Scanning Tunneling Microscopy And Its Application 2nd Edition

The scanning tunnelling microscope (STM) was invented by Binnig and Rohrer and received a Nobel Prize of Physics in 1986. Together with the atomic force microscope (AFM), it provides non-destructive atomic and subatomic resolution on surfaces. Especially, in recent years, internal details of atomic and molecular wavefunctions are observed and mapped with negligible disturbance. Since the publication of its first edition, this book has been the standard reference book and a graduate-level textbook educating several generations of nano-scientists. In Aug. 1992, the co-inventor of STM, Nobelist Heinrich Rohrer recommended: "The Introduction to Scanning tunnelling Microscopy by C.J. Chen provides a good introduction to the field for newcomers and it also contains valuable material and hints for the experts". For the second edition, a 2017 book review published in the Journal of Applied Crystallography said "Introduction to Scanning tunnelling Microscopy is an excellent book that can serve as a standard introduction for everyone that starts working with scanning probe microscopes, and a useful reference book for those more advanced in the field". The third edition is a thoroughly updated and improved version of the recognized "Bible" of the field. Additions to the third edition include: theory, method, results, and interpretations of the non-destructive observation and mapping of atomic and molecular wavefunctions; elementary theory and new verifications of equivalence of chemical bond interaction and tunnelling; scanning tunnelling spectroscopy of high Tc superconductors; imaging of self-assembled organic molecules on the solid-liquid interfaces. Some key derivations are rewritten using mathematics at an undergraduate level to make it pedagogically sound.

The Foundation for Advances in Medicine and Science (FAMS), the organizers of SCANNING 98, sponsored its third annual Atomic Force Microscopy/Scanning Tunneling Microscopy Symposium at the Omni Inner Harbor Hotelin Baltimore, Maryland, from May 9 to 12, 1998. This book represents the compilation of papers that were presented at the AFM/STM Symposium as well as a few that were presented at SCANNING 96 and SCANNING 97 meetings that took place in Monterey, California. The purpose of the symposium was to provide an interface between scientists and engineers, representatives of industry, government and academia, all of whom have a common interest in probe microscopies. The meetings offered an ideal forum where ideas could easily be exchanged and where individuals from diverse fields who are on the cutting edge ofprobe microscopy research could communicate with one another. Experts in probe microscopy from around the world representing a wide range of disciplines including physics, biotechnology, nanotechnology, chemistry, material science, etc., were invited to participate. The format of the meeting was structured so as to encourage communication among these individuals. During the first day’s sessions papers were presented on general topics such as application of scanning probe microscopy in materials science; STM and scanning tunneling spectroscopy of organic materials; fractal analysis in AFM; and nanomanipulation. Other papers presented included unexpected ordering of a molecule; synthesis ofpeptides and oligonucleotides; and analysis oflunar soils from Apollo 11.

Scanning Probe Microscopy - Analytical Methods provides a comprehensive overview of the analytical methods on the nanometer scale based on scanning probe microscopy and spectroscopy. Numerous examples of applications of the chemical contrast mechanism down to the atomic scale in surface physics and chemistry are discussed with extensive references to original work in the recent literature.

Scanning Probe Microscopy provides a comprehensive source of information for researchers, teachers, and graduate students about the rapidly expanding field of scanning probe theory. Written in the style of a textbook, it explains from scratch the theory behind today’s simulation techniques and gives examples of theoretical concepts through state-of-the-art simulations, including the means to compare these results with experimental data. The book provides the first comprehensive framework for electron transport theory with its various degrees of approximations used in today’s research, thus allowing extensive insight into the physics of scanning probes. Experimentalists will appreciate how the instrument's operation is changed by materials properties; theorists will understand how simulations can be directly compared to experimental data.

