CFEL SCIENCE

SEMINAR

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CFEL – Building 99, seminar room V (1st floor)

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The Role of Dynamic Effects in EUV Scattering from Rough Multilayers

Today, the semiconductor industry drives the development of high reflective multilayer coatings for the use of EUV light in the next-generation optical lithography. Lenses in classic lithography systems operating at 192 nm wavelength are replaced by multilayer mirrors optimized for high reflectivity at 13.5 nm wavelength.

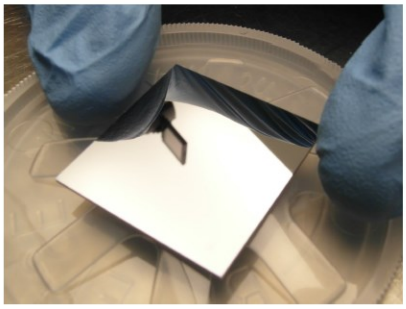

Fig. 1. Mo/Si multilayer mirror on silicon waver substrate.

We characterize high-quality Mo/Si multilayer mirrors with reflectivities well above 60% with respect to interface roughness using EUV light. These imperfections are an important loss mechanism for specular reflectivity and cause diffuse scattering. The resulting intensity distribution of diffusely scattered light provides information on vertical and lateral correlations of spacial frequencies of roughness through the appearance of resonant diffuse scattering (RDS) sheets. It thus serves as a natural tool for the investigation of roughness power spectral densities (PSD) of the interfaces. However, dynamical scattering contributions from thickness oscillations (Kiessig fringes) lead to Bragg lines which intersect the RDS sheets. This causes strong resonant enhancement in the scatter cross section. Hence, for power spectral density studies of multilayer interface roughness, resonant dynamical scattering can not be neglected. The scatter enhancement requires the application of a fully dynamic model in the distored-wave Born approximation to enable the extraction of the power spectral density of roughness.

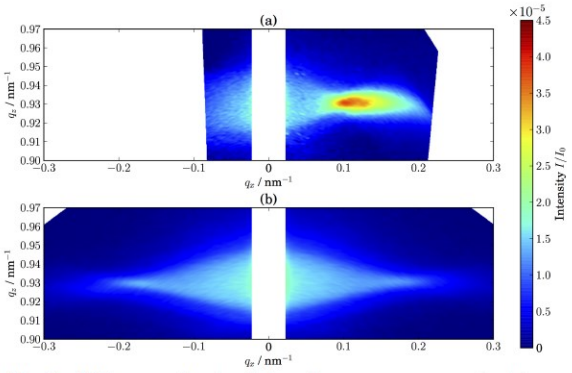

Fig. 2. Diffuse scattering intensity maps represented in reciprocal space recorded in different measurement geometries (a) and (b) for the same sample.

Hosts: Henry Chapman / Coherent Imaging Division + Saša Bajt / FS-ML