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X-Ray Diffraction Crystallography X-Ray Diffraction Two-dimensional X-ray Diffraction Thin Film Analysis by X-Ray Scattering X-Ray Diffraction for Materials Research X-ray Diffraction Elements of X-ray Diffraction X-Ray Diffraction Basic Concepts of X-Ray Diffraction Industrial Applications of X-Ray Diffraction X-Ray Diffraction for Materials Research X-Ray Diffraction by Polycrystalline Materials Fifty Years of X-Ray Diffraction Computer Simulation Tools for X-ray Analysis Novel Microstructures for Solids Fundamentals of Crystallography X-Ray Multiple-Wave Diffraction Nanoscale Materials Analyzing Materials Using Joint X-ray Fluorescence and Diffraction Spectra Three-Dimensional X-Ray Diffraction Microscopy X-Ray Diffraction Imaging X-Ray Diffraction Topography Polymer Morphology X-Ray Diffraction Modern Powder Diffraction Practical Residual Stress Measurement Methods Introduction to X-Ray Powder Diffractometry Collection of Simulated XRD Powder Patterns for Zeolites Fifth (5th) Revised Edition University Physics Structure Determination by X-Ray Crystallography The Basics of Crystallography and Diffraction X-ray Diffraction and the Identification and Analysis of Clay Minerals Investigations of Polar Nematics Using X-ray Diffraction and Dielectric Techniques; and X-ray Diffraction Studies of Disc-shaped Mesogens X-Ray Diffraction by Macromolecules X-Ray Diffraction by Disordered Lamellar Structures Evaluation of X-ray Elastic Constants Using X-ray Diffraction Data for Residual Stress Analysis A Practical Guide for the Preparation of Specimens for X-Ray Fluorescence and X-Ray Diffraction Analysis Analytical Geomicrobiology Dynamical Theory of X-ray Diffraction Modern Diffraction Methods

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X-Ray Diffraction Topography presents an elementary treatment of X-ray topography which is comprehensible to the non-specialist. It discusses the development of the principles and application of the subject matter. X-ray topography is the study of crystals which use x-ray diffraction. Some of the topics covered in the book are the basic dynamical x-ray diffraction theory, the Berg-Barrett method, Lang’s method, double crystal methods, the contrast on x-ray topography, and the analysis of crystal defects and distortions. The crystals grown from solution are covered. The naturally occurring crystals are discussed. The text defines the meaning of melt, solid state and vapour growth. An analysis of the properties of inorganic crystals is presented. A chapter of the volume is devoted to the characteristics of metals. Another section of the book focuses on the production of ice crystals and the utilization of oxides as laser materials. The book will provide useful information to chemists, scientists, students and researchers. This book presents a physical approach to the diffraction phenomenon and its applications in materials science. An historical background to the discovery of X-ray diffraction is first outlined. Next, Part 1 gives a description of the physical phenomenon of X-ray diffraction on perfect and imperfect crystals. Part 2 then provides a detailed analysis of the instruments used for the characterization of powdered materials or thin films. The description of the processing of measured signals and their results is also covered, as are recent developments relating to quantitative microstructural analysis of powders or epitaxial thin films on the basis of X-ray diffraction. Given the comprehensive coverage offered by this title, anyone involved in the field of X-ray diffraction and its applications will find this of great use. This text is intended to acquaint the reader, who has no prior knowledge of the subject, with the theory of x-ray diffraction, the experimental methods involved, and the main applications. No metallurgical data are given beyond that necessary to illustrate the diffraction methods involved. Exploration of fundamentals of x-ray diffraction theory using Fourier transforms applies general results to various atomic structures, amorphous bodies, crystals, and imperfect crystals. 154 illustrations. 1963 edition. This book explores novel methods for implementing X-ray diffraction technology as an imaging modality, which have been made possible through recent breakthroughs in detector technology, computational power, and data processing algorithms. The ability to perform fast, spatially-resolved X-ray diffraction throughout the volume of a sample opens up entirely new possibilities in areas such as material analysis, cancer diagnosis, and explosive detection, thus offering the potential to revolutionize the fields of medical, security, and industrial imaging and detection. Featuring chapters written by an international selection of authors from both academia and industry, the book provides a comprehensive discussion of the underlying physics, architectures, and applications of X-ray diffraction imaging that is accessible and relevant to neophytes and experts alike. Teaches novel methods for X-ray diffraction imaging Comprehensive and self-contained discussion of the relevant physics, imaging techniques, system components, and data processing algorithms Features state-of-the-art work of international authors from both academia and industry. Includes practical applications in the medical, industrial, and security sectors Organized nanoassemblies of inorganic nanoparticles and organic molecules are building blocks of nanodevices, whether they are designed to perform molecular level computing, sense the environment or improve the catalytic properties of a material. The key to creation of these hybrid nanostructures lies in understanding the chemistry at a