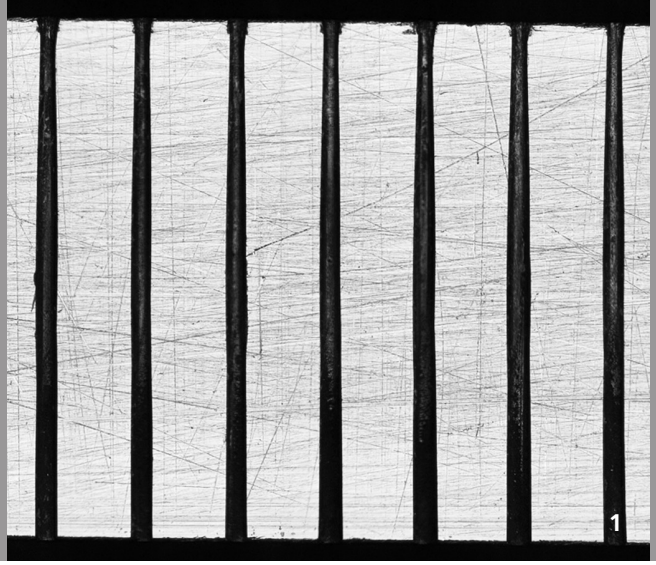

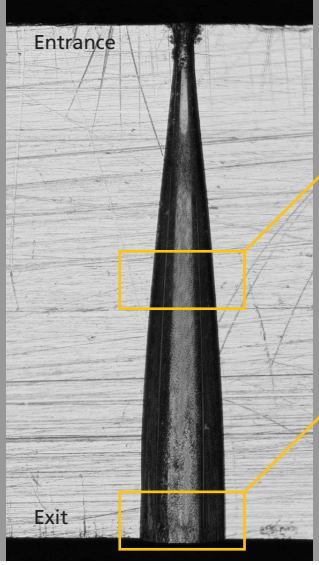

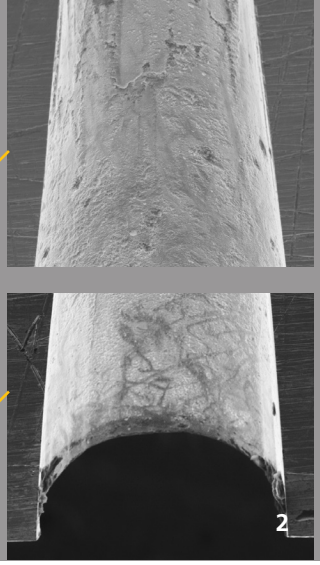

HELICAL DRILLING OF PRECISELY SHAPED HOLES

Task

Laser beam drilling has established itself in many applications where micro holes with diameters less than 100 µm have to be drilled. What is decisive here is generating either very round holes or a defined drill form – no matter if it is symmetrical, positive tapered or negative tapered. For these cases, helical drilling has proven itself as a good process with which round holes with defined shapes can be made.

Method

To investigate the helical drilling process, a frequency-doubled ps laser was used to drill holes in metals. Thanks to the very short pulse durations, the heat affected zone in the metal is minimized and very little melt generated. The helically drilled holes were made with a helical drilling optic developed at Fraunhofer ILT, whose optical rotation speed can be varied up to 36,000 rpm. By varying the pitch angle and the spiral diameter of the laser radiation in the drilling optic, the drill diameters as well as the conicity can be adjusted. To investigate the drill-hole quality, scanning electron microscopes images of the drill-hole entrance as well as exits and of cross sections were examined closely.

Result

In steel with a thickness of > 1 mm, defined cylindrical, positive tapered and negative tapered holes could be generated. On account of the short pulse duration used, no melt was generated so that no melt deposits could be detected at the hole entrance, exit or on the drill wall itself. The roughness of the drill wall is Ra < 2 µm.

Applications

The applications of the process lie in all fields where very precise drill holes are necessary. Examples of this are, e.g. drilling of injection nozzles, starting drill holes or ventilation holes.

Contact

Dipl.-Ing. Frank Zibner
Telephone +49 241 8906-325
frank.zibner@ilt.fraunhofer.de

Dr. Hermann Uchtmann
Telephone +49 241 8906-8022
hermann.uchtmann@ilt.fraunhofer.de

1 Cylindrical drill holes in steel.

2 Cross-section of a negative tapered conical drill hole in steel.