
Powder diffraction at the Australian Centre for Neutron Scattering: Recent results and capabilities

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Powder diffraction is a core neutron scattering tool with a long history in Australia. The Australian Centre for Neutron Scattering at the OPAL reactor facility hosts two world-class constant-wavelength neutron powder diffractometers, which share the largest beam guide in any research reactor. ECHIDNA (high resolution) is optimised for complex atomic and magnetic structure determination. Data collection proceeds in a traditional step-scan type acquisition using 128 linear position sensitive detectors with a typical scan time of 1-6 h. WOMBAT (high intensity) is one of the fastest neutron powder instruments in the world, featuring a 120 ° area detector with position sensitive detection. WOMBAT routinely measures to 1 min and down to 20 ms time resolution, with 20 µs stroboscopic measurement.

Experiments often use both instruments, with detailed structure examined at discrete parameter space points on ECHIDNA and over a greater range on WOMBAT. Research examples showcasing the instruments' capabilities will be presented. For WOMBAT, these will include the non-equilibrium real time electric field response of piezoelectric materials up to 10 kHz with multiple time bins (with the University of New South Wales) and the determination of lithium location within lithium-ion battery electrodes during battery charge-discharge cycling (with researchers at the University of Wollongong). Example equilibrium studies on ECHIDNA will include porous materials loaded with gas (with the Universities of Sydney and Melbourne, also on WOMBAT), amongst others.