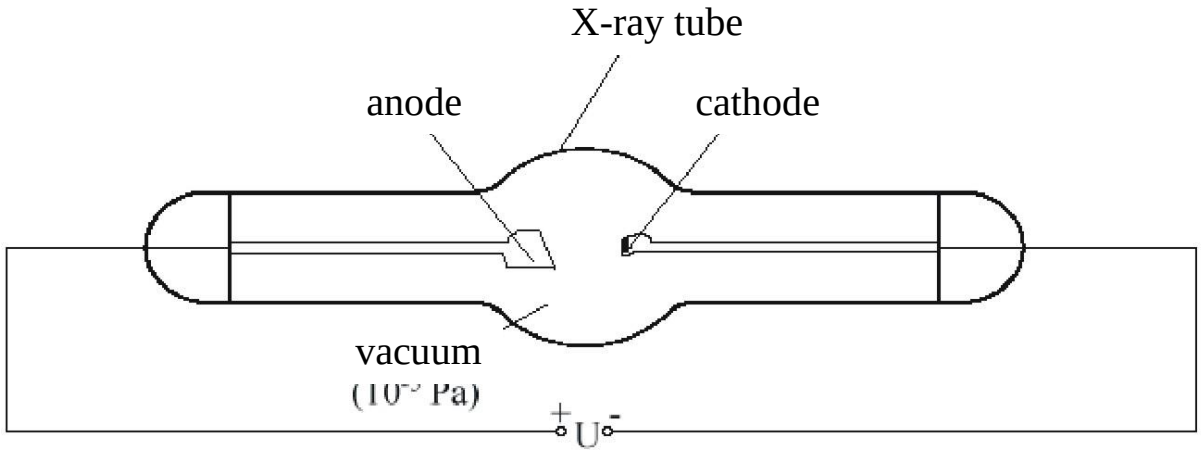
X-ray diffraction

Levels of investigation of structures

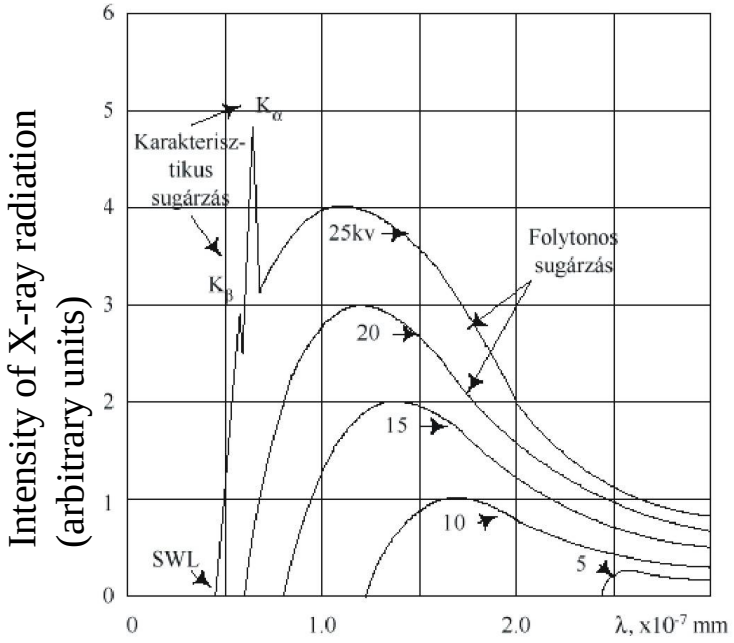
- Atomic level *(X-ray diffraction XRD, transmission electron microscope TEM, atomic force microscope AFM)*
- Microstructure *(scanning electron microscope SEM, X-ray spectroscopy)*
- Macrostructure *(classical metallography – „materialography”)*

Producing X-ray radiation

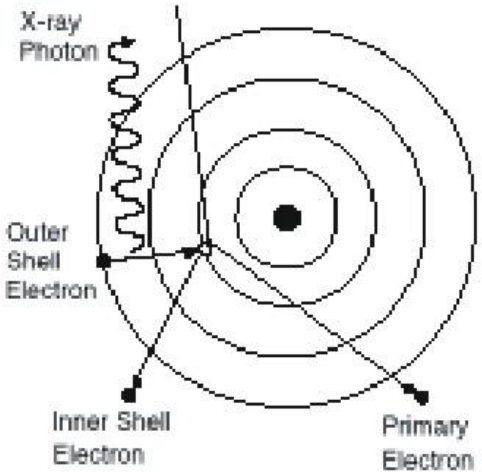


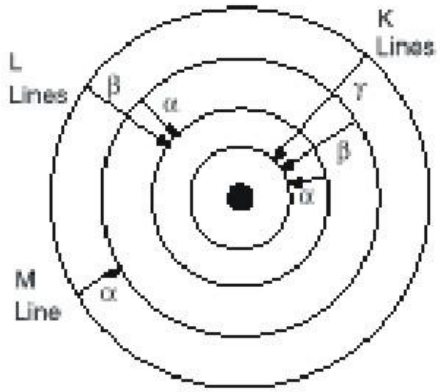
- Hot filament source
- 20-40 kV accelerating voltage