Brings a fresh point of view to the current state of correlative imaging and the future of the field This book provides contributions from international experts on correlative imaging, describing their vision of future developments in the field based on where it is today. Starting with a brief historical overview of how the field evolved, it presents the latest developments in microscopy that facilitate the correlative workflow. It also discusses the need for an ideal correlative probe, applications in proteomic and elemental analysis, interpretation methods, and how correlative imaging can incorporate force microscopy, soft x-ray tomography, and volume electron microscopy techniques. Work on placing individual molecules within cells is also featured. Correlative Imaging: Focusing on the Future offers in-depth chapters on: correlative imaging from an LM perspective; the importance of sample processing for correlative imaging; correlative light and volume EM; correlation with scanning probe microscopies; and integrated microscopy. It looks at: cryo-correlative microscopy; correlative cryo soft X-ray imaging; and array tomography. Hydrated-state correlative imaging in vacuo, correlating data from different imaging modalities, and big data in correlative imaging are also considered. Brings a fresh view to one of the hottest topics within the imaging community: the correlative imaging field Discusses current research and offers expert thoughts on the field’s future developments Presented by internationally-recognized editors and contributors with extensive experience in research and applications Of interest to scientists working in the fields of imaging, structural biology, cell biology, developmental biology, neurobiology, cancer biology, infection and immunity, biomaterials and biomedicine Part of the Wiley–Royal Microscopical Society series Correlative Imaging: Focusing on the Future will appeal to those working in the expanding field of the biosciences, correlative microscopy and related microscopic areas. It will also benefit graduate students working in microscopy, as well as anyone working in the microscopy imaging field in biomedical research.

Scanning Tunneling Microscopy II, like its predecessor, presents detailed and comprehensive accounts of the basic principles and the broad range of applications of STM and related scanning probe techniques. The applications discussed in this volume come predominantly from the fields of electrochemistry and biology. In contrast to those in STM I, these studies may be performed in air and in liquids. The extensions of the basic technique to map other interactions are described in chapters on scanning force microscopy, magnetic force microscopy, and scanning near-field optical microscopy, together with a survey of other related techniques. Also discussed here is the use of a scanning proximal probe for surface modification. Together, the two volumes give a comprehensive account of experimental aspects of STM and provide essential reading and reference material. In this second edition the text has been updated and new methods are discussed.

Electron tunnelling spectroscopy as a research tool has strongly advanced understanding of superconductivity. This book explains the physics and instrumentation behind the advances illustrated in beautiful images of atoms, rings of atoms and exotic states in

