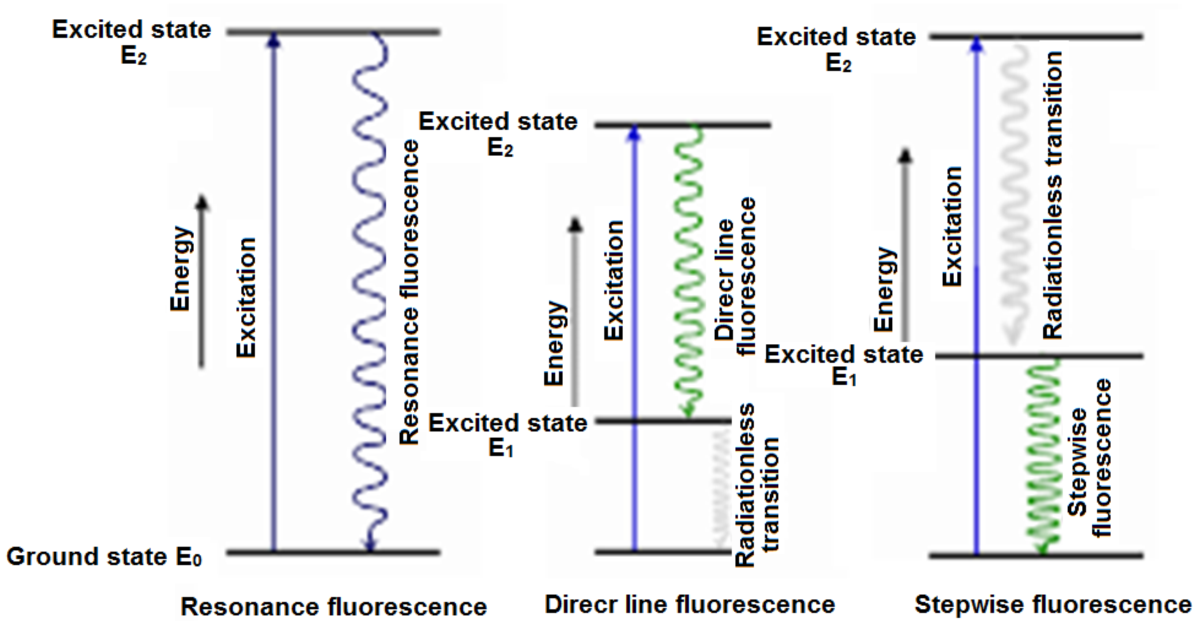
INTRODUCTION

Atomic fluorescence spectroscopy (AFS) depends on the measurement of the emission (fluorescence) emitted from gas-phase analyte atoms that have been excited to higher energy levels by absorption of electromagnetic radiation. The main advantage of fluorescence detection compared to absorption measurements is the greater sensitivity achievable because the fluorescence signal has a very low background. The resonant excitation provides selective excitation of the analyte to avoid interferences. AFS is useful to study the electronic structure of atoms and to make quantitative measurements. Analytical applications include flames and plasmas diagnostics, and enhanced sensitivity in atomic analysis.

PRINCIPLE OF AFS

In atomic fluorescence spectroscopy a radiation source is used . The radiation is absorbed by the sample at a particular wavelength to promote the sample electrons from its ground electronic state into an excited state. From this excited electronic state, the electron drops down to a lower electronic state emitting a photon with a specific wavelength in the process. By measuring the intensity of the emitted radiation at a particular wavelength and at 90 C^0 from incident radiation , it is possible to determine the concentration of the element being measured (analyte) .There are three main types of fluorescence as shown in the next figure, the most sensitive of these types is the resonance fluorescence .