White and characteristic X-ray



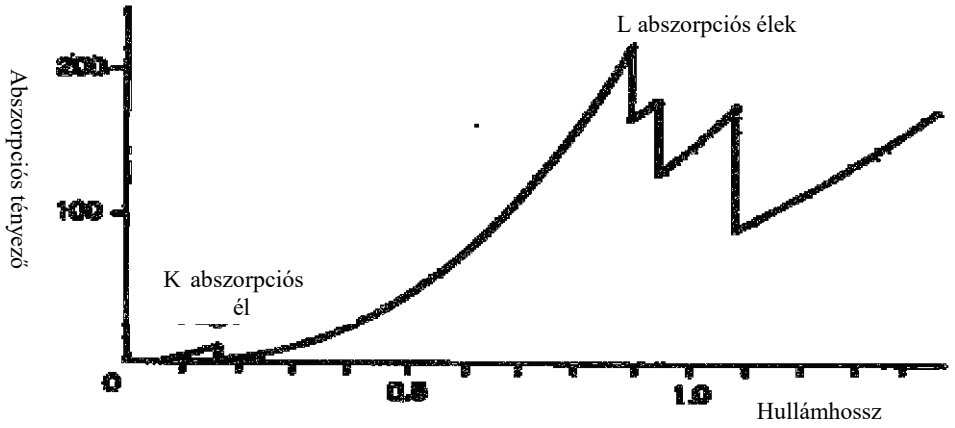
Characteristic X-ray radiation





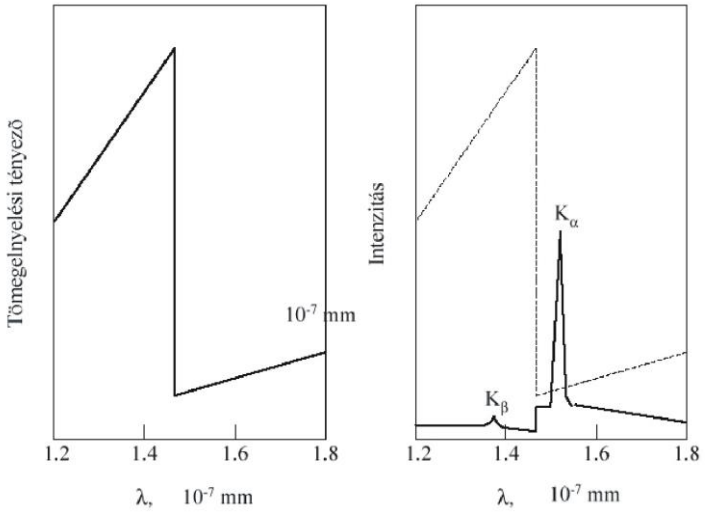
Absorption of X-rays

$$I(x) = I_0 e^{-\mu x}$$

