



Quick guide

X-ray Fluorescence Spectrometry (XRF)

In brief

- Elemental analysis from Be to U
- Solids, liquids, loose powders, filters, thin films of inorganic and organic materials
- Capable of quantifying elements from ppm to 100% in multi-element, multi-matrix samples from 0.5 mm to nearly 50 mm diameter
- Small spot analysis and mapping of elemental distribution

Applications

XRF instruments are widely used in:

- Cement manufacturing (from raw materials to final products, process and quality control)
- Iron, steel, sinters and slags
- Non-ferrous metals manufacturing (Al, Mg, brass, bronze, zinc)
- Petrochemicals (refineries, catalysts, polymers, chemicals, greases, lubricants)
- Environmental (air filters, soils, waters, waste materials, recycling)
- Geochemistry
- Glass, ceramics, refractories, raw materials as oxides, sulfides
- Food and beverages (nutrients and supplements in milk powders, cereals)
- Mining, minerals, ores and their processing
- Semiconductors, thin films and coatings
- Forensic labs
- Materials science and research
- Precious metals and dental alloys
- Paints and chemicals



Basic theory

XRF technique consists of irradiating a solid or a liquid sample with high-energy X-rays (from a controlled X-ray tube) which results in the secondary emission of X-rays (fluorescence). This fluorescence spectrum is characteristic of the elemental composition of the sample leading to qualitative and quantitative analysis of the bulk representative sample. There are two types of XRF instruments:

Wavelength Dispersive XRF (WDXRF)

uses crystals to disperse the fluorescence spectrum into individual wavelengths of each element providing high resolution and low background spectra for accurate determination of elemental concentrations. WDXRF analysis can be performed either sequentially using Goniometers (scanning system) for flexibility and optimum performance across the periodic table or simultaneously using Monochromators (fixed channels) for speed and precision for a given set of elements or a combination of both sequential and simultaneous devices.



Energy Dispersive XRF (EDXRF) uses a Solid State Detector to collect the complete fluorescence energy spectrum which is then processed for qualitative or quantitative analysis.



- Non-destructive analysis with minimal sample preparation
- High precision and reliability needed for process/quality control applications
- High flexibility and accuracy for investigative laboratory applications
- Ideally suited for the analysis of unknown samples using standard-less XRF analysis

Technology

EDXRF is a convenient technology to screen all kinds of materials for quick identification and quantification of elements from F to U. EDXRF instruments are generally portable or benchtop (transportable) for usage in the field or in a laboratory alongside other techniques with little or no sample preparation. Low cost of ownership and rapid elemental analysis of regular or irregular samples make EDXRF an attractive front-end analysis tool.

WDXRF technology is well established for high sensitivity down to low atomic number elements (from Be onwards), excellent repeatability and element selectivity in order to achieve performance needed for routine industrial applications. WDXRF is also exploited for its wide dynamic range and extremely good reliability for laboratory applications.

- ARL QUANT'X (EDXRF)
- ARL OPTIM'X (WDXRF)
- ARL PERFORM'X (WDXRF)
- ARL 9900 Series Slim-seq WDXRF
- ARL 9900 Series WDXRF with Integrated-Compact XRD
- ARL SMS-XY and OEM Automation Systems (WDXRF)
- ARL SMS-2000/2300, ARL SMS-2500/3500 Automation Systems with robots and sample preparation machines

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**Koen H. A. Janssens, Freddy
Adams, Anders Rindby**

Xrf Guide:

