Updates on optical metrology and fabrication for synchrotron mirrors at NSLS-II

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Amphithéâtre SOLEIL

SEMINAIRE

In most synchrotron applications, X-ray mirrors slope specification is key important parameter for applications using partially coherent X-ray beam. The slope error is typically specified at the sub 100 nrad RMS (from the period ranging few or single mm to the length of the mirror) for mirrors up to 1000 mm long by 50 mm wide. For applications using diffraction-limited X-ray beams (free electron lasers, diffraction-limited storage rings), height specification is a more relevant parameter to focus the beam at the diffraction limit and preserve the incoming bam wavefront from the source. In this case, the typical mirror height error specification is around 1nm or even sub-nm RMS level.

These very stringent requirements, whether specified in slope or height, bring enormous challenges to the synchrotron mirror metrology community. This important task requires dedicated metrology instruments to accurately characterize these high-precision mirrors when typical surface shapes can be flat, circular cylinders, off-axis elliptical cylinders, or even twodimensional curved shapes. Several metrology instruments have been developed at NSLS-II Optics and Metrology Laboratory to tackle these challenges to characterize these high-precision synchrotron mirrors. With several years of research and development, our group has established a procedure for **optical metrology and mirror fabrication** based on ion beam figuring. In our workflow, a stitching interferometer prototype based on a Fizeau interferometer is used as an in-process inspection tool to give the necessary metrology data feedback to a homemade ion beam figuring instrument for high-precision synchrotron optics fabrication. When the mirror is under specification, it will be inspected by other metrology instruments to make cross-validation.

Various metrology instruments, e.g., the stitching shack-Hartmann instrument, the nanoaccuracy surface profiler, the micro-stitching white light interferometer, and atomic force microscopy, are used as final inspection tools to characterize the optics fabricated in-house and/or supplied by external vendors.

In this talk, I will give an overview of these main activities: *Ex situ* metrology, ion beam figuring.

Ce séminaire sera suivi d'une pause café

Formalités d'entrée : accès libre dans l'amphi du pavillon d'Accueil.
Si la manifestation a lieu dans le Grand Amphi SOLEIL du Bâtiment Central merci de vous munir d'une piece d'identité (à échanger à l'accueil contre un badge d'accès).

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