fundamental level. This book serves as a reference book for researchers by providing fundamental understanding of many nanoscopic materials. New methods for the determination of the nature, proportion, and distribution of structural defects in microcrystallized lamellar systems are of utmost importance not only to experimentalists but also to theoreticians. Mathematical formalism - indispensable for such analyses - is well-illustrated by various examples, allowing this method to be easily adopted and even to be applied to other solids with lamellar or pseudo-lamellar structures. Crystallography may be described as the science of the structure of materi als, using this word in its widest sense, and its ramifications are apparent over a broad front of current scientific endeavor. It is not surprising, therefore, to find that most universities offer some aspects of crystallography in their undergraduate courses in the physical sciences. It is the principal aim of this book to present an introduction to structure determination by X-ray crystal lography that is appropriate mainly to both final-year undergraduate studies in crystallography, chemistry, and chemical physics, and introductory post graduate work in this area of crystallography. We believe that the book will be of interest in other disciplines, such as physics, metallurgy, biochemistry, and geology, where crystallography has an important part to play. In the space of one book, it is not possible either to cover all aspects of crystallography or to treat all the subject matter completely rigorously. In particular, certain mathematical results are assumed in order that their applications may be discussed. At the end of each chapter, a short bibliog raphy is given, which may be used to extend the scope of the treatment given here. In addition, reference is made in the text to specific sources of information. We have chosen not to discuss experimental methods extensively, as we consider that this aspect of crystallography is best learned through practical experience, but an attempt has been made to simulate the interpretive side of experimental crystallography in both examples and exercises. When bombarded with X-rays, solid materials produce distinct scattering patterns similar to fingerprints. X-ray powder diffraction is a technique used to fingerprint solid samples, which are then identified and cataloged for future use-much the way the FBI keeps fingerprints on file. The current database of some 70,000 material prints has been put to a broad range of uses, from the analysis of moon rocks to testing drugs for purity. Introduction to X-ray Powder Diffractometry fully updates the achievements in the field over the past fifteen years and provides a much-needed explanation of the state-of-the-art techniques involved in characterizing materials. It covers the latest instruments and methods, with an emphasis on the fundamentals of the diffractometer, its components, alignment, calibration, and automation. The first three chapters outline diffraction theory in clear language, accessible to both students and professionals in chemistry, physics, geology, and materials science. The book's middle chapters describe the instrumentation and procedures used in X-ray diffraction, including X-ray sources, X-ray detection, and production of monochromatic radiation. The chapter devoted to instrument design and calibration is followed by an examination of specimen preparation methods, data collection, and reduction. The final two chapters provide in-depth discussions of qualitative and quantitative analysis. While the material is presented in an orderly progression, beginning with basic concepts and moving on to more complex material, each chapter stands on its own and can be studied independently or used as a professional reference. More than 230 illustrations and tables demonstrate techniques and clarify complex material. Self-contained, timely, and user-friendly, Introduction to X-ray Powder Diffractometry is an enormously useful text and professional reference for analytical chemists, physicists, geologists and materials scientists, and upper-level undergraduate and graduate students in materials science and analytical chemistry. X-ray powder diffraction-a technique that has matured significantly in recent years-is used to identify solid samples and determine their composition by analyzing the so-called "fingerprints" they generate when X-rayed. This unique volume fulfills two major roles: it is the first textbook devoted solely to X-ray powder diffractometry, and the first up-to-date treatment of the subject in 20 years. This timely, authoritative volume features: * Clear, concise descriptions of both theory and practice-including fundamentals of diffraction theory and all aspects of the diffractometer * A treatment that reflects current trends toward automation, covering the newest instrumentation and automation techniques * Coverage of all the most common applications, with special emphasis on qualitative and quantitative analysis * An accessible presentation appropriate for both students and professionals * More than 230 tables and illustrations Introduction to X-ray Powder Diffractometry, a collaboration between two internationally known and respected experts in the field, provides invaluable guidance to anyone using X-ray powder diffractometers and diffractometry in materials science, ceramics, the pharmaceutical industry, and elsewhere. This book presents a complex approach to material composition determination based on the analysis of the joint X-ray spectrum, including fluorescence, scattering, and diffraction reflections. It considers fluorescence, scattered, and diffracted radiations within the common problem