high temperature superconductors, and summarizes the state of knowledge that has resulted.
Scanning tunneling microscopy (STM) and atomic force microscopy (AFM) are powerful tools for surface examination. In the past, many STM and AFM studies led to erroneous conclusions due to lack of proper theoretical considerations and of an understanding of how image patterns are affected by measurement conditions. For this book, two world experts, one on theoretical analysis and the other on experimental characterization, have joined forces to bring together essential components of STM and AFM studies: The practical aspects of STM, the image simulation by surface electron density plot calculations, and the qualitative evaluation of tip-force induced surface corrugations. Practical examples are taken from: * inorganic layered materials * organic conductors * organic adsorbates at liquid-solid interfaces * self-assembled amphiphiles * polymers This book will be an invaluable reference work for researchers active in STM and AMF as well as for newcomers to the field.
This new and completely updated edition features not only an accompanying CD-ROM, but also a new applications section, reflecting the many breakthroughs in the field over the last few years. It provides a complete set of computational models that describe the physical phenomena associated with scanning tunneling microscopy, atomic force microscopy, and related technologies. The result is both a solid professional reference and an advanced-level text, beginning with the basics and moving on to the latest techniques, experiments, and theory. In the section devoted to atomic force microscopy, the author describes the mechanical properties of cantilevers, atomic force microscope tip-sample interactions, and cantilever vibration characteristics. This is followed by an in-depth treatment of theoretical and practical aspects of tunneling phenomena, including metal-insulator-metal tunneling and Fowler-Nordheim field emission. The final section features applications, dealing with, among others, Kelvin and Raman probe microscopy. The self-contained presentation spares researchers valuable time spent hunting through the technical literature for the theoretical results required to understand the models presented. The Mathematica code for all the examples is included in the CD-ROM, affording the freedom to change the values and parameters of specific problems as desired, or even modify the programs themselves to suit various modeling needs.
Since the first edition of "Scanning 'funneling Microscopy I" has been pub lished, considerable progress has been made in the application of STM to the various classes of materials treated in this volume, most notably in the field of adsorbates and molecular systems. An update of the most recent develop ments will be given in an additional Chapter 9. The editors would like to thank all the contributors who have supplied up dating material, and those who have provided us with suggestions for further improvements. We also thank Springer-Verlag for the decision to publish this second edition in paperback, thereby making this book affordable for an even wider circle of readers. Hamburg, July 1994 R. Wiesendanger Preface to the First Edition Since its invention in 1981 by G. Binnig, H. Rohrer and coworkers at the IBM Zurich Research Laboratory, scanning tunneling microscopy (STM) has devel oped into an invaluable surface analytical technique allowing the investigation of real-space surface structures at the atomic level. The conceptual simplicity of the STM technique is startling: bringing a sharp needle to within a few Angstroms of the surface of a conducting sample and using the tunneling cur rent, which flows on application of a bias voltage, to sense the atomic and elec tronic surface structure with atomic resolution! Prior to 1981 considerable scepticism existed as to the practicability of this approach.
Introduces basic knowledge for nanomaterial characterization focusing on key properties and the different analytical techniques available Provides a quick reference to different analytical methods for a given property highlighting their pros and cons Presents numerous case studies, ranging from characterizing nanomaterials in coffee creamer suspension to measurement of airborne dust exposure levels Provides an introduction to other topics that are strongly related to nanomaterial characterization e.g. synthesis, reference material and metrology Includes state of the art techniques: scanning tunneling microscopy under extreme conditions, novel strategy for biological characterization and methods to visualize multidimensional characterization data
STM and SFM in Biology is a book fully dedicated to biological applications of the new technology of scanning probe microscopy (SX). The scanning tunneling microscope (STM) and its first off-spring, the scanning force microscope (SFM), resolve surface topography at the atomic scale. They also detect certain electronic and mechanical properties, and perform well in ultrahigh vacuum, ambient atmosphere, and aqueous solution environments. Thus, STM and SFM offer powerful tools for biological investigations of nucleic acids, proteins, membranes, and living cells. Introduces the reader to SXM Presents fundamentals of STM, SFM, and other SXMs Covers biological applications of STM and SFM Describes experimental techniques that can be reproduced in the laboratory Contains extended bibliographies that guide the reader to detailed source publications
Due to its nondestructive imaging power, scanning tunneling microscopy has found major applications in the fields of physics, chemistry, engineering, and materials science. This book provides a comprehensive treatment of scanning tunneling and atomic force microscopy, with full coverage of the imaging mechanism, instrumentation, and sample applications. The work is the first single-author reference on STM and presents much valuable information previously available only as proceedings or collections of review articles. It contains a 32-page section of remarkable STM images, and is organized as a self-contained work, with all mathematical derivations fully detailed. As a source of background material and current data, the book will be an invaluable resource for all scientists, engineers, and technicians using the imaging abilities of STM and AFM. It may also be used as a textbook in senior-year and graduate level STM courses, and as a supplementary text in surface science, solid-state physics, materials science, microscopy, and quantum mechanics.
Scanning Probe Microscopes: Applications in Science and Technology explains, analyzes, and demonstrates the most widely used microscope in the family of microscopes -- the scanning probe microscope. Beginning with an introduction to the development of SPMs, the author introduces the basics of scanning tunneling and atomic force microscopes (STMs an
This third edition is a thoroughly updated and improved version of the recognized "Bible" of the field.
The publication entitled "Surface Studies by Scanning Tunneling Mi Rl croscopy" by Binnig, Rohrer, Gerber and Weibel of the IBM Research Lab oratory in Riischlikon in 1982 immediately raised considerable interest in the sur face science community. It was demonstrated in Reference R1 that images from atomic structures of surfaces like individual steps could be obtained simply by scanning the surface with a sharp metal tip, which was kept in a constant distance of approximately 10 A from the sample surface. The distance control in scanning tunneling microscopy (STM) was realized by a feedback circuit, where the electri cal tunneling current through the potential barrier between tip and sample is used for regulating the tip position with a piezoelectric xyz-system. A similar experi mental approach has already been described by Young et al. for the determination l of the macroscopic roughness of a surface. A number of experimental difficulties had to be solved by the IBM group until this conceptual simple microscopic method could be applied successfully with atomic resolution. Firstly, distance and scanning control of the tip have to be operated

with sufficient precision to be sensitive to atomic structures. Secondly, sample holder and tunneling unit have to be designed in such a way that external vibrations do not influence the sample-tip distance and that thermal or other drift effects become small enough during measurement of one image.

Microscopes represent tools of the utmost importance for a wide range of disciplines. Without them, it would have been impossible to stand where we stand today in terms of understanding the structure and functions of organelles and cells, tissue composition and metabolism, or the causes behind various pathologies and their progression. Our knowledge on basic and advanced materials is also intimately intertwined to the realm of microscopy, and progress in key fields of micro- and nanotechnologies critically depends on high-resolution imaging systems. This volume includes a series of chapters that address highly significant scientific subjects from diverse areas of microscopy and analysis. Authoritative voices in their fields present in this volume their work or review recent trends, concepts, and applications, in a manner that is accessible to a broad readership audience from both within and outside their specialist area.

