



TWIST-LASER WELDING OF PLASTIC FILMS WITH 1567 NM ERBIUM FIBER-LASER RADIATION

Task

When lasers are used to weld plastics, an overlap joint is almost exclusively used, having a contour, simultaneous or quasi-simultaneous configuration. Since highly brilliant fiber lasers with 1060 nm (ytterbium-fiber laser), 1567 nm (erbium) or 1940 nm (thulium) have been in use, TWIST has provided another variant of the method, based on the superposition of a slow welding speed with a quick circular motion. This distributes the high intensity of a fiber laser beam to a larger geometric area. The homogeneity of the heat-affected zone is, thus, improved when compared to its counterpart when the typical lens shape is used in diode welding. In addition, the weld width can be varied within the same contour. Apart from their usual dependency upon parameters such as laser power, welding speed and focus diameter, TWIST-welded seams are influenced by the TWIST-circle diameter and oscillation feed rate, which determine the circular overlap.

Method

With a collimated beam diameter of 5 mm and a lens focal length of 345 mm, the focused beam diameter is 152 µm within the 150 x 150 mm large working field. To demonstrate the TWIST process, the welding contour was generated

consisting of three circles, each 15 mm in diameter and 2 mm circular ring width. The TWIST oscillation feed rate was changed for each circle to demonstrate a low, medium, or high overlap of the TWIST circles, see Figure 3.

Result

A transparent and a black film with 300 µm thickness were welded in an overlap joint. The welded seams appear distinctly as black lines since the milky light scattering of PET is reduced at these points by the melt connection with the lower foil. The laser power is 10 watts at 20 mm/s feed rate.

Applications

TWIST is preferably used to generate thin seams in microfluidic components and to reduce the welding depth for ordinary 1 - 3 mm wide weld widths. The wavelength of 1567 nm is well suited to weld brilliant white pigmented polymers since such TiO₂-filled plastics have significantly higher levels of transmission at 1567 nm than at 1060 nm.

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3 300 micron PET film, transparent on black, TWIST-welded with 1567 nm fiber-laser radiation and three TWIST overlaps.