[Handbook of Practical X-Ray Fluorescence Analysis](#) Burkhard Beckhoff, Birgit Kanngießer, Norbert Langhoff, Reiner Wedell, Helmut Wolff, 2007-05-18 X Ray fluorescence analysis is an established technique for non destructive elemental materials analysis This book gives a user oriented practical guidance to the application of this method The book gives a survey of the theoretical fundamentals analytical instrumentation software for data processing various excitation regimes including gracing incidents and microfocus measurements quantitative analysis applications in routine and micro analysis mineralogy biology medicine criminal investigations archeology metallurgy abrasion microelectronics environmental air and water analysis This book is the bible of X Ray fluorescence analysis It gives the basic knowledge on this technique information on analytical equipment and guides the reader to the various applications It appeals to researchers analytically active engineers and advanced students [A Practical Guide for the Preparation of Specimens for X-Ray Fluorescence and X-Ray Diffraction Analysis](#) Victor E. Bahrke, Ron Jenkins, Deane K. Smith, 1997-11-19 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 [Advances in Portable X-ray Fluorescence Spectrometry](#) B Lee Drake, Brandi L MacDonald, 2022-10-19 Over the last two decades advances in the design miniaturization and analytical capabilities of portable X ray fluorescence pXRF instrumentation have led to its rapid and widespread adoption in a remarkably diverse range of applications in research and industrial fields The impetus for this volume was that as pXRF continues to grow into mainstream use analysts should be increasingly empowered with the right information to safely and effectively employ pXRF as part of their analytical toolkit This volume provides introductory and advanced level users alike with readings on topics ranging from basic principles of pXRF and qualitative and quantitative approaches through to machine learning and artificial intelligence for enhanced applications It also includes fundamental guidance on calibrations the mathematics of calculating uncertainties and an extensive reference index of all elements and their interactions with X rays Contributing authors have

provided a wealth of information and case studies in industry specific chapters. These sections delve into detail on current standard practices in industry and research including examples from agricultural and geo exploration sectors research in art and archaeology and metals industrial and regulatory applications. As pXRF continues to grow in use in industrial and academic settings it is essential that practitioners continue to learn share and implement informed and effective use of this technique. This volume serves as an accessible guidebook and go to reference manual for new and experienced users in pXRF to achieve this goal. **Annual Book of ASTM Standards** American Society for Testing and Materials, 2007

Employment Safety and Health Guide, 2001 Includes original text of the Occupational safety and health act of 1970

X-Ray Fluorescence Spectroscopy for Laboratory Applications Michael Haschke, Jörg Flock, Michael Haller, 2021-01-18 Provides comprehensive coverage on using X ray fluorescence for laboratory applications. This book focuses on the practical aspects of X ray fluorescence XRF spectroscopy and discusses the requirements for a successful sample analysis such as sample preparation measurement techniques and calibration as well as the quality of the analysis results. X Ray Fluorescence Spectroscopy for Laboratory Applications begins with a short overview of the physical fundamentals of the generation of X rays and their interaction with the sample material followed by a presentation of the different methods of sample preparation in dependence on the quality of the source material and the objective of the measurement. After a short description of the different available equipment types and their respective performance the book provides in depth information on the choice of the optimal measurement conditions and the processing of the measurement results. It covers instrument types for XRF acquisition and evaluation of X Ray spectra analytical errors analysis of homogeneous materials powders and liquids special applications of XRF process control and automation. An important resource for the analytical chemist providing concrete guidelines and support for everyday analyses. Focuses on daily laboratory work with commercially available devices. Offers a unique compilation of knowledge and best practices from equipment manufacturers and users. Covers the entire work process sample preparation the actual measurement data processing assessment of uncertainty and accuracy of the obtained results. X Ray Fluorescence Spectroscopy for Laboratory Applications appeals to analytical chemists analytical laboratories materials scientists environmental chemists chemical engineers biotechnologists and pharma engineers.

A Complete Guide to Lead Paint Poisoning Litigation Alan Kaminsky, Paul J. Bottari, 1998 Develop the Winning Strategy in a Lead Poisoning Lawsuit A Complete Guide to Lead Paint Poisoning Litigation will help you effectively handle a lead paint poisoning case providing you with valuable strategies techniques and useful checklists.

Annual Book of ASTM Standards ASTM International, American Society for Testing and Materials, 2003 **X-Ray Fluorescence Spectrometry and Its Applications to Archaeology** Mary Kate Donais, David B. George, 2018-05-30 This book serves as a practical guide for applications of X ray fluorescence spectrometry a nondestructive elemental analysis technique to the study and understanding of archaeology. Descriptions of XRF theory and instrumentation

and an introduction to field applications and practical aspects of archaeology provide new users to XRF and or new to archaeology with a solid foundation on which to base further study Considering recent trends within field archaeology information specific to portable instrumentation also is provided Discussions of qualitative and quantitative approaches and applications of statistical methods relate back to types of archaeological questions answerable through XRF analysis Numerous examples figures and spectra from the authors field work are provided including chapters specific to pigments ceramics glass construction materials and metallurgical materials

