Highlight

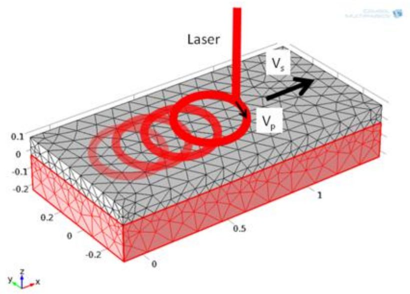
Aachen,
November 22, 2011

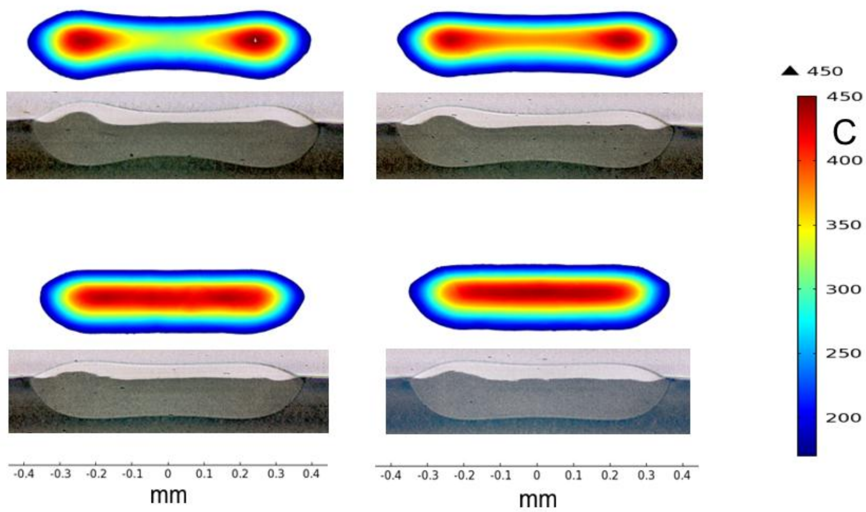
Computer Model calculating temperature distribution for TWIST Laser Polymer Welding

Based on the heat transfer equation as well as scattering of laser light within the upper joining partner, a computer model has been set up to calculate temperature distributions in TWIST laser polymer welding configuration to optimize the homogeneity of the heat affected zone and subsequently process performance.

To compare theory and experiment, TWIST welding experiments with 1µm fiber laser radiation have been carried out and the welding zone is analyzed by microtome slice cuts perpendicular to feed direction, showing the heat affected zone (HAZ) of both polymers. Welding tests indicate that a homogeneous HAZ leads to high strength and broad process range. Maximum homogeneity is achieved, if the TWIST contour is elliptical. The optimum ellipse's axes ratio depends on laser beam diameter, weld seam width and polymer. For 600 µm seam width in PP and 80µm fiber laser spot, homogeneity is achieved for 100/600µm axes.

Figure 1: Calculated temperature distribution (coloured) and weld seam cross sections for PP TWIST laser welding at P=4,5Watt, v=50mm/s, beam diameter 80µm.TWIST oscillation frequency 1000Hz (seeTWIST sketch below).
TWIST contour: ellipses with 600µm axis diameter lateral to weld direction and 600µm (upper left), 400µm, 200µm, 100µm axis diameter along weld direction





SEVENTH FRAMEWORK PROGRAMME

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