Strain Analysis using High Energy X-ray White Beam Diffraction

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One of the principal advantages of energy-dispersive diffraction for the determination of macroscopic average lattice parameters (and hence strain) is the possibility of refinement of the large section of the diffraction pattern, leading to improved accuracy and stability of interpretation. Precise channel to energy conversion is very important in full-pattern refinement in energy-dispersive X-ray diffraction. The channel to energy conversion of most detectors is not entirely linear. This presents an obstacle to obtaining accurate quantitative data for lattice strains by pattern refinement. We present a procedure for precise energy calibration determination, and show how the new energy conversion function was used successfully to perform whole pattern fitting of energy-dispersive X-ray diffraction patterns of Ti64 samples. The strain across the Ti64 bar calculated from the fitting results was compared with the profile obtained by single wavelength X-ray diffraction utilising Laue monochromator, and showed excellent agreement.

Keywords: energy-dispersive diffraction, synchrotron radiation, titanium alloy