EUV Reticle Inspection Test Platform

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Introduction
Mask defectivity remains a critical area for HVM with EUV Lithography. Even with the introduction of the EUV pellicle clean mask handling is still required in tools in which the pellicle is removed. The critical dimension for defects on the mask front-side will be sub-20 nm. For the back-side of the mask the 3D shape of defects needs to be measured to assess potential interference with chucking.

We have developed a modular reticle handling system for EUV masks. This system has been integrated with front and back-side inspection tools, meeting market requirements. This test platform allows for fully automated qualification of reticle handling modules and contamination research at very low particle per reticle-pass (PRP) levels down to the smallest relevant particle size.

Reticle handler
The TNO reticle handler is the backbone of the test platform. The system is capable of loading masks from both RSP200 and EUV Dual pod carriers into an ISO 1 environment. The design enables ultra-clean transfer of masks from EUV inner pods to the Rapid Nano 4 scan-box, while the orientation can be manipulated in a flip / rotation unit. Two inspection systems are connected to the reticle handling unit, while two additional slots are available for other tools or modules.

3D back-side inspection and cleaning
This tool measures a 3D height map of the back-side of a mask by optical coherence tomography (OCT). Height variations in a range of 40 µm can be detected with a reproducibility of 80 nm. When particles with a height that will interfere with electro-static chucking are detected this tool can remove them. The cleaning is local with minimum contact to the mask.

See poster ‘A quick, local, dry and minimum contact method for backside reticle cleaning’.

Front-side blank Inspection (Rapid Nano 4)
The Rapid Nano 4 is capable of inspecting blanks with a sensitivity down to 20 nm. The blank is illuminated from 9 different angles by a 193 nm laser. Scattered light is collected by an in-house developed mirror objective and imaged on a TDI camera. During inspection the blank is inside a pellicle covered scan-box, protecting the blank from contamination.

This work has been performed in the framework of the International Center for Contamination Control, established by TNO. Partners are welcome to join ICCC in the challenging development of dedicated contamination control solutions.