

A NEW GEOMETRY FOR 21ST CENTURY DIFFRACTION

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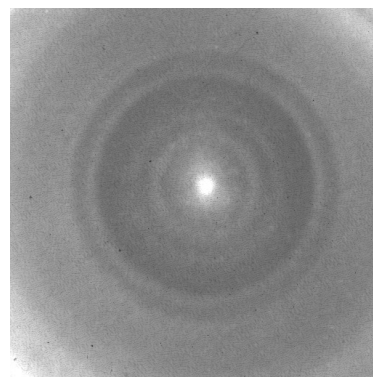
We present for the first time, a simple, novel geometry that enables the efficient measurement of diffraction data from polycrystalline materials through linear translation of a point detector.

Conventional angular dispersive diffraction techniques measure the opening angle of the Debye cones produced by the interaction of an interrogating X-ray beam and a sample. The layout and therefore physical size of standard instruments such as powder diffractometers are constrained by the inherently divergent ray geometry of diffracted signals. Our new approach is such that photons from all points around Debye rings are harvested and are forced to converge to a set of points on an axis, (hence *focal construct geometry*, FCG). Thus focal construct geometry employs a novel tubular interrogating or primary X-ray beam to affect a convergent and therefore inherently compact, diffracted ray geometry.

To illustrate the basic focal construct concept consider a simple diffraction experiment where a pencil X-ray beam strikes an ideal powder sample and produces (for simplicity in transmission) a 'single' Debye cone. If multiple X-ray beams are incident normally upon the sample such that the loci of their intersections with the sample lie equidistantly on a circle (radius, R_s) and the sample to detector distance, $D_z = R_s \cot 2\theta$ (θ is the Bragg angle), then the resultant Debye cones will possess a single convergence point along a principal axis. Focal construct geometry exploits these points of convergence, and a diffractogram is formed by measuring the intensity along the principal axis i.e. through translation of the detector.

We have undertaken initial testing and evaluation of this concept with simple collimators and a range of materials. Data from preliminary experiments in transmission mode will be presented and the diffractograms compared to their equivalent measured with a pencil beam.

This novel approach to the collection of diffraction data has far reaching implications for the measurement process, the quality of the resultant data and ultimately instrument design.



Sample-detector distance to 'focus' 113 from Al_2O_3 .

A clear intensity maximum is observed at the image centre and concentric circular terminal intensity rings are apparent (*these are not Debye rings nor do they occupy the position of Debye rings, further a 'single' Debye ring would not be detected using this set up due to its relatively low intensity*).