Interface-engineered EUV/Soft X-ray multilayer mirrors

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Abstract

EUV/Soft X-ray multilayer optics development at the Fraunhofer IOF Jena is covering the full spectral range from 1.0 nm to 100 nm. It was shown by many authors that optical performance and thermal stability of varied EUV/Soft X-ray multilayer mirrors can be considerably enhanced by transition from conventional two-layer to interface-engineered design. This paper covers some theoretical considerations in resources of interface-engineered design, material selection of diffusion barriers, and modern deposition techniques for controlled fabrication of following interface-engineered multilayers:

- Cr/Sc and Cr/V multilayers for the microscopy application in water window,
- La/B_4C (and Mo/Si) multilayers for lithography related applications,
- Y-based multilayers designed at wavelengths of 8...11 nm for solar and plasma physics and
- Si-based multilayers for monochromatization of high-order harmonic generation in the 20 ... 50 nm spectral range.

The paper summarizes recent progress and our present knowledge in preparation and characterization of high-reflective multilayer coatings for the EUV/Soft X-ray range on terms of minimum structure imperfections and maximum stability of optical performance.