

Applications of synthetic Ila diamonds at Spring-8

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Since 1994, SPring-8 has been developing diamond crystal optics in collaboration with Sumitomo Electric Industries Co. Ltd.

One of the earlier applications is “X-Ray Tri-chromator” for MAD protein crystallography consisting of three pairs of double crystal monochromator which can deliver three different wavelengths in a single beam path. The tri-chromator was installed on an x-ray undulator beamline with two tandem in-vacuum, vertically polarized undulators.

Another remarkable application is x-ray phase retarders that convert linear horizontal polarization from standard undulators to circular or linear vertical polarization. In the beginning, we used piezo-actuator to control the polarization states with the frequency of 30-40Hz. Combination of the phase retarder optics with phase sensitive detection system, we have extended the “Helicity Modulation Spectroscopy” technique to hard x-ray region. The technique has been widely applied to the X-ray Magnetic Circular Dichroism (XMCD) measurements at K-absorption edges. Recently, we have changed the actuator to a Galvano Motor that can make 1 kHz helicity modulation.

As for the high heat load optics, no serious attempts have been made in SPring-8. However, recently available high quality crystals will surely permit us to replace the existing silicon monochromators. We are planning to design a new DCM mechanism for the use of diamond, especially for high energy resolution beamlines where most photons from silicon crystals having wider bandpass are rejected by high-resolution optics.