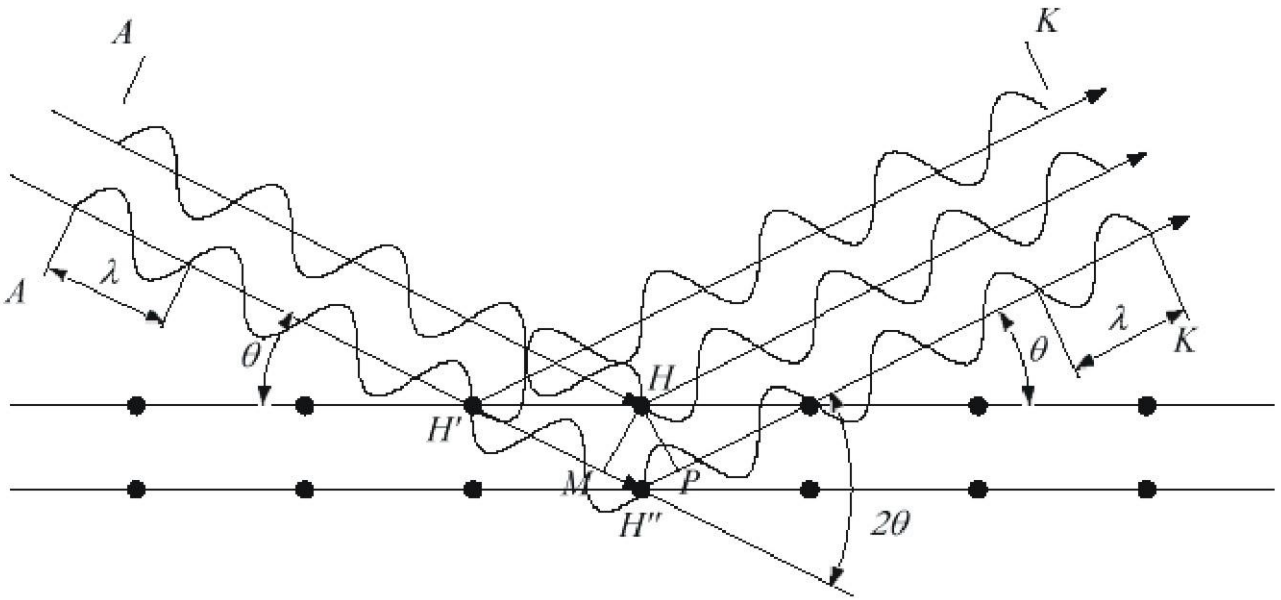


Absorption of X-rays

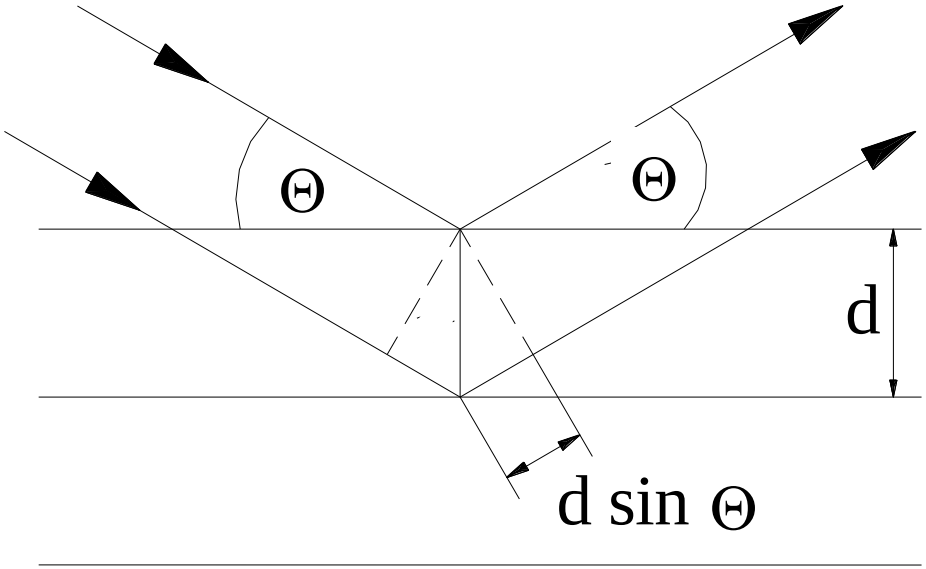
$$I(x) = I_0 e^{-\mu x}$$



X-ray diffraction

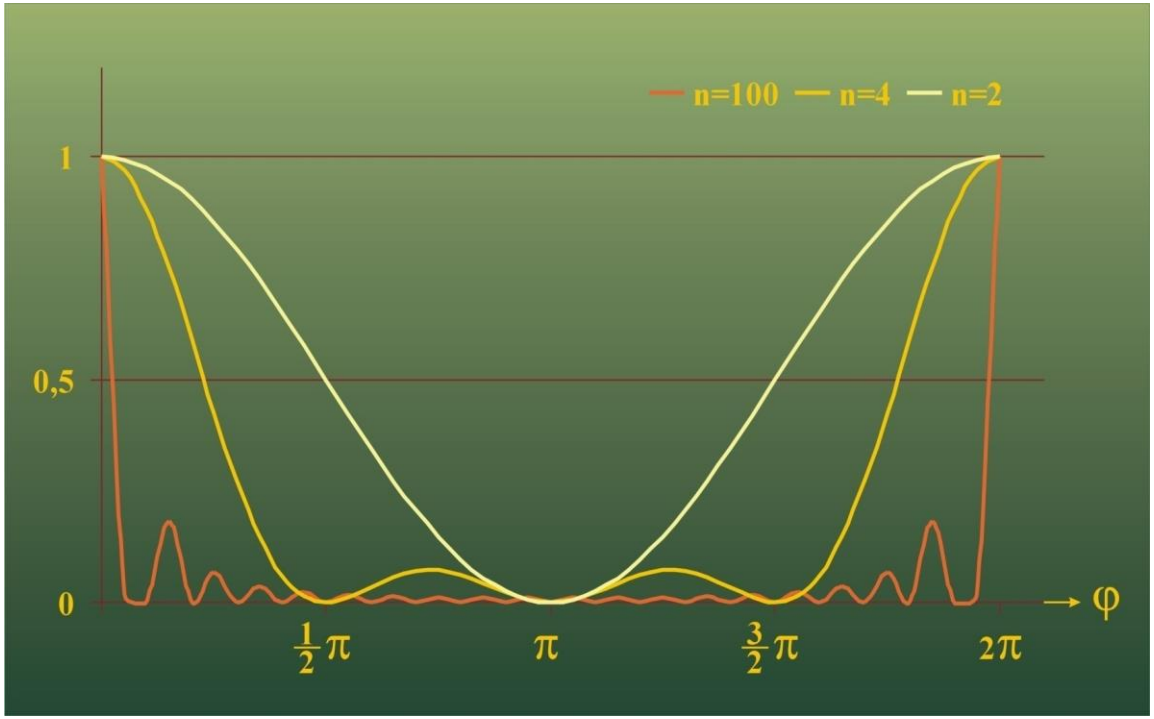


