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Test bench for development of cooling mechanism of the first optical crystal towards SPring-8-II

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SPring-8 will be upgraded to SPring-8-II, a fourth-generation synchrotron source based on a multi-bend achromat by 2028. Electron beam energy will change from 8 GeV to 6 GeV, substantially decreasing beam emittance. The reduced emittance enables direct observation of the photon source in a beamline design, thus demanding enhanced thermal and mechanical stability in the optics. Currently, most X-ray undulator beamlines at SPring-8 employ standardized double-crystal monochromators with silicon crystals indirectly cooled using liquid nitrogen. Distortion of the crystal directly affects beam quality; hence, optimizing thermal contact between crystal and holder is essential. To accurately replicate beamline operating conditions, we developed a test bench incorporating a crystal holder identical to the actual beamline configuration. In this test bench, the surface deformation of a cryogenically cooled silicon mounted on the holder is precisely measured using a Fizeau interferometer while heating it with an infrared laser, whose penetration depth closely matches that of X-rays. This presentation describes the test bench design and representative results.

Footnotes

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