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Presents, in a single volume, highlights of the recent work in the new field of atomic and nanometer-scale modification and manipulation of materials. Atomic manipulation techniques ranging from scanning tunneling microscopy to light-pressure lithography, and fabrication approaches ranging from molecular-beam epitaxy to molecular self-assembly are discussed. The book includes extensive discussions of the fundamental physical mechanisms underlying the modification and manipulation processes, as well as discussions of new phenomena observed in nanostructures. This book would be of interest to physicists, chemists and other scientists interested in atomic scale phenomena and nanostructures. Fullerenes became a new member of carbon allotropes in addition to diamond and graphite after the discovery of C60 (carbon 60) by Kroto et al. in 1985. The model of C60 was first proposed by Osawa in 1970. C60 is a hollow spherical molecule composed of 60 carbon atoms that contains 12 five-membered rings and 20 six-membered rings and has the same structure as a soccer ball. In 2001, C60 fullerene nanowhiskers (FNWs), which are single-crystal nanowhiskers solely composed of C60 molecules, were discovered in a colloidal solution of lead zirconate titanate (PZT) with added C60. This book focuses on the synthesis of FNWs, fullerene nanotubes, and fullerene nanosheets and describes the structural, mechanical, semiconducting, and thermal properties, as well as bio-related and solar applications of FNWs and related fullerene nanomaterials. This book covers a wide range of topics relating to carbon nanomaterials, from synthesis and functionalization to applications in advanced biomedical devices and systems. As they possess unique and attractive chemical, physical, optical, and even magnetic properties for various applications, considerable effort has been made to employ carbon nanomaterials (e.g., fullerenes, carbon nanotubes, graphene, nanodiamond) as new materials for the development of novel biomedical tools, such as diagnostic sensors, imaging agents, and drug/gene delivery systems for both diagnostics and clinical treatment. Tremendous progress has been made and the scattered literature continues to grow rapidly. With chapters by world-renowned experts providing an overview of the state of the science as well as an understanding of the challenges that lie ahead, Carbon Nanomaterials for Biomedical Applications is essential reading not only for experienced scientists and engineers in biomedical and nanomaterials areas, but also for graduate students and advanced undergraduates in materials science and engineering, chemistry, and biology. This book presents highlighted results coming up from

NanoCarbon2011, a Brazilian Carbon event. The topics cover the latest advances in Brazilian basic and applied research related to different carbon materials. The chapters address reviews on their fundamental and outstanding properties and describe various classes of new promising high-tech applications for carbon materials. Containing chapter contributions from over 130 experts, this unique publication is the first handbook dedicated to the physics and technology of X-ray imaging, offering extensive coverage of the field. This highly comprehensive work is edited by one of the world’s leading experts in X-ray imaging physics and technology and has been created with guidance from a Scientific Board containing respected and renowned scientists from around the world. The book's scope includes 2D and 3D X-ray imaging techniques from soft-X-ray to megavoltage energies, including computed tomography, fluoroscopy, dental imaging and small animal imaging, with several chapters dedicated to breast imaging techniques. 2D and 3D industrial imaging is incorporated, including imaging of artworks. Specific attention is dedicated to techniques of phase contrast X-ray imaging. The approach undertaken is one that illustrates the theory as well as the techniques and the devices routinely used in the various fields. Computational aspects are fully covered, including 3D reconstruction algorithms, hard/software phantoms, and computer-aided diagnosis. Theories of image quality are fully illustrated. Historical, radioprotection, radiation dosimetry, quality assurance and educational aspects are also covered. This handbook will be suitable for a very broad audience, including graduate students in medical physics and biomedical engineering; medical physics residents; radiographers; physicists and engineers in the field of imaging and non-destructive industrial testing using X-rays; and scientists interested in understanding and using X-ray imaging techniques. The handbook's editor, Dr. Paolo Russo, has over 30 years’ experience in the academic teaching of medical physics and X-ray imaging research. He has authored several book chapters in the field of X-ray imaging, is Editor-in-Chief of an international scientific journal in medical physics, and has responsibilities in the publication committees of international scientific organizations in medical physics. Features: Comprehensive coverage of the use of X-rays both in medical radiology and industrial testing The first handbook published to be dedicated to the physics and technology of X-rays Handbook edited by world authority, with contributions from experts in each field Fundamentals and Sensing Applications of 2D Materials provides a comprehensive understanding of a wide range of 2D materials. Examples of fundamental topics include: defect and vacancy engineering, doping and advantages of 2D materials for