

A lab-scale EUV high intensity exposure setup for small-spot exposures and angular resolved photoelectron spectroscopy

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The extreme ultraviolet high intensity exposure (EUV-HIEX) setup is a compact tool for irradiation of samples with high EUV doses designed to achieve maximum intensity within a small spot size in the sample plane. Applications can be found in the field of accelerated lifetime studies where the EUV-material interaction is investigated. Further applications are EUV induced outgassing studies and material modifications within adjustable gas atmospheres covering industrial to fundamental research tasks.

For the realization of the experimental setup the broadband EUV radiation is emitted by a discharge-produced plasma EUV source. The radiation is deflected using a multilayer (ML) mirror consisting of alternating Mo/Si layers optimized for an incidence angle of 45 degrees. The initial broadband emission is narrowed down by the ML mirror to in-band EUV at a main wavelength of 13.5 nm. By the implementation of a two shell Wolter collector, using external total reflection under grazing incidence angle, the emitted radiation is collected within a focal point focused into sample plane. The spatial distribution in the proximity of the sample plane is tunable, offering tunability ranging to from a small-spot ($\approx 80 \mu\text{m}$ FWHM) to a top-hat distribution ($\approx 200 \mu\text{m}$ FWHM). In addition, a SiN/Zr thin film system serves as an out-of-band filter with a high transmission for wavelengths between 5 nm and 20 nm.

The recent enhancements to the EUV-HIEX include the implementation of a monochromator to prepare the beam for ARPES measurements, ensuring a narrowband photon energy at 91.85 eV. In extension to this, an ARPES system is being implemented which, in addition to coupling monochromatic EUV radiation, also provides excitation in the UV at approximately 21 eV and in soft X-ray at approximately 1,500 eV. The refined setup not only enables rigorous testing of industrially relevant EUV components but also provides a robust analyzation platform for advancing fundamental research in material science.

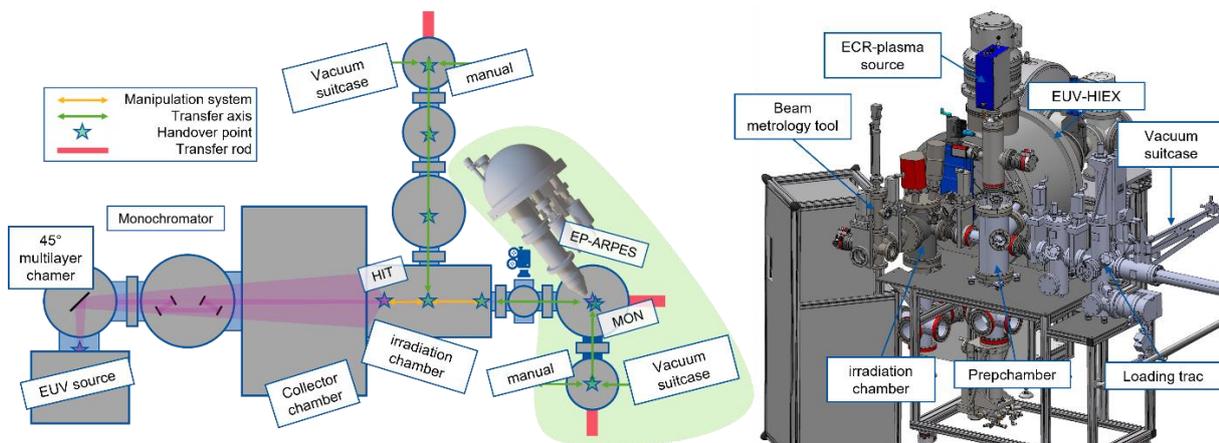


Figure 1 Schematic overview of the EUV-HIEX beamline (left) and construction models of the EUV-HIEX beamline.