

THE DETERMINATION OF CRYSTAL ORIENTATION USING  
THE LAUE BACK-REFLECTION TECHNIQUE

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Object

To determine the orientation of single crystals using the Laue Back-Reflection technique.

Theory

In the Laue technique, the Laue conditions for diffraction are relaxed by using "white" x-rays, i.e., a continuous spectrum. Each set of planes selects that wavelength for which the Bragg angle equals the angle of incidence of the x-rays. The Laue technique can be used in either transmission or back reflection geometries. The transmission method is seldom used since it requires relatively thin specimens of low absorption and, hence, special preparation techniques. The experimental arrangement, the optical geometry of the diffraction process and the nature of the resultant diffraction patterns for the Back-Reflection technique are shown in Chapter 8 of "Elements of X-ray Diffraction" by B.D. Cullity.

The diffracted beams from all the planes of a single zone lie on a cone of revolution tangent to the incident beam direction; the cone axis corresponds to the zone axis. The diffracted maxima lie on the surface of the cone and this cone intersects the film in the back reflection mode in a hyperbola. The film will thus consist of spots which lie on hyperbolae (note the spots through the film centerline fall on a straight line).

Experimental and Results

For your lab report **briefly** outline the LBR technique and determine the orientation of two grains or single crystals. Your report should include a stereographic projection of each grain's orientation that is **uniquely** indexed (round bracket notation).

Bragg's law is little help in the analysis of Laue patterns since the x-ray wavelength corresponding to a diffraction peak is unknown. Instead, we use the fact that the incident beam, diffracted beam and the normal to the diffracting planes are all coplanar, with the normal bisecting the former two. The interpretation of Laue patterns is explained in Chapter 8 of "Elements of X-ray Diffraction" by B.D. Cullity. The use of the Gouy chart for interpreting the pattern is outlined clearly (pp. 236-247); you may use either the spot plotting method or the method of plotting the zones directly (the latter is usually easier) to determine the orientation of two crystals.