Types of fluorescence

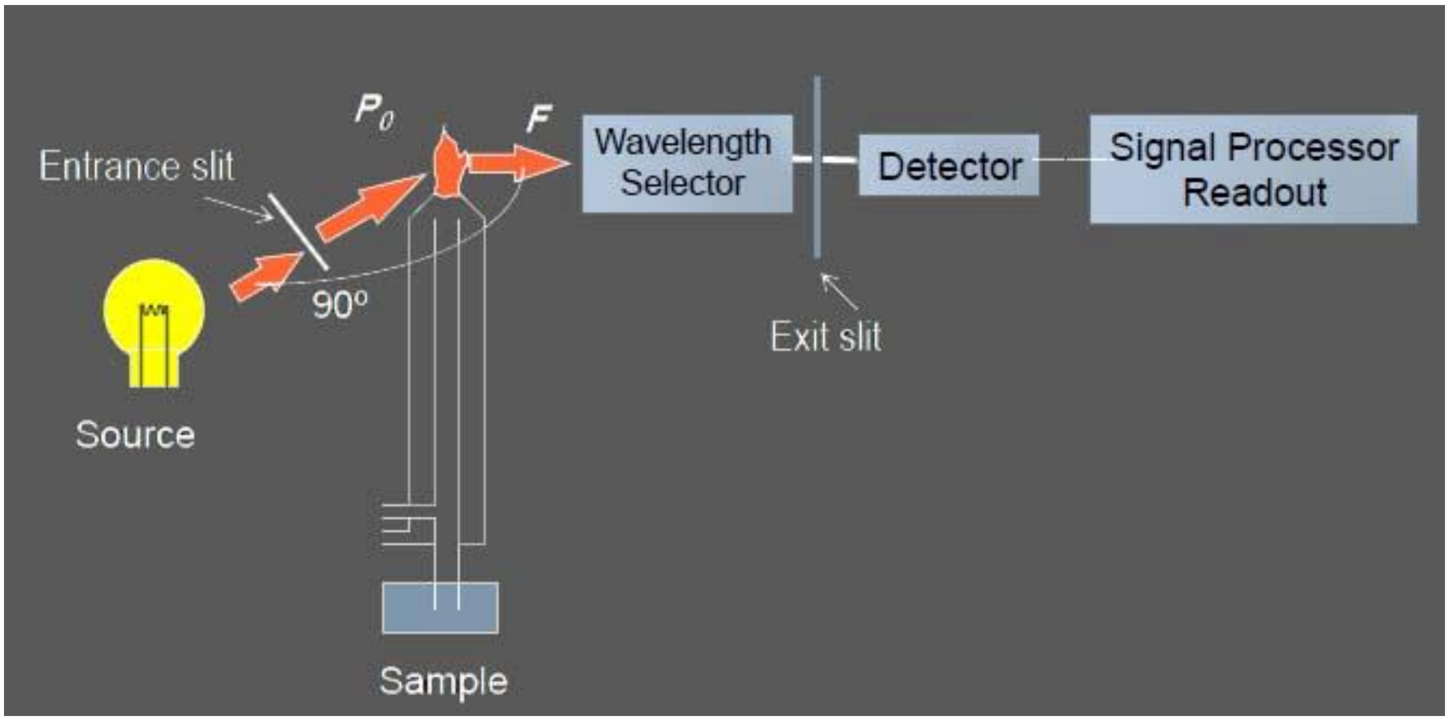


Types of fluorescence

INSTRUMENTATION

Atomic fluorescence spectrometry makes use of the same basic instrumental components as atomic absorption spectrometry; however, it measures the intensity of the radiation emitted by atoms that have been excited by the absorption of radiation of shorter wavelength than that emitted.

Analysis of solutions or solids requires that the analyte molecules be desolvated, vaporized,and atomized at a relatively low temperature in a heat pipe, flame, or graphite furnace. A hollow- cathode lamp , Xenon arc lamp or laser provides the radiation source needed to excite the atoms of the analyte. The atomic fluorescence is dispersed by monochromators and detected by photomultiplier tubes, similar to atomic absorption instrumentation.



