Time Resolved Electron Diffraction For Chemistry Biology And Material Science Volume 184 Advances In Imaging And Electron Physics

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Near-Field-Mediated Photon–Electron Interactions Springer Science & Business Media
TEM and SEM have contributed greatly to the progress of various research fields, which has been accelerated in the last few decades by highly functional electron microscopes and microscopy. In this tide of microscopy, various microscopic methods have been developed to make clear many unsolved problems, e.g. pulse beam TEM, environmental microscopy, correlative microscopy, etc. In this book, a number of reviews have been collected concerning these subjects. We think that the content in each chapter is impressive, and we hope this book will contribute to future advances in electron microscopy, materials science, and biomedicine.
Electronically Induced Structure Transformations in Graphite & Silver Studied Using Ultrafast Electron Crystallography Springer
Electron microscopy techniques are among the most powerful methods for characterization of materials, with the ability to reveal both the atomic-scale structure and composition. This information may be used to elucidate macroscopic properties or to optimize materials synthesis and processing. Instrumentation and techniques for dynamic in situ experiments are undergoing rapid development and have recently been applied to a wide range of problems. This book focuses on time-resolved electron microscopy (including diffraction and spectroscopy), as well as novel instrumentation for temperature and pressure control. In addition to discussing the application of electron microscopy techniques to the in situ study of the kinetics, thermodynamics and mechanisms of reaction, the book also explores their utility as efficient methods of optimizing processing conditions. Imaging techniques featured include: scanning tunneling microscopy, high-resolution electron microscopy, dark field transmission and reflection electron microscopy, Lorentz microscopy, electron holography, scanning and low-energy electron microscopy and photoemission electron microscopy
Emergent States in Photoinduced Charge-Density-Wave Transitions Academic Press
Structural phase transitions, mechanical deformations, and the embryonic stages of melting and crystallization are examples of phenomena that can now be imaged in unprecedented structural detail with high spatial resolution, and ten orders of magnitude as fast as hitherto. No monograph in existence attempts to cover the revolutionary dimensions that EM in its various modes of operation nowadays makes possible. The authors of this book chart these developments, and also compare the merits of coherent electron waves with those of synchrotron radiation. They judge it prudent to recall some important basic procedural and theoretical aspects of imaging and

diffraction so that the reader may better comprehend the significance of the new vistas and applications now afoot. This book is not a vade mecum - numerous other texts are available for the practitioner for that purpose.

Physical Biology Academic Press

Ever since the beginning of mankind's efforts to pursue scientific inquiry into the laws of nature, visualization of the very distant and the very small has been paramount. The examples are numerous. A century ago, the atom appeared mysterious, a “raisin or plum pie of no structure,” until it was visualized on the appropriate length and time scales. Similarly, with telescopic observations, a central dogma of the cosmos was changed and complexity yielded to simplicity of the heliocentric structure and motion in our solar system. For matter, in over a century of developments, major advances have been made to explore the inner microscopic structures and dynamics. These advances have benefited many fields of endeavor, but visualization was incomplete; it was limited either to the 3D spatial structure or to the 1D temporal evolution. However, in systems with myriads of atoms, 4D spatiotemporal visualization is essential for dissecting their complexity. The biological world is rich with examples, and many molecular diseases cannot be fully understood without such direct visualization, as, for example, in the case of Alzheimer's and Parkinson's. The same is true for phenomena in materials science, chemistry, and nanoscience. This anthology is an account of the collected works that have emerged over the past decade from Caltech. Through recent publications, the volume provides overviews of the principles, the electron-based techniques, and the applications made. Thanks to advances in imaging principles and technology, it is now possible with 4D electron microscopy to reach ten orders of magnitude improvement in time resolution while simultaneously conserving the atomic spatial resolution in visualization. This is certainly a long way from Robert Hooke's microscopy, which was recorded in his 1665 masterpiece Micrographia.

