



WELDING AND CUTTING OF FRP COMPONENTS

Task

In Europe, all vehicle manufacturers have to reduce the average CO₂ emissions of their vehicles to under 95 grams per kilometer by 2020, which corresponds to a fuel consumption of about four liters of gasoline per 100 kilometers. Innovative lightweight concepts based on fiber-reinforced thermoplastics (TP-FRP) can make a significant contribution to achieving this goal. For such TP-FRP components to be used economically, however, production costs and production times need to be reduced significantly, while the component complexity is increased.

Method

With a new laser-based approach, an innovative process chain shall be implemented, which, having few process steps, will lead to quick, automated and mass production of structural components made of TP-FRP. First, an easily manageable 3D preform with adjustable fiber orientation is made in a fiber spraying process, then equipped with metallic inserts and subsequently consolidated by variothermal tooling technology. In the final process steps, the sub-components are laser welded to increase their stiffness and laser cut for trimming. Thanks to these technologies, an economical process chain can be created for lightweight components with high stiffness.

1 *Trimming of the component demonstrated.*

2 *Lightweight components of a truck seat.*

Result

Components were made for truck seats with the process chain described here. To increase the stiffness, the component was constructed of two shells and welded all around the edge with a diode laser and trimmed with a CO₂ laser along the weld edge. With line optics (spot ~ 1 x 10 mm²) a process time of about 1.5 min has been achieved at a welding speed of 30 mm/s. The processing time is about 1.5 min for the cutting process in the 6 mm thick material (glass fiber/polyamide, fiber content 60 wt.-%).

Applications

The method demonstrated in this process chain for welding and cutting thermoplastic FRP components is an alternative to mechanical processing and gluing for the production of a widely variety of components and materials.

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