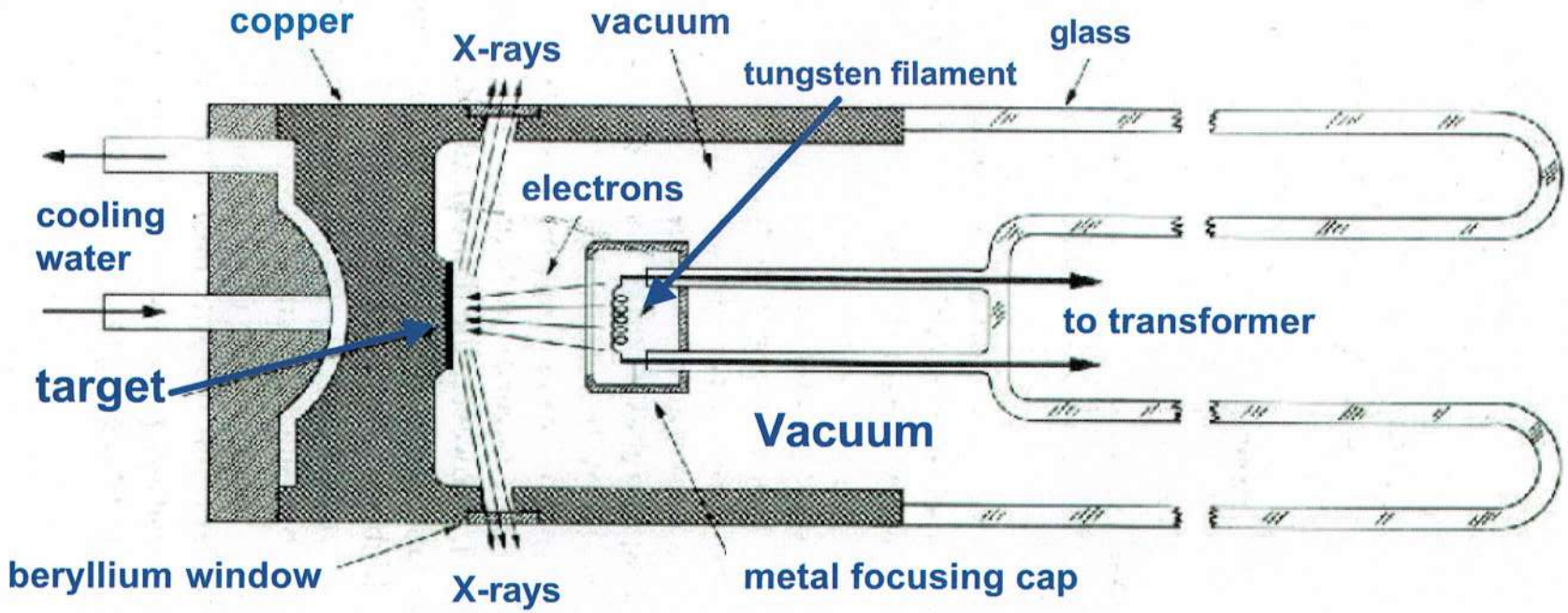
3.0 Production of X-rays

Cross section of sealed-off filament X-ray tube



X-rays are produced whenever high-speed electrons collide with a metal target. A source of electrons – hot W filament, a high accelerating voltage between the cathode (W) and the anode and a metal target, *Cu*, Al, Mo, Mg. The anode is a water-cooled block of Cu containing desired target metal.