sensing, 2D materials and composites for sensing, and 2D materials in biosystems. A wide range of applications are addressed, such as gas sensors based on 2D materials, electrochemical glucose sensors, biosensors (enzymatic and non-enzymatic), and printed, stretchable, wearable and flexible biosensors. Due to their sub-nanometer thickness, 2D materials have a high packing density, thus making them suitable for the fabrication of thin film based sensor devices. Benefiting from their unique physical and chemical properties (e.g. strong mechanical strength, high surface area, unparalleled thermal conductivity, remarkable biocompatibility and ease of functionalization), 2D layered nanomaterials have shown great potential in designing high performance sensor devices. Provides a comprehensive overview of 2D materials systems that are relevant to sensing, including transition metal dichalcogenides, metal oxides, graphene and other 2D materials system Includes information on potential applications, such as flexible sensors, biosensors, optical sensors, electrochemical sensors, and more Discusses graphene in terms of the lessons learned from this material for sensing applications and how these lessons can be applied to other 2D materials Nanotechnology is a diverse science that has brought about new applications in fields such as colloidal science, device physics and supra molecular chemistry. Environmental pollution treatment by nanomaterials is an emerging application of nanotechnology. It is gaining importance because of the increased environmental challenges due to the impact of modern industrial activities. Industrial activity involves the production and use of various toxic organic and inorganic chemicals which pollute nearby water streams, indirectly influencing aquatic and human life. Thus, there is a need to protect the environment through the development of new technologies and by enacting awareness drives for environmental sustainability. This volume summarizes cutting-edge research on nanomaterial utilization for environmental challenges.

Chapters introduce readers to the concepts of environmental protection, sustainability and monitoring. Readers will also learn about technologies used for keeping the environment safer, including ion exchangers, metallic oxide complexes, nanocomposite materials, porous membranes and nanocatalysts. This volume is intended to be an introductory reference for students and researchers undertaking advanced courses in materials science, environmental science and engineering, giving readers a glimpse into the fascinating world of nanotechnology. Quantum tunneling is an essential issue in quantum physics. Especially, the rapid development of nanotechnology in recent years promises a lot of applications in condensed matter physics, surface science and nanodevices, which are growing interests in fundamental issues, computational techniques and potential applications of quantum tunneling. The book involves two relevant topics. One is quantum tunneling theory in condensed matter physics, including the basic concepts and methods, especially for recent developments in mesoscopic physics and computational formulation. The second part is the field electron emission theory, which covers the basic field emission concepts, the Fowler Nordheim theory, and recent developments of the field emission theory especially in some fundamental concepts and computational formulation, such as quantum confinement effects, Dirac fermion, Luttinger liquid, carbon nanotubes, coherent emission current, quantum tunneling time problem, spin polarized field electron emission and non-equilibrium Green's function method for field electron emission. This book presents in both academic and pedagogical styles, and is as possible as self-complete to make it suitable for researchers and graduate students in condensed matter physics and vacuum nanoelectronics. Contents: Introduction"Quantum Tunneling Theory: "Quantum Physics and Quantum FormalismBasic Physics of Quantum Scattering and TunnelingWave Function Matching MethodWKB MethodLippmann-Schwinger FormalismNon-Equilibrium Green's Function MethodSpin TunnelingApplications"Field Electron Emission Theory: "IntroductionTheoretical Model and MethodologyFowler-Nordheim TheoryField Emission from SemiconductorsSurface Effects and ResonanceThermionic Emission TheoryTheory of Dynamical Field EmissionTheory of Spin Polarized Field EmissionTheory of Field Electron Emission from NanomaterialsComputer Simulations of Field EmissionThe Empirical Theory of Field EmissionFundamental Physics of Field Electron Emission Readership: Graduate students and researchers in vacuum nanoelectronics and physics. " Drawing from the second edition of the best-selling Handbook of Phosphors, Fundamentals of Phosphors covers the principles and mechanisms of luminescence in detail and surveys the primary phosphor materials as well as their optical properties. The book addresses cutting-edge developments in phosphor science and technology including oxynitride phosphors and the impact of lanthanide level location on phosphor performance. Beginning with an explanation of the physics underlying luminescence mechanisms in solids, the book goes on to interpret various luminescence phenomena in inorganic and organic materials. This includes the interpretation of the luminescence of recently developed low-dimensional systems, such as quantum wells and dots. The book also discusses the excitation mechanisms by cathode-ray and ionizing radiation and by electric fields to produce electroluminescence. The book classifies phosphor materials according to the type of