The Nobel Prizes 2018 Springer

The papers in this volume cover the major areas of research activity in the field of ultrafast optics at the present time, and they have been selected to provide an overview of the current state of the art. The purview of the field is the methods for the generation, amplification, and characterization of electromagnetic pulses with durations from the pieo-to the attosecond range, as well as the technical issues surrounding the application of these pulses in physics, chemistry, and biology. The contributions were solicited from the participants in the Ultrafast Optics IV Conference, held in Vienna, Austria, in June 2003. The purpose of the conference is similar to that of this book: to provide a forum for the latest advances in ultrafast optical technology. Ultrafast light sources provide a means to observe and manipulate events on the scale of atomic and molecular dynamics. This is possible either through appropriate shaping of the time-dependent electrie field, or through the ap plication of fields whose strength is comparable to the binding forces of the electrons in atoms and molecules. Recent advances discussed here include the generation of pulses shorter than two optical cycles, and the ability to measure and to shape them in all degrees of freedom with unprecedented 2 21 2 precision, and to amplify them to the Zettawatt/cm (10 W /cm) range.

Electron Microscopy Oxford [England] ; New York : Oxford University Press

Imaging and spectroscopy are the most important and challenging techniques for not only research on materials science, chemistry, and biology, but also medical diagnoses. In this book, we have collected information on several novel imaging and spectroscopic techniques, including time-resolved electron diffraction/microscopy for materials science, various spectroscopes for physics and chemistry, and high-resolution computed tomography for medical science. We think that the content in each chapter is impressive and we hope this book will contribute to future instrument developments and new applications.

In Situ Electron and Tunneling Microscopy of Dynamic Processes: Volume 404 World Scientific

A self-contained book on electron microscopy and spectrometry techniques for surface studies.

Transmission Electron Microscopy Springer Science & Business Media

This book presents an Ultrafast Low-Energy Electron Diffraction (ULEED) system that reveals ultrafast structural changes on the atomic scale. The achievable temporal resolution in the low-energy regime is improved by several orders of magnitude and has enabled the melting of a highly-sensitive, molecularly thin layer of a polymer crystal to be resolved for the first time. This new experimental approach permits time-resolved structural investigations of systems that were previously partially or totally inaccessible, including surfaces, interfaces and atomically thin films. It will be of fundamental importance for understanding the properties of nanomaterials so as to tailor their properties.

Time-resolved Macromolecular Crystallography Academic Press

The behavior of nanoscale materials can change rapidly with time either because the environment changes rapidly or because the influence of the environment propagates quickly across the intrinsically small dimensions of nanoscale materials. Extremely fast time resolution studies using X-rays, electrons and neutrons are of very high interest to many researchers and is a fast-evolving and interesting field for the study of dynamic processes. Therefore, in situ structural characterization and measurements of structure-property relationships covering several decades of length and time scales (from atoms to millimeters and femtoseconds to hours) with high spatial and temporal resolutions are crucially important to understand the synthesis and behavior of multidimensional materials. The techniques described in this book will permit access to the real-time dynamics of materials, surface processes and chemical and biological reactions at various time scales. This book provides an interdisciplinary reference for research using in situ techniques to capture the real-time structural and property responses of materials to surrounding fields using electron, optical and x-ray microscopies (e.g. scanning, transmission and low-energy electron microscopy and scanning probe microscopy) or in the scattering realm with x-ray, neutron and electron diffraction.

Chemistry in Action: Making Molecular Movies with Ultrafast Electron Diffraction and Data Science World Scientific

Recent technological advances in synchrotron and neutron sources, detectors, and computer hardware and software have made possible diffraction techniques which collect data at successive moments in time. This is the first book to bring together reviews and research articles covering the three branches of time-resolved diffraction--X-ray, electron, and neutron field. Time-Resolved Diffraction covers gases, liquids, amorphous solids, fibers, and crystals and does so in a multidisciplinary framework which includes examples from molecular biology and chemistry, as well as techniques from physics and materials science. The various time scales of data collection cover ten orders of magnitude, from the sub-pico domain to the kilosecond. Research scientists and graduate students will find this book the most complete compendium of work in this developing field.

Reminiscences Of Ahmed H.zewail: Photons, Electrons And What Else? - A Portrait From Close Range. Remembrances Of His Group Members And Family Royal Society of Chemistry

The thesis provides the necessary experimental and analytical tools to unambiguously observe the atomically resolved chemical reactions. A great challenge of modern science has been to directly observe atomic motions during structural transitions, and while this was first achieved through a major advance in electron source brightness, the information content was still limited and new methods for image reconstruction using femtosecond electron diffraction methods were needed. One particular challenge lay in reconciling the innumerable possible nuclear configurations with the observation of chemical reaction mechanisms that reproducibly give the same kind of chemistry for large classes of molecules. The author shows that there is a simple solution that occurs during barrier crossing in which the highly anharmonic potential at that point in nuclear rearrangements couples high- and low-frequency vibrational modes to give highly localized nuclear motions, reducing hundreds of potential degrees of freedom to just a few key modes. Specific examples are given in this thesis, including two photoinduced phase transitions in an organic system, a ring closure reaction, and two direct observations of nuclear reorganization driven by spin transitions. The emerging field of structural dynamics promises to change the way we think about the physics of chemistry and this thesis provides tools to make it happen.

