

Elemental measurements are inaccurate with spectrometers



AI Overview

Elemental measurements with spectrometers can be inaccurate due to stray light, calibration errors, optical misalignments, sample issues, and environmental factors, but these can be mitigated through proper calibration, optical design improvements, and careful sample handling.

Common Sources of Inaccuracy

Stray Light: Stray light refers to any detected signal outside the intended measurement wavelength. It is particularly problematic at high absorbance levels, causing measured absorbance to be lower than the true value and leading to deviations from the Beer-Lambert law. Stray light can originate from scattering at optical components, higher diffraction orders, inter-reflections within the spectrometer, or internal reflections in prisms and mirrors. Symptoms include absorbance plateauing at high concentrations and poor resolution of sharp spectral features.

Calibration Errors: Incorrect wavelength calibration or misalignment of optical components, such as monochromators and slits, can result in inaccurate wavelength assignments and erroneous elemental readings. Photomultiplier tube sensitivity variations and improper positioning of the light beam can also introduce errors.

Instrumental Limitations: Variations in optical path length, polarization effects, and detector sensitivity can affect measurement accuracy. For example, partially polarized light reflecting off sample surfaces can distort readings if not accounted for.

Sample-Related Errors: Contamination, improper preparation, or inconsistent sample thickness can lead to inaccurate measurements. In IR spectroscopy, water contamination can produce unwanted absorption bands, while in nuclear spectroscopy, low count rates and spectrum drift can reduce accuracy.

Environmental Factors: Temperature fluctuations, vibrations, and ambient light can influence spectrometer performance, affecting both the dete...

Article Content

Possible Pitfalls in the Analysis of Minerals and Loose ...

Portable X-ray fluorescence spectroscopy is now widely used in almost any field of geoscience. Handheld XRF analysers are easy to use, and results are available in almost real time

Spectroscopy Accuracy | OES | Measurement Errors | Hitachi High-Tech

When we take a measurement with our spectroscopy instrument, we want to trust the result. Whether we are measuring composition or thickness, and whether our method is XRF, OES

4.11: Mass Spectrometry

Mass Spectrometers The detector which measures the amount and type of secondary ions sputtered from the sample surface is a mass

Chemists Debate the Value of Elemental Analysis

C& EN contacted several elemental analysis providers for this story but did not hear back by its deadline. Putting elemental analysis to the test In the face of this uncertainty, chemists have taken it upon

d1qi01379c 412..416

Reviewing elemental analysis data In contrast to synthetic organic chemistry, elemental analysis is an essential part of substance characterization in the field of (bio)inorganic coordination chemistry. A

Nine Elements That Challenge Handheld XRF Analyzers — But Are

In several cases, ha new generation of high-capability, mobile and portable OES metal analyzers. They can quickly and precisely measure these challenging elements, or supply ectrometer is the flagship

What must be specified to achieve a valid spectroscopic

Suspended, scattering matter and refraction changes lead to baseline shifts and inaccurate measurements. In atomic absorption and infrared

EGUsphere

X-ray fluorescence spectrometry (XRF) is one of the most widespread techniques used to determine the elemental composition of PM. In recent years, new systems known as online XRF

Intercomparison of online and offline XRF spectrometers for

L. Cadeo et al.: Intercomparison of online and offline XRF spectrometers 6437

Regarding the ED-XRF method, new systems have been developed that are able to sample PM particles with a sub- hourly

Accurate mass measurement for the determination of

The application of accurate mass measurement for the determination of elemental formula has its origin in the 1950s and for many years was only

Most Common Elemental Analysis Techniques

This article discusses the techniques for determination of elemental composition and the highly sensitive instrumentation required for them.

1.1: Introduction to Elemental Analysis

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Troubleshooting Common Spectrometer Issues

Learn how to troubleshoot common spectrometer issues and get better results. Discover expert-backed support from NE LabSystems.

Spectroscopy Troubleshooting 101

Spectroscopy is a powerful analytical technique used to identify and quantify the chemical composition of a sample. However, like any other analytical technique, it is not immune to

Searching for the Truth: Elemental Analysis–A Powerful but Often

Elemental analysis is a broad term utilized to describe multiple techniques to identify the atomic composition of matter. Accurately knowing the composition of a substance is important to understand

A Comprehensive Analysis of the Factors Affecting the Accuracy of U,

This article discusses how various factors can affect the accuracy of U, Th, and K elemental content measurements in natural gamma spectroscopy logs. These factors include errors

Portable x-ray fluorescence calibrations: Workflow and guidelines for ...

These spectrometers are based on a versatile, relatively cheap, and stable technique, allowing fast measurement of a large number of samples in the field or the laboratory. It is also a non

Data Quality in Geochemical Elemental and Isotopic

The availability of a number of well-characterized geological certified reference samples having both elemental and isotopic data-enabled matrix

What XRF Can and Can't Analyze: A Guide for Beginners

Discover what XRF can and can't analyze, its applications, and limitations. Learn how to choose the right technique for your elemental analysis

Resolving Inaccurate Spectrometer Results: A 2025 Troubleshooting

This guide provides researchers and drug development professionals with a comprehensive framework for diagnosing, troubleshooting, and preventing inaccurate spectrometer analysis.

Flame and Furnace Atomic Absorption Spectroscopy

We have patented many technologies associated with atomic absorption spectrometers and provide fast, accurate and sensitive instrumentation for elemental analysis. Agilent Atomic Absorption

The assessment of the usability of selected instrumental ...

In the literature, the most frequently appearing validation parameters for quantitative elemental analyses are the accuracy and precision of the measurement as well as the detection limit

Avoiding common errors in X-ray photoelectron spectroscopy data ...

There may be cases where one desires quantitative elemental information from an XPS analysis, but not necessarily chemical state information. In these situations, one may simply integrate

Dealing With the Masses: A Tutorial on Accurate Masses, Mass 32 ...

Figure 2 Accurately Measuring Masses and Determining Elemental Formulae The term mass accuracy refers to how close the mass measured by the mass spectrometer comes to the

The Importance of Spectrometer Calibration

The Importance of Spectrometer Calibration A spectrometer is a term used for any instrument that is used to study, identify and analytically measure electromagnetic radiation that is emitted by a

Elemental analysis under scrutiny again as competition raises

Elemental analysis has researchers divided but there is consensus on its limitations. The exact mass measurement must be reliable with confidence in the instrument – and with larger molecules, ...

Accuracy of Spectrophotometer Readings

The needle deflection or the number shown on the digital display of a spectrophotometer is proportional to the transmittance of the solution. How do

Error Analysis in Atomic Spectroscopy: A Step-by-Step Guide

Atomic spectroscopy is a powerful analytical technique used to determine the elemental composition of a wide range of samples. However, like any analytical technique, it is not immune to

Spectrometers for Elemental Spectrochemical Analysis, Part I: The

Spectrometers for Elemental Spectrochemical Analysis, Part I: The Basic Spectrometer An overview of the instrumentation used in elemental spectrochemical analysis. A spectrometer consists

X Ray Spectrometers

Energy-dispersive X-ray spectroscopy (EDS/EDX) is defined as an analytical technique used to determine the chemical or elemental composition of a sample by measuring the X-ray emissions

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