of analytical spectrum formation. The complex methods for analyzing the material composition by joint spectra of fluorescence, Compton scattering and diffraction proposed here allow for a widening of the area of the application of X-ray methods. The book will be useful for specialists in the field of solid state physics, as well as advanced and post-graduate students. Publisher Description The audience for this thorough overview includes advanced undergraduates and postgraduate researchers in macromolecular sciences who can benefit from more familiarity with the use of X-ray diffraction for obtaining structural information on biological substances, natural and synthetic high polymeric materials. X-Ray Diffraction by Macromolecules comprises three parts: fundamental, experimental and analytical, and the volume as a whole may serve as an intermediate textbook to bridge the treatments found in primers and specialist works. It presents a thorough treatment of principles and applications, and gives full, practical details on experimental methods and the treatment of results, along with many examples of actual analysis. This successful text/reference, now in a new edition, explores the applications and limitations of data produced by the interaction of X-rays with clay minerals. This edition pays particular attention to integrating the mineralogy of soils and features a new chapter on disorder and polytypes. Chapter Four, from the first edition, has been expanded and split into two chapters, "Structure and Properties: General Treatment" and "Structure, Nonmenclature, and Occurrences of Clay Minerals." Essential in agriculture, geology, and in making informed engineering decisions, this text offers the necessary information on the properties of these minerals, combining theoretical discussion with recipe-like directions for laboratory procedures. Ideal for students who have completed introductory geology, chemistry, and mineralogy courses, this text can also be used as a reference for researchers and workers in industry. With contributions by Paul

F. Fewster and Christoph Genzel While X-ray diffraction investigation of powders and polycrystalline matter was at the forefront of materials science in the 1960s and 70s, high-tech applications at the beginning of the 21st century are driven by the materials science of thin films. Very much an interdisciplinary field, chemists, biochemists, materials scientists, physicists and engineers all have a common interest in thin films and their manifold uses and applications. Grain size, porosity, density, preferred orientation and other properties are important to know: whether thin films fulfill their intended function depends crucially on their structure and morphology once a chemical composition has been chosen. Although their backgrounds differ greatly, all the involved specialists a profound understanding of how structural properties may be determined in order to perform their respective tasks in search of new and modern materials, coatings and functions. The author undertakes this in-depth introduction to the field of thin film X-ray characterization in a clear and precise manner. This book provides a clear introduction to topics which are essential to students in a wide range of scientific disciplines but which are otherwise only covered in specialised and mathematically detailed texts. It shows how crystal structures may be built up from simple ideas of atomic packing and co-ordination, it develops the concepts of crystal symmetry, point and space groups by way of two dimensional examples of patterns and tilings, it explains the concept of the reciprocal lattice in simple terms and shows its importance in an understanding of light, X-ray and electron diffraction. Practical examples of the applications of these techniques are described and also the importance of diffraction in the performance of optical instruments. The book is also of value to the general reader since it shows, by biographical and historical references, how the subject has developed and thereby indicates some of the excitement of scientific discovery. This book teaches the users on how to construct a library of routines to simulate scattering and diffraction by almost any kind of samples. The main goal of this book is to break down the huge barrier of difficulties faced by beginners from many fields (Engineering, Physics, Chemistry, Biology, Medicine, Material Science, etc.) in using X-rays as an analytical tool in their research. Besides fundamental concepts, MatLab routines are provided, showing how to test and implement the concepts. The major difficult in analysing materials by X-ray techniques is that it strongly depends on simulation software. This book teaches the users on how to construct a library of routines to simulate scattering and diffraction by almost any kind of samples. It provides to a young student the knowledge that would take more than 20 years to acquire by working on X-rays and relying on the available textbooks. The scientific productivity worldwide is growing at a breakneck pace, demanding ever more dynamic approaches and synergies between different fields of knowledge. To master the fundamentals of X-ray physics means the opportunity of working at an infiniteness of fields, studying systems where the organizational understanding of matter at the atomic scale is necessary. Since the discovery of X radiation, its usage as investigative tool has always been under fast expansion afforded by instrumental advances and computational resources. Developments in medical and technological fields have, as one of the master girders, the feasibility of structural analysis offered by X-rays. One of the major difficulties faced by beginners in