Advances in Imaging and Electron Physics Academic Press

This concise and carefully developed text offers a reader friendly guide to the basics of time-resolved spectroscopy with an emphasis on experimental implementation. The authors carefully explain and relate for the reader how measurements are connected to the core physical principles. They use the time-dependent wave packet as a building block for understanding quantum dynamics, progressively advancing to more complex topics. The topics are discussed in paired sections, one discussing the theory and the next presenting the related experimental methods. A wide range of readers including students and newcomers to the field will gain a clear and practical understanding of how to measure aspects of molecular dynamics such as wave packet motion, intramolecular vibrational relaxation, and electron-electron coupling, and how to describe such measurements mathematically.

Advances in Imaging and Electron Physics Academic Press

This text is a companion volume to Transmission Electron Microscopy: A Textbook for Materials Science by Williams and Carter. The aim is to extend the discussion of certain topics that are either rapidly changing at this time or that would benefit from more detailed discussion than space allowed in the primary text. World-renowned researchers have contributed chapters in their area of expertise, and the editors have carefully prepared these chapters to provide a uniform tone and treatment for this exciting material. The book features an unparalleled collection of color figures showcasing the quality and variety of chemical data that can be obtained from today’s instruments, as well as key pitfalls to avoid. As with the previous TEM text, each chapter contains two sets of questions, one for self assessment and a second more suitable for homework assignments. Throughout the book, the style follows that of Williams & Carter even when the subject matter becomes challenging—the aim is always to make the topic understandable by first-year graduate students and others who are working in the field of Materials Science Topics covered include sources, in-situ experiments, electron diffraction, Digital Micrograph, waves and holography, focal-series reconstruction and direct methods, STEM and tomography, energy-filtered TEM (EFTEM) imaging, and spectrum imaging. The range and depth of material makes this companion volume essential reading for the budding microscopist and a key reference for practicing researchers using these and related techniques.

Correlative Light and Electron Microscopy III Springer Science & Business Media

These two volumes on Femtochemistry present a timely contribution to a field central to the understanding of the dynamics of the chemical bond. This century has witnessed great strides in time and space resolutions, down to the atomic scale, providing chemists, biologists and physicists with unprecedented opportunities for seeing microscopic structures and dynamics. Femtochemistry is concerned with the time resolution of the most elementary motions of atoms during chemical change -- bond breaking and bond making -- on the femtosecond (10-15 second) time scale. This atomic scale of time resolution has now reached the ultimate for the chemical bond and as Lord George Porter puts it, chemists are near the end of the race against time. These two volumes cover the general concepts, techniques and applications of femtochemistry.Professor Ahmed Zewail, who has made the pioneering contributions in this field, has from over 250 publications selected the articles for this anthology. These volumes begin with a commentary and a historical chronology of the milestones. He then presents a broad perspective of the current state of knowledge in femtochemistry by researchers around the world and discusses possible new directions. In the words of a colleague, "it is a must on the reading-list for all of my students ... all readers will find this to be an informative and valuable overview."The introductory articles in Volume I provide reviews for both the non-experts as well as for experts in the field. This is followed by papers on the basic concepts. For applications, elementary reactions are studied first and then complex reactions. Volume I is complete with studies of solvation dynamics, non-reactive systems, ultrafast electron diffraction and the control of chemical reactions.Volume II continues with reaction rates, the concept of elementary intramolecular vibrational-energy redistribution (IVR) and the phenomena of rotational coherence which has become a powerful tool for the determination of molecular structure via time resolution. The second volume ends with an extensive list of references, according to topics, based on work by Professor Zewail and his group at Caltech.These collected works by Professor Zewail will certainly be indispensable to both experts and beginners in the field. The author is known for his clarity and for his creative and systematic contributions. These volumes will be of interest and should prove useful to chemists, biologists and physicists. As noted by Professor J Manz (Berlin) and Professor A W Castleman, Jr. (Penn State): femtochemistry is yielding exciting new discoveries from analysis to control of chemical reactions, with applications in many domains of chemistry and related fields, e.g., physical, organic and inorganic chemistry, surface science, molecular biology, ... etc.

