

Instrumentation of Atomic Absorption

Spectroscopy

The instrumentation of atomic absorption spectroscopy is same as tha of flame photometry and atomic fluorescence.

Flame spectrophotometers are used in all of them. Flame is used to convert molecules into atoms.

Typical flame spectrophotometers:

(a) single-beam design

(b) double-beam design.

Components of spectrophotometer:

- 1) Radiation source**
- 2) Atomizer**
- 3) Monochromator/wavelength selector**
- 4) Detector**
- 5) Read out system**

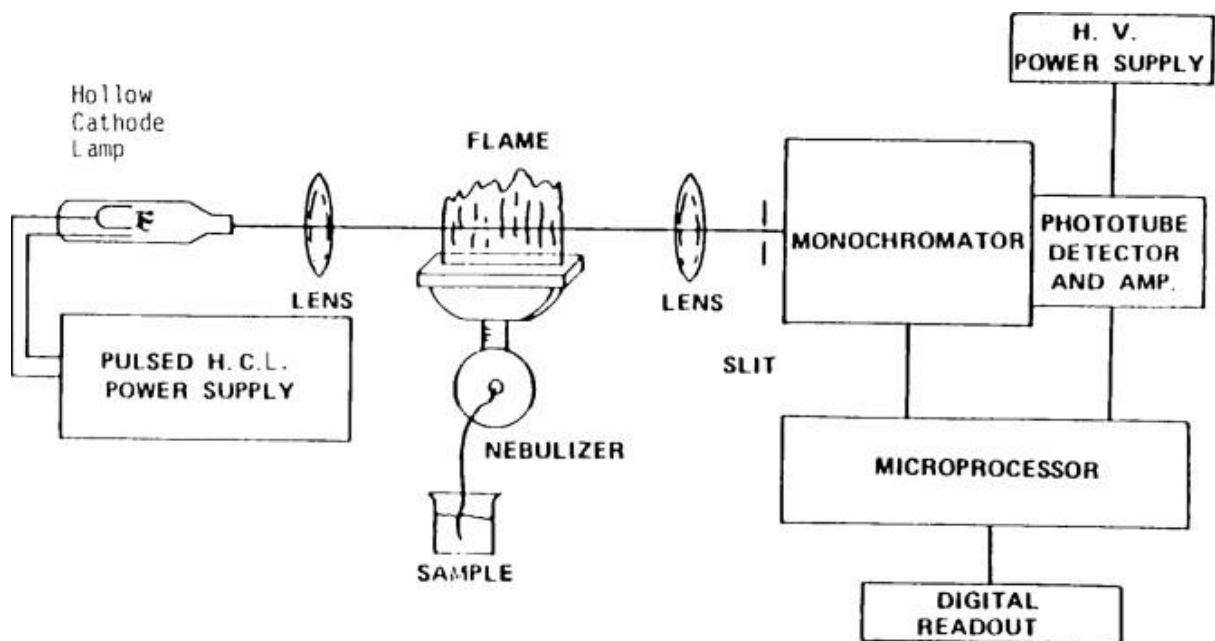


Fig : Single beam Spectrophotometer

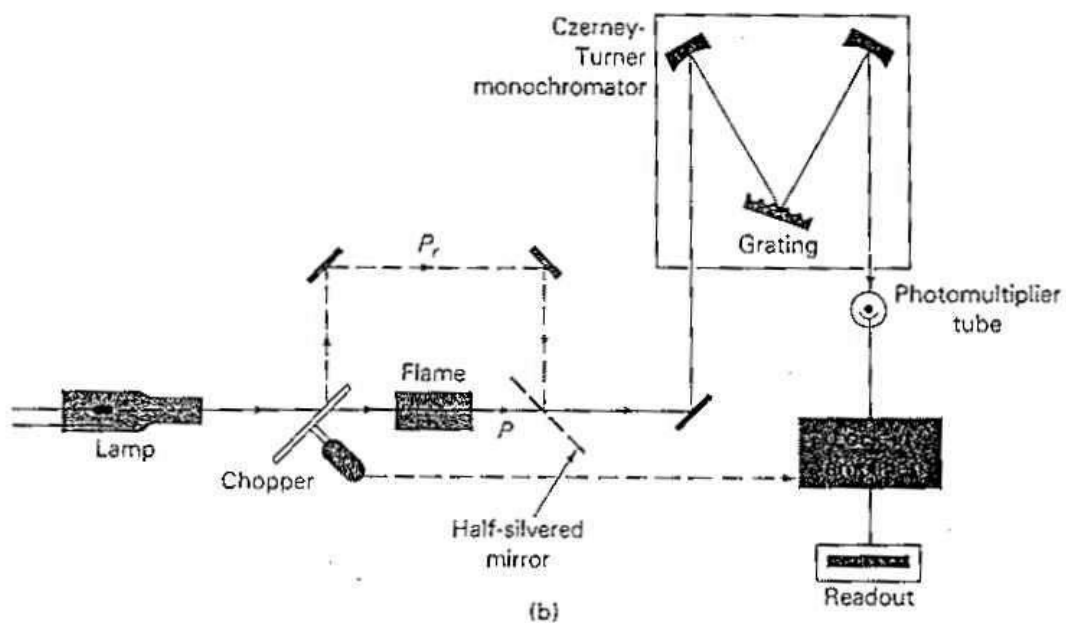


Fig: Double beam Spectrophotometer

1) Radiation Source:

