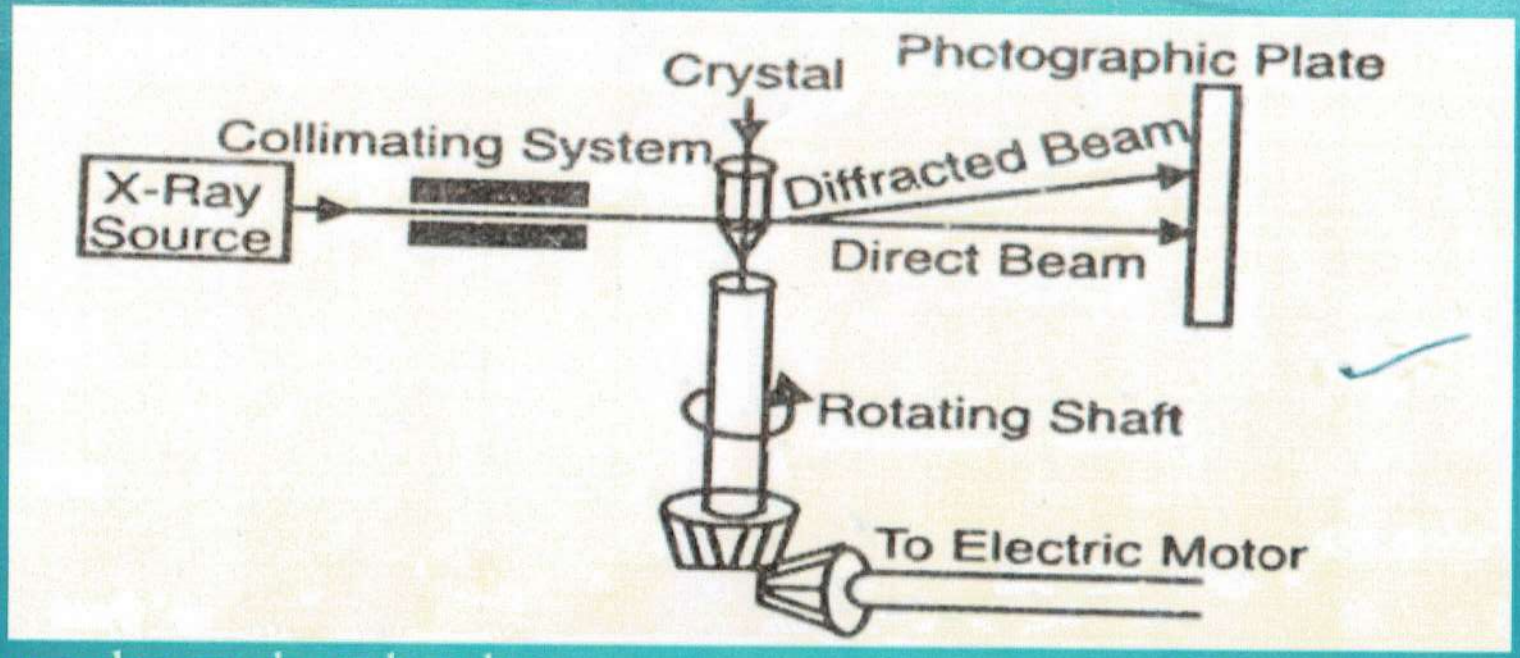
DETERMINATION OF CRYSTAL STRUCTURE BY BRAGG,S LAW

- X-Rays falls on crystal surface
- The crystal is rotated and x-rays are made to reflect from various lattice planes
- The intense reflections are measured by bragg's spectrometer and the glancing angles for each reflection is recorded
- Then on applying bragg's equation ratio of lattice spacing for various groups of planes can be obtained.
- Ratio's will be different for different crystals
- Experimentally observed ratio's are compared with the calculated ratio's ,particular structure may be identified.

ROTATING CRYSTAL METHOD:

