset of the National library of Medicine and fully compatible with MATLAB® and major commercial FEM/BEM electromagnetic software simulators. This book covers the basic concepts of computational low-frequency electromagnetics in an application-based format and hones the knowledge of these concepts with hands-on MATLAB® modules. The book is divided into five parts. Part 1 discusses low-frequency electromagnetics, basic theory of triangular surface mesh generation, and computational human phantoms. Part 2 covers electrostatics of conductors and dielectrics, and direct current flow. Linear magnetostatics is analyzed in Part 3. Part 4 examines theory and applications of eddy currents. Finally, Part 5 evaluates nonlinear electrostatics. Application examples included in this book cover all major subjects of low-frequency electromagnetic theory. In addition, this book includes complete or summarized analytical solutions to a large number of quasi-static electromagnetic problems. Each Chapter concludes with a summary of the corresponding MATLAB® modules. Combines fundamental electromagnetic theory and application-oriented computation algorithms in the form of stand alone MATLAB® modules Makes use of the three-dimensional Method of Moments (MoM) for static and quasistatic electromagnetic problems Contains a detailed full-body computational human phantom from the Visible Human Project® Female, embedded implant models, and a collection of homogeneous human shells Low-Frequency Electromagnetic Modeling for Electrical and Biological Systems Using MATLAB® is a resource for electrical and biomedical engineering students and practicing researchers, engineers, and medical doctors working on low-frequency modeling and bioelectromagnetic applications.

The First International Symposium on Dielectric Materials and Applications (ISyDMA’2016) was held in Kenitra (4 May, 2016) and in Rabat (May 5-6, 2016), Morocco. ISyDMA’2016 provided an international forum for reporting the most recent developments in Advanced Dielectric Materials and applications. The goal of this collection of peer reviewed papers is to pro-

vide researchers and scientists from all over the world with recent developments in dielectric materials and their innovative applications. The book will be useful for materials scientists, physicists, chemists, biologists, and electrical engineers engaged in fundamental and applied research or technical investigations of such materials.

Covering the development of field computation in the past forty years, this book is a concise, comprehensive and up-to-date introduction to methods for the analysis and synthesis of electric and magnetic fields. A broad view of the subject of field models in electricity and magnetism, ranging from basic theory to numerical applications, is offered. The approach throughout is to solve field problems directly from partial differential equations in terms of vector quantities.

Provides a comprehensive discussion of planar transmission lines and their applications, focusing on physical understanding, analytical approach, and circuit models Planar transmission lines form the core of the modern high-frequency communication, computer, and other related technology. This advanced text gives a complete overview of the technology and acts as a comprehensive tool for radio frequency (RF) engineers that reflects a linear discussion of the subject from fundamentals to more complex arguments. Introduction to Modern Planar Transmission Lines: Physical, Analytical, and Circuit Models Approach begins with a discussion of waves on transmission lines and waves in material medium, including a large number of illustrative examples from published results. After explaining the electrical properties of dielectric media, the book moves on to the details of various transmission lines including waveguide, microstrip line, co-planar waveguide, strip line, slot line, and coupled transmission lines. A number of special and advanced topics are discussed in later chapters, such as fabrication of planar transmission lines, static variational methods for planar transmission lines, multilayer planar transmission lines, spectral domain analysis, resonators, periodic lines and surfaces, and metamaterial realization and circuit models. Emphasizes modeling using physical concepts, circuit-models, closed-form expressions, and full derivation of a large number of expressions Explains advanced mathematical treatment, such as the variation method, conformal mapping method, and SDA Connects each section of the text with forward and backward cross-referencing to aid in personalized self-study Introduction to Modern Planar Transmission Lines is an ideal book for senior undergraduate and graduate students of the subject. It will also appeal to new researchers with the inter-disciplinary background, as well as to engineers and professionals in industries utilizing RF/microwave technologies.