Bragg-equation

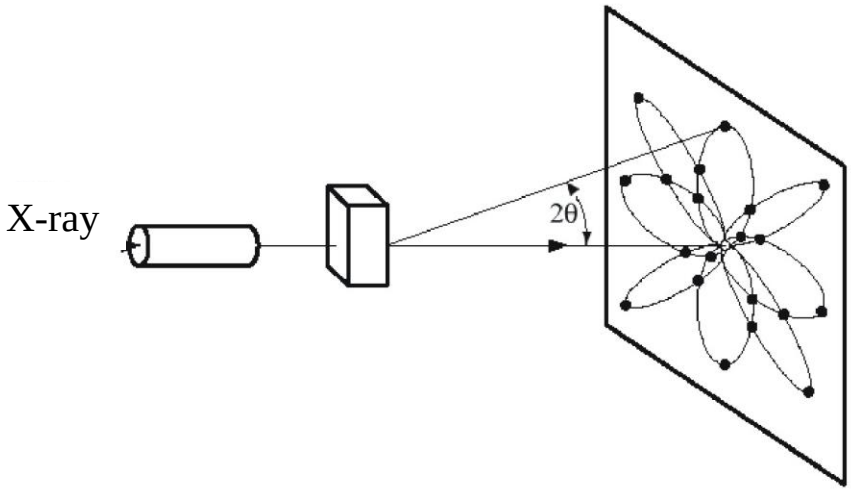


$$n\lambda = 2d \sin \Theta$$

More reflecting planes

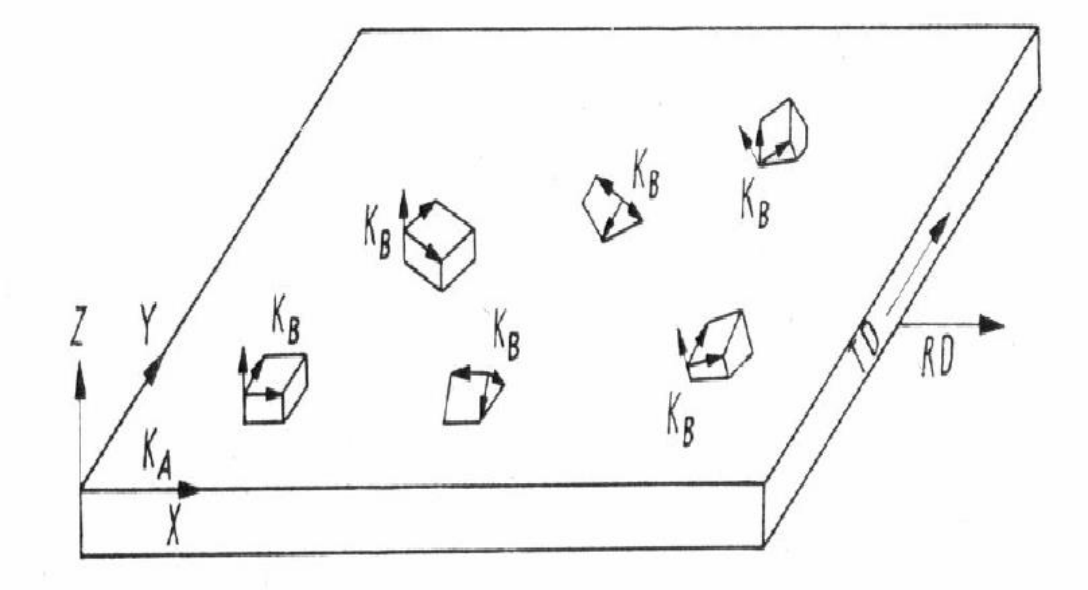


Laue-method

