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Characterization of thermal distortion effects on beam line optics for EUV interferometry and soft x-ray microscopy

R. Beguiristain, J. Underwood, M. Koike, K. Jackson, P. Batson, H. Medecki, S. Rekewa, and D. Attwood

Center for X-ray Optics, Lawrence Berkeley Laboratory, 1 Cyclotron Rd., MS 2-400, Berkeley, CA 94720

A long undulator installed at a low emittance storage ring, generates quasi-monochromatic beams of high brightness and improved coherence properties; however, this also raises concerns regarding high heat loads on both beamline and experimental end station components. There have been intensive research efforts to develop beamline optics to exploit brightness and coherence properties of the undulator radiation. These optics are also able to withstand the high heat loads produced by intense beams impinging on beam-line mirrors and gratings that may deform their surfaces considerably and thus, degrade the overall performance of the beamline. The effects of undulator radiation loading on newly designed indirectly cooled mirrors and gratings, developed at the Center for X-ray Optics (CXRO) at the Lawrence Berkeley National Laboratory (LBNL), for beamlines devoted to EUV interferometry and soft x-ray microscopy at the Advanced Light Source (ALS) will be presented in this study. An accurate description of the surfaces of the distorted mirrors and gratings will ensure that the quality of the beam is preserved through the beamline [1]. Also, the effects of high intensity focusing beams of synchrotron radiation can introduce distortions on EUV interferometry and soft x-ray microscopy end station components such as Fresnel zone plates, transmission gratings, masks and membranes. Heat loading efforts on these optical elements will be described and some experimental data presented in this study.

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[1] R. Beguiristain, M. Koike, and T. Namioka, “The Effects of Head Load on the Performance of a Grating Monochromator on an Undulator Beamline Simulation,” Proc. SPIE 2011, 559-564 (1993).