



LASER CUTTING OF CFRP

Task

Since it has great lightweight potential, carbon fiber reinforced plastic (CFRP) is being used more and more in many industrial sectors, yet it creates high tool wear when it is machined by milling or drilling. This drawback can be overcome by means of contactless laser cutting.

The cut kerf is formed with a scanning-based step-by-step ablation process to reduce the thermal influence. As material thickness increases, kerfs with high aspect ratios are formed, especially when single-mode lasers with their outstanding focusability are used. These ratios do not allow, among others, effective ablation at the kerf base due to the ablation behavior and shading. Furthermore, a greater proportion of the laser power only leads to heat impact, thus enlarging the heat-affected zone (HAZ). In addition, the removal of material from the kerf base by the cut edges is increasingly hampered as the aspect ratios increase.

Method

When staggered cutting tracks are used, the kerf width can be increased, thereby improving the accessibility for the laser radiation and the removal of the emission products. The offset, number and sequence of scans as well as the distribution of possible cooling phases are varied for processing with different beam caustics.

One option for applying these processing strategies is pre-cut machining, which utilizes parameters to optimize efficiency, then a final trimming of the pre-cut edge, which utilizes parameters to minimize the HAZ.

Result

By means of the ablation variants under investigation, the HAZ can be substantially reduced, in some cases by up to 50 percent, or the processable cutting depth increased without enlarging the HAZ. The required number of scans for a cut is reduced for larger material thicknesses as compared to machining with single tracks because with greater cutting depth, the removal rate is maintained.

Applications

Trimming CFRP components or cutting holes are process steps required in all CFRP processing sectors, in particular in the aviation and automotive industries. The methods presented here expand the thickness range that can be processed, but also result improvements in cutting quality in CFRP components with material thicknesses from 2 - 3 mm.

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3 Cutting process of CFRP.

4 CFRP cut edge, 8 mm material thickness.