Scanning Tunneling Microscopy III provides a unique introduction to the theoretical foundations of scanning tunneling microscopy and related scanning probe methods. The different theoretical concepts developed in the past are outlined, and the implications of the theoretical results for the interpretation of experimental data are discussed in detail. Therefore, this book serves as a most useful guide for experimentalists as well as for theoreticians working in the field of local probe methods. In this second edition the text has been updated and new methods are discussed.

The first U. S. Army Natick Research, Development and Engineering Center Atomic Force/Scanning Tunneling Microscopy (AFM/STM) Symposium was held on lune 8-10, 1993 in Natick, Massachusetts. This book represents the compilation of the papers presented at the meeting. The purpose ofthis symposium was to provide a forum where scientists from a number of diverse fields could interact with one another and exchange ideas. The various topics inc1uded application of AFM/STM in material sciences, polymers, physics, biology and biotechnology, along with recent developments inc1uding new probe microscopies and frontiers in this exciting area. The meeting's format was designed to encourage communication between members of the general scientific community and those individuals who are at the cutting edge of AFM, STM and other probe microscopies. It immediately became clear that this conference enabled interdisciplinary interactions among researchers from academia, industry and government, and set the tone for future collaborations. Expert scientists from diverse scientific areas including physics, chemistry, biology, materials science and electronics were invited to participate in the symposium. The agenda of the meeting was divided into three major sessions. In the first session, Biological Nanostructure, topics ranged from AFM ofDNA to STM imagmg ofthe biomoleeule tubulin and bacterialluciferase to the AFM of starch polymer double helices to AFM imaging of food surfaces.

Scanning Tunneling MicroscopyAcademic Press

This book explains the operating principles of atomic force microscopy and scanning tunneling microscopy. The aim of this book is to enable the reader to operate a scanning probe microscope successfully and understand the data obtained with the microscope. The chapters on the scanning probe techniques are complemented by the chapters on fundamentals and important technical aspects. This textbook is primarily aimed at graduate students from physics, materials science, chemistry, nanoscience and engineering, as well as researchers new to the field.

This book explains the operating principles of atomic force microscopy with the aim of enabling the reader to operate a scanning probe microscope successfully and understand the data obtained with the microscope. This enhanced second edition to "Scanning Probe Microscopy" (Springer, 2015) represents a substantial extension and revision to the part on atomic force microscopy of the previous book. Covering both fundamental and important technical aspects of atomic force microscopy, this book concentrates on the principles the methods using a didactic approach in an easily digestible manner. While primarily aimed at graduate students in physics, materials science, chemistry, nanoscience and engineering, this book is also useful for professionals and newcomers in the field, and is an ideal reference book in any atomic force microscopy lab.

Written by three leading experts in the field, this textbook describes and explains all aspects of the scanning probe microscopy. Emphasis is placed on the experimental design and procedures required to optimize the performance of the various methods. Scanning Probe Microscopy covers not only the physical principles behind scanning probe microscopy but also questions of instrumental designs, basic features of the different imaging modes, and recurring artifacts. The intention is to provide a general textbook for all types of classes that address scanning probe microscopy. Third year undergraduates and beyond should be able to use it for self-study or as textbook to accompany a course on probe microscopy. Furthermore, it will be valuable as reference book in any scanning probe microscopy laboratory. Novel applications and the latest important results are also presented, and the book closes with a look at the future prospects of scanning probe microscopy, also discussing related techniques in nanoscience. Ideally suited as an introduction for graduate students, the book will also serve as a valuable reference for practising researchers developing and using scanning probe techniques.

A comprehensive introduction to scanning tunnelling microscopy and related scanning probe techniques.

Scanning tunneling microscopy (STM) provides three-dimensional real- space images of surfaces at high spatial resolution. When the surface is flat and clean, even atoms can be imaged. Its extreme usefulness has led it to near instantaneous acceptance as a characterization tool. This book covers fundamental concepts of STM operation, image interpretation, instrumentation, and techniques for various applications. It als contains advanced treatments of theory and spectroscopy. Surface physicists, electrochemists, materials scientists, and other scientists who see a use for STM will find the depth of coverage and accompanying reference lists in this book essential to their work. In addition, those who wish to add the capabilities of probe microscopy to their operations, such as microscopists and quality control engineers, will find the basic information in this book.