using this fantastic tool lies in the analysis of experimental data. There are only few cases where it is possible to extract structural information directly from experiments. In most cases, structure models and simulation of radiation-matter interaction processes are essential. The advent of intense radiation sources and rapid development of nanotechnology constantly creates challenges that seek solutions beyond those offered by standard X-ray techniques. Preparing new researchers for this scenario of rapid and drastic changes requires more than just teaching theories of physical phenomena. It also requires teaching of how to implement them in a simple and efficient manner. In this book, fundamental concepts in applied X-ray physics are demonstrated through available computer simulation tools. Using MatLab, more than eighty routines are developed for solving the proposed exercises, most of which can be directly used in experimental data analysis. Therefore, besides X-ray physics, this book offers a practical programming course in modern high-level language, with plenty of graphic and mathematical tools. X-ray diffraction crystallography for powder samples is a well-established and widely used method. It is applied to materials characterization to reveal the atomic scale structure of various substances in a variety of states. The book deals with fundamental properties of X-rays, geometry analysis of crystals, X-ray scattering and diffraction in polycrystalline samples and its application to the determination of the crystal structure. The reciprocal lattice and integrated diffraction intensity from crystals and symmetry analysis of crystals are explained. To learn the method of X-ray diffraction crystallography well and to be able to cope with the given subject, a certain number of exercises is presented in the book to calculate specific values for typical examples. This is particularly important for beginners in X-ray diffraction crystallography. One aim of this book is to offer guidance to solving the problems of 90 typical substances. For further convenience, 100 supplementary exercises are also provided with solutions. Some essential points with basic equations are summarized in each chapter, together with some relevant physical constants and the atomic scattering factors of the elements. Rigorous graduate-level text stresses modern applications to nonstructural problems such as temperature vibration effects, order-disorder phenomena, crystal imperfections, more. Problems. Six Appendixes include tables of values. Bibliographies. Authored by a university professor deeply involved in X-ray diffraction-related research, this textbook is based on his lectures given to graduate students for more than 20 years. It adopts a well-balanced approach, describing basic concepts and experimental techniques, which make X-ray diffraction an unsurpassed method for studying the structure of materials. Both dynamical and kinematic X-ray diffraction is considered from a unified viewpoint, in which the dynamical diffraction in single-scattering approximation serves as a bridge between these two parts. The text emphasizes the fundamental laws that govern the interaction of X-rays with matter, but also covers in detail classical and modern applications, e.g., line broadening, texture and strain/stress analyses, X-ray mapping in reciprocal space, high-resolution X-ray diffraction in the spatial and wave vector domains, X-ray focusing, inelastic and time-resolved X-ray scattering. This unique scope, in combination with otherwise hard-to-find information on analytic expressions for simulating X-ray diffraction profiles in thin-film heterostructures, X-ray interaction with phonons, coherent scattering of Mössbauer radiation, and energy-variable X-ray diffraction, makes the book indispensable for any serious user of X-ray diffraction techniques. Compact and self-contained, this textbook is suitable for students taking X-ray diffraction courses towards specialization in materials science, physics, chemistry, or biology. Numerous clear-cut illustrations, an easy-to-read style of writing, as well as rather short, easily digestible chapters all facilitate comprehension. By illustrating a wide range of specific applications in all major industries, this work broadens the coverage of X-ray diffraction beyond basic tenets, research and academic principles. The book serves as a guide to solving problems faced everyday in the laboratory, and offers a review of the current theory and practice of X-ray diffraction, major advances and potential uses. The first hands-on guide to XRD and XRF sampling and specimen preparation Systematic errors from poor sampling and improper specimen preparation can easily render X-ray diffraction (XRD) and X-ray fluorescence (XRF) data of questionable use for analysis. But, until now, the practical information that can help to reduce these errors has never been readily available in one volume. This book fills a vital gap in the literature, bringing together a wealth of material previously available only in workbooks, company manuals, and other inside sources. It provides detailed coverage of the major tasks involved in X-ray analysis - complete with theory, step-by-step methods, equipment suggestions, and problem-solving tips. With a full complement of tools and techniques, this comprehensive guide helps both beginners and experienced analysts to make the best decision on sample treatment and get accurate XRD and XRF results-saving valuable time, money, and effort. Covers X-ray techniques for analyzing biological, geological, metallic, ceramic, and other materials * Addresses all aspects of specimen preparation, including handling unusual or very small samples, liquids