Lab-based EUV spectroscopy: A guide from data acquisition to the reconstructed sample

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The continuous development in the semiconductor industry to ever-smaller nanostructures with an increased complexity raises the need to improve the metrology capabilities accordingly. Needs from the industry include the characterization of novel materials within the EUV spectral range as well as the characterization of deposition, etching, and lithographic processes. The Chair for Technology of Optical Systems at the RWTH Aachen University has realized a compact EUV spectrometer which utilizes a discharge-produced plasma (DPP) EUV source for a broadband and spectrally resolved reflectance measurements of samples under investigation [1,2]. The non-destructive reflectance measurements for variable grazing incidence angles are the basis for the model-based reconstruction of the geometrical and material properties of thin-films as well as periodically structured samples under investigation with high accuracy [3]. Since several optical components are placed within the optical beam path, a calibration measurement is required to compensate for the influence of these components.

In this presentation, the authors provide a detailed guide on the reconstruction of thin-film samples starting by the acquisition and processing of raw data and ending with the determination of uncertainties for reconstructed sample parameters including optical constants, surface properties and layer thicknesses. The involvement of supplementary data on the sample and the corresponding uncertainties are included within this reconstruction and provide the opportunity to combine the benefits of different measurement techniques.

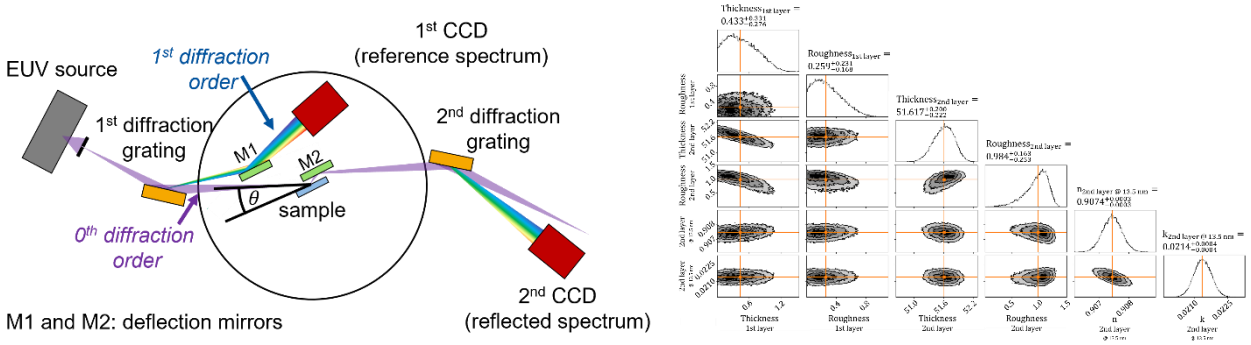

Figure 1: Schematic drawing of the compact EUV spectrometer (left). Typical reconstruction result as a corner plot to visualize parameter correlations and uncertainties (right).

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

[3] L. Bahrenberg, S. Danylyuk, S. Glabisch, M. Ghafoori, S. Schröder, S. Brose, J. Stollenwerk and P. Loosen, (2020), Opt. Express **28(14)**, 20389