

# High-precision glass processing with innovative coordinate grinding technology

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## ABSTRACT

Technical systems are constantly getting reduced in size while functions are to be improved. The requirements for high-tech components exceed the feasible limits of production technologies. Integrated precision components must meet ever-increasing demands with regard to optical and geometric properties. Conventional technologies of glass machining often cannot withstand these requirements. Grinding, lapping and polishing processes are realized on separate machines. Thus, the manual change of components between the machines and constraints in machine kinematics result in significant loss of accuracy as well as restrictions in design and functionality.

To meet the requirements, ShapeFab developed a more efficient manufacturing process for high-precision components made of glass. All previously separated manufacturing steps are combined on one machine. By means of high-precision 5-axis CNC jig grinding and corresponding integration of CAD-CAM chain, processes of finest machining and polishing can be fully combined. This leads to application of optically effective surfaces to almost any geometrical element. In addition, the machining of complex geometries can be accelerated due to highly automated processes, even in low volume production.

With our technology a new generation of components with structures from 300  $\mu\text{m}$  is available. High-precision parts can be designed smaller, lighter and multifunctional. For example, fixing geometries can be directly integrated in optical functional and freeform areas. This allows the components to be integrated into the final application with  $\mu\text{m}$ -precision, even without fixtures or further adjustment elements. The whole technical system can be designed compactly and costs for additional mechanical components can be saved.

Applications can be found in almost all areas of photonics. Especially requirements from the semiconductor industry, optics, medical technology and laser technology can be fulfilled.

**Keywords:** Glass components, Manufacturing, Fine grinding, Polishing, CNC glass machining, CAD-CAM integration, Surface finishing