



LASER WELDING OF THERMOPLASTIC FIBER-COMPOSITE COMPONENTS

Task

If fiber-reinforced plastics are to become a viable option for large-series production, manufacturing costs and cycle times need to be reduced dramatically compared with the conventional production chain for sheet-metal parts. In order to fulfill functional strength requirements, components are likely to become more complex, with a potential knock-on effect of higher manufacturing costs. Laser welding is an ideal alternative to complex fiber-reinforced plastic components, offering a solution for manufacturing clean, rapid and permanent fixed joints to create closed reinforced structures using overlap configuration.

Method

Laser welding based on an overlap configuration – a setup that is commonplace in industrial applications – relies heavily on the optical properties of the joining partners. The top joining partner must be sufficiently transparent for the laser radiation to penetrate the weld zone without any loss of intensity. The lower joining partner must be strongly absorbing so that the incident radiation can be converted into heat near to the surface. But the high fiber component in fiber-reinforced-plastic structural components gives rise to widely varying optical properties, thus significantly altering

the way the radiation propagates. The welding process must tolerate these local changes if it is to meet the requirements of series-production welding. Moreover, the large component dimensions and the three-dimensional geometries mean the components cannot be pressed together using conventional joining devices to generate the necessary heat contact.

Result

By enlarging the process window, with a view to varying the optical properties as widely as possible, it was possible to determine a reliable working point for a high-quality welded joint. The use of a robot-controlled, flexible clamping mechanism with integrated machining optics (Leister) allows even three-dimensional components to be pressed together.

Applications

Laser welding of additional stiffening structure makes it possible to meet enhanced stiffness and crash-test requirements. In particular this allows a substantial weight reduction (~ 25 percent) in seat backrests, which have to meet more stringent requirements with the attachment of a third seat belt.

Contact

Dipl.-Ing. Andreas Rösner
Phone +49 241 8906-158
andreas.roesner@ilt.fraunhofer.de

Dr. Alexander Olowinsky
Phone +49 241 8906-491
alexander.olowinsky@ilt.fraunhofer.de

1 Laser welding a 2/3-split seat backrest (Weber).