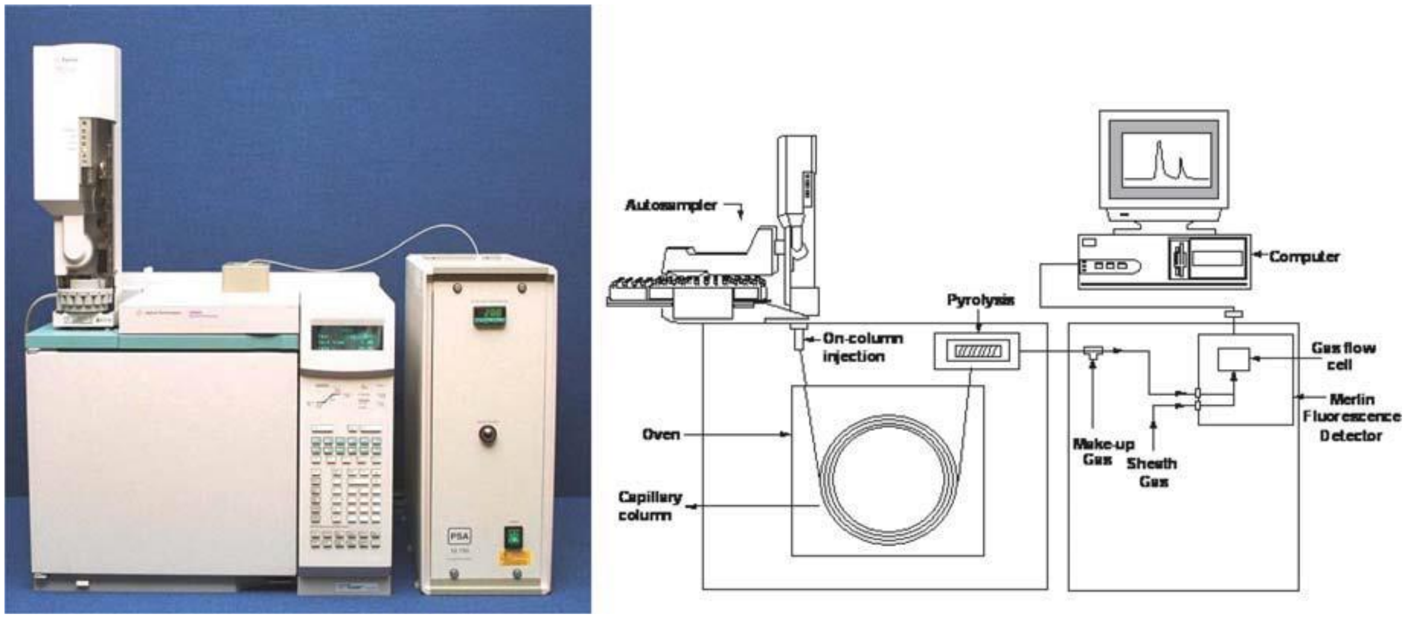
P0
F
Entrance slit
Wavelength Selector
Detector
Signal Processor Readout
90º
Exit slit
Source
Sample

Types of Interference in AFS

Species with spectra where the lines overlap or are very close together are rare, and are well known and characterized, so they do not adversely affect the accuracy of the analysis. Most of the problems which can occur with AF spectra are from the atomization process, such as matrix effects, chemical reactions which create unexpected species in the analyte, or light source drift. With the exception of the chemical interference, these can be taken care of with background correction.

APPLICATION

Atomic Fluorescence Spectrometry (AFS) is an ideal technique for determination of hydride forming elements (mainly As, Se and Sb) and Hg. The analytical features of AFS, such as detection limits below ppm and the wide linear calibration range, good accuracy and precision, allow its application to a great variety of environmental, biological , geological , metallurgical , medical , pharmaceutical , petrochemical and food samples. AFS represents a suitable alternative to other atomic spectrometers commonly employed in elemental analysis such as Atomic Absorption Spectrometry (AAS) and Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). However , AFS is not popular as such techniques . AFS is used as a detector in the gas chromatographic technique (see next figure) .



Schematic diagram and photograph of the GC-AFS system.