Strain and stress determination by the Rietveld refinement

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The determination of residual strain/stress and texture is commonly carried out by analysis of a few diffraction lines. We will review alternative approaches that rely on the information obtained from all available diffraction lines and multiple patterns taken at the different diffraction vector orientations. One way to estimate the complete strain and stress tensors is to refine strain-related parameters (both isotropic and anisotropic) in Rietveld refinement. Anisotropic component has to include \textit{hkl}-dependent correction for different crystallographic directions, which is normally limited to higher crystallographic symmetries. One of the newer approaches is expanding strain and stress tensor components in series of spherical harmonics, which allows for accurate determination of strain and stress for arbitrary crystal and sample symmetries. The method yields the texture-weighted strain orientation distribution function (WSODF) and average strain and stress tensors that are usually of engineering interest.

Both approaches require multiple diffraction lines and patterns, which makes energy-dispersive measurements and multiple detectors very useful. We will present results obtained by the energy-dispersive synchrotron and time-of-flight (TOF) neutron measurements.