Instrumentation of Atomic Fluorescence Spectrophotometry

Instruments for atomic fluorescence spectrometry (AFS) consist of:

(1) Radiation source

(2) Sample holder = atomizer

(3) Wavelength selector

(4) Detector

(5) Signal processor and readout

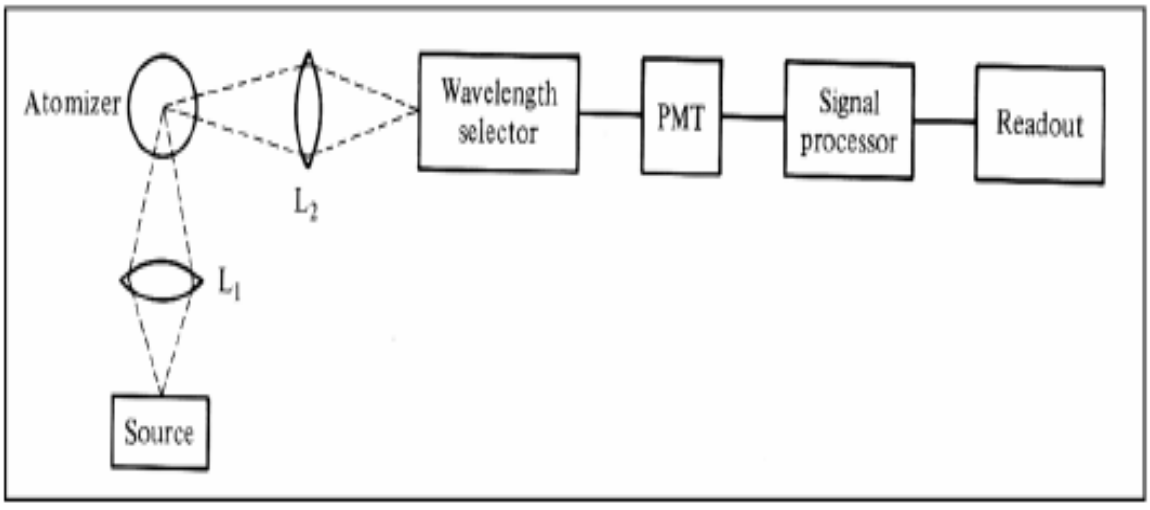

Fig: Sketch Diagram of Atomic Fluorescence Spectroscopy

1)Radiation Source

a) Hollow Cathode Lamps

Consists of a tungsten anode and a cylindrical cathode sealed in a glass tube that is filled with neon or argon at a pressure of 1 to 5 torr.

The cathode is constructed of the metal whose spectrum is desired.

Ionization of the inert **g**as occurs when a potential on the order of 300 V is applied across the electrodes, which generates a current of about 5 to 15 mA.

If the potential is sufficiently large, the gaseous cation acquire enough kinetic energy to dislodge some of the metal atoms from the cathode surface and produce an atomic cloud in a process called sputtering.

A portion of the sputtered metal atom are in excited states and thus emit their characteristic radiation as they return to the ground state.

Eventually, the metal atoms diffuse back to the cathode surface or to the glass walls of the tube and are redeposited.

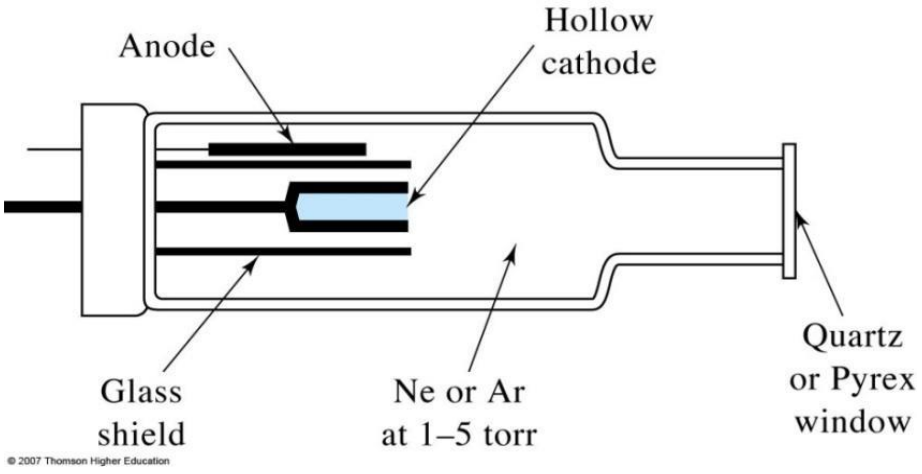

Fig: Hollow Cathode Lamp

b)Electrodeless Discharge Lamps (EDLs):

These provide radiant intensities that are usually one to two orders of magnitude greater than hollow cathode lamps.

A typical lamp is constructed from a sealed quartz tube containing a few torr of an inert gas such as argon and a small quantity of the metal (or its salt) whose spectrum is of interest.

The lamp is energized by an intense field of radio-frequency or microwave radiation. Ionization of the argon occurs to give ions that are accelerated by the high-frequency component of the field until they gain sufficient energy to excite the atoms of the metal whose spectrum is sought. Electrodeless discharge lamps are available commercially for 15 or more elements.

EDLs exhibit better detection limits than do hollow-cathode lamps." This occurs because EDLs for these elements are more intense than the corresponding hollow-cathode lamps, and thus, EDLs are quite useful in determining these elements.

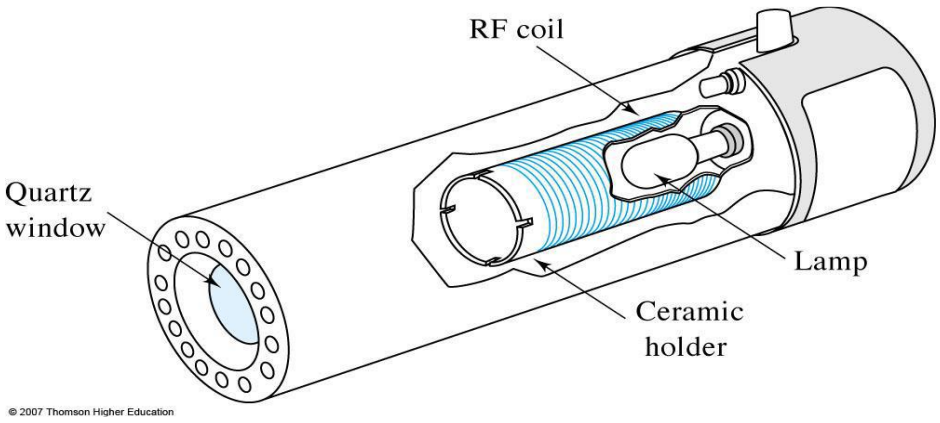

Fig: Electrodeless Discharge Lamp

Other source like

c) Mercury Arc lamp d) Xenon Arc lamp e) Hydrogen lamp f) Laser Diodes are also used as radiation source.

2)Atomizer:

It is used to convert the sample into gaseous or atomic state. The process of conversion of molecules into atoms is called atomization. In atomic fluorescence spectroscopy it is necessary to convert molecules into atoms. Following atomization techniques are used for this purpose

The **two most common methods** of sample atomization encountered in AFS,

a)Flame atomization

b)Electrothermal atomization

•Three specialized atomization procedures are also used

c) Glow-Discharge Atomization

d) Hydride Atomization

e) Cold-Vapor Atomization

Flame and electrothermal Atomization can discuss in next lecture