DOWNLOAD PDF ATLAS OF BACKSCATTERING KIKUCHI DIFFRACTION PATTERNS

Chapter 1 : (IUCr) Books, journals, tables

^IAtlas of Backscattering Kikuchi Diffraction Patterns will provide a comprehensive handbook on how to identify crystalline phases in metals, semiconductors, ceramics and minerals in the fields of materials science and engineering, metallurgy, physics, physical chemistry, crystallography and geology.

It provides information on the orientation of crystals with a spatial resolution of a few microns in our system. This contrast is due to the diffraction of the backscattered electrons by the crystal. Those electrons, generated by an incident electron beam in the SEM, spread beneath the specimen surface in all directions. This produces a divergent source of electrons within an interaction volume in the sample, which will diffract with the crystal planes according to the Bragg condition. Because the electrons travel from the source in all directions, for each set of planes for which the Bragg condition is satisfied, the diffracted beams lie on the surface of a cone whose axis is normal to the diffracted plane. Those cones intersect with a phosphor screen placed in front of the specimen and give rise to the pattern see Figures below. The pattern generated on the phosphor screen is detected by viewing the screen through a view port with a CCD video camera which is configured for on-chip integration. On-chip integration is required because the signal glowing of the phospor screen is so weak that the CCD readout noise exceeds the detected signal if video rates are used. There are a number of good commercial systems available see below. Money is always in short supply, so we have chosen to use readily available components to build our own EBSP system parts are listed below. The cover is fitted with a 2" diam view window. Mounted on the cover is a Cohu CCD camera with manual gain and offset and wired to permit on-chip integration. For camera control and image acquisition, we use NIH Image which permits triggering of the on-chip integration and transfer of a single readout for the image. For pattern acquisition it is essential that the video camera control be set on manual and gain and offset are both at minimum. The sample is then imaged so grains can be see. This can done two ways. The patterns are acquired by placing the beam on a single grain with the spot mode. The image is acquired in NIH Image using the on-chip integration mode. An integration for seconds will generally yield a good image. Phosphor screen -- 2" scintillator screen from Grant Scientific Corp. Machine shop time for port cover and screen holder. What can I do with it? The contrast in the images can be enhanced by subtracting the background intensity electronicaly. The geometrical arrangement of Kikuchi bands in the EBSP provides information on crystal symmetry, crystal orientation, as the acquired pattern is indexed to determine grain orientation, grain to grain misorientation and even crystal deformation. Distortion due to projection of these bands onto a phosphorous screen make the patterns very difficult to analyse "by hand". Instructions can be found here. It is a good idea to look at the instruction manual first, then download the files. Sample preparation The sample surface must be crystalline and without excessive plastic deformation. In the case of metals, this is generally obtained by electropolishing the surface of the specimen after polishing. For poorly-conductor material, sample preparation consists of providing a means of shunting the electron beam current to avoid surface charging. Carbon coating may be required for insulators and semiconductors, but coatings must be minimized less than Angstroms to ensure sufficient signal to noise ratios for usable patterns. More information on the formation of the EBSP, as well as on specimen preparation can be found in the references given below.

Chapter 2 : Valerie Randle - Wikipedia

MICROSCOPY IN MATERIALS SCIENCE SERIES Atlas of Backscattering Kikuchi Diffraction Patterns D J Dingley University of Bristol, Bristol, UK K Z Baba-Kishi.

