



TESTING A LASER POLISHING MACHINE IN TOOL AND MOLD MANUFACTURING

Task

For the surface finishing of dies and molds, e.g. for the production of glass bottles, manual polishing is currently still the state-of-the-art. And yet the increasing lack of specialized labor as well as the high costs and processing times, in particular for free-form surfaces, have led to a great need for automated polishing processes. Therefore, Fraunhofer ILT, in cooperation with industrial partners, has developed a machine tool for the laser polishing of metal surfaces. This machine, conceived for tool manufacturing, unifies a five-axis portal machine with a dynamic three-axis laser scanning system. For the processing of free-form surfaces all eight axes can be moved simultaneously, thus achieving a seamless finish. After users take a short training seminar, they can program this machine, in spite of its complex kinematics, with standard CAM software (e.g. PowerMill or SiemensNX) and a postprocessor developed at Fraunhofer ILT.

Method

The industrial testing of the machine took place in the mold construction of an industrial partner from the sector of glass bottle production. After the machine operators were trained in the machine control (Siemens Sinumerik 840D sl) and the CAM programmers in using the ILT-postprocessor, the laser polishing machine was used in the manufacture of glass-blown molds. The emphasis during testing lay in the assessment of ergonomic operation, process stability of the machine under industrial conditions, as well as operational behavior of the laser-polished surfaces during glass production.

Result

Within the scope of the running tests, the machine tool has proven to be fully industry ready and easy to operate after the machine operators as well as the CAM programmers take a brief training seminar. The good accessibility of the machine tool table, both manually as well as via crane loading, the adaptive measuring system to determine the position of the clamped workpiece and the automated polishing process all ensure good ergonomics. The mold inserts out of grey cast iron (EN-GJS-400-15) can be laser polished reproducibly and prove to be more resistant in production than hand-polished surfaces due to the increased hardness of the remelted surface layer.

Applications

Fields of application can be found, above all, in tool and mold manufacturing, with a focus on applications with surface qualities in the range of $Ra\ 0.15\ \mu m$ to $0.40\ \mu m$. Among these count mold inserts for glass production and tools for cold or warm forming.

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3 Machine tool for laser polishing.

4 Laser-polished tool.