TECHNICAL SPECIFICATION

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Surface chemical analysis — Use of Total Reflection X-ray Fluorescence spectroscopy in biological and environmental analysis

Analyse chimique des surfaces — Utilisation de réflexion spectroscopie des rayons X de fluorescence totale dans l'analyse biologique et de l'environnement

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 201, *Surface chemical analysis*.

Introduction

Total Reflection X-Ray Fluorescence (TXRF) spectroscopy is a reliable technique for chemical analysis. TXRF today is employed in electronic industry quality control. TXRF is also a powerful multi-elemental method for trace and ultra-trace analysis of different kind of samples that can be grouped as follows: environmental samples (as water, soil, aerosols, deposits, plants), geological and mineralogical samples (as ore, crystals, mineral raw materials), technological samples (as petroleum and petroleum products, thin films, wastes, metals, polymers), biological samples (as blood, serum, urine, human tissue), food samples (as fish, fruit, meat, nuts, mushroom), pharma and biomedical samples (as pharmaceuticals, cell culture media), archaeological, art, and forensic samples. Sample preparation is critical for the quantitative analysis and depends on the sample and its aggregate state.

Because of its capability to analyse different kinds of samples, TXRF is suitable for chemical metrology at the nanoscale, both for heavy metals and light elements in environmental and biological analysis.

The key advantages of TXRF are the following:

a) simultaneous multi-element trace analysis including halogenides;

b) analysis of very small sample amounts (lower than nanograms to microgram range depending on sample preparation and condition);

c) simple quantification using an internal standard and possibility of reference-free quantification;

d) suitable for various sample types and applications;

e) theoretically low matrix or memory effects;

f) relatively short time is required for measurement collection;

g) high-sensitivity, low-detection limits depending on sample (elements) matrix, preparation method, and instrumentation.

Surface chemical analysis — Use of Total Reflection X-ray Fluorescence spectroscopy in biological and environmental analysis

1 Scope

This Technical Specification provides a framework on the uses of Total Reflection X-Ray Fluorescence (TXRF) spectroscopy for elemental qualitative and quantitative analysis of biological and environmental samples. It is meant to help technicians, biologist, doctors, environmental scientists, and environmental engineers to understand the possible uses of TXRF for elemental analysis by providing the guidelines for the characterization of biological and environmental samples with TXRF spectroscopy.

Measurements can be made on equipment of various configurations, from laboratory instruments to synchrotron radiation beamlines or automated systems used in industry.

This Technical Specification provides guidelines for the characterization of biological and environmental samples with TXRF spectroscopy. It includes the following: (a) description of the relevant terms; (b) sample preparation; (c) experimental procedure; (d) discussions on data analysis and result interpretation; (e) uncertainty; (f) case studies; and (g) references.

2 Normative references

No normative references cited in this document.

3 Terms, definitions, symbols, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
sample carrier
flat substrate where the specimen is deposited

Note 1 to entry: The reference surface corresponds to the flat surface of the sample carrier, where the residue lays. The most important feature of the sample carrier is to be a reflector/mirror for X-rays. Surface roughness, matrix, and contamination of the sample carrier have an impact on TXRF measurements.

3.1.2
residue
specimen that lays on the sample carrier to be measured