Edington "Electron beam analysis of materials" by M. Identify crystalline phases from their diffraction data. Special issue of Zeitschrift Kirstallographie on electron crystallography. See Fultz and Howe book Section 6. See Fultz and Howe book pages , , 4. It has been organized under the initiative of the Commission on electronic diffraction at the International Union of Crystallographers and at its financial support. The second important circumstance was that the school was carried out in institute where the method electron diffraction structural analysis EDSA was born and was developed within long years, having own traditions and a history. Founders of a method in Russia were Z. Vainshtein becoming subsequently the director of the Institute of crystallography. Later a wide range of structures including thin films, metals and alloys, oxides, semoconductors, catalysts and compex minerals have been solved by electron crystallography, in many laboratories around the world. The objectives of this School was to provide a basic knowledge for PhD students and scientists interested in applying electron crystallography techniques for structure determinations of inorganic materials and nanostructures. The subjects of the school were: Practical training with software and exercises was an essential part of the School. Experts known in the field of electronic crystallography have taken part in work of school: Marks Chicago university , K. Wierich Aachen university , M. The Russian school has been submitted by 5 lecturers: Klechkovskaja all from Institute of crystallography , L. Vilkov Moscow State university , and M. Many of the registered participants could not arrive on school on financial reasons because of expensive travel. It concerned also foreign young scientific and Russian participants from the remote regions of Russia and the countries of nearest abroad. The saturated scientific program has not allowed to give a lot of attention to studying of Moscow and it cultural values. Therefore only one visiting the Moscow Kremlin which has made indelible impression on participants of school has been organized. Due to this not only it was possible to solve many organizational questions, but also to render financial support to the young scientists, mainly, as travel-grants. The big support and assistance in carrying out of school was rendered by the former Chairman of the commission on electron diffraction at IUCr Douglas Dorset and the organizer of previous schools on electronic crystallography in Europe Sven Hofmoller. Anatoly Avilov Report of Congress and commission Meeting. Aug 14, Geneva J. Eades Secretary At an earlier meeting of the IUCr executive committee, the current committee was nominated; all those nominated subsequently agreed to serve on the new CED. ECA and the American Cryst. A vote of appreciation was expressed to Sven Hovmuller for his work in organising schools in the past, and for his work with the CED. An extended discussion followed on the possibility of making the CED a home for cryomicroscopists in biology. Bing Jap expressed the view that the materials scientists could learn a lot about quantification of data from the biologists, and no one disagreed. This general idea was supported. The Commission sponsored two microsymposia: Van Dyck and J. First, Dirk Van Dyck presented the results of a round robin test of software packages for carrying out multiple beam dynamical scattering calculations. With proper controls, the results are found to be equivalent. This work is to be published in Ultramicroscopy. While other attendees thought that this may be a less easy task than establishing whether or not a computational package gives useful results, it was agreed that results of such a study might be announced on an expanded web site, linking to various laboratories carrying out such electron crystallographic structure analyses. This suggestion partially answers a suggestion made by Li Fan-hua that a publication discussing procedures for structure analysis in electron crystallography may result eventually e. Obviously, this web site would appropriate to link to the various other laboratory sites. Also relevant are the possible topics to be discussed at the upcoming European Microscopy Meeting to be held in Brno, Czech Republic. Ingrid Voigt-Martin and Dr. John Fryer have been planning sessions and a tutorial on electron crystallography. In general, there is a need to improve communications between microscopy and crystallographic societies, particularly if both purport to represent and promote research in electron crystallography.

Chapter 3 : Formats and Editions of Atlas of backscattering Kikuchi diffraction patterns [blog.quintoapp.com]

This monograph describes the principles and methods for obtaining backscattering Kikuchi diffraction patterns in the scanning electron microscope for the purpose of.

