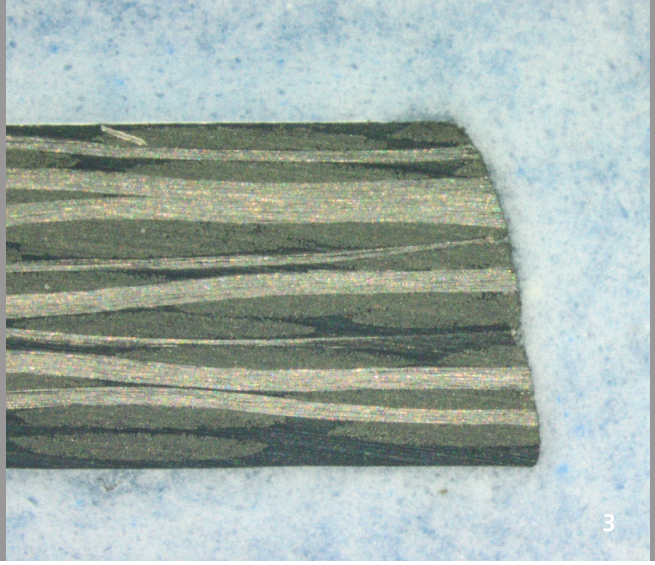

CUTTING OF FIBER-REINFORCED THERMOPLASTIC POLYMERS

Task

The use of fiber-reinforced polymers (FRP) with thermoplastic matrix is gaining increasing importance in the mass production of fiber-reinforced parts due to short cycle times. The ability to shape thermoplastic FRPs by heating and pressing, similar to conventional process chains for metal part production, enables production processes with large lot sizes at reasonable production costs. However, trimming and assembly of sub components still require new approaches that do not affect the outstanding properties of the new lightweight materials. Flexible production methods, such as tape laying or fiber spraying, achieve near net shape parts, but cutting holes and precise trimming remain as indispensable manufacturing steps. Therefore, productive cutting processes are required, which lead to a low thermal influence on the cut edge.

Method

Laser cutting of FRPs, in principle, is a preferred process, but must be modified from conventional process approaches to avoid overheating the matrix material and negatively influencing the material properties. Thus, low heat input to the material can be achieved by short interaction times, made possible by short pulsed laser radiation and high processing speeds. In multiple passes the material is successively ablated with a newly developed ns-CO_2-laser in the kilowatt power range until a complete cutting kerf is produced.

Result

The heat affected zone is reduced by the multi-pass process, compared with a cut in a single pass at correspondingly lower cutting speed. The effective cutting speed is the same for both cases. By using lasers in the kilowatt power range and above, researchers at the Fraunhofer ILT have achieved cutting speeds of several m/min, thereby making the process suitable for serial production.

Applications

FRP is a core material in lightweight design, and laser cutting can be an essential step in the production chain. The applicability for glass fiber-reinforced polymers opens up a broad field of applications, e. g. in vehicle manufacturing, mechanical engineering, consumer goods and the sports equipment industry. This research has been funded as part of the EU project »FibreChain« and the BMBF project »InProLight«.

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3 Cross section cut edge carbon fiber/PA6 (thickness: 2 mm).