and solutions, and more * Features special chapters on specimen preparation equipment and XRF standards * Contains useful bibliography and helpful references. X-ray diffraction is a useful and powerful analysis technique for characterizing crystalline materials commonly employed in MSE, physics, and chemistry. This informative new book describes the principles of X-ray diffraction and its applications to materials characterization. It consists of three parts. The first deals with elementary crystallography and optics, which is essential for understanding the theory of X-ray diffraction discussed in the second section of the book. Part 2 describes how the X-ray diffraction can be applied for characterizing such various forms of materials as thin films, single crystals, and powders. The third section of the book covers applications of X-ray diffraction. The book presents a number of examples to help readers better comprehend the subject. X-Ray Diffraction for Materials Research: From Fundamentals to Applications also • provides background knowledge of diffraction to enable nonspecialists to become familiar with the topics • covers the practical applications as well as the underlying principle of X-ray diffraction • presents appropriate examples with answers to help readers understand the contents more easily • includes thin film characterization by X-ray diffraction with relevant experimental techniques • presents a huge number of elaborately drawn graphics to help illustrate the content The book will help readers (students and researchers in materials science, physics, and chemistry) understand crystallography and crystal structures, interference and diffraction, structural analysis of bulk materials, characterization of thin films, and nondestructive measurement of internal stress and phase transition. Diffraction is an optical phenomenon and thus can be better understood when it is explained with an optical approach, which has been neglected in other books. This book helps to fill that gap, providing information to convey the concept of X-ray diffraction and how it can be applied to the materials analysis. This book will be a valuable reference book for researchers in the field and will work well as a good introductory book of X-ray diffraction for students in materials science, physics, and chemistry. Origin, Scope, and Plan of this Book In July 1962 the fiftieth anniversary of Max von Laue's discovery of the Diffraction of X-rays by crystals is going to be celebrated in Munich by a large international group of crystallographers, physi cists, chemists, spectroscopists, biologists, industrialists, and many others who are employing the methods based on Laue's discovery for their own research. The invitation for this celebration will be issued jointly by the Ludwig Maximilian University of Munich, where the discovery was made, by the Bavarian Academy of Sciences, where it was first made public, and by the International Union of Crystallo graphy, which is the international organization of the National Committees of Crystallography formed in some 30 countries to repre sent and advance the interests of the 3500 research workers in this field. The year 1912 also is the birth year of two branches of the physical sciences which developed promptly from Laue's discovery, namely X-ray Crystal Structure Analysis which is most closely linked to the names ofW. H. (Sir William) Bragg and W. L. (Sir Lawrence) Bragg, and X-ray Spectroscopy which is associated with the names of W. H. Bragg, H. G. J. Moseley, M. de Broglie and Manne Siegbahn. Crystal Structure Analysis began in November 1912 with the first papers ofW. L. Bragg, then still a student in Cambridge, in which, by analysis of the Laue diagrams _of zinc blende, he determined the correct lattice upon which the structure of this crystal is built. With a focus on structure-property relationships, this book describes how polymer morphology affects properties and how scientists can modify them. The book covers structure development, theory, simulation, and processing; and discusses a broad range of techniques and methods. • Provides an up-to-date, comprehensive introduction to the principles and practices of polymer morphology • Illustrates major structure types, such as semicrystalline morphology, surface-induced polymer crystallization, phase separation, self-assembly, deformation, and surface topography • Covers a variety of polymers, such as homopolymers, block copolymers, polymer thin films, polymer blends, and polymer nanocomposites • Discusses a broad range of advanced and novel techniques and methods, like x-ray diffraction, thermal analysis, and electron microscopy and their applications in the morphology of polymer materials In this, the only book available to combine both theoretical and practical aspects of x-ray diffraction, the authors emphasize a "hands on" approach through experiments and examples based on actual laboratory data. Part I presents the basics of x-ray diffraction and explains its use in obtaining structural and chemical information. In Part II, eight experimental modules enable the students to gain an appreciation for what information can be obtained by x-ray diffraction and how to interpret it. Examples from all classes of materials -- metals, ceramics, semiconductors, and polymers -- are included. Diffraction patterns and Bragg angles are provided for students without diffractometers. 