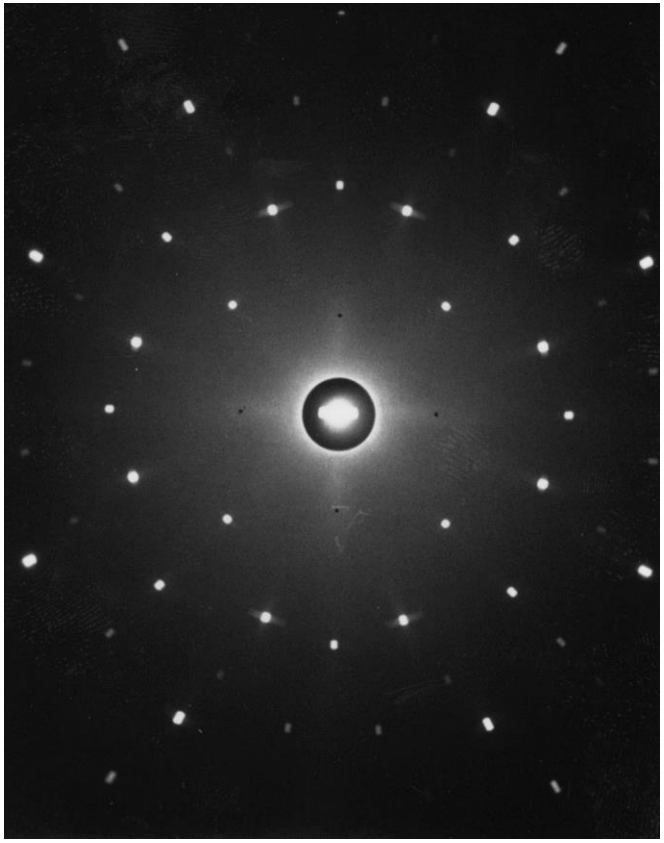


- white X-ray
- single crystal

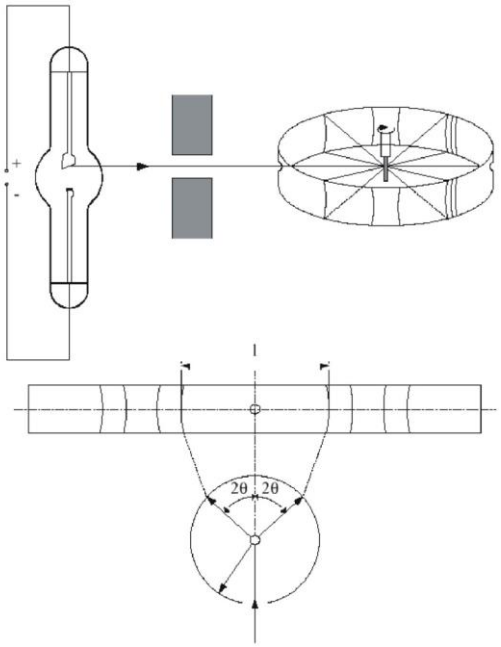
Orientation



Laue-image of a
Si single crystal

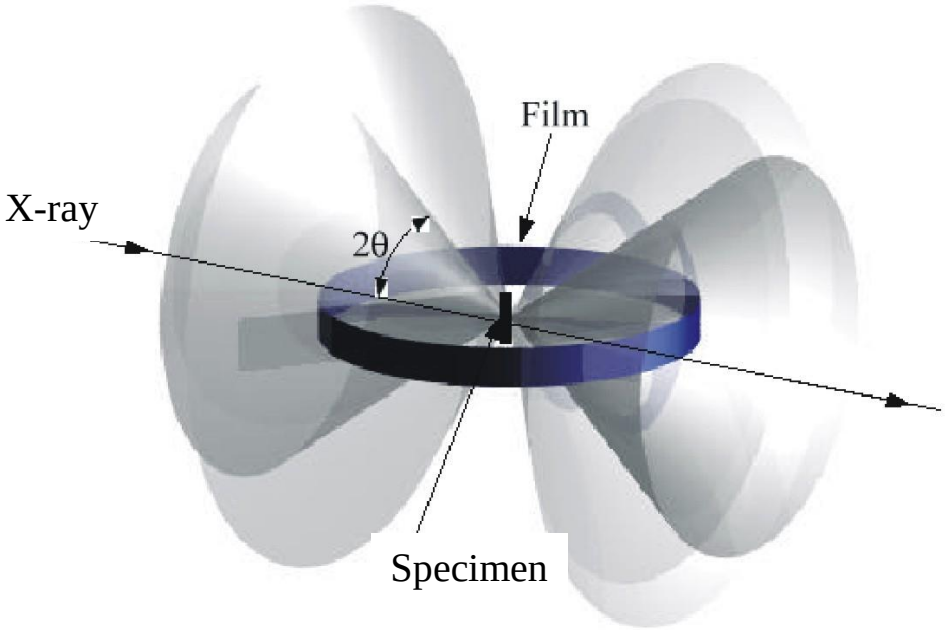


