A Novel Facility for Diamond Anvil Cell Diffraction at the SRS, Daresbury, UK

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A new focusing monochromator has been installed for diffraction experiments from samples at high pressures in diamond anvil cells. The X-ray source is a 5 Tesla superconducting wiggler magnet. The monochromator, a sagittally bent silicon crystal, produces a monochromatic beam at 27.94 keV deflected horizontally from the incident beam, and focuses 4mm of the available vertical radiation fan from the wiggler down to a line focus approximately 100 μ m high. The band width of the beam is 3×10^{-3} with a divergence in the vertical direction, caused by the focusing, of 1 milli-radian. This is well matched to experimental requirements and gives a flux gain of approximately 100, compared to the station with a simple Si 111 channel-cut monochromator previously used for these experiments.

The new station has been used to record image plate exposures from gypsum (CaSO₄.H₂O) at elevated P in a diamond anvil cell [0.7, 2.2 GPa]. Measurements taken with exposures of 120s show well defined powder patterns. Unit cell parameters and atomic positions for Ca, S and O have been refined from these data, following calibration of the sample to image plate distance with silicon powder.

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