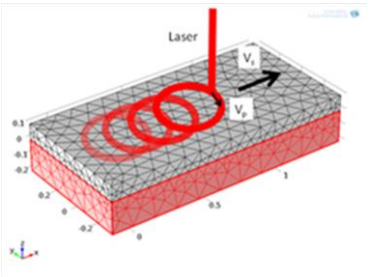
Highlight

Aachen,
August 23, 2012

Investigating TWIST method for laser polymer welding

Within PolyBright's WP4 the polymer welding process itself is under investigation. Within the frame of Task 4.2, the TWIST method is investigated by welding 1 mm PP step plates, PP T-samples with fiber laser radiation and measuring weld strength as well as heat affected zone (HAZ) shapes. The results are compared with mathematical simulations.

Figure 1: Fiber laser polymer welding using the TWIST method. A focused laser spot is superimposed with high speed relative to the welding contour



TWIST welding of 1 mm PP is carried out with fiber laser radiation and the weld strength is presented for TWIST circle contour and TWIST ellipse contour as function of laser power, see Figure 2.

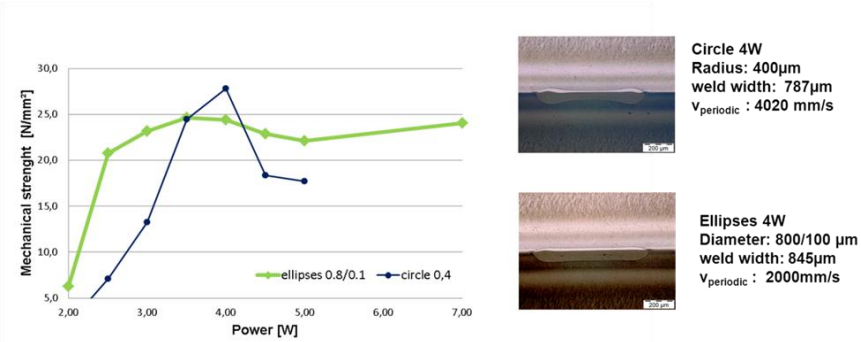


Figure 2: TWIST welding of PP, v=50mm/s, seam width 800µm with TWIST circle and TWIST ellipse.

The resulting weld seam widths are identical 0,8 mm, a broad process window can be observed when using the TWIST ellipse.

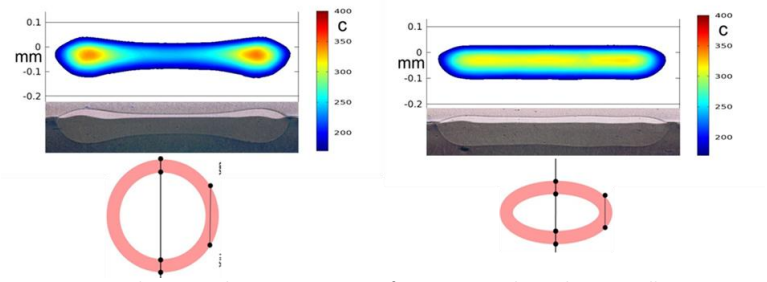


Figure 3: HAZ theory and HAZ experiment for TWIST circle and TWIST ellipse welding of PP

This corresponds to a higher HAZ homogeneity compared to TWIST circle as depicted in the microtome cuts of Figure 2.

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This experimental PP welding result is compared with a mathematical simulation, using identical welding parameters and thermo-mechanical PP data. The comparison is depicted in Figure 3, showing good accordance between computed temperature distribution and microscope images taken from a microtome cut of a welded PP flat sample. For a fixed laser spot (determined by the collimated beam and the scanner lens), the weld seam width can be homogeneously increased only by switching from TWIST circle to TWIST ellipse contour.

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