

New developments of computer-aided crystallographic analysis in transmission electron microscopy

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A new computer program for on-line crystallographic analysis in transmission electron microscopy (TEM) is presented. The program is based on the fast on-line determination of single-crystal orientations from Kikuchi and spot patterns. Spot patterns, which are particularly useful in the case of highly deformed metals, are analyzed by a new digital image processing procedure. This procedure improves the precision and ease of the orientation measurement. The program permits the on-line measurement of glide systems characterized by the Burgers vector and the crystallographic line direction of dislocations and their glide planes. The determination of twin systems, based on the misorientation calculation for any crystal structure, is included as well. The possibility of determining the foil thickness permits the complete crystallographic characterization of interfaces. Finally, the program facilitates the discrimination of phases and includes the fit of the lattice parameters a , b and c from diffraction patterns. The new procedures are described in detail. Application examples are given for all functions.

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1. Introduction

Transmission electron microscopy (TEM) is one of the most important tools for studies in materials science. It does not only allow the observation of the microstructure inside a material, but also the quantification of the character of microstructural elements, such as crystallographic symmetry of phases, the orientation of grains, Burgers vectors and the line direction of dislocations, twin systems, types of interfaces, and so on, by the analysis of diffraction patterns. Furthermore, TEM allows the determination of the chemical composition of very small regions in combination with energy dispersive X-ray analysis (EDX) or electron energy loss spectrometry (EELS).

Two research projects on the determination of deformation mechanisms in titanium alloys and on the recrystallization mechanisms in Fe–36% Ni have been carried out by the author; both required extensive crystallographic studies with TEM. Therefore, a universal computer program for the evaluation of electron diffraction patterns and their application to crystallographic problems was created (C programming language, DOS/Windows operating system), in order to facilitate and speed up the quantitative crystallographic work employing TEM in the normal diffraction mode. The program is based on the fast on-line determination of individual crystal orientations from electron diffraction patterns. It subsequently permits the on-line determination of Burgers vectors,

the type and glide plane of dislocations and the determination of twinning systems. It has also been applied to crystallographic analyses of phases and interfaces in TiAl intermetallic alloys and in Al_2O_3 .

The main features of the program are as follows.

- (i) On-line orientation determination from Kikuchi and spot patterns of any crystal structure. The program uses new algorithms for the indexing and orientation calculation which allow Kikuchi and spot patterns to be treated for all crystal structures in a similar way. Even patterns containing only one zone axis and complicated spot patterns are included in one single procedure.
- (ii) A digital image processing procedure is used to determine the intensity and positions of spots in a spot pattern from highly deformed materials. This considerably improves the accuracy and ease of orientation determinations from spot patterns.
- (iii) Support for work in the diffraction mode of the microscope by simulating the crystal tilt in a double-tilt or rotation-tilt sample holder. These features are, together with the possibility to display the stereographic projection, particularly helpful for tilt experiments.
- (iv) On-line determination of the Burgers vector and crystallographic line direction of dislocations. From these values, the dislocation type (screw, edge or mixed) and the slip plane are calculated.
- (v) Calculation of misorientations between crystals of any crystal symmetry for the determination of twinning systems.

New Developments In Electron Microscopy

Masashi Arita, Norihito Sakaguchi



New Developments In Electron Microscopy:

New Developments in Electron Microscopy H. E. Huxley, 1971 **Electron Microscopy of Plant Pathogens** Kurt Mendgen, Dietrich-Eckhardt Lesemann, 2012-12-06 Plants fungi and viruses were among the first biological objects studied with an electron microscope One of the two first instruments built by Siemens was used by Helmut Ruska a brother of Ernst Ruska the pioneer in constructing electron microscopes H Ruska published numerous papers on different biological objects in 1939 In one of these the pictures by G A Kausche E Pfankuch and H Ruska of tobacco mosaic virus opened a new age in microscopy The main problem was then as it still is today to obtain an appropriate preparation of the specimen for observation in the electron microscope Beam damage and specimen thickness were the first obstacles to be met L Marton in Brussels not only built his own instrument but also made considerable progress in specimen preparation by introducing the impregnation of samples with heavy metals to obtain useful contrast His pictures of the bird nest orchid root impregnated with osmium were revolutionary when published in 1934 It is not the place here to recall the different techniques which were developed in the subsequent years to attain the modern knowledge on the fine structure of plant cells and of different plant pathogens The tremendous progress obtained with tobacco mosaic virus is reflected in the chapter by M Wurtz on the fine structure of viruses in this Volume New cytochemical and immunological techniques considerably surpass the morphological information obtained from the pathogens especially at the host parasite interface *New Developments In Applied Superconductivity - Proceedings Of The International Symposium* Yukioka Murakami, 1989-06-01 This symposium focused on new superconductors electronics magnet technology energy and new applications Recent discoveries in HTc with transition temperatures over 90 K have spawned a search for practical new applications These applications extend from current uses such as that of the medical MRI to future applications represented by research on new high temperature materials They span from microcircuit applications to the proposed SMES and fusion reactor applications Recent Advancements in Multidimensional Applications of Nanotechnology Virat Khanna, Suneev Anil Bansal, Vishal Chaudhary, Reddicherla Umapathi, 2024-07-31 Recent Advancements in Multidimensional Applications of Nanotechnology provides a comprehensive overview of the latest advancements and applications of nanotechnology across various dimensions Covering a wide range of topics from electron microscopy to nanotherapeutic strategies the book explores the diverse applications of nanotechnology in industries and research fields Key Features Comprehensive Coverage Gain insights into electron microscopy biogenic synthesis methods energy applications and more Industry Applications Discover how nanotechnology is revolutionizing industries such as energy oil and gas agriculture and healthcare Cutting Edge Developments Stay ahead of the curve with discussions on copper oxide nanoparticles nano coatings and thin film optimization for solar cells Biomedical Breakthroughs Explore the exciting realm of biomedical applications from metallic nanoparticles in healthcare to biogenic synthesis methods Practical Insights Benefit from practical insights and case studies that showcase real world applications of nanotechnology