Debye-Scherrer method

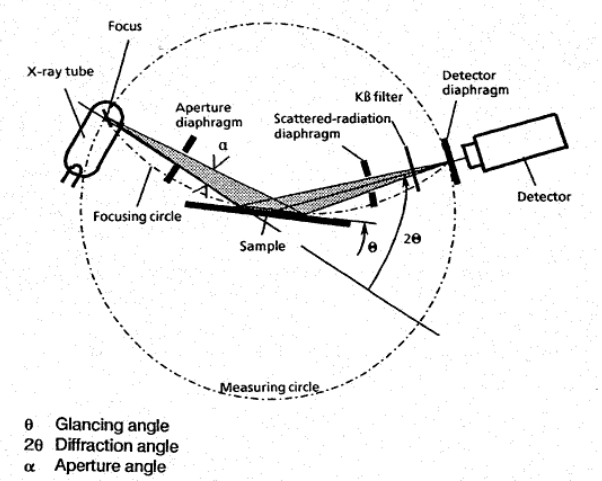


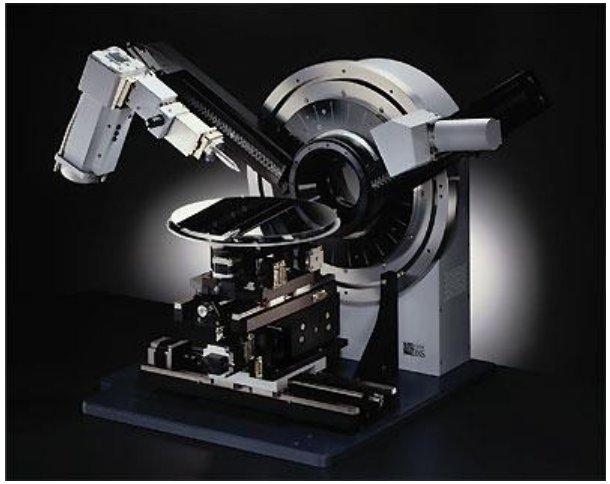
- monochromatic X-ray
- powdered sample
- phase analysis
- lattice parameter determination

