

Principle of Metal Alloy Spectrometer

Article Overview

Metal alloy spectrometers operate on the principle that excited atoms emit light at characteristic wavelengths, allowing precise identification and quantification of elements in alloys.

Core Principle

Metal alloy spectrometers, particularly Optical Emission Spectrometers (OES), function based on Atomic Emission Spectroscopy (AES). When a metal sample is exposed to a high-energy source, such as an electric spark or arc, the atoms in the sample are excited to higher energy levels. As these atoms return to their ground state, they emit photons at wavelengths unique to each element, effectively producing an atomic “fingerprint” for elements like iron, magnesium, or titanium . By capturing and analyzing this emitted light, the spectrometer provides both qualitative and quantitative information about the alloy composition .

Operational Steps

- **Sample Preparation:** The metal surface is cleaned and flattened to remove oxides or contaminants, ensuring consistent excitation .
- **Electrical Excitation:** A high-voltage spark or arc vaporizes a small portion of the metal, creating a plasma of excited atoms. Temperatures can exceed 10,000°C, sufficient to energize electrons .
- **Light Emission and Detection:** As electrons return to lower energy states, they emit light at element-specific wavelengths. This light is collected by an optical system with diffraction gratings and directed to detectors such as photomultiplier tubes or CCD arrays

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