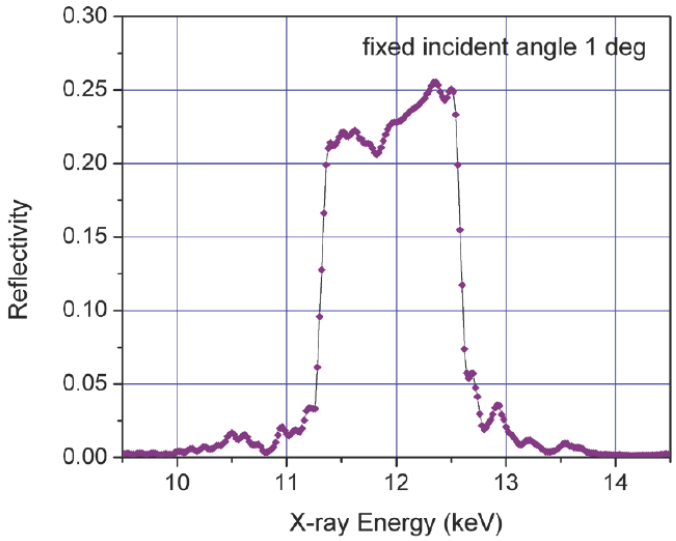
New synthetic mirrors provide high x-ray beams for custom applications

X-ray synchrotron sources are important tools used by many thousands of researchers in the physical and biomedical sciences and engineering. X-ray measurements are both enabled and limited by available x-ray optics. Perfect crystals (silicon, diamond) are popular but their pristine crystalline lattices also limit energy bandwidths and significantly reduces x-ray throughput.

Scientists at the Cornell High Energy Synchrotron Source (CHESS) collaborated with industrial partners at Osmic Inc. to develop fabrication technology for synthetic multilayer x-ray optics with custom and varied energy bandwidths. Osmic kept their furnaces warm (to avoid drift) while sending optics via overnight mail to CHESS, where they were characterized and refined. The result include optics with especially narrow energy bandwidths of 0.22%, that will allow traditionally weak bending magnet x-ray beamlines to produce intensities comparable to high-powered insertion devices. In addition, extraordinarily large energy bandwidth optics, 5% and 10%, should help develop new data collection techniques needed for protein crystallography on the smallest known specimens.



The energy acceptance (reflectivity) of custom synthetic multilayer x-ray mirrors designed to provide high x-ray intensity for fast studies of protein crystals.

This work is notable because fabrication and testing of x-ray optics were done simultaneously – coupling the high-resolution characterization capabilities of a synchrotron x-ray source with industrial fabrication of novel products. Narrow bandpass synthetic multilayer optics could significantly increase the productivity of some underutilized beamlines at synchrotron x-ray facilities.

See also:

CHESS Newsletter 2005 articles on multilayer fabrication and protein crystallography measurements