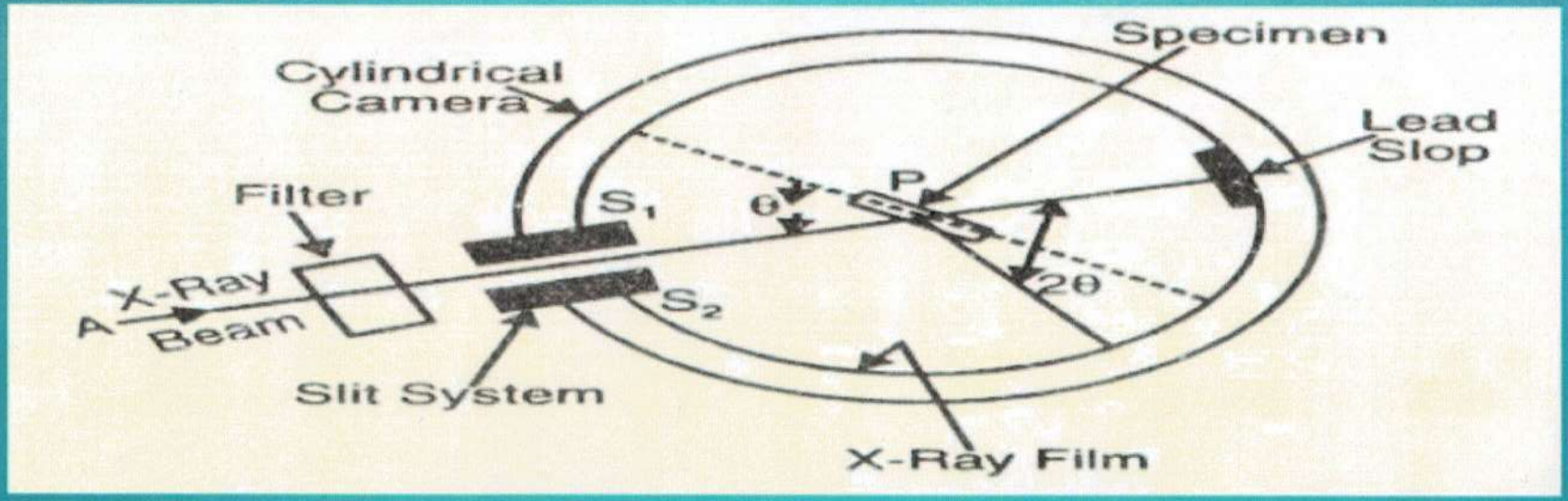


Photographs can be taken by :

- 1.Complete rotation method:in this method series of complete revolutions occur
- Each set of a plane in a crystal diffracts four times during rotation
- Four diffracted beams are distributed into a rectangular pattern in the central point of photograph
- 2.Oscillation method:the crystal is oscillated at an angle of 15° or 20°
- The photographic plate is also moved vack and forth with the crystal
- The position of the spot on the plate indicates the orientation of the crystal at which the spot wasformed

POWDER CRYSTAL METHOD:

X-ray powder diffraction (XRD) is a rapid analytical technique primarily used for phase identification of a crystalline material and can provide information on unit cell dimensions. The analyzed material is finely ground, homogenized, and average bulk composition is determined.



Fine powder is struck on a hair with a gum ,it is suspended vertically in the axis of a cylindrical camera

- When monochromatic beam is allowed to pass different possibilities may happen

1. There will be some particles out of random orientation of small crystals in the fine powder
2. Another fraction of grains will have another set of planes in the correct positions for the reflections to occur
3. Reflections are possible in different orders for each set

- If the angle of incidence is θ then the angle of reflection will be 2θ
- If the radius is r the circumference 2πr corresponds to a scattering angle of 360°