The para- uation of plastic and elastic strains Troost et al. Consequently, greater these parameters on BKDPs recorded directly on film are intensity, backscattered out of the surface, is obtained from described in detail. The methods described are suitable for a submicron area of the sample. The resolution of BKDPs, practical purposes, providing speed of calculation but lim- investigated by Hjelen and Nes , is highly anisotrop- ited accuracy. The inherent factors that limit the accuracy ic and is dependent on various parameters: At a high accelerating voltage, 30 kV for ex- Kikuchi bands and diffuseness of Kikuchi band edges orig- ample, the resolution is reduced because of the increased inating from inelastic scattering of electrons. The methods penetration depth of the electrons in the specimen. The lateral optimum resolution for Key words: The depth resolution fraction patterns of the diffraction volume is better than 50 nm. When the diffraction pattern is recorded on film, the required inten- sity of the electron flux is by an order of magnitude lower Introduction than that required for exciting the phosphor screen. These and Dingley b. BKDPs suitable for crystallographic analysis Baba-Kishi The qualitative analyses include identification of vari- a. The primary applications of BKDPs are: Extensive computer simulation of Kikuchi lines is required to find a perfect match between the diffraction pattern and the sim- Address for reprints: Simulation of a diffraction pattern can be particularly time consuming if the diffraction pattern is K. Quantitative methods required for pattern Hung Hom, Kowloon, Hong Kong interpretation primarily involve intensity calculations across Scanning Vol. They are the cross-wire shad- Intensity calculations in BKDPs can be carried out ow method and the moving-camera method Randle Since ECPs are discussed later in this section. The method used for and BKDPs are related by the theorem of reciprocity, in- crystallographic analysis of BKDPs recorded from bulk tensity extrapolation between the two techniques is satis- crystals, particularly from crystals that have several facets factory Reimer Intensity calculations across Kikuchi and complex morphology, is the known-orientation bands recorded from tilted samples can also be carried out method. Randle , was originally proposed by Dingley and is now widely used in orientation microscopy and texture analysis Dingley and Randle , Dingley et al. Methods The method is much simpler than the above-mentioned techniques and could have an accuracy of 0. Many commercial systems offered for texture analy- metrical construction on BKDPs. These parameters include sis utilize this method. The following detailed analysis electron-source point or pattern centre, specimen-to-film illustrates the geometry of the method and its inherent distance, interzonal angles, interplanar angles, and Bragg limitations. The principle governing the method is to ob- angles. There is no systematic and detailed description of tain a BKDP of a crystal whose orientation relative to the these methods in the literature. The purpose of this paper recording film and the beam direction is known precise- is, therefore, to provide a detailed analysis of these meth- ly. The BKDP should have a known projected zone axis ods with emphasis on their limitations in practice. Under these Determination of Pattern Center conditions, the pattern centre coincides with the position where the centre of the known zone axis appears. In ad- The position of pattern center PC is defined as the point dition, the chosen orientation is such that it enables an- of intersection of the photographic plane in gnomonic pro- other known zone axis to appear vertically below the jection with a normal drawn from the electron source point. This position is also described by the point of intersection The practical characteristics of this method are as fol- of a sphere of reflection with the plane of the photograph lows. A 5 mm2 silicon wafer single crystal cleaved along Baba-Kishi and Dingley b. There are various tech- is permanently mounted on a purpose built stub so niques that can be used to locate PC on a BKDP and that that the surface normal [] of the crystals makes an angle offer varying degrees of precision and speed. The tech- of At this orientation the crystal is rotated so that orientation method. Under these con- The three steel-ball method involves analysis of three ditions, the [] zone axis is normal to both the record- elliptical shadows projected onto the pattern by placing ing plane and the incident beam direction. This arrangement three spherical steel balls at a suitable distance from the also ensures that the [] zone axis appears vertically specimen. This technique has been widely used by Biggin below []. The BKDP obtained with the above arrange- and Dingley on micro-Kossel x-ray diffraction ment is used as a calibration pattern Fig. It has been re- cide exactly with the [] zone axis, assuming that the ported that the analysis of these techniques is very time distance between the final objective lens of the microscope consuming and the accuracy produced is of the order 0. The circular mask method described by Venables and specimens remained constant. In practice, however, this is Bin-jaya involves analysis of a single circular shad- not the case as working distances can be varied primarily ow on the pattern. The analysis of this method, in com- by differences in sample height and the positions where parison with the three steel-ball method, is more the electron beam strikes the sample surface. This is rele- straightforward and the accuracy produced is similar. In order to The Known-Orientation Method establish the difference in working distances, or the dif- ference in heights when the working distance is constant, The known-orientation method is widely used in com- between the unknown and calibration specimens, their pat- mercial SEMs with facilities for texture analysis. The terns have to be superimposed. To carry this out accurate- method relies on a silicon wafer for calibration. There are ly, two fiducial objects such as needles are permanently two other methods to calibrate for pattern centre that do fixed to the camera. The shadows labeled i, j in Figure 2, K. The position with respect to the camera geometry. We therefore get tern centre with reference to the needle shadow tips is eas- ily established. To keep illustrations simple, a single shadow instead of two shadows will be used. According to Figure specific camera. For crystallographic analysis, several diffraction pat- terns are often required. To carry out [] measurements on various patterns, the pattern centre and PC This improves the overall accuracy of the measurements. The use of needle shadows is especially relevant when the sample morphology is highly varied and the surface is rough. The study of minerals often entails the use of very rough samples with complex morphology. The pattern centre is marked with a and the unknown, are used consecutively. The shadows labeled i, j, were formed by two needles. The lines D1R and D2P of lengths the objective current at constant values and to fix the work- s and r lie in the plane of the film and are situated at right ing distance. Using this technique, moving-camera cali- angles to OP. Applying the cosine rule to the triangles lens currents. This method can improve tions, respectively: A specific pair of Kikuchi lines can then be selected for precise lattice para- Since the lengths d, r, and s are readily measured on the meter measurements or for strain analysis. Brief details pattern, the above three simultaneous equations can hence are given below. A value for Z can also be calculated if the selected The method involves reducing the capture angle of BKDPs zone axes were the [] and [] of the calibration pat- by increasing the specimen-to-film distance Z to about tern. The work of Wilkinson describes a technique with high spatial resolution, capable of sensitivity to elas- Determination of True Interzonal Angles tic strains of the order 0. In measuring the tetragonal lattice distortion, an accuracy of 0. The principles of con- Determination of Specimen-to-Film Distance struction for this method and its practical aspects are as follows. The specimen to film distance SFD Z is defined as the length of a normal drawn from the electron source point Film in gnomonic projection O to the pattern centre PC Fig. The three steel-ball method and the cir- y cular mask method involved extensive analysis of shadows P projected onto MKXD and BKD patterns by fiducial ob- x r jects, producing an accuracy in the range of 0. One of these is the cosine rule method. The cosine rule method requires measurements in the plane of a BKDP which is taken from a crystal of known Z l2 l1 structure, preferably cubic. The following parameters must be known: As illustrated in Figure 4a, the points D1 and D2 are situated on the plane P D2 of the gnomonic projection and represent the centre points of two selected zone axes [uvw]1 and [uvw]2 , respective- ly. To locate the angle point A, a perpendicular line OP of length Z is drawn from the centre of the sphere, O, to the pattern centre at P. The length Z is also the radius of the circumscribing sphere centred at O. A gnomonogram is then constructed as shown in Figure 4b. This relation- Z ship is shown to be true, using the following: In b practice, the angle point A is determined by measuring or calculating the length EL on the film plane. A set of mea- b Geometrical reconstruction of Figure 4a to determine the angle point A. This method appears complex, that of the graphic method. It can also be used as an alternative method to verify zone axis angles mea- Determination of True Interplanar Angles sured by the technique described below. In addition to the graphic method described above, a An inherent limitation of the gnomonic projection is that vectorial method of interzonal angle measurement can be as the angle of incidence between the source point and the used. A description is given here. In the presence of such distortions, coordinates x1, y1, Z and x2, y2, Z with respect to the interplanar angles which are measured from the patterns pattern centre PC, where Z is the specimen-to-film dis- give false values. The only exception to this is for angles â€" â€" â€" â€" tance. To determine true interplanar angles in distorted regions, there is a method which can be applied to patterns taken from any crystal system. The only known parameter required PC X by this method is the accurate position of the pattern cen- tre PC on the plane of projection. The point A represents the centre of the point where the zone axis at which two pairs of Kikuchi lines with indices h1 k1 l1 and Z h2 k2 l2 , whose interplanar angle is required, meet. In exactly the same manner, the point B with coordinates b1, b2, Z is chosen along the plane h2 k2 l2. The method described requires measurements in the O plane of the film. Using ordinary measuring devices, an FIG. The pattern in Figure 8a shows a zone axis with four projected mirror To determine the lattice parameters of a crystal, it is planes terminating at the tetrad, with indices []. In general, these line drawn from the pattern centre to intersect the Kikuchi ratios are given by: The accura- PC cy obtained with this method is generally low.