New Developments in Diagnostic Virology P.A. Bachmann, 2012-12-06 The contributions to this book derived from the Seventh Munich Symposium on Microbiology on June 3 and 4 1981 which was organized by the WHO Centre for Collection and Evaluation of Data on Comparative Virology at the Institute of Medical Microbiology Infectious and Epidemic Diseases University of Munich Federal Republic of Germany One of our principal purposes was to establish a forum at which the comparative aspects of questions of current interest in the field of medical virology could be discussed In addition to the presentation of recent findings in microbiology our overall aim was to crystallize trends and indicate new directions for future research activities This book is a topical review of New Horizons in Diagnostic Virology Every one interested in virology is aware of the tremendous progress made in viral diagnostic techniques during recent years and the growing importance of viral diagnosis in human and veterinary medicine There is yet another step that diagnostic virology has to take the introduction on a routine basis of methods of molecular biology into the viral diagnostic laboratory The application of monoclonal antibodies and techniques for the chemical and biological identification of proteins carbohydrates and enzymes are discussed as is the introduction of techniques for the characterization of nucleic acids in viral diagnosis Circular - National Bureau of Standards United States. National Bureau of Standards, 1950

New Developments in Nanotechnology Research Eugene V. Dirote, 2007 Nanotechnology is a catch all description of activities at the level of atoms and molecules that have applications in the real world A nanometer is a billionth of a metre about 1/80 000 of the diameter of a human hair or 10 times the diameter of a hydrogen atom Nanotechnology is now used in precision engineering new materials development as well as in electronics electromechanical systems as well as mainstream biomedical applications in areas such as gene therapy drug delivery and novel drug discovery techniques This book presents the latest research in this frontier field

Immuno-Gold Electron Microscopy in Virus Diagnosis and Research Alexander D. Hyatt, Bryan Eaton, 1992-11-10 This book presents a wide variety of immuno gold techniques for use in virus diagnosis and research Protocols are presented for state of the art techniques including in situ hybridization freeze substitution and the utilization of ultra small probes and replicas for use by virologists and electron microscopists identifying and studying viruses their components and replication in cells The procedures are described by eminent scientists and are pertinent to both experienced researchers and newcomers to this field who are interested in the localization of low antigenic mass structures

Electron Microscopy Masashi Arita, Norihito Sakaguchi, 2019-10-02 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 **National Library**

of Medicine Current Catalog National Library of Medicine (U.S.),1972 First multi year cumulation covers six years 1965
70 **Circular** United States. National Bureau of Standards,1950 **Recent Advances in Mechanics** E.E.

Gdoutos,Anthony N. Kounadis,2011-01-19 This book contains 24 papers presented at the symposium on Recent Advances in Mechanics dedicated to the late Professor Academician Pericles S Theocaris in commemoration of the tenth anniversary of his death The papers are written by world renowned and recognized experts in their fields and serve as a reference and guide for future research The topics covered in the book can be divided into three major themes Mathematical methods in applied mechanics nine papers experimental mechanics nine papers and fracture mechanics six papers Topics covered include Application of reciprocity relations to laser based ultrasonics boundary value problems of the theory of elasticity optimal design in contact mechanics scaling of strength and lifetime distributions of quasibrittle structures directional distortional hardening in plasticity vibration of systems instability phenomena in damped systems variational methods for static and dynamic elasticity problems an accelerated Newmark scheme for solving the equations of motion in the time domain photoelastic tomography electronic speckle pattern interferometry composites exposed to fire sampling moir microelectromechanical systems experimental mechanics in nano scale advanced cement based nanocomposites piezonuclear transmutations in brittle rocks under mechanical loading stress triaxiality at crack tips studied by caustics reinforcement of a cracked elastic plate with defects some actual problems of fracture mechanics cyclic plasticity with applications to extremely low cycle fatigue of structural steel and fracture of a highly filled polymer composite **New Developments in**