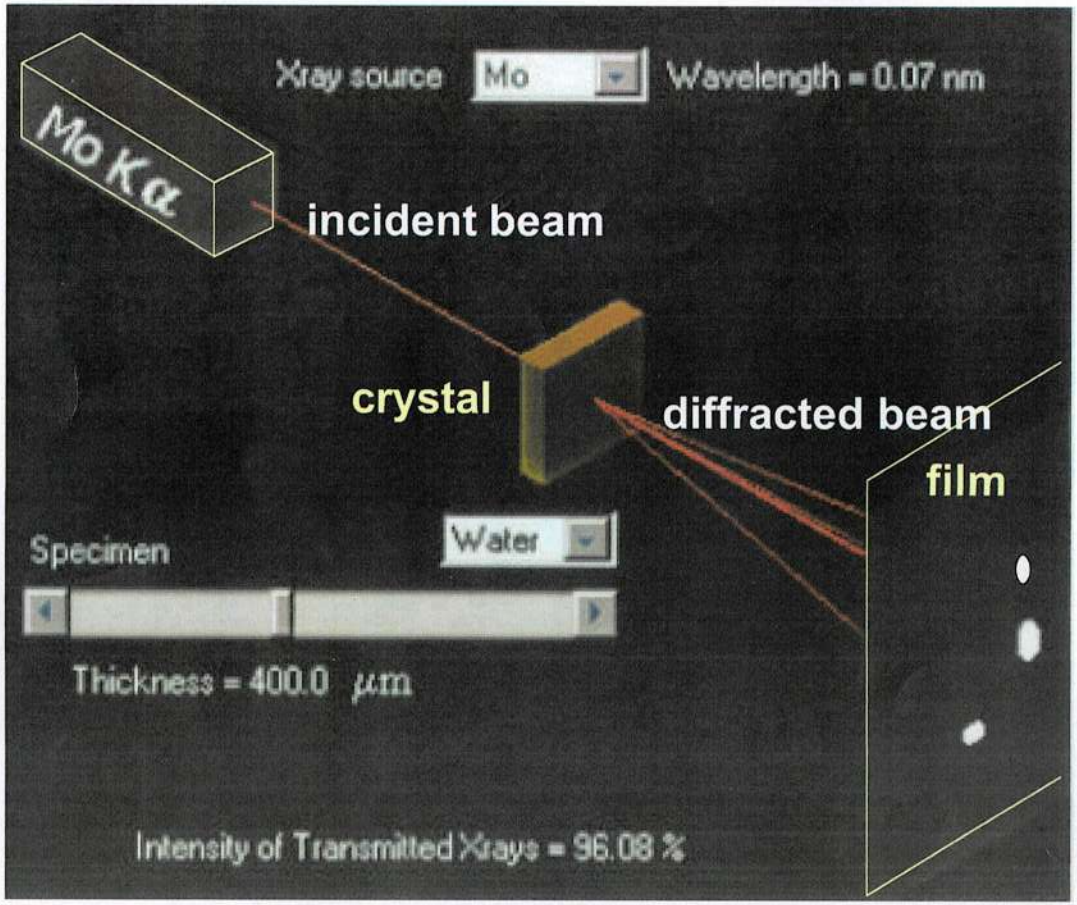
$$\Theta = 360 * 1/\pi r$$

- From the above equation the value of θ can be calculated and substituted in bragg's equation to get the value of d

- **Applications**
- Useful for determining the complex structures of metals and alloys
- characterization of crystalline materials
- identification of fine-grained minerals such as clays and mixed layer clays that are difficult to determine optically
- determination of unit cell dimensions
- measurement of sample purity

X-ray Diffraction (XRD)

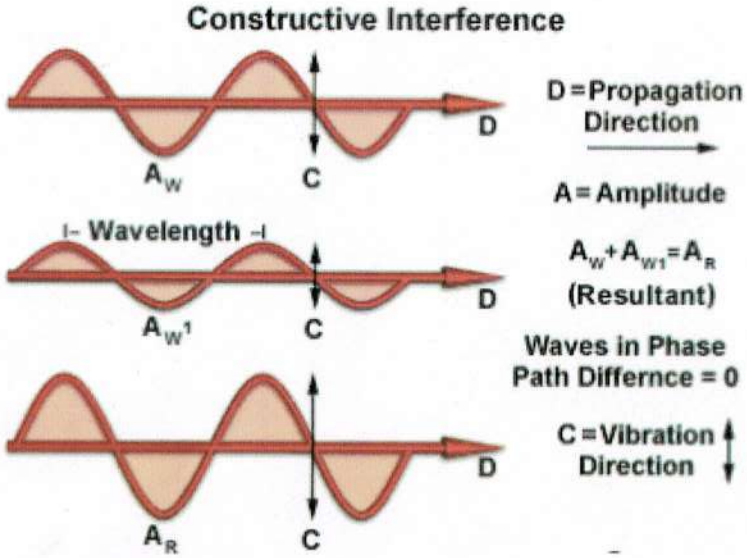
The atomic planes of a crystal cause an incident beam of X-rays to interfere with one another as they leave the crystal. The phenomenon is called X-ray diffraction.



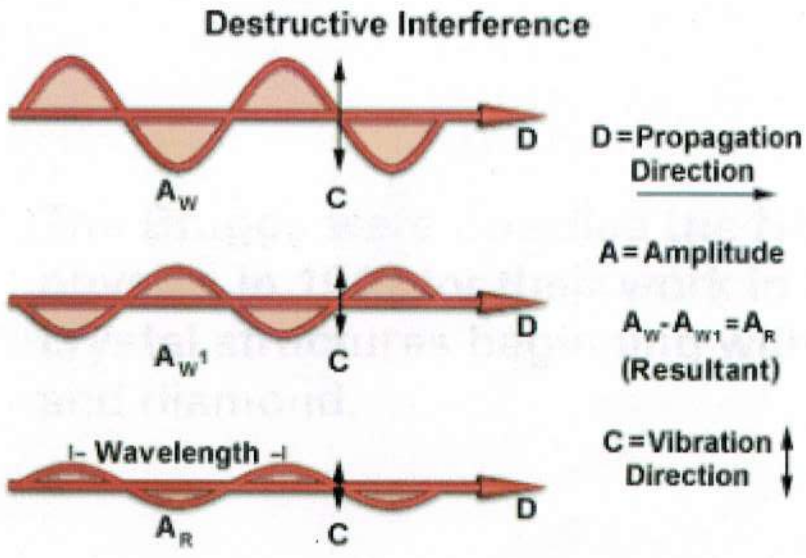
Effect of sample thickness on the absorption of X-rays

http://www.matter.org.uk/diffraction/x-ray/default.htm

Constructive and Destructive Interference of Waves



Constructive Interference
In Phase



Destructive Interference
Out of Phase