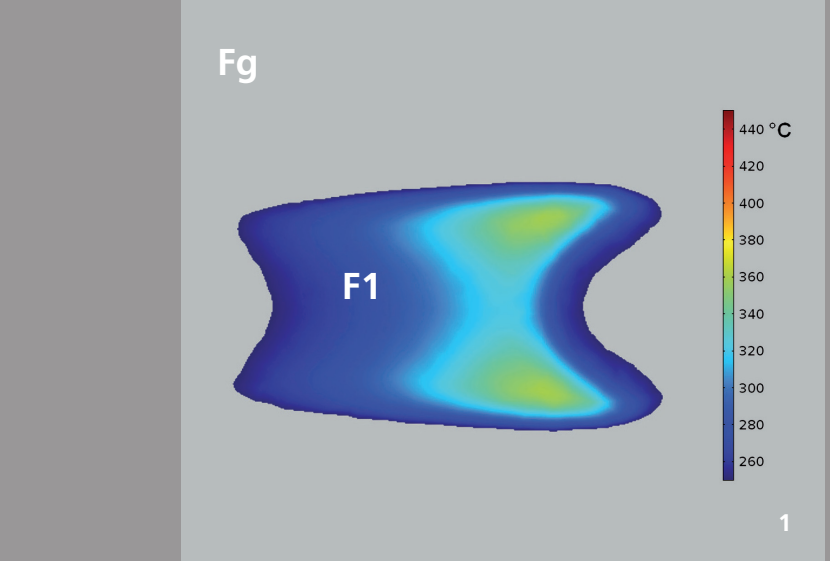

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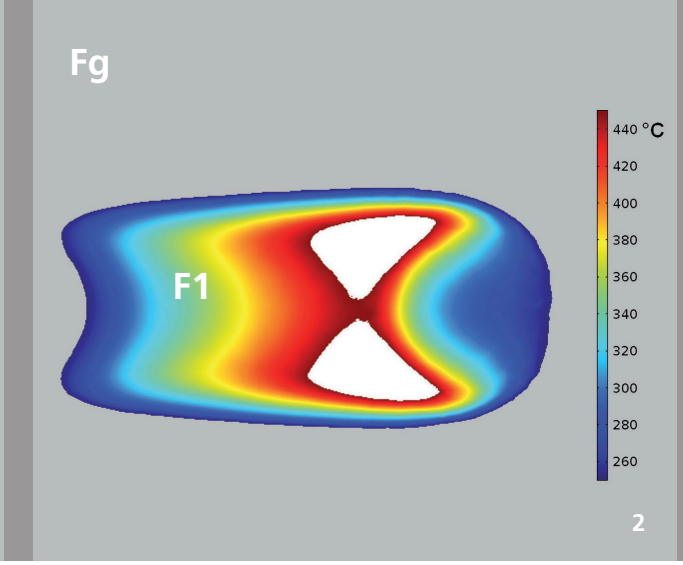


2

SIMULATION OF THE WELD STRENGTH OPTIMUM IN LASER WELDING OF POLYMERS

Task

The weld strength of a polymer joint depends, first of all, on the joint section of the seam. In particular, when polymers are welded with lasers, predicting this strength accurately is nearly impossible because the area of the molten zone depends on multiple factors, such as absorption, beam diameter welding strategy and others. To obtain the optimum weld strength for a given material and device geometry, extended experiments and analyses have to be performed.

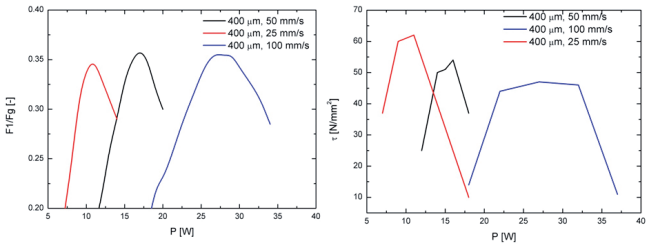
Method

Using a new simulation technique based on a combined simulation of radiation propagation and temperature development the current procedure can be reduced to a few verification trials. To do this, the weld strength is correlated with the thermal simulation results. The temperature field of the joining zone was calculated for the different experimental parameters. From this simulation, an area F1 of the joining is defined and calculated, where the temperature exceeds the melting temperature (250° C), but is smaller than the degradation temperature (450° C). This area corresponds to an optimum welding condition, thus providing the highest weld strength.

Calculated temperature fields for 2 different laser powers (Figure 1: 12 W, Figure 2: 17 W).

Result

The comparison of the measured weld strength and the area F1 shows a local maximum at the same laser power. The process parameter where the optimum weld strength is reached can be obtained by calculating the temperature field.



Applications

This new optimization approach can be used to plan and dimension laser polymer welding processes and to design the corresponding components.

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