This book presents a unified view of the rapidly growing field of scanning tunneling microscopy and its many derivatives. After examining novel scanning-probe techniques and the instrumentation and methods, the book provides detailed accounts of STM applications. It examines limitations of the present-day investigations and provides insight into further trends. "I strongly recommend that Professor Bai's book be a part of any library that serves surface scientists, biochemists, biophysicists, material scientists, and students of any science or engineering field...There is no doubt that this is one of the better (most thoughtful) texts." Journal of the American Chemical Society (Review of 1/e)

Scanning tunneling microscopy (STM) and its extensions have become revolutionary tools in the fields of physics, materials science, chemistry, and biology. These new microscopies have evolved from their beginnings asresearch aids to their current use as commercial tools in the laboratory and on the factory floor. New wonders continue to unfold as STM delivers atomic scale imaging and electrical characterization of the newly emerging nanometer world. This volume in the METHODS OF EXPERIMENTAL PHYSICS Series describes the basics of scanning tunneling microscopy, provides a fundamental theoretical understanding of the technique and a thorough description of the instrumentation, and examines numerous examples and applications. Written by the pioneers of the field, this volume is an essential handbook for researchers and users of STM, as well as a valuable resource for libraries.

'I recommend this book to anyone interested in learning the history of nanoscale science, and to those who would like to better understand some of the ethical, legal and social dilemmas to what I believe has rightly been labeled the technology of the 21st century.' - Rocky Rawstern, Nanotechnology Now Science and engineering, industry and politics, environmentalists and transhumanists are Discovering the Nanoscale. Policy makers are demanding explicit consideration of ethical, legal and social aspects, and popular books are explaining the

achievements and promises of nanoscience. It may therefore seem surprising that this is the first collection of studies that considers nanoscience and nanotechnologies from the critical perspective of Science and Technology Studies (STS). However, when one appreciates that such a critical perspective needs to be historically informed it often involves intimate acquaintance with the research process. Accordingly, this book on the historical, analytical, and ethical study of nanoscience and -technology has come together in a period of several years. Though it presents only first results, these results for the most part stem from sustained investigations of nanoscience and nanotechnologies and of the contexts that are shaping their development. Nanoscience and technologies are developing very quickly, and for this reason, both pose a challenge to the more reflective approach commonly taken by science studies, while at the same time requiring the perspective provided by science studies scholars. Many are convinced that nothing meaningful can be said about the social and ethical implications of nanotechnologies at this early stage, but one can already see what programmatic attitudes go into nanoscale research, what metaphors are shaping it, and what conception of nature is implicit in its vision. It is also often assumed that in order to consider all aspects of nanotechnologies it is sufficient to know a bit of the science and to have some ethical intuitions. This collection of papers establishes that one also needs to appreciate nanoscale research and development in the larger context of the changing relations of science, technology, and society.

This book represents the compilation of papers presented at the second Atomic Force Microscopy/Scanning Tunneling Microscopy (AFM/STM) Symposium, held June 7 to 9, 1994, in Natick, Massachusetts, at Natick Research, Development and Engineering Center, now part ofU.S. Army Soldier Systems Command. As with the 1993 symposium, the 1994 symposium provided a forum where scientists with a common interest in AFM, STM, and other probe microscopies could interact with one another, exchange ideas and explore the possibilities for future collaborations and working relationships. In addition to the scheduled talks and poster sessions, there was an equipment exhibit featuring the newest state-of-the-art AFM/STM microscopes, other probe microscopes, imaging hardware and software, as well as the latest microscope-related and sample preparation accessories. These were all very favorably received by the meeting's attendees. Following opening remarks by Natick's Commander, Colonel Morris E. Price, Jr., and the Technical Director, Dr. Robert W. Lewis, the symposium began with the Keynote Address given by Dr. Michael F. Crommie from Boston University. The agenda was divided into four major sessions. The papers (and posters) presented at the symposium represented a broad spectrum of topics in atomic force microscopy, scanning tunneling microscopy, and other probe microscopies.

This thesis focuses on the energy band engineering of graphene. It presents pioneering findings on the controlled growth of graphene and graphene-based heterostructures, as well as scanning tunneling microscopy/scanning tunneling spectroscopy (STM/STS) studies on their electronic structures. The thesis primarily investigates two classes of graphene-based systems: (i) twisted bilayer graphene, which was synthesized on Rh substrates and manifests van Hove singularities near Fermi Level, and (ii) in-plane h-BN-G heterostructures, which were controllably synthesized in an ultrahigh vacuum chamber and demonstrate intriguing electronic properties on the interface. In short, the thesis offers revealing insights into the energy band engineering of graphene-based nanomaterials, which will greatly facilitate future graphene applications.

