

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

P. Ruiz, B. Delmon



New Developments In Electron Microscopy:

New Developments in Electron Microscopy H. E. Huxley, 1971 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.
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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.

New Developments In Applied Superconductivity - Proceedings Of The International Symposium Yukitaka 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.

National Library of Medicine Current Catalog National Library of Medicine (U.S.), 1972 First multi year cumulation

covers six years 1965 70 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 *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 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 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.

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