There are many books on the use of numerical methods for solving engineering problems and for modeling of engineering artifacts. In addition there are many styles of such presentations ranging from books with a major emphasis on theory to books with an emphasis on applications. The purpose of this book is hopefully to present a somewhat different approach to the use of numerical methods for - gineering applications. Engineering models are in general nonlinear models where the response of some appropriate engineering variable depends

in a nonlinear manner on the - plication of some independent parameter. It is certainly true that for many types of engineering models it is sufficient to approximate the real physical world by some linear model. However, when engineering environments are pushed to - treme conditions, nonlinear effects are always encountered. It is also such - treme conditions that are of major importance in determining the reliability or failure limits of engineering systems. Hence it is essential than engineers have a toolbox of modeling techniques that can be used to model nonlinear engineering systems. Such a set of basic numerical methods is the topic of this book. For each subject area treated, nonlinear models are incorporated into the discussion from the very beginning and linear models are simply treated as special cases of more general nonlinear models. This is a basic and fundamental difference in this book from most books on numerical methods.

Semiconductor technologies are moving at such a fast pace that new materials are needed in all types of application. Manipulating the materials and their properties at atomic dimensions has become a must. This book presents the case of interlayer dielectrics materials whilst considering these challenges. Interlayer Dielectrics for Semiconductor Technologies cover the science, properties and applications of dielectrics, their preparation, patterning, reliability and characterisation, followed by the discussion of different materials including those with high dielctric constants and those useful for waveguide applications in optical communications on the chip and the package. * Brings together for the FIRST time the science and technology of interlayer deilectrics materials, in one volume * written by renowned experts in the field * Provides an up-to-date starting point in this young research field.

An introduction to color in three-dimensional image processing and the emerging area of multi-spectral image processing The importance of color information in digital image processing is greater than ever. However, the transition from scalar to vector--valued image functions has not yet been generally covered in most textbooks. Now, Digital Color Image Processing fills this pressing need with a detailed introduction to this important topic. In four comprehensive sections, this book covers: The fundamentals and requirements for color image processing from a vector-valued viewpoint Techniques for preprocessing color images Three-dimensional scene analysis using color information, as well as the emerging area of multi--spectral imaging Applications of color image processing, presented via the examination of two case studies In addition to introducing readers to important new technologies in the field, Digital Color Image Processing also contains novel topics such as: techniques for improving three-dimensional reconstruction, three-dimensional computer vision, and emerging areas of safety and security applications in luggage inspection and video surveillance of high--security facilities. Complete with full-color illustrations and two applications chapters, Digital Color Image Processing is the only book that covers the breadth of the subject under one convenient cover. It is written at a level that is accessible for first- and second-year graduate students in electrical and computer engineering and computer science courses, and that is also appro-

priate for researchers who wish to extend their knowledge in the area of color image processing.

Introducing the interdisciplinary field of interface chemistry modelling across a wide range of academic disciplines and industry sectors. Ten original research articles are presented that bridge knowledge acquisition and practical work, providing a starting point for the research and development of applications. The book describes the characterization of interfaces at the nanoscale, using a wide range of key nanomaterials, such as graphene, TiO2, zeolites, semimetals, and organic polymers; and the study of their different physical chemical properties, such as catalysis, adsorption, friction, diffusion, and the characterization of nanocomposites and heterojunctions, with many different industrial applications. The resulting collection of papers is equally relevant for advanced students (senior and graduate) and for engineers and scientists from a variety of different academic backgrounds working in the multidisciplinary field of nanotechnology.

"The book comprehensively covers all the current and the emerging areas of the physics and the technology of high permittivity gate dielectric materials, including, topics such as MOSFET basics and characteristics, hafnium-based gate dielectric materials, Hf-based gate dielectric processing, metal gate electrodes, flat-band and threshold voltage tuning, channel mobility, high-k gate stack degradation and reliability, lanthanide-based high-k gate stack materials, ternary hafnia and lanthania based high-k gate stack films, crystalline high-k oxides, high mobility substrates, and parameter extraction. Each chapter begins with the basics necessary for understanding the topic, followed by a comprehensive review of the literature, and ultimately graduating to the current status of the technology and our scientific understanding and the future prospects." .

An extrapolation of ULSI scaling trends indicates that minimum feature sizes below 0.1 mu and gate thicknesses of Audience: Both expert scientists and engineers who wish to keep up with cutting edge research, and new students who wish to learn more about the exciting basic research issues relevant to next-generation device technology.