luminescence centers employed or the class of host materials used and interprets the optical properties of these materials, including their luminescence characteristics and mechanisms. Placing a strong emphasis on those materials that are important from a practical point of view, the coverage also includes those possessing no possibility for practical use but are important from a theoretical standpoint. A practical, in-depth description of the physics behind electron emission physics and its usage in science and technology Electron emission is both a fundamental phenomenon and an enabling component that lies at the very heart of modern science and technology. Written by a recognized authority in the field, with expertise in both electron emission physics and electron beam physics, An Introduction to Electron Emission provides an in-depth look at the physics behind thermal, field, photo, and secondary electron emission mechanisms, how that physics affects the beams that result through space charge and emittance growth, and explores the physics behind their utilization in an array of applications. The book addresses mathematical and numerical methods underlying electron

emission, describing where the equations originated, how they are related, and how they may be correctly used to model actual sources for devices using electron beams. Writing for the beam physics and solid state communities, the author explores applications of electron emission methodology to solid state, statistical, and quantum mechanical ideas and concepts related to simulations of electron beams to condensed matter, solid state and fabrication communities. Provides an extensive description of the physics behind four electron emission mechanisms—field, photo, and secondary, and how that physics relates to factors such as space charge and emittance that affect electron beams. Introduces readers to mathematical and numerical methods, their origins, and how they may be correctly used to model actual sources for devices using electron beams Demonstrates applications of electron methodology as well as quantum mechanical concepts related to simulations of electron beams to solid state design and manufacture Designed to function as both a graduate-level text and a reference for research professionals Introduction to the Physics of Electron Emission is a valuable learning tool for postgraduates studying quantum mechanics, statistical mechanics, solid state physics, electron transport, and beam physics. It is also an indispensable resource for academic researchers and professionals who use electron sources, model electron emission, develop cathode technologies, or utilize electron beams. Fundamentals of Low Emission Flameless Combustion and Its Applications is a comprehensive reference on the flameless combustion mode and its industrial applications, considering various types of fossil and alternative fuel. Several experimental and numerical accomplishments on the fundamentals of state-of-the-art flameless combustion is presented, working to clarify the environmentally friendly aspects of this combustion mode. Author Dr. Hosseini presents the latest progresses in the field and highlights the most important achievements since invention, including the fundamentals of thermodynamics, heat transfer and chemical kinetics. Also analyzed is fuel consumption reduction and the efficiency of the system, emissions formation and the effect of the flameless mode on emission reduction. This book provides a solid foundation for those in industry employing flameless combustion for energy conservation and the mitigation of pollutant emissions. It will provide engineers and researchers in energy system engineering, chemical engineering, industrial engineers and environmental engineering with a reliable resource on flameless combustion and may also serve as a textbook for senior graduate students. Presents the fundamentals of flameless combustion and covers advances since its invention Includes experimental and numerical investigations of flameless combustion Analyzes emission formation and highlights the effects of the flameless mode on emission reduction Fundamentals of Gas–Surface Interactions presents the study of the surface itself and the study of the gas phase partner of the interaction in which physical or chemical transformation of the gas resulted from that interaction. This book discusses the study of the energy and momentum exchanges resulting from the gas–solid physical interaction in which either gas or solid phase properties can be measured. Organized into three parts encompassing 33 chapters, this book begins with an overview of the different sensitive physical methods for the study of surface topography, surface defects, and surface irregularities to an accuracy of a few Angstroms. This text then reviews the adsorption at very low coverage that has yielded to equilibrium analysis. Other chapters consider the measurement of surface area by adsorption and optical techniques. The final chapter deals with scattering processes including momentum and energy transfer. This book is a valuable resource for engineers. This Solution Manual, a companion volume of the book, Fundamentals of Solid-State Electronics, provides the solutions to selected problems listed in the book. Most of the solutions are for the selected problems that had been assigned to the engineering undergraduate students who were taking an introductory device core course using this book.This Solution Manual also contains an extensive appendix which illustrates the application of the fundamentals to solutions of state-of-the-art transistor reliability problems which have been taught to advanced undergraduate and graduate students. Nanotechnology is no longer a merely social talking point and is beginning to affect the lives of everyone. Carbon nanotechnology as a major shaper of new nanotechnologies has evolved into a truly interdisciplinary field, which encompasses chemistry, physics, biology, medicine, materials science and engineering. This is a field in which a huge amount of literature has been