The radiation source used in atomic absorption is same as discussed in atomic fluorescence spectroscopy i.e

Hollow cathode lamp

Electrodeless Discharge lamp

Xenon arc lamp

Mercury arc Lamp

Laser diodes etc.

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 gas 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.

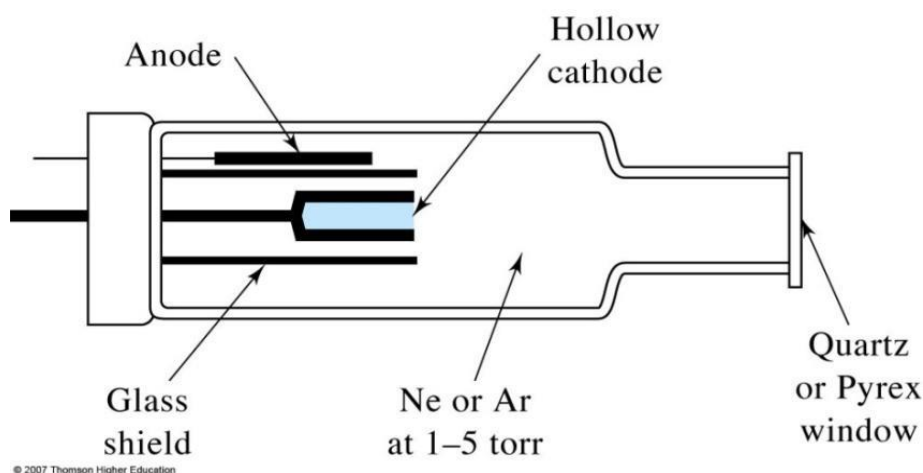


Fig: Hollow Cathode Lamp

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.

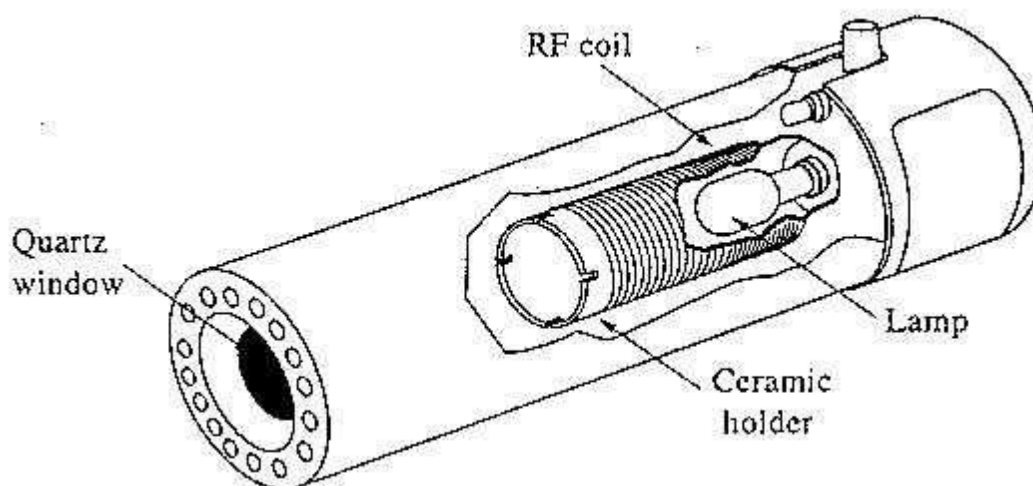


Fig: Electrodeless Discharge Lamp

2) Atomizer:

Flame atomizer and Electrothermal atomizers are mostly used as discussed in atomic fluorescence spectroscopy.

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

Next Discuss in next lecture