

Ultra-Precision Micromachining for Optical Applications

Machine basics:

- Microgantry® nano4x manufactured by Kugler GmbH, Salem
- CNC-controlled 4-axes machining system
- air-bearing X- and Y-axes driven by ironless linear motors guarantee excellent positioning accuracies
- fine-grained granite machine base and gantry design result in a thermal and mechanical extremely solid setup and long-term machining capabilities with highest precision
- integration of tool (Blum LaserControl) and workpiece (Renishaw touch-trigger probe) measurement systems for the implementation of efficient compensation cycles

Integration of three machining modes

Air-bearing high-speed work spindle:

- for micromilling, -grinding and -drilling
- operates at up to 180,000 rpm
- spindle growth detection and compensation
- application of diamond tools for surfaces with $R_a < 20$ nm
- the use of a minimal lubrication system as well as a flooding machining equipment opens up a large variety of machinable substrate materials (steel, nonferrous metals, polymers...)

High repetition rate picosecond laser:

- for laser ablation and polishing processes
- repetition rates of up to 600 kHz
- pulse duration < 10 ps
- wavelengths of 1064, 532 and 355 nm

Air-bearing flycutting-spindle

- for the fabrication of plane, spherical and aspherical optical components with highest surface accuracies ($R_a < 10$ nm) by diamond metal-cutting in nonferrous metals and polymers

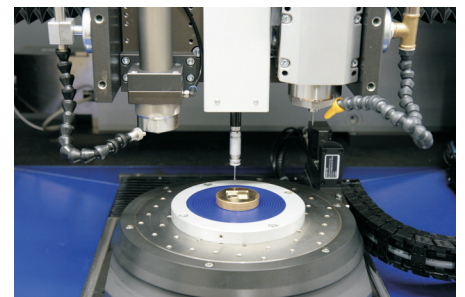
Applications:

Fabrication of optical components like

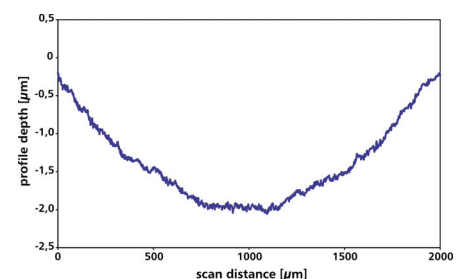
- freeform surfaces for aberration correction elements
- metal optics (mirrors, gratings)
- master moulds for replication processes
- integrated systems with microopto mechanical and/or fluidic functionalities (MOEMS)



Microgantry® nano4x machining center



From left to right: Laser focusing head, measuring probe and main work spindle



Profilometric scan of an aberration correction element for planar integrated optical systems

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