



HIGH-SPEED LASER MICROSTRUCTURING FOR PLASTIC METAL HYBRIDS

Task

The automotive and aviation industry are responding to the challenge of saving weight by using innovative lightweight construction concepts. In multi-material lightweight construction, materials are selected according to local loads and requirements. The cost of producing lighter components, however, should remain as constant as possible with comparable or even improved component properties. To achieve this, the industry needs fast, reliable and cost-effective joining methods for connecting dissimilar materials such as plastic and metal.

Method

Fraunhofer ILT has been researching the laser-based joining of plastics with metals for many years. For this purpose, undercut cavities are produced in the metal by means of laser microstructuring and are filled with plastic melt in the subsequent thermal joining process. To increase the productivity of this process chain, Fraunhofer ILT has developed a polygon-based laser microstructuring scanner system as part of the EU project »ComMUnion«, which enables continuous high-speed process control using high-performance fiber lasers. The generation of cavities with very high process speeds was investigated for various materials.

Results

Through the use of the high-speed scanner, feed rates of up to 0.5 m/min can be achieved during laser microstructuring. This corresponds to a 2.5 fold productivity increase. The feasibility was proven for various metallic materials, such as high-strength steels, titanium and aluminum.

Applications

The system was originally developed to pretreat surfaces in tape laying processes for the automotive industry. However, the undercut structures make it possible to generate high strength joints with a variety of thermal joining methods. Since the process is highly productive, it is particularly suitable to produce continuous joint connections, such as for window frame profiles.

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*3 Polygon-based scanner system
for laser microstructuring.*

*4 Continuous high-speed structuring
process of a steel profile.*