Spectrometer for Determination of Non-metallic Elements

Overview

This paper presented a novel LIBS precision-targeted methodology for multimodal characterization of the morphology and composition of non-metallic inclusions in metal materials.

Key Takeaways

Spectrometers for non-metallic elements include XPS, NMR, ICP-MS, and specialized XRF instruments, each suited for different sample types and analytical needs. X-ray Photoelectron Spectroscopy (XPS)XPS is highly effective for analyzing non-metal elements such as nitrogen, oxygen, fluorine, phosphorus, sulfur, and xenon. It works by irradiating a sample with X-rays, causing electrons to be ejected from atomic orbitals.

The kinetic energy of these electrons is measured, providing element-specific information and chemical state data.

XP

S is particularly useful for surface analysis and thin films, offering high sensitivity to non-metals in both organic and inorganic compounds (Thermo Fisher Scientific). Nuclear Magnetic Resonance (NMR) SpectroscopyNMR spectroscopy can be applied to non-metallic elements like nitrogen, oxygen, fluorine, phosphorus, and sulfur. It provides detailed structural information, including chemical shifts and spin-spin coupling, which helps in interpreting molecular structures and complex compounds.

NM

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R is widely used in organic and inorganic chemistry for both qualitative and quantitative analysis of non-metal-containing compounds (Berger et al.). Inductively Coupled Plasma Mass Spectrometry (ICP-MS)ICP-MS is a versatile technique capable of detecting both metals and several non-metals in liquid samples at very low concentrations. The sample is atomized and ionized in a plasma, and ions are detected based on their mass-to-charge ratio.

ICP-MS is highly sensitive, allows isotopic analysis, and is suitable for environmental, biological, and industrial applications where trace non-metal detection is required (Wikipedia). X-ray Fluorescence (XRF)While XRF is traditionally used for metals, certain advanced XRF instruments can detect light elements starting from magnesium. Portable and bench-top XRF spectrometers provide rapid, non-destructive elemental analysis, making them useful for fieldwork, mineral exploration, and alloy verification.

However, XRF is generally less sensitive for very light non-metals like hydrogen, carbon, or nitrogen (Bruker).

Choosing the Right Spectrometer

Surface vs bulk analysis: XPS excels at surface characterization, while ICP-MS and NMR analyze bulk samples. Sample state: ICP-MS requires liquid samples, NMR works with solids, liquids, or gels, and XPS requires vacuum-compatible solid samples. Sensitivity: ICP-MS offers the highest sensitivity for trace non-metals, whereas XRF is faster but less sensitive for light elements.

Structural information: NMR provides detailed molecular structure, while XPS gives chemical state information. In summary, the choice of spectrometer depends on the element of interest, sample type, and analytical goal. For comprehensive non-metal analysis, combining techniques like XPS for surface chemistry, NMR for molecular structure, and ICP-MS for trace quantification often provides the most complete information.

Article Content

Multimodal characterization methodology of non-metallic inclusions in ...

This paper presented a novel LIBS precision-targeted methodology for multimodal characterization of the morphology and composition of non-metallic inclusions in metal materials.

Non-Metallic Materials Testing

Creative Proteomics provides a non-metallic material testing platform to help you understand the chemical properties of the main and minor components in substances and comply with legal

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Quick guide Spark-Optical Emission Spectrometry (OES)

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Standard Guide for Elemental Analysis by Wavelength Dispersive X

5.1 X-ray fluorescence spectrometry can provide an accurate and precise determination of metallic and many non-metallic elements in a wide variety of solid and liquid materials.

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A comprehensive review of mass spectrometry analysis of

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Development of a direct dilution method for the simultaneous ...

Abstract The deficiency and overnutrition of both metal and non-metallic elements in human body can pose harmful effects to human health. Therefore, it is necessary to determination of

Determination of Non-Metals by Molecular Absorption: A Minireview

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Nonmetals are challenging elements to determine by atomic absorption spectrometry (AAS). Their determination by molecular absorption spectrometry (MAS) began in the 1970s when

Sorption Preconcentration and Analytical Determination of Cu, Zr and

These sorbents have been successfully used for the preconcentration of platinum and toxic elements from different kinds of secondary raw materials. The aim of this work is to investigate the capabilities

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The spectrometer for metal analysis, ferro.lyte®, is ideally suited for sorting and identifying unknown alloys, e.g. during the recycling of non-ferrous metals, since multi-element determination can also be

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Determination of Non-metallic Elements by Capacitively Coupled Helium Microwave Plasma Atomic-emission Spectrometry with Capillary Gas Chromatography

X-ray fluorescence spectrometry for environmental analysis: Basic ...

X-ray fluorescence spectrometry (XRF) is a well-established analytical atomic technique for qualitative and quantitative chemical analysis of environmental samples with various matrices and

Determination of the Non-metallic Elements in Herbal Tea

The feasibility of using inductively coupled plasma tandem mass spectrometry (ICP-MS/MS) to overcome spectral overlaps in the determination of non-metallic elements was investigated.

ASTM International

5.1 X-ray fluorescence spectrometry can provide an accurate determination of metallic and many non-metallic elements in a wide variety of solid and liquid materials. This guide covers the

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