NTS Optel
Customized High Volume Testing solution for Wafer Level Optics

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About NTS Optel

NTS Optel is a High tech engineering and manufacturing company, specialized in applied optics, opto-mechatronics, imaging and laser technology.

- **Consultancy, Design, Co-development**
  Starting with optics: When standard available products cannot solve the question, Our Optel engineers are capable to investigate and design a dedicated solution for you. We use techniques such as Laser, Custom Optics, Spectroscopy, Vision and LED.

- **Product design, prototyping and series production**
  We focus on providing the best suitable solution by design and can assemble your prototype and series at NTS Optel. In addition we make use of our Group enabling ultra precise machining, granite and sheetmetal manufacturing. Our vertically integrated global footprint enables assembly and manufacturing on all continents.

Part of NTS-Group

**Eindhoven**

- Headquartered in Eindhoven, the Netherlands
- € 270+ Million turnover
- 1700+ Employees worldwide
- 70+ Years of experience in manufacturing industry
NTS Optel capabilities

We use ray tracing for our optical designs.

And apply all imaginable optical techniques:

- Vision techniques
- Laser triangulation, distance and 3D-measurement
- Laser and white light interferometry
- Laser diffraction
- Spectroscopy

from EUV, UV, visible, NIR to IR.

Add the electronics:

- Analog and digital electronics design
- Embedded software

We design and build the mechanics

And implement software for processing, control and GUI

We are capable of providing complete solutions!
What we do: Development and manufacturing of optical modules and systems

- Multi Lens Array
- Laser in Reticle
- Wavefront scrambler
- UV beam homogenizer (Semicon application)
- Multi product examples for medical, Analytical applications
- Eye surgery application
- Lidar systems: Design and small series production
- MEMS based Lidar systems

NTS Optel role: Development and production
What we do in micro optics: Typical test parameters (on DOE/MLA/Micro Optics)

• Relative zero order power
• Occurrences of hot-spots
• Total diffraction efficiency
• Horizontal and vertical diffraction or refraction angles (FOV)
• Relative spot or line powers
• Pattern contrast
• Spot and line quality in terms of FWHM
• Homogeneity over spot profile or diffusor profile
• Low and high frequency inhomogeneity of diffusor
• Any other parameters our customers would like to test….
Optical Wafer Tester: Modular re-usable direct imaging (conoscope) and rear projection imaging
Diffuse reflective screen

Projector FOV

Narrow and wide field IR-camera’s
Technical challenges we have seen and solved

**Pattern imaging optics:**
Cover a large FOV (up to 150°) with sufficient resolution
  - Solution: Custom designed aspherical objective
Low sensitivity drop-off and distortion over the FOV
  - Solution: Custom designed aspherical f-theta objective with low distortion + built in distortion calibration target and angular sensitivity
  - Optics without vignetting.
Tolerance in wafer surface location
  - Custom Optics designed with large entrance pupil => less sensitive to misalignment.
Sufficient working distance
  - Custom Optics designed with minimum workable distance
Noise reduction
  - Speckle reduction by moving projection screen

**Laser module:**
Accurate center wavelength
  - Lasers are wavelength preselected and temperature controlled
Stable operation
  - Temperature control + optical feedback + RF modulation.
Spot size fitting the active area
  - Custom aperture which is relayed to the active area. (Relay optics)
High beam quality
  - Built in spatial filter to clean up beam profile.
Many more challenges we solved:

Wafer handling, gripping and clamping
• manually/EFEM,
• Use of vacuum or mechanical solutions

Bow/warp of wafer (up to 1-2 millimeters!):
• Requiring bow/warp mapping
• Tip-tilt and height corrections with 6Dof stage

Pitch variations over wafer:
• Alignment on multiple fiducials
• Use actual elements.

Sensitivity drift of pattern imaging camera: \(\sim 0.5\% / \text{degr.} \at 940\text{nm}.
• Thermal control
• Regular reference measurements with calibration optics

Calibration:
• Distortion based on reference grating
• Sensitivity over VOF with calibration LED
• Laser power level (100% level)
We invite you to contact us? Ruud.van.Oers@nts-group.nl

Questions?

Accelerating the future