Mitigation of polarization-dependent uncertainties in a compact EUV spectrometer

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The need for non-destructive, optical metrology for nanostructures and materials with growing demands on sensitivity to ever-smaller features pushes the development of metrology techniques like EUV and X-ray reflectometry and scatterometry. At RWTH Aachen University a setup was realized that uses EUV radiation from discharge-produced plasma (DPP) EUV sources [1] to allow high precision EUV metrology in a compact setup [2,3]. The radiation from the DPP EUV source is initially unpolarized, but the reflection off any surface in the setup including diffraction gratings, deflection mirrors and the sample itself introduces a partly polarization to the probing radiation which is only partly accounted for in the calibration of the setup and contributes to the measurement uncertainty on the measured reflectance.

In this presentation the influence of polarization on the measured reflectance and uncertainty is determined with respect to incidence angle and wavelength. Additionally, a calibration strategy is introduced which allows to separate the polarization effect of the metrology setup from the polarization introduced by the sample itself. This reduces the measurement uncertainties due to polarization and allows to reconstruct the sample dependent polarization as an additional sample parameter in addition to e.g., optical constants, layer thicknesses and, surface structures.

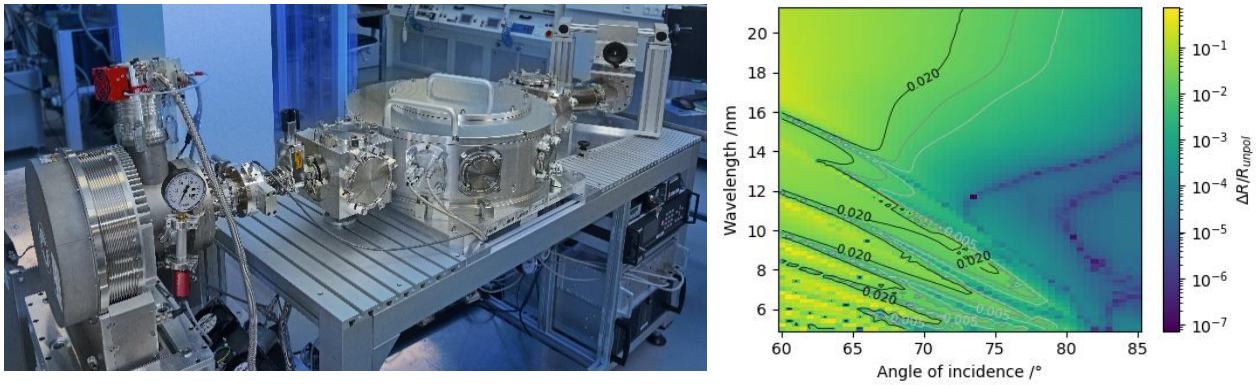

Figure 1 Photograph of the compact EUV spectrometer with a footprint of 1 x 2.5 m² (left). Estimated error on reflectance of a molybdenum sample if polarization effects are neglected (right).

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[2] M. Banyay and L. Juschkin, (2009), Appl. Phys. Lett. **94(6)**, 63507

[3] S. Schröder, L. Bahrenberg, N. K. Eryilmaz, S. Glabisch, S. Danylyuk, S. Brose, J. Stollenwerk and P. Loosen, (2020), Proc. SPIE **11517**, 115170S