Structure of an Atomic Emission Spectrometer

Article Overview

An atomic emission spectrometer consists of an atomization/excitation source, an optical system for wavelength separation, and a detector to measure emitted light intensity.

Atomization and Excitation Source

The atomization source converts the sample into free gaseous atoms, while the excitation source promotes electrons to higher energy levels. Common sources include:

o Flames: Used for liquid or solution samples; the sample is nebulized and introduced into a high-temperature flame, which atomizes and excites the atoms simultaneously .
o Plasmas: Hot, partially ionized gases (e.g., inductively coupled plasma) that provide high temperatures for excitation, suitable for multielement analysis and refractory elements .
o Arcs and Sparks: Often used for solid samples; the sample is vaporized and excited by electrical discharge .

Sample Introduction

Liquid samples are typically introduced via a nebulizer and spray chamber, which produce a fine aerosol for atomization in the flame or plasma. Solid samples are either dissolved in a solvent or directly ablated using a laser or spark discharge .

Optical System

The optical system separates the emitted light into its component wavelengths. This usually involves:

o Monochromators or spectrographs: To isolate specific emission lines corresponding to different elements.
o High-resolution optics: Necessary for resolving closely spaced spectral lines in multielement samples .

Detector

The detector measures the intensity of the emitted light, which is proportional to the number of excited atoms. Common detectors include:

o Photomultiplier tubes (PMTs): Highly sensitive for low-intensity emissions.
o Charge-coupled devices (CCDs): Allow simultaneous detection of multiple wavelengths, enabling multielement analysis .

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Data Processing

The measured emission intensities are processed to determine elemental concentrations. The intensity of each spectral line is related to the number of atoms in the excited state, often using the Boltzmann distribution to account for temperature effects .

Summary

In essence, an atomic emission spectrometer is composed of:
o Sample introduction system (nebulizer, spray chamber, or solid ablation setup)
o Atomization and excitation source (flame, plasma, arc, or spark)
o Optical system (monochromator or spectrograph)
o Detector (PMT or CCD)
o Data processing unit to convert emission intensities into quantitative elemental information . This configuration allows AES to perform sensitive, multielemental analysis across a wide range of sample types, including metals, nonmetals, and refractory compounds .

In the present unit, you would learn about spectrometric methods based on atomic spectra. Herein, we would take up atomic

Applications of Atomic Spectra Atomic spectra are important for a variety of analytical techniques. Techniques including atomic

Abstract Atomic spectroscopy includes a number of analytical techniques used to deter-mine the elemental composition of a sample

Inductively Coupled Plasma Optical Emission Spectroscopy ICP-OES is short for optical (or atomic) emission spectrometry with

Classical theory was unable to explain the existence of atomic emission spectra, also known as line-emission spectra. According to

Atomic emission based on emission from a plasma was introduced in 1964. For an on-line introduction to much of the material in this

Atomic emission spectroscopy (AES) is a powerful analytical technique used to identify and quantify elements in

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There are many possible electron transitions for each atom, and each transition has a specific energy difference. This collection of

Schematic of an AES experiment. As in AA spectroscopy, the sample must be converted to free atoms, usually in a high-temperature

In atomic emission spectrometry (AES), a reproducible and representative amount of the sample is introduced into an atomization

Spectroscopy - Atomic Structure, Light, Wavelengths: The emission and absorption spectra

Atomic emission spectroscopy (AES or OES) uses quantitative measurement of the optical emission from excited atoms to determine

Atomic Emission Spectroscopy 7.1 Introduction Atomic emission spectroscopy (AES) deals with the excitation of atoms or elemen

An introduction to atomic absorption, emission and fluorescence spectroscopy techniques, all yielded by the science

In this section we consider two additional techniques for achieving atomic emission: arc sources and spark sources.

Atomic Emission Spectroscopy Principle The theory or working principle of Atomic Emission Spectroscopy involves the examination

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