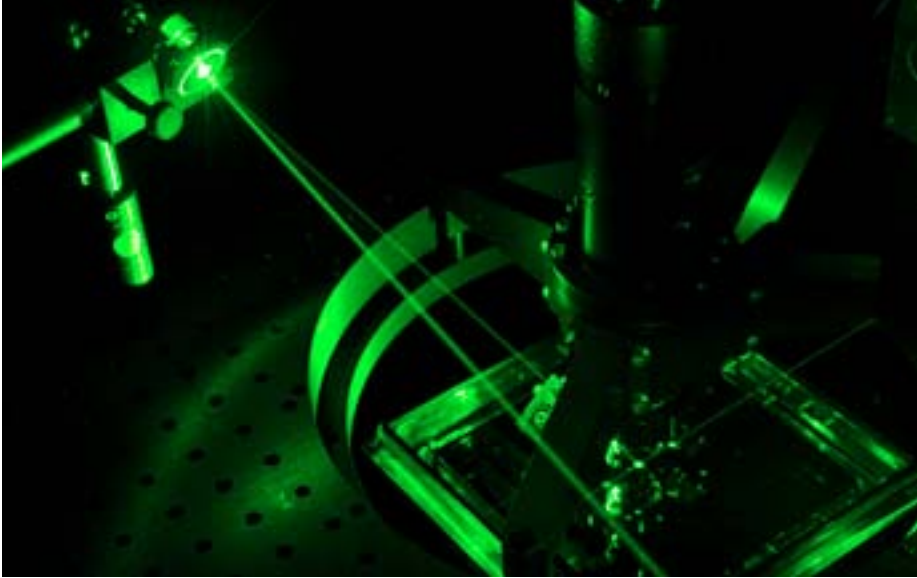


RAPID NANO PARTICLE SCANNER



TNO innovation
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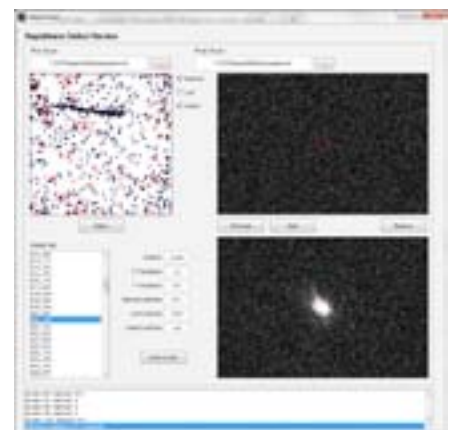
TNO has led the field of particles in EUV domain for over 10 years and, in addition, has extensive experience in optics lifetime, vacuum technology and ultra-clean handling.

The EUV era is about to witness the launch of a new generation of reticle handling equipment that is expected to subject to far stricter requirements on particle contamination than for all previous nodes. This will make particle measurements on reticles important for a new group of industry.

The Rapid Nano is an affordable tool for particle inspection of EUV blank reticles and reticle substrates (152 x 152). The Rapid Nano is suitable for scanning the complete surface of a blank reticle in a protective scanbox. The inspection system makes use of a double dark-field concept whereby information is recorded by a high-definition camera. The data is stored as raw image format and is made available for off-line data processing and reviewing.

SUPPORTING EQUIPMENT DEVELOPMENT

Contamination rates in sub-units, mock-ups and functional models can be determined during the equipment development process. Using the Rapid Nano in the development enables the identification of bottlenecks while combating contamination at an early stage of development is more cost-effective than having to solve contamination issues at a later stage.



Top left: Graphical overview of particles found.

Top right: Situation first scan.

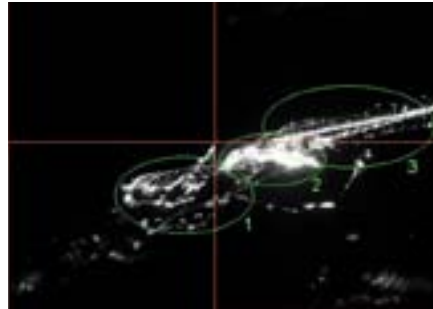
Bottom right: Second scan same position with added particle.

Bottom left: List of added particles.

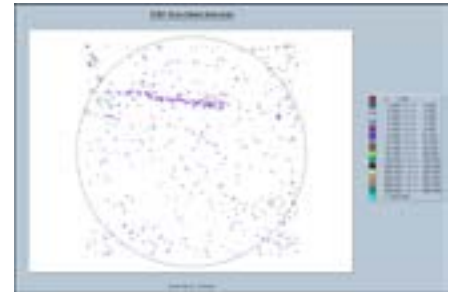
DETECT 50NM PARTICLES AT SCAN RATE OF 100CM²/HOUR

SUPPORTING FORENSIC ANALYSIS OF PARTICLES

When particles are found, material identification assists the first preventive step: tracing the particle source. SEM analysis alone is not likely to be sufficient. As particle levels are low, finding a representative particle will take a lot of SEM time. The Rapid Nano provides a results file in KLARF format. This enables a quick lock on particle positions and fast analysis.



Analyzing causes: 1 landing zone of tweezers; 2 impact; 3 retract.



Graphical presentation of particles by size for qualification purposes.

PARTICLE QUALIFICATION EQUIPMENT

No customer wants to process valuable EUV reticles in unqualified equipment. The Rapid Nano generates a differential analysis between two scans. This way it is able to find a single added particle on a reticle blank. By scanning reticle substrates before and after handling in equipment to be qualified, the cleanliness level of the equipment can be shown and a full qualification procedure on particle cleanliness can be performed.

SPECIFICATIONS OF RAPID NANO

| | |
|--------------------------|---|
| Inspection Technology | Laser dark-field measurement technology |
| Inspection surface | Reflective surfaces (wafers, reticle blanks) |
| Inspection image area | Full reticle (152 x 152 mm) using the scanbox protective environment (EP1434094A1). Using a customised holder – any surface up to 200 x 200 mm. |
| Inspection environment | During inspection the substrate is positioned in a patented protective environment <ul style="list-style-type: none"> • Scanbox design protects the reticle during scanning • Reticle can be stored or transported within the scanbox |
| Scan time | 2 hours / reticle |
| Pin pointing accuracy | Better than 2µm (for particles < 500nm) |
| Defect size on blanks | > 35nm (PSL equivalent size) |
| Safety | Laser class 1 system equipped with interlocks |
| Defect analysis | Offline analysis, results reported: <ul style="list-style-type: none"> • ASCII - (KLARF format) • Overview image (complete scan) • Cross linked image (pre- and post-scan) for adder analysis • Defect images (raw data) for manual defect review |
| Mechanical interface | Mechanical interface with the scanbox / scan stage <ul style="list-style-type: none"> • Default: Manual handling (load / unload) of the scanbox • Optional: Pod in Pod, RSP200 or custom automated mechanical interface with the target equipment. |
| Footprint (LxWxH) | 1.5 m x 1.2 m x 2.2 m |
| Energy consumption | Power 230V / 16A secured |
| Environment (clean room) | Class 10.000 or better Temperature variation < 4 degrees Celsius |
| Qualification standard | SEMI M50 - Test Methods for Determining Capture Rate and False Count Rate for Surface Scanning Inspection Systems by the Overlay Method |

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