



LASER CUTTING FOR CFRP-METAL HYBRID COMPOUNDS

Task

For a multitude of assemblies, for example, in automotive engineering or aerospace, the best approach to optimize component weight is to combine fiber composite material and lightweight metals, such as high-strength steels, aluminum or titanium. The joint between CFRP and metal can be prepared with a laser in compliance with the specific process requirements for the very different material groups; furthermore, it is wear-free. Such processes can be used to drill holes in already overlapping layers of CFRP and metal for rivet joints, or to cut the contours for combined positive- and material-locking joints.

Method

The CFRP material is cut by sequentially ablating material with a high-performance fiber laser and a fast galvo-scanner. When the material is stacked, the scanning strategy is chosen in such a way that the resulting CFRP kerf width and kerf shape offer favorable conditions for the subsequent laser cut in the metal. This cut is then carried out with cutting gas in one overpass. For the cases considered here, the same laser beam source was successfully used for both steps, but there are also scenarios in which different lasers could be used for CFRP and metal from an economical and technical point of view.

Results

A very good connection of the cuts carried out in the two process steps has been achieved both in butt-joint arrangement and overlapping material composites. When the material is stacked, the cut in the metal below does not damage the contact area. Depending on the combination of thicknesses, the heat-affected zone can increase in size at the edge of the CFRP through the metal cut.

Applications

Connections of fiber composite material to metal parts are present in all areas of lightweight construction. In addition to the applications in vehicle construction, connection flanges for pipes in vessel construction are another example where this process can be used. It is also possible to transfer the processes to applications with other hybrid materials, for example in disassembly engineering when nuclear power plants are dismantled.

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3 Cut edge for a CFRP-titanium joint.

4 CFRP-metal contour cuts.