generated within recent years, and the number of publications is still increasing every year. Carbon Nanotechnology aims to provide a timely coverage of the recent development in the field with updated reviews and remarks by world-renowned experts. Intended to be an exposition of cutting-edge research and development rather than a kind of conference proceeding, Carbon Nanotechnology will be very useful not only to experienced scientists and engineers, who wish to broaden their knowledge of the wide-ranging nanotechnology and/or to develop practical devices, but also to graduate and senior undergraduate students who look to make their mark in this field of the future. · A comprehensive treatment from materials chemistry and structure-property to practical applications · Offers an in-depth analysis of various carbon nanotechnologies from both fundamental and practical perspectives · An easily accessible assessment of the materials properties and device performances based on all of the major classes of carbon nanomaterials, including: carbon fiber; diamond; C60; and carbon nanotubes · A concise compilation of the practical applications of carbon nanotechnologies from polymer-carbon nanocomposites to sensors, electron emitters, and molecular electronics Carbon forms a variety of allotropes due to the diverse hybridization of s- and p-electron orbitals, including the time-honored graphite and diamond as well as new forms such as C60 fullerene, nanotubes, graphene, and carbyne. The new family of carbon isotopes—fullerene, nanotubes, graphene, and carbyne—is called “nanostructured carbon” or “nanocarbon.” These isotopes exhibit extreme properties such as ultrahigh mechanical strength, ultrahigh charge–carrier mobility, and high thermal conductivity, attracting considerable attention for their electronic and mechanical applications as well as for exploring new physics and chemistry in the field of basic materials science. Electron sources are important in a wide range of areas, from basic physics and scientific instruments to medical and industrial applications. Carbon nanotubes (CNTs) and graphene behave as excellent electron-field emitters owing to their exceptional properties and offer several benefits compared to traditional cathodes. Field emission (FE) produces very intense electron currents from a small surface area with a narrow energy spread, providing a highly coherent electron beam—a combination that not only provides us with the brightest electron sources but also explores a new field of electron beam–related research. This book presents the enthusiastic research and development of CNT-based FE devices and focuses on the fundamental aspects of FE from nanocarbon materials, including CNTs and graphene, and the latest research findings related to it. It discusses applications of FE to X-ray and UV generation and reviews electron sources in vacuum electronic devices and space thrusters. Finally, it reports on the new forms of carbon produced via FE from CNT. This book serves as an introduction to the concepts of medical biotechnology, with great details about fundamentals and early disciplines of study as well as emerging fields and the latest research. The book follows a chronological order from the earliest discoveries and breakthroughs of medical biotechnology to the latest areas of study. The book contains up-to-date citations for each chapter and section, which makes it easy for the reader to understand the concept and also to follow the latest developments in the particular area. It is an ideal book for undergraduate and graduate students who aspire to derive basic knowledge and are also keen on learning about the latest advancements in the field of medical biotechnology. This book is dedicated to field emission electronics, a promising field at the interface between “classic” vacuum electronics and nanotechnology. In addition to theoretical models, it includes detailed descriptions of experimental and research techniques and production technologies for different types of field emitters based on various construction principles. It particularly focuses on research into and production of field cathodes and electron guns using recently developed nanomaterials and carbon nanotubes. Further, it discusses the applications of field emission cathodes in new technologies such as light sources, flat screens, microwave and X-ray devices. This book explores the aggregation-induced emission (AIE) effect, which has opened new avenues for the development of advanced luminogenic materials in the aggregate or solid state. By enabling light emission in the practically useful solid state, AIE has the potential to significantly expand the technological applications of luminescent materials. This book addresses principles, methods, and applications of AIEs, offering a new platform for the investigation of light-emitting processes from luminogen

