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Multiple scattering in neutron Laue diffraction

Apart from the specialised but important application to phase determination, multiple scattering in single-crystal neutron diffraction is usually an undesirable source of error. The presence of multiple scattering for a particular Bragg reflection can be verified by performing an azimuthal scan, if the diffractometer offers that possibility, or by varying the wavelength. Either of these checks is generally straightforward on a monochromatic diffractometer, where attention can be easily focused on a single reflection. Correction for multiple scattering ranges from rejection of the reflections affected in longer-wavelength experiments to subtraction of an empirically determined constant contribution from all data in shorter-wavelength experiments.

Little consideration has thus far been given to the contribution of multiple scattering to neutron Laue diffraction, due primarily to multiple scattering being less likely to occur in the samples best adapted to the technique. In addition,scanning a single reflection to detect the presence of multiple scattering is not the forte of Laue diffraction where many reflections are excited and detected simultaneously, and the broad waveband further complicates the possibility to correct for multiple scattering.

Here we show that the multiple scattering can occur in a neutron Laue experiment by using two single crystals (in a diamond-anvil high-pressure cell) to highlight the effect in the Laue pattern. The (few) observations in this unconventional experiment allow estimation of the magnitude of the effect in standard neutron Laue experiments both at reactor and spallation sources.

Topic

Neutron Instruments & Techniques

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