Time-resolved Diffraction BoD – Books on Demand

Advances in Imaging & Electron Physics merges two long-running serials—Advances in Electronics & Electron Physics and Advances in Optical & Electron Microscopy. The series features extended articles on the physics of electron devices (especially semiconductor devices), particle optics at high and low energies, microlithography, image science and digital image processing, electromagnetic wave propagation, electron microscopy, and the computing methods used in all these domains. Contributions from leading authorities Informs and updates on all the latest developments in the field

4D Electron Microscopy Springer Nature

Advances in Imaging and Electron Physics merges two long-running serials--Advances in

Electronics and Electron Physics and Advances in Optical and Electron Microscopy. This series features extended articles on the physics of electron devices (especially semiconductor devices), particle optics at high and low energies, microlithography, image science and digital image processing, electromagnetic wave propagation, electron microscopy, and the computing methods used in all these domains. Contributions from leading authorities Informs and updates on all the latest developments in the field

Novel Imaging and Spectroscopy World Scientific Publishing Company

This book features reviews by leading experts on the methods and applications of modern forms of microscopy. The recent awards of Nobel Prizes awarded for super-resolution optical microscopy and cryo-electron microscopy have demonstrated the rich scientific opportunities for research in novel microscopies. Earlier Nobel Prizes for electron microscopy (the instrument itself and applications to biology), scanning probe microscopy and holography are a reminder of the central role of microscopy in modern science, from the study of nanostructures in materials science, physics and chemistry to structural biology. Separate chapters are devoted to confocal, fluorescent and related novel optical microscopies, coherent diffractive imaging, scanning probe microscopy, transmission electron microscopy in all its modes from aberration corrected and analytical to in-situ and time-resolved, low energy electron microscopy, photoelectron microscopy, cryo-electron microscopy in biology, and also ion microscopy. In addition to serving as an essential reference for researchers and teachers in the fields such as materials science, condensed matter physics, solid-state chemistry, structural biology and the molecular sciences generally, the Springer Handbook of Microscopy is a unified, coherent and pedagogically attractive text for advanced students who need an authoritative yet accessible guide to the science and practice of microscopy.

Elastic and Inelastic Scattering in Electron Diffraction and Imaging BoD – Books on Demand

The decision of Springer-Verlag to publish this book in English came as a pleasant surprise. The fact is that I started writing the first version of the book back in 1978. I wished to attract attention to potentialities inherent in selected-area electron diffraction (SAED) which, for various reasons, were not being put to use. By that time, I had at my disposal certain structural data on natural and synthetic minerals obtained using SAED and high-resolution electron microscopy (HREM), and this stimulated my writing this book. There were several aspects concerning these data that I wished to emphasize. First, it was mostly new and understudied minerals that possess the peculiar structural features studied by SAED and HREM. This could interest mineralogists, crystallo chemists, and crystallographers. Second, the results obtained indi cated that, under certain conditions, SAED could be an effective, and sometimes the only possible, method for structure analysis of minerals. This inference was of primary importance, since fine dispersion and poor crystallinity of numerous natural and synthe tic minerals makes their structure study by conventional diffrac tion methods hardly possible. Third, it was demonstrated that in many cases X-ray powder diffraction analysis of dispersed miner als ought to be combined with SAED and local energy dispersion analysis. This was important, since researchers in structural min eralogy quite often ignored, and still ignore even the simplest in formation which is readily available from geometrical analysis of SAED patterns obtained from microcrystals.

Electron Diffraction and High-Resolution Electron Microscopy of Mineral Structures Springer Nature

This book provides an introduction to the fundamental concepts, techniques, and methods used for electron microscopy at high resolution in space, energy, and even in time. It delineates the theory of elastic scattering, which is most useful for spectroscopic and chemical analyses. There are also discussions of the theory and practice of image calculations, and applications of HRTEM to the study of solid surfaces, highly disordered materials, solid state chemistry, mineralogy, semiconductors and metals. Contributors include J. Cowley, J. Spence, P. Buseck, P. Self, and M.A. O'Keefe. Compiled by experts in the fields of geology, physics and chemistry, this comprehensive text will be the standard reference for years to come.

Reflection Electron Microscopy and Spectroscopy for Surface Analysis Cambridge University Press

Includes bibliographical references and index.