RESIDUAL STRESS MEASUREMENTS USING PARALLEL BEAM OPTICS

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Residual strain/stress determination involves precise measurement of diffracted peak position. In order to perform these measurements credibly, the goniometer must be well aligned, and sample placement at the center of rotation must be reproducible. Despite this care, certain common experiments are still difficult with divergent x-ray beams because of the inherent optics. For example, depending on the ratio of the beam width to sample diameter, diffraction from "highly" curved samples can contribute a shift in observed 2θ peak position. In a second example, residual stress measurements at high temperatures encounter sample surface displacement due to the thermal expansion/contraction of the sample mount, contributing a shift in observed 2θ peak position. Although methods exist to correct for these 2θ shifts, utilization of parallel beam optics (PBO) easily and effectively remove these peak shifts, which is particularly useful in residual strain/stress measurement.

The focus of this talk will be the utilization of PBO to experimentally remove/minimize these diffraction peak shifts, which are basically due to sample surface displacement intrinsic to these experiments. Data were collected from cylindrical samples (diameter ~ 6 mm) at ambient temperature and alumina scale samples at elevated temperatures to compare powder diffractometers equipped with standard slits and parallel beam attachments. Experimental considerations will be discussed. Residual stresses or strains were determined.

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