

Mechanical Design of an Ultra-High-Vacuum Compatible Compact Hard X-ray Monochromator with Artificial Channel-Cut Crystal Mechanism*

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Abstract

A compact ultra-high-vacuum (UHV)-compatible x-ray monochromator has been designed and constructed at the Advanced Photon Source (APS) 8-ID beamline for coherent small angle x-ray scattering applications [1]. The monochromator is designed for a small gap between the two crystals (~3 mm) that helps in maintaining a nearly constant spatial offset while changing energy with a single sine-bar mechanism. The sine-bar mechanism is driven by an UHV-compatible linear motion stage with HR-U piezoelectric servomotors from Nanomotion Incorporation. The piezo-electric motors operate under closed loop with encoder feedback to a resolution of 10 nm. An UHV-compatible artificial channel-cut crystal mechanism [2] was integrated in the monochromator to allow for the two independent crystals to be super polished to state-of-the-art for preserving the beam brilliance, whereas the same is not feasible with a channel cut crystal. Mechanical designs for the UHV-compatible artificial channel-cut crystal mechanism and the sine-bar mechanism with piezoelectric servomotor drivers are presented in this paper.

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References:

- [1] S. Narayanan, D. Shu, and A. Sandy, "Design of an Ultra High Vacuum Artificial Channel Cut Monochromator for Coherent X-ray Scattering Applications", to be published in the proceedings of SRI 2006.
- [2] D. Shu, T.S. Toellner, E.E. Alp, Nucl. Instrum. Methods A 467-468, 771 (2001).