Progress of EUV-Reflectometer Tooling with Upgraded V4 Platform

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INTRODUCTION
EUV masks are a key for the successful insertion of EUV lithography. However – especially in actinic metrology – there are still several gaps in the supply chain. Spectral reflectance curves from EUV reflectometry provide key information for the qualification of blanks and masks; information needed across the EUV photomask lifecycle from mask blank suppliers over mask houses to in-fab. Learning from experiences with EUV mask and blank reflectometers (EUV-MBR) which have been in operation for more than 10 years, we have redesigned our platform for better serving industrial use in production environments. We devoted special efforts into mechanical stability, accessibility for service, cleanliness, precision and accuracy, RSP-200 pod handling.

Three beam polychromatic concept for speed and quality
Our EUV, XUV Reflectometry solutions are based on our proprietary “three beam polychromatic” reflectometry, where the sample is measured synchronously to two reference mirrors stationary in the tool.

Immanent wavelength calibration
A special advantage of the spectroscopic approach is that all spectra are immanently wavelength calibrated as observed Xenon emission lines - known from NIST - can be directly link to them. Based on the accuracy of the NIST data and correlation of each single spectrum to them to better than 1 %, i.e. 1.7 pm an accuracy of better 3 pm and a reproducibility of better 0.5 pm is achieved.

EUV Mask (blank) Reflectometer Tool
With the EUV-MBR we have developed a high end tool for the industrial lab for routine fully automatic recipe based processing. By using our product EUV-Lamp we offer maintenance intervals and MTBFs in the range of some 2.000 samples or 100.000 spots and low CoO.

Meanted spectrum correlated to simulated spectrum from NIST line table of each spectrum is wavelength calibrated.

EUV-MBR: Clean room compatible architecture and controls.
Architecture of the EUV-MBR makes it modular for being customized and easy accessible for fast service and maintenance such that we continue to achieve 99 % supplier dependent uptime as with existing tools.

Typical Performance Features and Specs

Outlook
We can envision supplementing our EUV-MBR with concepts from the actinic pellicle transmission tool (EUV-PTT: see our other poster). While spectral resolved reflectance data from the MBR are indispensable for mask blank manufactures, we propose that full area quality scan provides the information needed by mask houses and in-fab mask integrity checks. Of special interest for the latter is that actinic metrology pads on masks may be minimized down to 50-50 µm and also masks can be qualified. Like in the EUV-PTT, we propose “EUV-inband reflectometry” (EUV-IRT) for quality mapping of the whole sample surface with respect to the feature counting in the scanner, i.e. the integrated inband EUV reflection.

The new mode of EUV-IRT qualifies whole mask or blank within less than 1 hour while providing the key “central parameters” of R_{x,y,z} of EUV-50 and FWHM for selected spots. A side effect of detecting larger actinic defects of about 1 µm is given. Add-ons like scatterometry or flare quantification may be supplied. As we want to target our development to the requirements of e.g. mask houses, we would be curious to hear from expectations or inputs from interested parties.

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