192 illustrations. The role of diffraction methods for the solid-state sciences has been pivotal to determining the (micro)structure of a material. Particularly, the expanding activities in materials science have led to the development of new methods for analysis by diffraction. This book offers an authoritative overview of the new developments in the field of analysis of matter by (in particular X-ray, electron and neutron) diffraction. It is composed of chapters written by leading experts on 'modern diffraction methods'. The focus in the various chapters of this book is on the current forefront of research on and applications for diffraction methods. This unique book provides descriptions of the 'state of the art' and, at the same time, identifies avenues for future research. The book assumes only a basic knowledge of solid-state physics and allows the application of the described methods by the readers of the book (either graduate students or mature scientists). An introductory and intermediate level handbook written in pragmatic style to explain residual stresses and to provide straightforward guidance about practical measurement methods. Residual stresses play major roles in engineering structures, with highly beneficial effects when designed well, and catastrophic effects when ignored. With ever-increasing concern for product performance and reliability, there is an urgent need for a renewed assessment of traditional and modern measurement techniques. Success critically depends on being able to make the most practical and effective choice of measurement method for a given application. Practical Residual Stress Measurement Methods provides the reader with the information needed to understand key residual stress concepts and to make informed technical decisions about optimal choice of measurement technique. Each chapter, written by invited specialists, follows a focused and pragmatic format, with subsections describing the measurement principle, residual stress evaluation, practical measurement procedures, example applications, references and further reading. The chapter authors represent both international academia and industry. Each of them brings to their writing substantial hands-on experience and expertise in their chosen field. Fully illustrated throughout, the book provides a much-needed practical approach to residual stress measurements. The material presented is essential reading for industrial practitioners, academic researchers and interested students. Key features: • Presents an overview of the principal residual stress measurement methods, both destructive and non-destructive, with coverage of new techniques and modern enhancements of established techniques • Includes stand-alone chapters, each with its own figures, tables and list of references, and written by an invited team of international specialists University Physics is designed for the two- or three-semester calculus-based physics course. The text has been developed to meet the scope and sequence of most university physics courses and provides a foundation for a career in mathematics, science, or engineering. The book provides an important opportunity for students to learn the core concepts of physics and understand how those concepts apply to their lives and to the world around them. Due to the comprehensive nature of the material, we are offering the book in three volumes for flexibility and efficiency. Coverage and Scope Our University Physics textbook adheres to the scope and sequence of most two- and three-semester physics courses nationwide. We have worked to make physics interesting and accessible to students while maintaining the mathematical rigor inherent in the subject. With this objective in mind, the content of this textbook has been developed and arranged to provide a logical progression from fundamental to more advanced concepts, building upon what students have already learned and emphasizing connections between topics and between theory and applications. The goal of each section is to enable students not just to recognize concepts, but to work with them in ways that will be useful in later courses and future careers. The organization and pedagogical features were developed and vetted with feedback from science educators dedicated to the project. VOLUME III Unit 1: Optics Chapter 1: The Nature of Light Chapter 2: Geometric Optics and Image Formation Chapter 3: Interference Chapter 4: Diffraction Unit 2: Modern Physics Chapter 5: Relativity Chapter 6: Photons and Matter Waves Chapter 7: Quantum Mechanics Chapter 8: Atomic Structure Chapter 9: Condensed Matter Physics Chapter 10: Nuclear Physics Chapter 11: Particle Physics and Cosmology Offers a rigorous treatment of the theory of crystallography and detailed descriptions of experimental applications in a wide range of sciences, including computational aspects, protein crystallography and crystal physics. A comprehensive handbook outlining state-of-the-art analytical techniques used in geomicrobiology, for advanced students, researchers and professional scientists. X-ray diffraction is a useful and powerful analysis technique for characterizing crystalline materials commonly employed in MSE, physics, and chemistry. This informative new book describes the principles of X-ray diffraction and its applications to materials characterization. It consists of three parts. The first deals with elementary crystallography and optics, which is essential for understanding the theory of X-ray diffraction discussed in the second section of the book. Part 2 describes how the X-ray diffraction can be applied for characterizing such various forms of materials as thin films, single crystals, and powders. The third section of the book covers applications of X-ray diffraction. The book presents a number of examples to help readers better comprehend the subject. X-Ray Diffraction for Materials Research: From Fundamentals to Applications also • provides background knowledge of diffraction to enable nonspecialists to become familiar with the