Diffraction cones

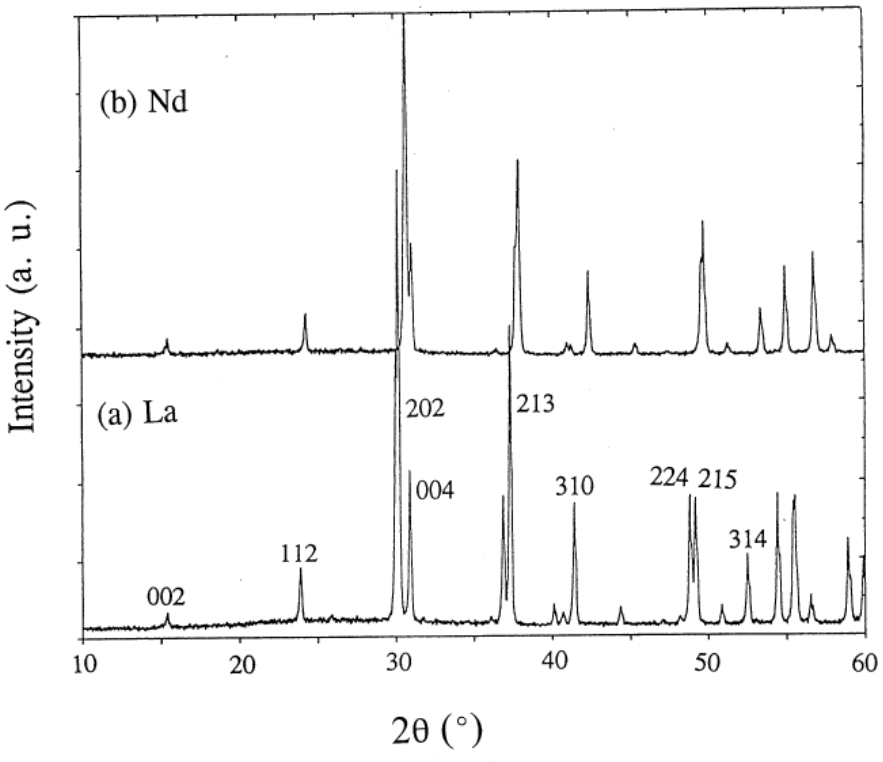


Diffractometer

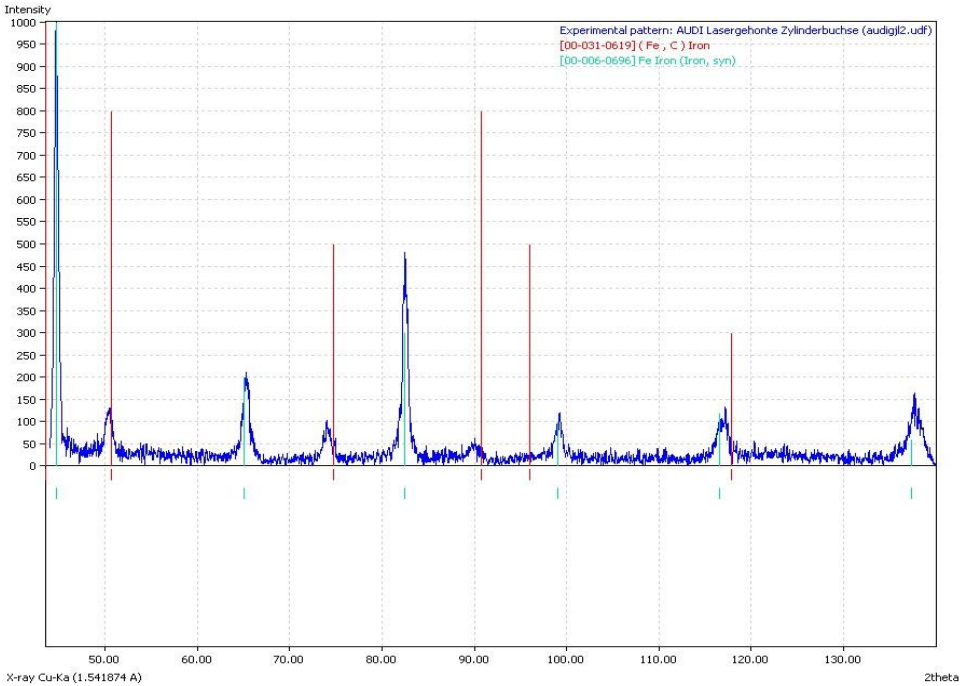




