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Wide-bandpass “multilayer” monochromator for small angle scattering/diffraction studies on biological systems

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We have utilized a “multilayer” monochromator (a pair of layered synthetic microstructures) in small-angle x-ray scattering/diffraction studies of biological materials. Many biological applications of SAXS/D technique, in particular time-resolved studies, are often limited by the flux available to experiments. The wider energy bandpass of the multilayer monochromator provides a higher beam flux by a factor of 10 or more, compared with that of the Si(111) double-crystal monochromator. At the SSRL BL 4-2 SAXS/D facility, two types of multilayers have been used: Mo/C on Si substrate, fabricated at Lawrence Berkeley Laboratory [1] and Mo/B₄C on Si substrate, obtained from Osmic, Inc. The energy bandpass of the former multilayer is about 150 eV at 10 keV, and that of the latter is expected to be slightly wider. A pair of the latter multilayers gives 8×10^{11} photons/s in a beam size 1×2 mm² (FWHM) at a photon beam energy of 9 keV and SPEAR ring current of 85 mA. We will present excellent quality diffraction/scattering patterns from muscle fibers and protein solutions which show no significant smearing artifacts due to the wider energy bandpass.

[1] S. Brennan et al., Nucl. Instrum. & Methods in Phys. Res. A 347, 417-21 (1994).