Probing multilayer stack reflectors by low coherence interferometry in extreme ultraviolet

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We use low coherence interferometry to investigate the depth structure of a complex multilayer stack reflector as phase shift mask (PSM). The probing instrument is an interferometer based on a Fresnel's bimirror [1] illuminated by relatively wide band synchrotron undulator light near 13.5 nm. The PSM sample depth structure generates interferograms contrast modulation, which is just the principle used in Optical Coherence Tomography (OCT) [2].
In this presentation we explain the experimental context, and then show the interferograms we obtained during a series of interferometry experiments on PSM components, at the XIL beamline of the Swiss Light Source synchrotron [3]. The PSM sample consists of two Mo-Si multilayer stacks encapsulating a thin layer of silica. Materials are deposited by ion beam sputtering on a silicon super-polished substrate. Simulations support our understanding of the interferogram modulation in relation with resonance structure of multilayer stacks. To get an intuitive understanding of the complex contrast modulation, the reflection on the PSM stack reflector can be considered as a reflection on effective planes.

First results in this spectral range may open the way to a new physical approach to extreme ultraviolet sample characterisation in the form of line-scan optical coherence tomography.

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