DOWNLOAD PDF ATLAS OF BACKSCATTERING KIKUCHI DIFFRACTION PATTERNS

Chapter 4 : International Union Of Crystallography

downloadable file of Atlas Of Backscattering Kikuchi Diffraction Patterns Microscopy In Materials Science that you could be grabbed this with no registration at blog.quintoapp.com For your information, we can not store pdf download Atlas Of Backscattering Kikuchi Diffraction Patterns Microscopy In Materials Science.

Books, journals, tables Books, special issues of journals, tables. More details, including ISBN numbers and out-of-print books can be found on at specialist booksellers on the web. Electron Diffraction in the TEM;. Bios Royal Micros Soc. Analytical electron microscopy for materials science;. Excellent, up to date, practical. High resolution electron microscopy and related techniques;. Society of French Microscopists. Advanced computing in electron microscopy. Transmission Electron Microscopy and Diffractometry of Materials;. Excellent coverage of theory and worked examples. A textbook for materials science;. Pedagogically sound introductory text. How to do HREM, and theory. Electron energy loss spectroscopy in the electron microscope. Convergent beam electron diffraction IV;. Superb collection of CBED patterns. How to do quantitative CBED. Worked example of finding space-group from CBED patterns. Vols 1 and 2. High resolution electron microscopy for materials science;. Beautiful collection of HREM images and examples of their analysis. Electron Microscopy of thin crystals;. Classic text with many worked examples. Electron-diffraction Analysis of Clay Mineral Structures;. Excellent broad coverage with all the basic physics, including radiation damage. Tonomura, Springer-Verlag, Introduction to electron holography;. Electron microscopy in heterogeneous catalysis; P. Crystallography and crystal defects;. Identify crystalline phases from their diffraction data. Special issue of Zeitschrift Kirstallographie on electron crystallography. See Fultz and Howe book Section 6. See Fultz and Howe book pages , , The International Union of Crystallography is a non-profit scientific union serving the world-wide interests of crystallographers and other scientists employing crystallographic methods.

Chapter 5 : EBSP: Introduction

Atlas of backscattering Kikuchi diffraction patterns. T1 - Atlas of backscattering Kikuchi diffraction patterns. AU - Dingley,DJ. AU - Baba-Kishi,KZ.

Chapter 6 : Atlas of backscattering Kikuchi diffraction patterns - University of Bristol

Atlas of Backscattering Kikuchi Diffraction Patterns, (Microscopy in Materials Science Series) (1st Edition) by David J. Dingley, V. Randle (Department Of Materials Engineering, Karim Z. Baba-Kishi, Valerie Randle.