



LASER PROCESSES FOR THE PRODUCTION OF LIGHTWEIGHT HYBRID COMPONENTS

Task

By combining different materials and integrating several process steps in the manufacturing process, research has developed approaches to optimize the weight of components in lightweight construction and to manufacture them inexpensively. In order to produce multi-material components in processes suitable for series production, however, the industry needs appropriate joining and separation processes for selected materials.

Method

As part of the BMBF project »HyBrilLight«, Fraunhofer ILT has developed a hybrid component that demonstrates the successful implementation of new, innovative laser processes in lightweight construction. They were used for a so-called car roof bow, based on the original component of the BMW 7 series, which consists of a fiber-reinforced plastic strut with two metal connecting sheets. Using ultrashort pulsed laser radiation, Fraunhofer ILT generated sponge-like microstructures on the connecting sheets, which enable the plastic to claw into the metal surface. The parts are actually joined as the plastic component is produced in the compression molding process: here, the structured connecting sheets are inserted

into the variothermal mold and then pressed with the glass fiber-reinforced plastic and local carbon-fiber reinforcing tapes. Finally, the excess overhang of the GFRP-CFRP material mix is trimmed using a fiber laser in a multi-pass process.

Results

The generated plastic-metal hybrid compounds, which are based on mechanical clawing mechanism in the generated microstructures, can withstand shear forces of up to 50 MPa. The multi-pass method with fiber lasers makes it possible to cut and trim material combinations of glass and carbon fiber-reinforced plastics with a minimized heat affected zone. Since the joining process is integrated into the primary molding process of the plastic component, the process chain has been shortened and the process time reduced significantly.

Applications

Joining and trimming of multi-material composites are process steps required in all areas of lightweight construction, especially in the automotive and aerospace industries.

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1 Roof bow with plastic-metal hybrid connection.

2 Remote laser cutting of CFRP-GFRP material mix.