

## **X-ray Topography for Evaluation of X-ray Mirrors That Function by Means of Total-external-reflection**

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In this presentation, X-ray topography techniques normally used for measuring crystal quality and for qualifying X-ray monochromators is employed to study and compare mirror surfaces fabricated by various polishing and figuring techniques. The topography unit at the Advanced Photon Source has been successfully used to characterize optic crystals for many years. This work extends that effort to x-ray mirrors. X-ray mirrors are used in total-external-reflection to reflect, filter, or focus X-ray beams. Surface morphology (that is, the optical quality) is almost universally determined by metrology with visible light. In such measurements, surface height deviations from the ideal or specified profile is represented by the power spectral density or, more simply, in terms of surface finish and figure representing the fine and coarse surface features, respectively. This information reflects the quality of the visible surface but not the state of strain in the subsurface. Because many of today's X-ray mirrors are made of single crystal silicon, it is possible to employ X-ray topography to gain an understanding of the state of strain of the subsurface. The strain in the subsurface depends on the polishing and figuring process. The present approach complements the information provided by optical metrology for a more comprehensive understanding of optical surfaces and may prove invaluable for characterizing coherent-preserving optics where scattering and subsurface penetration of X-rays might impact reflected beam quality or for understanding mirror deformations that occur as a result of polishing.

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