SIMULATION OF THE TEMPORAL EVOLUTION OF DRILL HOLE CONTOUR WHEN DRILLING WITH LASER RADIATION

Task

The asymptotic ablation contour observed when long pulsed laser radiation is used to drill can be excellently described by »AsymptoticDrill«, a software developed at Fraunhofer ILT. However, this software only describes the final contour while assuming constant pulses. A variation of the pulse characteristics during the process can have a significant influence on the drilling and, thus, lead to a significant improvement in quality (for example, cylindrical drill holes). This state creates the need to develop a dynamic ablation model, one which can describe the pulse-resolved evolution of the drill hole.

Method

The aim of modeling and simulation is to describe and predict the pulse-resolved evolution of the drill hole on the basis of a reduced ablation model. According to the asymptotic ablation model, this new model should allow the customer to implement interactive simulation software for direct use.

Result

A reduced ablation model, which describes the pulse-resolved evolution of the drill hole, has been developed, numerically implemented and confirmed by comparison with experimental data (Figure 3). Fraunhofer ILT will offer an interactive simulation software (»DynamicDrill«) for use on a PC, laptop or smart devices in the spring of 2016.

Applications

In addition to the application described here, drilling metals with long pulsed laser radiation, the developed ablation model can also be applied in the field of USP ablation of dielectric and semiconducting materials.

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3 Comparison between the simulated
drill hole contour and experimental results.

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