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A preliminary experimental study on neutron holography technique at CMRR

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Neutron holography is an imaging technique permitting the three-dimensional reconstruction of the micro-structure of the original sample by using monochrome neutron beam. Neutron holography is able to penetrate deeply into matter with high resolution, and is applicable to the micro-structure investigation of a wide variety of hydrogen-containing compounds and neutron-absorbing isotopes doping crystals. In contrast to X-ray and electron holography techniques which are based on similar principles, the limited intensity of neutron source and the difficulties on beam modulating create obstacle in neutron holography experiments, thus the hardware and reconstruction methods need to be improved for wider applications. Neutron holography in China has not been studied yet limited by the experimental condition.

A systematic primary research of neutron holography according to China Mianyang Research Reactor (CMRR) condition has been carried out, including numerical simulation, reconstruction approaches, critical experiment parameters. Recently a holography experiment of a Pd-H single crystal was carried out by using high resolution neutron diffractometer at CMRR. The results reveal the position of atomic Pd nucleus in accordance with numerical simulations. Since the reconstructed image quality is worse than expected due to limited efficiency and recording time, ways to improve the holographic image are discussed.

These results will be helpful for future works on instrument construction and applications of neutron holography.

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