aggregates. Applications of AIE include biomedical diagnostics, sensor materials, and optoelectronic devices, among others, and are described in detail within the book. The development of a new generation of AIEgens, a deep understanding of the AIE mechanism(s), and the exploration of advanced technological applications will enable this exciting field to develop further. Headed by the pioneering researcher who started the field, Professor Ben Zhong Tang, this book combines both principles and applications and brings together global researchers in the field to report the progress, current challenges, and potential breakthroughs that may be accomplished in the near future. Provides an authoritative account of the fundamentals, properties, and potential of AIE by the pioneer of this active, highly-researched field; Highlights technological applications of AIE spanning biomedicine, sensor materials, and optoelectronics, among others; Presents a comprehensive view on challenges in the further development of AIE and derived technologies. The series Topics in Current Chemistry Collections presents critical reviews from the journal Topics in Current Chemistry organized in topical volumes. 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.The chapter "Aggregation-Induced Emission In Electrochemiluminescence: Advances and Perspectives" is available open access under a CC BY 4.0 License via link.springer.com. The purpose of this school, addressed to young researchers and graduate students (physicists, chemists and engineers), was to provide the basis of fundamental properties of nanostructured materials and an introduction to more specialized and up-to-date topics. The topics were remarkably interdisciplinary, covering theory, materials preparation, structural characterization, thermodynamic aspects and mechanical, optical, electrical and magnetic properties. Contents:Synthesis of Nanostructured Materials: Synthesis, Structure and Properties of Nanostructured Materials (R W Siegel)Nanocrystalline Soft Ferromagnetic Alloys Obtained by Devitrification of an Amorphous Phase: Kinetic Aspects (P Allia & F Vinai)Mill Scale-Up and Cost Analysis in the Mechanosynthesis of Nanophase Materials (D Basset et al)Electronic, Structural and Thermodynamic Properties of Nanostructured Materials:Electronic Structure of Small Metal Particles (A Bifone & F Bassani)Conventional Wide Angle X-Ray Scattering (WAXS): Investigation of Nanocrystalline Powders (S Martelli)Scattering of Slow Neutrons in Nanocrystals (C Petrillo)Physical Properties of Nanostructured Materials: Superparamagnetic Properties of Nanoparticles (D Fiorani & J L Dormann)Magnetic Anisotropy in Nanostructured Materials (M Solzi)Magnetoelasticity and Its Fundamental Role in Nanocrystalline Materials (L Lanotte)and other papers Readership: Materials scientists and condensed matter physicists. keywords: Industrial Applications of Carbon Nanotubes covers the current applications of carbon nanotubes in various industry sectors, from the military to visual display products, and energy harvesting and storage. It also assesses the opportunities and challenges for increased commercialization and manufacturing of carbon nanotubes in the years ahead. Real-life case studies illustrate how carbon nanotubes are used in each industry sector covered, providing a valuable resource for scientists and engineers who are involved and/or interested in carbon nanotubes in both academia and industry. The book serves as a comprehensive guide to the varied uses of carbon nanotubes for specialists in many related fields, including chemistry, physics, biology, and textiles. Explains how carbon nanotubes can be used to improve the efficiency and performance of industrial products Includes real-life case studies to illustrate how carbon nanotubes have been successfully employed Explores how carbon nanotubes could be mass-manufactured in the future, and outlines

the challenges that need to be overcome Expert coverage of vacuum microelectronics-principles, devices,and applications The field of vacuum microelectronics has advanced so swiftlythat commercial devices are being fabricated, and applications arebeing developed in displays, wireless communications, spacecraft,and electronics for use in harsh environments. It is a rapidlyevolving, interdisciplinary field encompassing electricalengineering, materials science, vacuum engineering, and appliedphysics. This book surveys the fundamentals, technology, and deviceapplications of this nascent field. Editor Wei Zhu brings togethersome of the world's foremost experts to provide comprehensive andin-depth coverage of the entire spectrum of vacuummicroelectronics. Topics include: Field emission theory Metal and silicon field emitter arrays Novel cold cathode materials Field emission flat panel displays Cold cathode microwave devices Vacuum Microelectronics is intended forpractitioners in the display, microwave, telecommunications, andmicroelectronics industries and in government and universityresearch laboratories, as well as for graduate students majoring inelectrical engineering, materials science, and physics. It providescutting-edge, expert coverage of the subject and serves as both anintroductory text and a professional reference. This is a comprehensive text describing the basic physics and technological applications of vacuum arcs. Part I describes basic physics of the vacuum arc, beginning with a brief tutorial review of plasma and electrical discharge physics, then describes the arc ignition process, cathode and anode spots which serve as the locus for plasma generation, and resultant interelectrode plasma. Part II describes the applications of the vacuum arc for depositing thin films and coatings, refining metals, switching high power, and as sources of intense electron, ion, plasma, and x-ray beams. Carbon forms a variety of allotropes due to the diverse