This volume includes contributions on: field theory and advanced computational electromagnetics; electrical machines and transformers; optimization and interactive design; electromagnetics in materials; coupled field and electromagnetic components in mechatronics; induction heating systems; bioelectromagnetics; and electromagnetics in education.

Final program from the ETCMOS 2017 conference, May 28-30, 2017, in Warsaw, Poland.

Les Houches School, October 11-15, 1999

Part 1 is particularly concerned with physical properties, electrical ageing and modeling with topics such as the physics of charged dielectric materials, conduction mechanisms, dielectric relaxation, space charge, electric ageing and life end models and dielectric experimental characterization. Part 2 concerns some applications specific to dielectric materials: insulating oils for transformers, electrorheological fluids, electrolytic capacitors, ionic membranes, photovoltaic conversion, dielectric thermal control coatings for geostationary satellites, plastics recycling and piezoelectric po-

lymers.

Colour imaging technology has become almost ubiquitous in modern life in the form of monitors, liquid crystal screens, colour printers, scanners, and digital cameras. This book is a comprehensive guide to the scientific and engineering principles of colour imaging. It covers the physics of light and colour, how the eye and physical devices capture colour images, how colour is measured and calibrated, and how images are processed. It stresses physical principles and includes a wealth of real--world examples. The book will be of value to scientists and engineers in the colour imaging industry and, with homework problems, can also be used as a text for graduate courses on colour imaging.

This book aims to provide a comprehensive reference into the critical subject of failure and degradation in organic materials, used in optoelectronics and microelectronics systems and devices. Readers in different industrial sectors, including microelectronics, automotive, lighting, oil/gas, and petrochemical will benefit from this book. Several case studies and examples are discussed, which readers will find useful to assess and mitigate similar failure cases. More importantly, this book presents methodologies and useful approaches in analyzing a failure and in relating a failure to the reliability of materials and systems. Presents methodologies for analysing the reliability, failure, and degradation of different organic materials, used in optoelectronics and microelectronics; Provides an overview of different failure mechanisms in different organic materials; Explains how to correlate product performance and reliability to materials degradation; Provides an overview of simulation techniques and methodologies to predict lifetime and reliability of engineering materials and components; Integrates several degradation causes in different materials (thermal, moisture, light radiation, mechanical damage, and more) into large-scale system solutions in several industrial domains (lighting, automotive, oil/-gas, and transport and more); Includes case studies from different failure/degradation mechanisms in different industrial sectors.

Most books on nondestructive evaluation (NDE) focus either on the theoretical background or on advanced applications. Bridging the gap between the two, Ultrasonic and Electromagnetic NDE for Structure and Material Characterization: Engineering and Biomedical Applications brings together the principles, equations, and applications of ultrasonic and electromagnetic NDE in a single, authoritative resource. This is also one of the first books to incorporate a number of popular NDE methods based on electromagnetic techniques. Combines Engineering and Biological Material Characterization Techniques in One Book The book begins with the relevant fundamentals of mechanics and electromagnetic theory, derives the basic equations, and then, step by step, covers state-of-the-art topics and applications of ultrasonic and electromagnetic NDE that are at the forefront of research. These include engineering, biological, and clinical applications such as structural health monitoring, acoustic microscopy, the characterization of biological cells, and terahertz imaging. Covers Numerous Applications of Ultrasonic and Electromagnetic Techniques—from the Traditional to the Advanced Written in plain

language by some of the world's leading experts, the book includes worked-out examples and exercises that make this an outstanding resource for coursework. The coverage of traditional and advanced NDE applications also appeals to practicing engineers and researchers.

ANTENNA AND EM MODELING WITH MATLAB ANTENNA TOOLBOX™ An essential text to MATLAB Antenna Toolbox™ as accessible and easy-to-use full-wave antenna modeling tool Antenna and EM Modeling with MATLAB Antenna Toolbox™ is a textbook on antennas intended for a one semester course. The core philosophy is to introduce the key antenna concepts and follow them up with full-wave modeling and optimization in the MATLAB Antenna Toolbox™. Such an approach will enable immediate testing of theoretical concepts by experimenting in software. It also provides the direct path to research work. The fundamental families of antennas — dipoles, loops, patches, and traveling wave antennas — are discussed in detail, together with the respective antenna arrays. Using antenna parameters such as impedance, reflection coefficient, efficiency, directivity, and gain, the reader is introduced to the different ways of understanding the performance of an antenna. Written for senior undergraduates, graduates as well as RF/Antenna engineers, Antenna and EM Modeling with Antenna Toolbox™ is a resource that: Provides 14 video assisted laboratories on using Antenna Toolbox™ Includes approximately 50 real-world examples in antenna and array design Offers approximately 200 homework problems Provides multiple ready-to-use standalone MATLAB® scripts