topics • covers the practical applications as well as the underlying principle of X-ray diffraction • presents appropriate examples with answers to help readers understand the contents more easily • includes thin film characterization by X-ray diffraction with relevant experimental techniques • presents a huge number of elaborately drawn graphics to help illustrate the content The book will help readers (students and researchers in materials science, physics, and chemistry) understand crystallography and crystal structures, interference and diffraction, structural analysis of bulk materials, characterization of thin films, and nondestructive measurement of internal stress and phase transition. Diffraction is an optical phenomenon and thus can be better understood when it is explained with an optical approach, which has been neglected in other books. This book helps to fill that gap, providing information to convey the concept of X-ray diffraction and how it can be applied to the materials analysis. This book will be a valuable reference book for researchers in the field and will work well as a good introductory book of X-ray diffraction for students in materials science, physics, and chemistry. X-ray multiple-wave diffraction, sometimes called multiple diffraction or N-beam diffraction, results from the scattering of X-rays from periodic two or higher-dimensional structures, like 2-d and 3-d crystals and even quasi crystals. The interaction of the X-rays with the periodic arrangement of atoms usually provides structural information about the scatterer. Unlike the usual Bragg reflection, the so-called two-wave diffraction, the multiply diffracted intensities are sensitive to the phases of the structure factors in volved. This gives

X-ray multiple-wave diffraction the chance to solve the X-ray phase problem. On the other hand, the condition for generating an X ray multiple-wave diffraction is much more strict than in two-wave cases. This makes X-ray multiple-wave diffraction a useful technique for precise measure ments of crystal lattice constants and the wavelength of radiation sources. Recent progress in the application of this particular diffraction technique to surfaces, thin films, and less ordered systems has demonstrated the diver sity and practicability of the technique for structural research in condensed matter physics, materials sciences, crystallography, and X-ray optics. The first book on this subject, Multiple Diffraction of X-Rays in Crystals, was published in 1984, and intended to give a contemporary review on the fundamental and application aspects of this diffraction. High-resolution x-ray diffraction and scattering is a key tool for structure analysis not only in bulk materials but also at surfaces and buried interfaces from the sub-nanometer range to micrometers. This book offers an overview of diffraction and scattering methods currently available at modern synchrotron sources and illustrates bulk and interface investigations of solid and liquid matter with up-to-date research examples. It presents important characteristics of the sources, experimental set-up, and new detector developments. The book also considers future exploitation of x-ray free electron lasers for diffraction applications. An indispensable resource for researchers and students in materials science, chemistry, physics, and pharmaceuticals Written by one of the pioneers of 2D X-Ray Diffraction, this updated and expanded edition of the definitive text in the field provides comprehensive coverage of the fundamentals of that analytical method, as well as state-of-the art experimental methods and applications. Geometry convention, x-ray source and optics, two-dimensional detectors, diffraction data interpretation, and configurations for various applications, such as phase identification, texture, stress, microstructure analysis, crystallinity, thin film analysis, and combinatorial screening are all covered in detail. Numerous experimental examples in materials research, manufacture, and pharmaceuticals are provided throughout. Two-dimensional x-ray diffraction is the ideal, non-destructive analytical method for examining samples of all kinds including metals, polymers, ceramics, semiconductors, thin films, coatings, paints, biomaterials, composites, and more. Two-Dimensional X-Ray Diffraction, Second Edition is an up-to-date resource for understanding how the latest

2D detectors are integrated into diffractometers, how to get the best data using the 2D detector for diffraction, and how to interpret this data. All those desirous of setting up a 2D diffraction in their own laboratories will find the author’s coverage of the physical principles, projection geometry, and mathematical derivations extremely helpful. Features new contents in all chapters with most figures in full color to reveal more details in illustrations and diffraction patterns Covers the recent advances in detector technology and 2D data collection strategies that have led to dramatic increases in the use of two-dimensional detectors for x-ray diffraction Provides in-depth coverage of new innovations in x-ray sources, optics, system configurations, applications and data evaluation algorithms Contains new methods and experimental examples in stress, texture, crystal size, crystal orientation and thin film analysis Two-Dimensional X-Ray Diffraction, Second Edition is an important working resource for industrial and academic researchers and developers in materials science, chemistry, physics, pharmaceuticals, and all those who use x-ray diffraction as a characterization method. Users of all levels, instrument technicians and X-ray laboratory managers, as well as instrument developers, will want to have it on hand.