A Practical Guide to Total Reflection X-ray Fluorescence Martina Schmeling,Diane Eichert,2023-11-01 A Practical Guide to Total Reflection X ray Fluorescence discusses how a wide range of samples can be analyzed using Total Reflection X ray Fluorescence TXRF to obtain meaningful and accurate results Sample handling is a complex problem and often very targeted approaches are needed The strengths and weaknesses of the method are discussed in the context of each application in this book This includes guidelines and suggestions of how to treat and analyze different samples and how to evaluate the data In addition to sample handling users of TXRF will learn how to use and calibrate the instrumentation what specific features are present and which experimental parameters need to be considered and how to evaluate the data The book is divided into two parts with the first part describing the theoretical aspects of the method and the second part being solely dedicated to its applications The book emphasizes a practical approach to the method including advantages and also limitations The primary concept throughout the book is the chemical measurement process and how it applies to TXRF analysis The concept is introduced in the first part of the book describing its main aspects like samples sample handling and quantification In the second part of the book the topic is applied to the different application fields of TXRF presented as separated chapters Key case studies emphasizing the strength of the method are included in each of the chapters The book also explains in detail the calibration of the instrument and method experimental parameters to apply quantification procedures and spectra evaluation This book serves as a valuable resource for users and users to be in the field of elemental and trace analysis All co authors offer extensive experience in the field of TXRF and can guide users through the chemical measurement process of a specific field of application including what elements are most suitable and what issues may occur

CICS Command Level Programming Alida Jatich,1991-05-28 This Second Edition includes all relevant information regarding IBM s latest major update releases of CICS Using a step by step tutorial it shows how to develop and maintain CICS code for maximum system effectiveness Coverage includes all commands support functions and VS COBOL II detailed information on using the first microcomputer OS 2 version of CICS and table setup and system utilities for applications programmers developing software on personal computers By providing a wealth of real world examples teaches readers a practical streamlined approach to problem solving using the latest CICS coding techniques

CICS Handbook Yukihisa Kageyama,1989 In the 640 page book the author covers every major concept in CICS and illustrates it with usable programs or subroutines It is the most complete reference

available to programmers and application programmers for day to day use **Standard Guide for X-Ray Fluorescence XRF Spectroscopy of Pigments and Extenders , Strategy and Methodology for Radioactive Waste Characterization** International Atomic Energy Agency,2007 Over the past decade significant progress has been achieved in the development of waste characterization as well as control procedures and equipment This has been a direct response to ever increasing requirements for quality and reliability of information on waste characteristics Failure in control procedures at any step can have important adverse consequences and may result in producing waste packages which are not compliant with the waste acceptance criteria for disposal thereby adversely impacting the repository The information and guidance included in this publication corresponds to recent achievements and reflects the optimum approaches thereby reducing the potential for error and enhancing the quality of the end product Official Reference Book and Buyers' Guide ,1983

Standard Guide for Selecting Components for Wavelength-Dispersive X-Ray Fluorescence XRF Systems ,
 Microsoft C, C++ Microsoft Corporation,1991 The book is divided into two parts Part 1 The Comprehensive Index is a compilation of all of the indexes in the documentation set for Microsoft C C version 7 0 In this index the reader can look up any topic covered in the Microsoft C C books Part 2 Error Messages lists Microsoft C C error and warning messages in alphanumeric order Each message includes an explanation of what went wrong and what action to take to correct the problem Error messages can also display the input file and line number where the error occurred Introd CICS Using COBOL Andrew M. Suhy,1991 Text for courses in CICS On Line Programming Command Level Programming could also be used as suppl in Adv COBOL if it has on line emphasis IBM Mainframe Computer Required Hands on step by step tutorial presentation of CICS Develops a subset of CICS that embodies all the common characteristics of the most popular CICS product closest thing available to an official standard in any book *Microscopic X-Ray Fluorescence Analysis* Koen H. A. Janssens,Freddy Adams,Anders Rindby,2000-06-15 Table of contents **American Laboratory ,2002**

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