Proceedings of the NATO Advanced Study Institute on Basic Concepts and Applications of Scanning Tunneling Microscopy, Erice, Italy, April 17-29, 1989

A practical introduction to basic theory and contemporary applications across a wide range of research disciplines Over the past two decades, scanning probe microscopies and spectroscopies have gained acceptance as indispensable characterization tools for an array of disciplines. This book provides novices and experienced researchers with a highly accessible treatment of basic theory, alongside detailed examples of current applications of both scanning tunneling and force microscopies and spectroscopies. Like its popular predecessor, Scanning Probe Microscopy and Spectroscopy, Second Edition features contributions from distinguished scientists working in a wide range of specialties at university, commercial, and government research labs around the world. Chapters have been edited for clarity, conciseness, and uniformity of presentation to provide professionals with a concise working reference to scanning probe microscopic and spectroscopic principles, techniques, and practices. This Second Edition has been substantially revised and expanded to reflect important advances and new applications. In addition to numerous examples, the Second Edition features expanded coverage of electrostatic and magnetic force microscopies, near-field optical microscopies, and new applications of buried interfaces in nanomechanics, electrochemistry, and biology. Scanning Probe Microscopy and Spectroscopy, Second Edition is an indispensable working resource for surface scientists, microscopists, and spectroscopists in materials science, chemistry, engineering, biochemistry, physics, and the life sciences. It is also an unparalleled reference text for advanced undergraduates and graduate students in those fields.

Scanning Tunneling Microscopy I provides a unique introduction to a novel and fascinating technique that produces beautiful images of nature on an atomic scale. It is the first of three volumes that together offer a comprehensive treatment of scanning tunneling microscopy, its diverse applications, and its theoretical treatment. In this volume the reader will find a detailed description of the technique itself and of its applications to metals, semiconductors, layered materials, adsorbed molecules and superconductors. In addition to the many representative results reviewed, extensive references to original work will help to make accessible the vast body of knowledge already accumulated in this field.

This volume will be devoted to the technical aspects of electrical and electromechanical SPM probes and SPM imaging on the limits of resolution, thus providing technical introduction into the field. This volume will also address the fundamental physical phenomena underpinning the imaging mechanism of SPMs.

Inorganic 2D nanomaterials, or inorganic graphene analogues, are gaining great attention due to their unique properties and potential energy applications. They contain ultrathin nanosheet morphology with one-dimensional confinement, but unlike pure carbon graphene, inorganic two-dimensional nanomaterials have a more abundant elemental composition and can form different crystallographic structures. These properties contribute to their unique chemical reaction activity, tunable physical properties and facilitate applications in the field of energy conversion and storage. Inorganic Two-dimensional Nanomaterials details the development of the nanostructures from computational simulation and theoretical understanding to their synthesis and characterization. Individual chapters then cover different applications of the materials as electrocatalysts, flexible supercapicitors, flexible lithium ion batteries and thermoelectrical devices. The book provides a comprehensive overview of the field for researchers working in the areas of materials chemistry, physics, energy and catalysis.

This book presents a unified view of the rapidly growing field of scanning tunneling microscopy and its many derivatives. After examining novel scanning-probe techniques and the instrumentation and methods, the book provides detailed accounts of STM applications. It examines limitations of the present-day investigations and provides insight into further trends."I strongly recommend that Professor Bai's book be a part of any library that serves surface scientists, biochemists, biophysicists, material scientists, and students of any science or engineering field...There is no doubt that this is one of the better (most thoughtful) texts." "Journal of the American Chemical Society" ("Review of 1/e)"

This first book to focus on the use of SPMs to actively manipulate molecules and nanostructures on surfaces goes way beyond conventional treatments of scanning microscopy merely for imaging purposes. It reviews recent progress in the use of SPMs on such soft materials as polymers, with a particular emphasis on chemical discrimination, mechanical properties, tip-induced reactions and manipulations, as well as their nanoscale electrical properties. Detailing the practical application potential of this hot topic, this book is of great interest to specialists of

wide-ranging disciplines, including physicists, chemists, materials scientists, spectroscopy experts, surface scientists, and engineers.