

Measurement of: Rocking curve and topography of single crystals

Equipment : 12kW rotating anode double crystal X-ray diffractometer (DCD)

Property Measured: Evaluation of degree of crystalline perfection of single crystals

Photograph (small size)

Basisc Principle:

The principle of high-resolution X-ray diffraction (HRXRD) is based on the plane wave dynamical theory of X-ray diffraction [Batterman, B. W.; Cole, H., Rev. Mod. Phys.36 (1964) 681 – 717] which takes into account interactions between waves scattered from all irradiated units. In the crystal, the constituent atoms/ ions/ molecules are



arranged in a periodic fashion and thereby the wave fronts so formed by all the atoms diffract in the same way as the visible light. There are only few directions govern by the Bragg equation $2d\sin\theta_B = n\lambda$ when d being the inter planar distance or lattice spacing, θ_B Bragg angle and n order of diffraction, in which these wavelets reinforce or interfere constructively each other to produce plane waves, the so-called diffracted waves. Using a parallel, monochromatic and plane polarized X-ray beam, if we record the diffracted intensity as a function of glancing or rocking angle θ around θ_B , we get diffraction curve also known as rocking curve (RC).

Capabilities:

The system mainly consist a 12 kW rotating anode X-ray generator and double crystal goniometer with microprocessor based control system to move the goniometer during recording the rocking curve and topography. This system could be used to study the structural characterization of single crystals and epitaxial thin films using high-resolution double crystal X-ray diffractometry technique. The following information could be obtained from this study:

- (i) The evaluation of degree of crystalline perfection of single crystals by knowing the value of full width at half maximum (FWHM) from the recorded rocking curves
- (ii) The existence of structural grain boundaries and tilt angle(s) between the adjacent grains if any and
- (iii) The determination of the perpendicular strain or lattice mismatch between epitaxial film and the substrate.

Sample Requirement: min.: 10mm x10mm and Max.: 100mm x 100 mm