hybridization of s- and p-electron orbitals, including the time-honored graphite and diamond as well as new forms such as C60 fullerene, nanotubes, graphene, and carbyne. The new family of carbon isotopes—fullerene, nanotubes, graphene, and carbyne—is called “nanostructured carbon” or “nanocarbon.” These isotopes exhibit extreme properties such as ultrahigh mechanical strength, ultrahigh charge–carrier mobility, and high thermal conductivity, attracting considerable attention for their electronic and mechanical applications as well as for exploring new physics and chemistry in the field of basic materials science. Electron sources are important in a wide range of areas, from basic physics and scientific instruments to medical and industrial applications. Carbon nanotubes (CNTs) and graphene behave as excellent electron-field emitters owing to their exceptional properties and offer several benefits compared to traditional cathodes. Field emission (FE) produces very intense electron currents from a small surface area with a narrow energy spread, providing a highly coherent electron beam—a combination that not only provides us with the brightest electron sources but also explores a new field of electron beam–related research. This book presents the enthusiastic research and development of CNT-based FE devices and focuses on the fundamental aspects of FE from nanocarbon materials, including CNTs and graphene, and the latest research findings related to it. It discusses applications of FE to X-ray and UV generation and reviews electron sources in vacuum electronic devices and space thrusters. Finally, it reports on the new forms of carbon produced via FE from CNT. Enhanced field emission (EFE) presents the main impediment to higher acceleration gradients in superconducting niobium (Nb) radiofrequency cavities for particle accelerators. The strength, number and sources of EFE sites strongly depend on surface preparation and handling. The main objective of this thesis project is to systematically investigate the sources of EFE from Nb, to evaluate the best available surface preparation techniques with respect to resulting field emission, and to establish an optimized process to minimize or eliminate EFE. To achieve these goals, a scanning field emission microscope (SFEM) was designed and built as an extension to an existing commercial scanning electron microscope (SEM). In the SFEM chamber of ultra high vacuum, a sample is moved laterally in a raster pattern under a high voltage anode tip for EFE detection and localization. The sample is then transferred under vacuum to the SEM chamber equipped with an energy-dispersive x-ray spectrometer for individual emitting site characterization. Compared to other systems built for similar purposes, this apparatus has low cost and maintenance, high operational flexibility, considerably bigger scan area, as well as reliable performance. EFE sources from planar Nb have

been studied after various surface preparation, including chemical etching and electropolishing, combined with ultrasonic or high-pressure water rinse. Emitters have been identified, analyzed and the preparation process has been examined and improved based on EFE results. As a result, field-emission-free or near field-emission-free surfaces at ĩ40 MV/m have been consistently achieved with the above techniques. Characterization on the remaining emitters leads to the conclusion that no evidence of intrinsic emitters, id est, no fundamental electric field limit induced by EFE, has been observed up to ĩ40 MV/m. Chemically etched and electropolished Nb are compared and no significant difference is observed up to ĩ40 MV/m. To address concerns on the effect of natural air drying process on EFE, a comparative study was conducted on Nb and the results showed insignificant difference under the experimental conditions. Nb thin films deposited on Cu present a possible alternative to bulk Nb in superconducting cavities. The EFE performance of a preliminary energetically deposited Nb thin film sample are presented. Now ubiquitous in public discussions about cutting-edge science and technology, nanoscience has generated many advances and inventions, from the development of new quantum mechanical methods to far-reaching applications in electronics and medical diagnostics. Ushering in the next technological era, Fundamentals of Picoscience focuses on the instrumentation and experiments emerging at the picometer scale. One picometer is the length of a trillionth of a meter. Compared to a human cell of typically ten microns, this is roughly ten million times smaller. In this state-of-the-art book, international scientists and researchers at the forefront of the field present the materials and methods used at the picoscale. They address the key challenges in developing new instrumentation and techniques to visualize and measure structures at this sub-nanometer level. With numerous figures, the book will help you: Understand how picoscience is an extension of nanoscience Determine which experimental technique to use in your research Connect basic studies to the development of next-generation picoelectronic devices The book covers various approaches for detecting, characterizing, and imaging at the picoscale. It then presents picoscale methods ranging from scanning tunneling microscopy (STM) to spectroscopic approaches at sub-nanometer spatial and energy resolutions. It also covers novel picoscale structures and picometer positioning systems. The book concludes with picoscale device applications, including single molecule electronics and optical computers. Introductions in each chapter