TYPES OF MONOCHROMATORS

In order to do monochromatization,2 methods are available

1.Filter

2.Crystal monochromator

a)Flat crystal monochromator

b)Curved crystal monochromator

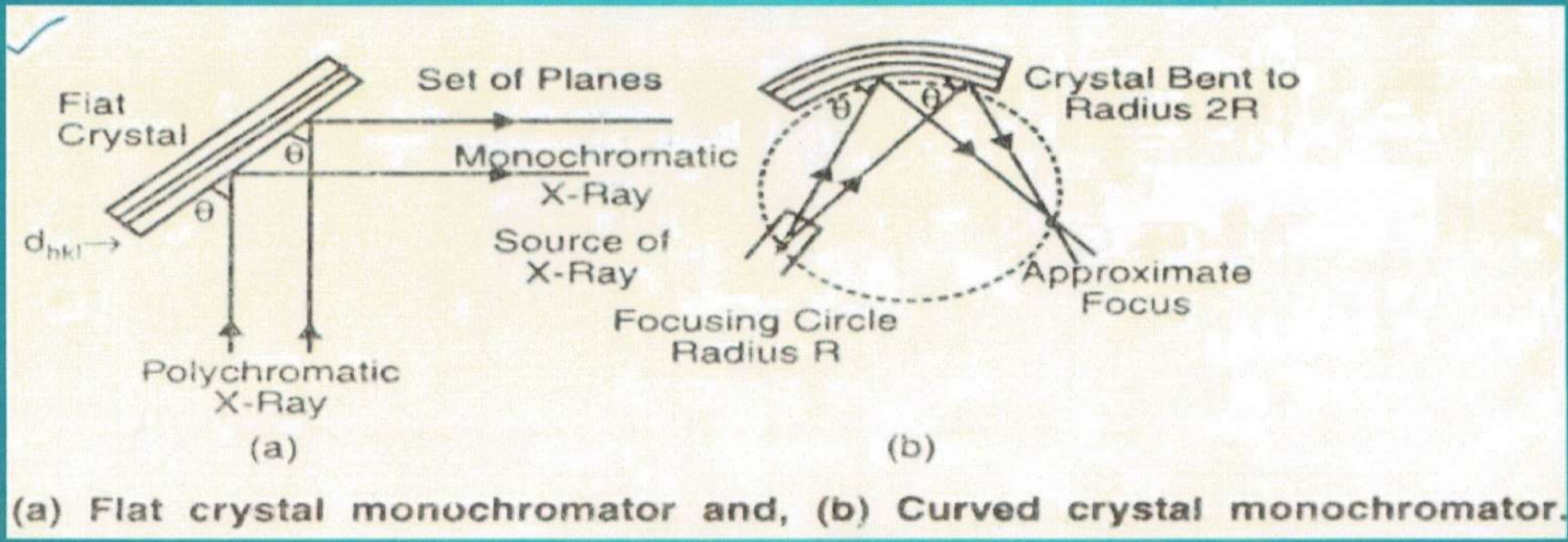
Materials used-Nacl,quartz etc,.

- A.FILTER: X-ray beam may be partly monochromatized by insertion of a suitable filter
- A filter is a window of material that absorbs undesirable radiation but allows the radiation of required wavelength to pass

•2)CRYSTAL MONOCHROMATOR : Crystal monochromators is made up of suitable crystalline material positioned in the x-ray beam so that the angle of reflecting planes satisfied the Bragg's equation for the required wavelength

the beam is split up into component wavelengths

crystals used in monochromators are made up of materials like Nacl, lithium fluoride , quartz etc.



(a) Flat crystal monochromator and, (b) Curved crystal monochromator.

DETECTORS

- The x-ray intensities can be measured and recorded either by
- 1)Photographic methods

- 2)Counter methods
  - a) Geiger - Muller tube counter
  - b) Proportional counter
  - c) Scintillation detector
  - d) Solid state semi conductor detector
  - e) Semi conductor detectors

- Both these types of methods depends upon ability of x-rays to ionize matter and differ only in the subsequent fate of electrons produced by the ionizing process.

- **Photographic method:** To record the position and intensity of x-ray beam a plane or cylindrical film is used
- The film after exposing to x-ray is developed
- The blackening of the developed film is expressed in terms of density units D given by

$$D=\log I_0/I$$

I_0- incident intensities

I- transmitted intensities

D-Total energy that causes blackening of the film

D is measured by densitometer

The photographic method is mainly used in diffraction studies since it reveals the entire diffraction pattern on a single film .

Dis advg: time consuming and uses exposure of several hours