In-lab EUV spectroscopy for the characterization of optical properties and nanoscale geometries

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The authors present studies on in-lab EUV spectroscopy performed on a variety of thin film materials and structured surfaces. Metrology with EUV radiation has gained more traction recently due to its introduction as the working wavelength in EUV lithography for high volume manufacturing.

EUV radiation with wavelengths between 10 nm and 15 nm shows excellent potential for both thin films and structured films metrology. This work therefore focuses on spectroscopic measurements of EUV reflectance and transmittance in this wavelength range. The realized in-lab EUV spectroscopy setup utilizes a compact discharge-produced plasma as its EUV source. Its working principle is based on the measurement of the EUV spectrum of the source before and after reflection off the sample under investigation.

\textbf{Fig. 1} Left: Schematic drawing of the EUV spectroscopy setup. Right: photograph of the spectroscopy setup located in a cleanroom at RWTH Aachen

The presented applications of the technique include the reconstruction of optical constants for novel materials such as EUV mask absorbers and photoresists, the monitoring of degradation and contamination mechanisms for materials relevant to lithography applications, the characterization of EUV pellicles and ultrathin layer systems as well as the model-based reconstruction of laterally periodic structures.

\textbf{Fig. 2:} Experimentally obtained reflectivity curves for SiO\textsubscript{2} at different grazing incidence angles $\theta$