explain basic concepts, define technical terms, and give context to the main material. The surface of solids had long been considered simply the external boundary which determined the outside appearance of the solids but had no intrinsic character of its own. The concept that surfaces have specific properties and are the first and foremost means of communication between individual things and the rest of the universe is fairly new, coming into prominence only in the early sixties. This new concept of surface properties was the result of a vast accumulation of knowledge due to recent development of research in this area. This breakthrough of surface science resulted from the combined action of four factors: (i) control of surface sample prep aration, (ii) control of the surface's environment, (iii) improve ment of measurement tools and techniques, and (iv) the importance of surface properties in many new industrial areas. Nearly eighty techniques are now available to help us answer to the following questions: what is the surface structure or arrangement of surface atoms? what are the atomic species present? what is the spatial distribution of foreign atoms? what are the nature and distribution of possible defects on the surface? what is the electronic structure of the surface atoms? what is the motion of atoms on the surface? In general, two or more analytical techniques are used concurrently to assure unequivocal answers to problems. Different techniques employ different combina. tions of incident probes and the scattered or secondary particles that convey information regarding the sur faces. The papers included in this issue of ECS Transactions were originally presented in the symposium ¿Carbon Nanotubes and Nanostructures: From Fundamental Properties and Processes to Applications and Devices¿, held during the 216th meeting of The Electrochemical Society, in Vienna, Austria from October 4 to 9, 2009. Recent technological breakthrough in the field of Terahertz radiation has triggered new applications in biology and biomedicine. Particularly, biological applications are based on the specific spectroscopic fingerprints of biological matter in this spectral region. Historically

with the discovery of new electromagnetic wave spectrum, we have always discovered new medical diagnostic imaging systems. The use of terahertz wave was not realized due to the absence of useful terahertz sources. Now after successful generation of THz waves, it is reported that a great potential for THz wave exists for its resonance with bio-molecules. There are many challenging issues such as development of THz passive and active instrumentations, understanding of THz-Bio interaction for THz spectroscopy, THz-Bio nonlinear phenomena and safety guideline, and THz imaging systems. Eventually the deeper understanding of THz-Bio interaction and novel THz systems enable us to develop powerful THz biomedical imaging systems which can contribute to biomedical industry. This is a truly interdisciplinary field and convergence technology where the communication between different disciplines is the most challenging issue for the success of the great works. One of the first steps to promote the communications in this convergence technology would be teaching the basics of these different fields to the researchers in a plain language with the help of Convergence of Terahertz Science in Biomedical Systems which is considered to be 3-4th year college students or beginning level of graduate students. Therefore, this type of book can be used by many people who want to enter or understand this field. Even more it can be used for teaching in universities or research institutions. Carbon nanotubes (CNTs) have novel properties that make them potentially useful in many applications in nanotechnology, electronics, optics and other fields of materials science. These characteristics include extraordinary strength, unique electrical properties, and the fact that they are efficient heat conductors. Field emission is the emission of electrons from the surface of a condensed phase into another phase due to the presence of high electric fields. CNT field emitters are expected to make a breakthrough in the development of field emission display technology and enable miniature X-ray sources that will find a wide variety of applications in electronic devices, industry, and medical and security examinations. This first monograph on the topic covers all aspects in a concise yet comprehensive manner - from the fundamentals to applications. Divided into four sections, the first part discusses the preparation and characterization of carbon nanotubes, while part two is devoted to the field emission properties of carbon nanotubes, including the electron emission mechanism, characteristics of CNT electron sources, and dynamic behavior of CNTs during operation. Part three highlights field emission from other nanomaterials, such as carbon nanowalls, diamond, and silicon and zinc oxide nanowires, before concluding with frontier R&D applications of CNT emitters, from vacuum electronic devices such as field emission displays, to electron sources in electron microscopes, X-ray sources, and microwave amplifiers. Edited by a pioneer in the field, each chapter is written by recognized experts in the respective fields. Carbon nanotubes (CNTs) have novel properties that make them potentially useful in many applications in nanotechnology, electronics, optics and other fields of materials science. These characteristics include extraordinary strength, unique electrical properties, and the fact that they are efficient heat conductors. Field