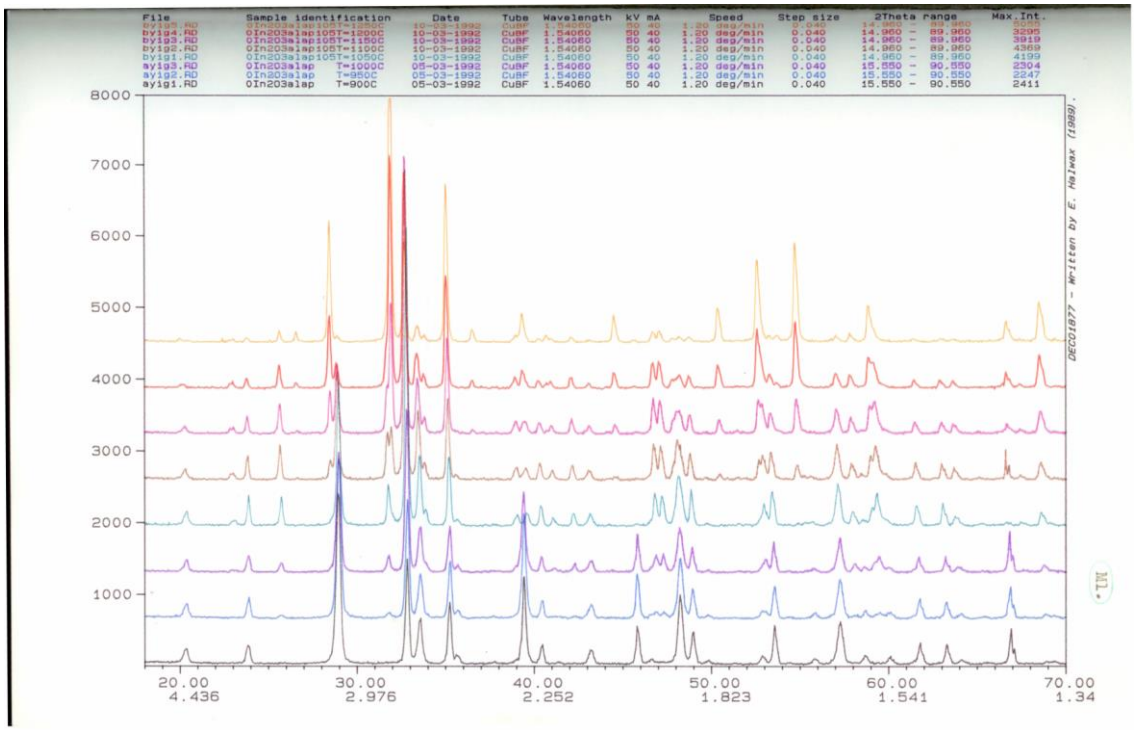
Diffractogram



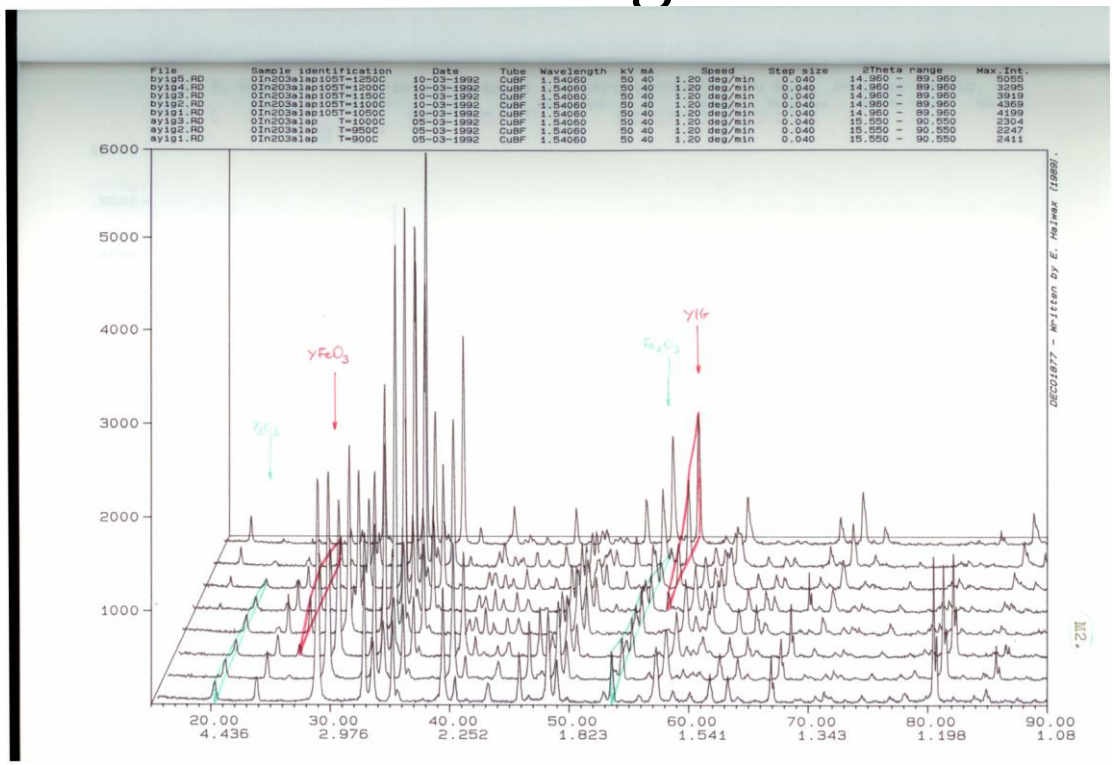
Diffractogram



Diffractogram



Diffractogram



Diffractogram