Nanosensors for Pharmaceutical Analysis Sibel A. Ozkan,Afzal Shah,2019-05-22 New Developments for Nanosensors in Pharmaceutical Analysis presents an overview of developments in nanosensor usage in pharmaceutical analysis thereby helping pharmaceutical companies attain reliable precise and accurate analysis of pharmaceuticals This book presents very simple precise sensitive selective fast and relatively inexpensive methods for pre treatment prior to analysis These methods may be considered for further application in clinical studies and assays The book includes the manufacturing of sensors for pharmaceutical analysis at nano or smaller scales and gives simple and relatable designs for the fabrication of sensors Twelve chapters cover an introduction to the topic immobilization techniques mechanism effect of nanomaterials on structure optical nanosensors for pharmaceutical detection chemical nanosensors in pharmaceutical analysis noble metal nanoparticles in electrochemical analysis of drugs photo electrochemical nanosensors for drug analysis molecularly imprinted polymer based nanosensors for pharmaceutical analysis nanomaterials for drug delivery systems nanomaterials enriched nucleic acid based biosensors nanosensors in biomarker detection and nanomaterials based enzyme biosensors for electrochemical applications Presents nanosensor types synthesis immobilizations and applications in different fields Gives simple repeatable designs for the fabrication of sensors for pharmaceutical analysis Details how to carry out sensitive analysis of pharmaceuticals using nanosensors Describes how to synthesize and immobilize nanosensors and how nanosensors can be

applied in drug assay Proposes innovative ways to optimize pharmaceutical processes with nanosensors **New**
Developments in Selective Oxidation by Heterogeneous Catalysis P. Ruiz, B. Delmon, 1992-02-06 This volume contains invited papers and communications presented at the Third European Workshop Meeting on Selective Oxidation by Heterogeneous Catalysis The purpose of the meeting was to present recent results and to discuss new aspects of partial oxidation by heterogeneous catalysis The following topics were discussed Novel processes for obtaining new fine chemicals by catalytic partial oxidation selective oxidation and oxidative dehydrogenation of alkanes new catalysts and advances in preparation methods of oxidation catalysts new phenomena in partial oxidation and new aspects of surface chemistry in oxide catalysts new applications of physicochemical methods for characterization of oxide catalysts oxidation with other agents than oxygen and catalytic oxidation of carbohydrates This book will provide a valuable set of data on reactions of selective oxidation which will be extremely useful to catalyst and related practitioners whether fundamentalists or highly applied and to process engineers who wish to evaluate current findings in this field The wide range approach to reactions of selective oxidation will disseminate knowledge in specialized areas of selective oxidation and encourage innovation and creativity

Functional Nanostructures Sudipta Seal, 2010-06-02 Nanocrystalline materials exhibit the outstanding properties and represent a new class of structural materials having a wide range of applications In particular there is considerable interest in developing nanocrystalline materials to be used as functional materials in aerospace applications automotive industry wear applications MEMS etc The future progress in these high technological applications of nanocrystalline materials crucially depends on development of new methods of their fabrication and understanding of the underlying nano scale and interface effects causing their unique mechanical properties **The Beginnings of Electron Microscopy - Part 2** Peter W.

Hawkes, Martin Hÿtch, 2022-04-26 The Beginnings of Electron Microscopy Part 2 Volume 221 in the Advances in Imaging and Electron Physics series highlights new advances in the field with this new volume presenting interesting chapters on Recollections from the Early Years Canada USA My Recollection of the Early History of Our Work on Electron Optics and the Electron Microscope Walter Hoppe 1917 1986 Reminiscences of the Development of Electron Optics and Electron Microscope Instrumentation in Japan Early Electron Microscopy in The Netherlands L L Marton 1901 1979 The Invention of the Electron Fresnel Interference Biprism The Development of the Scanning Electron Microscope and much more Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in Advances in Imaging and Electron Physics series Synapse Development and Maturation Pasko Rakic, John Rubenstein, Bin

Chen, Kenneth Y. Kwan, 2020-05-29 Synapse Development and Maturation the latest release in the Comprehensive Developmental Neuroscience series presents the latest information on the genetic molecular and cellular mechanisms of neural development The book provides a much needed update that underscores the latest research in this rapidly evolving field with new section editors discussing the technological advances that are enabling the pursuit of new research on brain

development This volume focuses on the synaptogenesis and developmental sequences in the maturation of intrinsic and synapse driven patterns Features leading experts in various subfields as section editors and article authors Presents articles that have been peer reviewed to ensure accuracy thoroughness and scholarship Includes coverage of mechanisms which regulate synapse formation and maintenance during development Covers neural activity from cell intrinsic maturation to early correlated patterns of activity **New Developments in Advanced Welding** N Ahmed,2005-09-30 Recent developments in high technology areas have significantly transformed the welding industry Automation computers process control sophisticated scientific instruments and advanced processing methods are all common in today s modern industry Today s engineers and technologists have to support complex systems and apply sophisticated welding technologies This comprehensive new book discusses the changes in advanced welding technologies preparing the reader for the modern industry New Developments in Fertilizer Technology ,1987 **New Developments in Electron Microscopy** [proceedings of a Symposium Held at the Royal Society in 1970] Hugh Esmor Huxley,Aaron Klug,1971

New Developments In Electron Microscopy Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has become more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**New Developments In Electron Microscopy**," written by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we shall delve to the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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