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Neutron diffraction at high pressure, low temperature under light irradiation

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The exploration of multi-dimensional phase diagrams is a topical subject. However, the simultaneous variation of several control parameters such as temperature, pressure and light irradiation requires a suitably optimized sample environment, particularly when the aim of the experiment is to obtain structural information. We report on a new such sample environment, developed in the context of neutron diffraction measurements, in which the sample can be submitted to pressures up to 7 kbar, temperatures down to 1.7 K and light irradiation in the 660 to 852nm wavelength range, simultaneously. The Ti-Zr alloy pressure cell combines a high mechanical resistance over a wide temperature range with an acceptable neutron background level. The pressure medium is helium gas, ensuring the best possible hydrostatic conditions over a very broad temperature range. The low-temperature environment is obtained from an ILL-type 'orange cryostat'. After focusing into an optical fiber, laser light is transmitted to the sample through a sapphire optical window implemented in the pressure cell. The laser flux density at the sample position is of ~30mW/cm2. The geometry of the set-up is optimized to offer a wide optical access (+/- 50° vertical, +/-165° horizontal), particularly well suited for Laue neutron diffraction techniques. First results obtained on the pressure-photo-induced spin crossover of a model coordination complex will be presented.

Keywords: high pressure, light irradiation, neutron diffraction