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Further tests on liquid-nitrogen-cooled, thin silicon-crystal monochromators on a focused wiggler synchrotron beam

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Many of the insertion device beamlines at the Advanced Photon Source (APS) will implement liquid-nitrogen-cooled, double-crystal monochromators. Two experimental studies have been made over the past year under APS-like conditions at the European Synchrotron Radiation Facility (ESRF) which indicate that symmetric, Bragg reflection, cryogenic monochromators can handle the central cone of radiation from APS undulator A up to at least 100 mA with less than 1 arcsec broadening of the rocking curve. Recently, a newly designed cryogenic, thin crystal was tested at ESRF beamline BL3 that had less mechanical strain than the previously tested crystal resulting in better resolution of the thermal component of the strain. Data were collected for the thin portion (0.7 mm) of the crystal as well as the thick part (>25 mm). The Si(333) rocking curve at 30 keV at low power for the thin section was <1 arcsec at room temperature and increased to 2.1 arcsec when cooled to 78 K, while the thick part broadened from about 0.85 to 1.0 arcsec. Rocking curves were measured as a function of incident power by inserting various Al attenuators in the beam. The beam cross section at the crystal was measured to be about 0.317 x 1.125 mm^2 (FWHM). The crystal was tested up to an incident power of 185.7 W and an average power density of 520 W/mm^2. The rocking curve of the thick section broadened to 1.7 arcsec and that of the thin section broadened to 2.5 arcsec at the highest incident powers.

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