# The new EUV Ellipsometer of PTB

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After having developed metrology with synchrotron radiation at the storage rings BESSY I and BESSY II for more than 25 years [1], PTB extended its capabilities for EUV metrology with the EUV beamline at the Metrology Light Source (MLS). The new beamline was designed to provide high radiant power in the spectral range from 5 nm to 50 nm, particularly in the spectral region around 13.5 nm (EUV) which is going to be used for semiconductor lithography. Consequently, the large EUV reflectometer has been moved from the soft X-ray beamline to this beamline.

With the development of larger numerical aperture optics for EUV and advanced illumination concepts for lithographic imaging, the polarization performance of the optical elements becomes ever more important. At PTB, we use monochromatized bending magnet radiation for the characterization of the optical elements because of the superior temporal stability and rapid tune ability of the wavelength. Thus the polarization of the radiation is almost linear, depending on the vertical beamline acceptance angle, and cannot be manipulated.

Therefore, we decided to equip the soft X-ray beamline which delivers particularly well collimated and highly linearly polarized radiation with a flexible sample manipulator which allows to freely set the orientation of the plane of deflection. Thus we are able to characterize samples in any orientation with respect to the linearly polarized incident light. For practical reasons, we designed the new instrument not for full-size, heavy weight EUV optics but for samples up to 6” square, i.e. the size of EUV photo masks. We additionally can add a linear polarization analyzer working with a Brewster reflector to analyze the state of polarization of the reflected beam. Furthermore, the detector can be moved to any angular position with respect to the incoming beam to also measure complete bidirectional scattering distributions. This is particularly interesting for the characterization of surface roughness on mirrors or the characterization of structured surfaces as for EUV photo masks.

We present the results of the commissioning of the new instrument.

[1] B.Beckhoff, et al.; Phys. Status Solidi B 246, 1415-1434 (2009)