

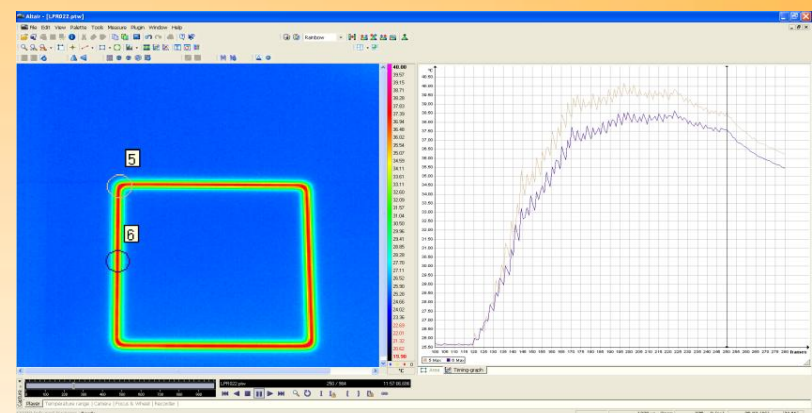
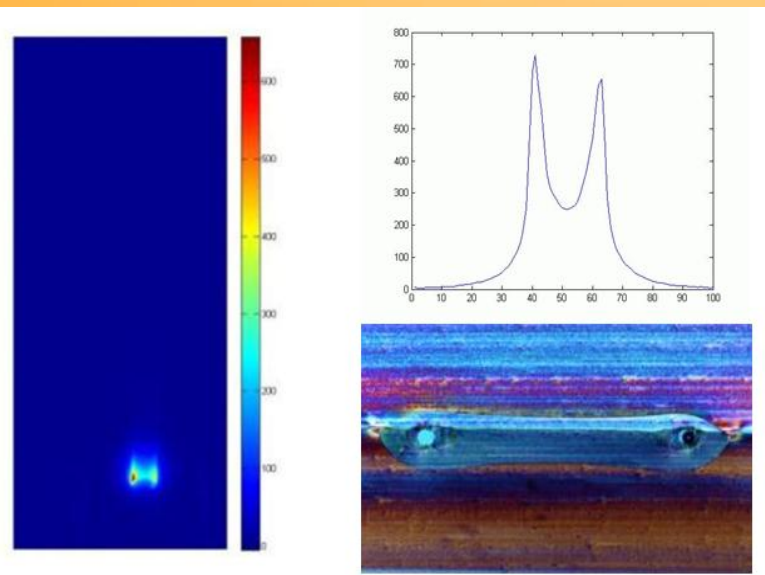


WP7 – QUALITY ASSURANCE AND PROCESS CONTROL FOR ZERO FAILURE MANUFACTURING



ABSTRACT

For laser polymer welding, the weld seam homogeneity is important for weld strength and process window width, cannot be measured by pyrometers, since there is no spatial resolution. A thermal camera is used to check the influence of welding parameters on the weld seam homogeneity.



Thermal camera signals and microtome cut for TWIST welding 6 W, TWIST axis = 0,4 mm, ellipse ratio 1/3)

QSLW weld imaged with thermal imaging during welding (left) and power-vs-time curve at A (right)

METHOD

In laser welding of polymers, 2D imaging through the upper joining partner by detecting heat radiation opens up the opportunity to get a qualitative representation of phenomena within the HAZ. It is the only method used with which a two-dimensional analysis of the energy input is possible. By computer post-processing, the data set of the camera can be represented graphically.

Regions of high temperature, where polymer decomposition is possible, can be located. The thermal 2D image provides signals that indicate processes inside the joining zone without providing an iterative detected temperature value.

Quantification of any temperature is not possible with accuracy. To assess the homogeneity of a welded joint the method provides useful information.

HIGHLIGHTS

Figure 1 shows on the left a typical image recorded by the thermal camera, which is printed with Matlab® using the data of the camera. On the upper right graphic, a cross section through the peaks of the highest intensity is visible. This cross section is an average out of 200 frames taken by the camera system during the process. Down right, a cut through the weld is shown, indicating the HAZ homogeneity of the weld. According to the pictures, it is obvious that the vision system gives information about the destruction of the polymer. Figure 2 shows similar imaging from the whole weld during QSLW welding at 327Hz.

OUTLOOK

Thermal camera imaging seems to be the only method for detecting 2D thermal data out of welds during welding. Due to high investment costs, an industrial application is reasonable only for selected applications.

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