

LASER WELDING OF POLYMERS WITH CLASS A SURFACES

Task

When polymers need to be welded free of marks with overlap joints, (diode) laser radiation in the range of 1000 nm is the preferred process to accomplish this. In contrast to ultrasound, friction and hot plate welding, this laser-based welding process not only limits the heat affected zone to a small area around the contact area of both joining partners but also does not extend this zone to the surface. For shiny, bright colors of the polymers used, as is typical for household appliances, this laser-based process has not yet established itself since the transparency of the upper joining partner is too low.

Within the scope of a joint project funded by the EU – »Extending the process limits of laser polymer welding with high-brilliance beam sources - PolyBright« the welding of white-white connections should be demonstrated through the use of alternative fiber laser wavelengths around 1500 nm.

Method

In close cooperation between the participating project partners, a door handle was initially chosen as a concrete application (Electrolux) and modified slightly. Additionally, the previously developed color additives and radiation absorbers were selected. Subsequently, the welding took place in a prototype plant built at Fraunhofer ILT, which contains a 1567 nm fiber laser (IPG).

Result

The cover out of bright gray, glossy PC was welded onto the same colored lower part free of marks by means of the TWIST® contour process, which used 1567 nm erbium laser radiation at $v = 15\text{mm/s}$ and $P = 30\text{ W}$. The components were pressed against a glass plate in a common mount; a scanner (Arges) ensured that the laser beam, with 1.8 mm diameter, moved in a circular path along the outer edge of the welding contour of the door handle as well as that there was an overlapping circular wobble movement with a 0.5 mm radius. In addition to the availability of high-power 1500 nm lasers, this application is based on the high transmission of many polymers at these wavelengths.

Applications

Bright, glossy plastics are mostly used where the optical appearance is of great importance. This is the case for household appliances, furniture, consumer items and automobile interiors.

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1 Door handle out of PC (cover) welded onto lower part out of ABS by means of 1567 nm erbium fiber-laser radiation.