This 5th edition of the Zeolite Powder Pattern Collection contains calculated patterns of 218 zeolite materials representing 174 framework topologies. The almost exponential growth of new zeolite topologies reflects the continued success of zeolite synthesis researchers in producing novel materials. Collection of Simulated XRD Powder Patterns for Zeolites includes materials of interest to zeolite scientists following the policies established at recent IZA conferences. The materials included have corner-sharing tetrahedral frameworks with no restrictions on chemical composition. Covers an increase of 41 new topologies since the 4th edition in 2001 Data collected from diverse literature sources Represents an extensive compilation of data For many years, evidence suggested that all solid materials either possessed a periodic crystal structure as proposed by the Braggs or they were amorphous glasses with no long-range order. In the 1970s, Roger Penrose hypothesized structures (Penrose tilings) with long-range order which were not periodic. The existence of a solid phase, known as a quasicrystal, that possessed the structure of a three dimensional Penrose tiling, was demonstrated experimentally in 1984 by Dan Shechtman and colleagues. Shechtman received the 2011 Nobel Prize in Chemistry for his discovery. The discovery and description of quasicrystalline materials provided the first concrete evidence that traditional crystals could be viewed as a subset of a more general category of ordered materials. This book introduces the diversity of structures that are now known to exist in solids through a consideration of quasicrystals (Part I) and the various structures of elemental carbon (Part II) and through an analysis of their relationship to conventional crystal structures. Both quasicrystals and the various allotropes of carbon are excellent examples of how our understanding of the microstructure of solids has progressed over the years beyond the concepts of traditional crystallography. Three-dimensional x-ray diffraction (3DXRD) microscopy is a novel experimental method for structural characterisation of polycrystalline materials. The position, morphology, phase, strain and crystallographic orientation of hundreds of grains or sub-grain embedded within mm-cm thick specimens can be determined simultaneously. Furthermore, the dynamics of the individual structural elements can be monitored during typical processes such as deformation or annealing. The book gives a comprehensive account of the methodology followed by a summary of selected applications. The method is presented from a mathematical/crystallographic point-of-view but with sufficient hands-on details to enable the reader to plan his or her own experiments. The scope of applications includes work in materials science and engineering, geophysics, geology, chemistry and pharmaceutical science. Volume 20 of Reviews in Mineralogy attempted to: (1) provide examples illustrating the state-of-the-art in powder diffraction, with emphasis on applications to geological materials; (2) describe how to obtain high-quality powder diffraction data; and (3) show how to extract maximum information from available data. In particular, the nonambient experiments are examples of some of the new and exciting areas of study using powder diffraction, and the interested reader is directed to the rapidly growing number of published papers on these subjects. Powder diffraction has evolved to a point where considerable information can be obtained from ug-sized samples, where detection limits are in the hundreds of ppm range, and where useful data can be obtained in milliseconds to microseconds. We hope that the information in this volume will increase the reader's access to the considerable amount of information contained in typical diffraction data.

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