SEGMENTAL QUASI-SIMULTANEOUS WELDING OF ABSORBER-FREE TRANSPARENT PLASTICS

Task

In the development of high-tech products, such as lab-on-a-chip systems, the laser welding processes used are facing steadily increasing requirements. For example, a homogeneous welding contour has to be generated while having a simultaneously low thermal load of the component, even with complex seam geometries. Furthermore, possible defects in the component should be detected during the welding process and possibly sorted out.

Method

As a technological approach, quasi-simultaneous welding is used with laser radiation, which is characterized, in comparison to contour welding, by a defined energy input in the joining area. The integration of a pyrometer guarantees a spatially resolved recording of the heat distribution. With the pyrometric temperature measurement, the entire seam contour is segmented into individual segments, making it possible to adjust the irradiation order and welding parameters per segment during the welding process. As a result, a heat accumulation and, thus, a possible distortion of the component are prevented in tight-fitting seam contours.

Results

The automatic segmentation of the seam contour has been implemented in an operating software prototype. The advantages of quasi-simultaneous welding could be proven with selected materials, both experimentally and by means of simulative investigations.

Applications

The focus of this process development is, in particular, on components from the field of microfluidics, since a gentle and precise melting of the plastic is required due to the high seam densities. In addition, the general trend towards miniaturization to ever more complex components opens up new application areas in the automotive, electronics and medical technology sectors.

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3 Individual components of a micropump (demonstrator component).