The series Topics in Current Chemistry presents critical reviews of the present and future trends in modern chemical research. The scope of coverage is all areas of chemical science including the interfaces with related disciplines such as biology, medicine and materials science. The goal of each thematic volume is to give the non-specialist reader, whether in academia or industry, a comprehensive insight into an area where new research is emerging which is of interest to a larger scientific audience. Each review within the volume critically surveys one aspect of that topic and places it within the context of the volume as a whole. The most significant developments of the last 5 to 10 years are presented using selected examples to illustrate the principles discussed. The coverage is not intended to be an exhaustive summary of the field or include large quantities of data, but should rather be conceptual, concentrating on the methodological thinking that will allow the non-specialist reader to understand the information presented. Contributions also offer an outlook on potential future developments in the field. Review articles for the individual volumes are invited by the volume editors. Readership: research chemists at universities or in industry, graduate students.

Professor Kun Huang is widely known for his collaboration with Max Born in writing the classic monograph, ?Dynamical Theory of Crystal Lattices?. During his years of active research, he has made many important contributions to solid state physics. The present collection of papers is selected at his own choice as representing his most influential works. Thus one finds included his pioneering work on the interac-

tion of radiation field with polar lattices and the resulting coupled vibration modes (later known as ?polariton?); the systematic development of his theory of radiative and nonradiative multiphonon transition processes associated with lattice relaxation; his early prediction of diffuse X-ray scattering due to crystal defects; and his recent research works on low-dimensional semiconductor structures, etc.Professor Huang has found by his experience that scientists interested in these papers often want to know more particulars underlying the research work (background, motivation and rationale involved etc.). Thus he was led to write a commentary which is published alongside the papers.

Molecular Modeling and Multiscaling Issues for Electronic Material Applications provides a snapshot on the progression of molecular modeling in the electronics industry and how molecular modeling is currently being used to understand material performance to solve relevant issues in this field. This book is intended to introduce the reader to the evolving role of molecular modeling, especially seen through the eyes of the IEEE community involved in material modeling for electronic applications. Part I presents the role that quantum mechanics can play in performance prediction, such as properties dependent upon electronic structure, but also shows examples how molecular models may be used in performance diagnostics, especially when chemistry is part of the performance issue. Part II gives examples of large-scale atomistic methods in material failure and shows several examples of transitioning between grain boundary simulations (on the atomistic level)and large-scale models including an example of the use of quasi-continuum methods that are being used to address multiscaling issues. Part III is a more specific look at molecular dynamics in the determination of the thermal conductivity of carbon-nanotubes. Part IV covers the many aspects of molecular modeling needed to understand the relationship between the molecular structure and mechanical performance of materials. Finally, Part V discusses the transitional topic of multiscale modeling and recent developments to reach the submicronscale using mesoscale models, including examples of direct scaling and parameterization from the atomistic to the coarse-grained particle level.

Given such problems as rejection, the interface between an implant and its human host is a critical area in biomaterials. Surfaces and Interfaces for Biomaterials summarizes the wealth of research on understanding the surface properties of biomaterials and the way they interact with human tissue. The first part of the book reviews the way biomaterial surfaces form. Part Two then discusses ways of monitoring and characterizing surface structure and behavior. The final two parts of the book look at a range of in vitro and in vivo studies of the complex interactions between biomaterials and the body. Chapters cover such topics as bone and tissue regeneration, the role of interface interactions in biodegradable biomaterials, microbial biofilm formation, vascular tissue engineering and ways of modifying biomaterial surfaces to improve biocompatibility. Surfaces and Interfaces for Biomaterials will be a standard work on how to understand and control surface processes in ensuring biomaterials are used successfully in medicine.