emission is the emission of electrons from the surface of a condensed phase into another phase due to the presence of high electric fields. CNT field emitters are expected to make a breakthrough in the development of field emission display technology and enable miniature X-ray sources that will find a wide variety of applications in electronic devices, industry, and medical and security examinations. This first monograph on the topic covers all aspects in a concise yet comprehensive manner ? from the fundamentals to applications. Divided into four sections, the first part discusses the preparation and characterization of carbon nanotubes, while part two is devoted to the field emission properties of carbon nanotubes, including the electron emission mechanism, characteristics of CNT electron sources, and dynamic behavior of CNTs during operation. Part three highlights field emission from other nanomaterials, such as carbon nanowalls, diamond, and silicon and zinc oxide nanowires, before concluding with frontier R&D applications of CNT emitters, from vacuum electronic devices such as field emission displays, to electron sources in electron microscopes, X-ray sources, and microwave amplifiers. Edited by a pioneer in the field, each chapter is written by recognized experts in the respective fields. Meeting the need for teaching material suitable for students of atmospheric science and courses on atmospheric radiation, this textbook covers the fundamentals of emission, absorption, and scattering

of electromagnetic radiation from ultraviolet to infrared and beyond. Much of the contents applies to planetary atmosphere, with graded discussions providing a thorough treatment of subjects, including single scattering by particles at different levels of complexity. The discussion of the simple multiple scattering theory introduces concepts in more advanced theories, such that the more complicated two-stream theory allows readers to progress beyond the pile-of-plates theory. The authors are physicists teaching at the largest meteorology department in the US at Penn State. The problems given in the text come from students, colleagues, and correspondents, and the figures designed especially for this book facilitate comprehension. Ideal for advanced undergraduate and graduate students of atmospheric science. * Free solutions manual available for lecturers at www.wiley-vch.de/supplements/ Oxide-based materials and structures are becoming increasingly important in a wide range of practical fields including microelectronics, photonics, spintronics, power harvesting, and energy storage in addition to having environmental applications. This book provides readers with a review of the latest research and an overview of cutting-edge patents received in the field. It covers a wide range of materials, techniques, and approaches that will be of interest to both established and early-career scientists in nanoscience and nanotechnology, surface and material science, and bioscience and bioengineering in addition to graduate students in these areas. Features: Contains the latest research and developments in this exciting and emerging field Explores both the fundamentals and applications of the research Covers a wide range of materials, techniques, and approaches Principles of Electron Optics: Applied Geometrical Optics, Second Edition gives detailed information about the many optical elements that use the theory presented in Volume 1: electrostatic and magnetic lenses, quadrupoles, cathode-lens-based instruments including the new ultrafast microscopes, low-energy-electron microscopes and photoemission electron microscopes and the mirrors found in their systems, Wien filters and deflectors. The chapter on aberration correction is largely new. The long section on electron guns describes recent theories and covers multi-column systems and carbon nanotube emitters. Monochromators are included in the section on curved-axis systems. The lists of references include many articles that will enable the reader to go deeper into the subjects discussed in the text. The book is intended for postgraduate students and teachers in physics and electron optics, as well as researchers and scientists in academia and industry working in the field of electron optics, electron and ion microscopy and nanolithography. Offers a fully revised and expanded new edition based on the latest research developments in electron optics Written by the top experts in the field Covers every significant advance in electron optics since the subject originated Contains exceptionally complete and carefully selected references and notes Serves both as a reference and text

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- Fundamentals Of Solid state Electronics
- Fundamentals Of Picoscience
- Carbon Nanotubes And Nanostructures From Fundamental Properties And Processes To Applications And Devices
- Fundamental Research On Raw Materials Used For Electron Emissivity On Indirectly Heated Cathodes
- Principles And Applications Of Aggregation Induced Emission
- Fundamentals And Advances In Medical Biotechnology
- Industrial Applications Of Carbon Nanotubes
- Handbook Of X ray Imaging
- Fundamentals Of Atmospheric Radiation
- Principles Of Electron Optics Volume
- Fundamental Properties Of Nanostructured Materials
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- Enhanced Field Emission Studies On Niobium Surfaces Relevant To High Field Superconducting Radio Frequency Devices
- Fullerene Nanowhiskers
- Fundamentals Of Low Emission Flameless Combustion And Its Applications
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