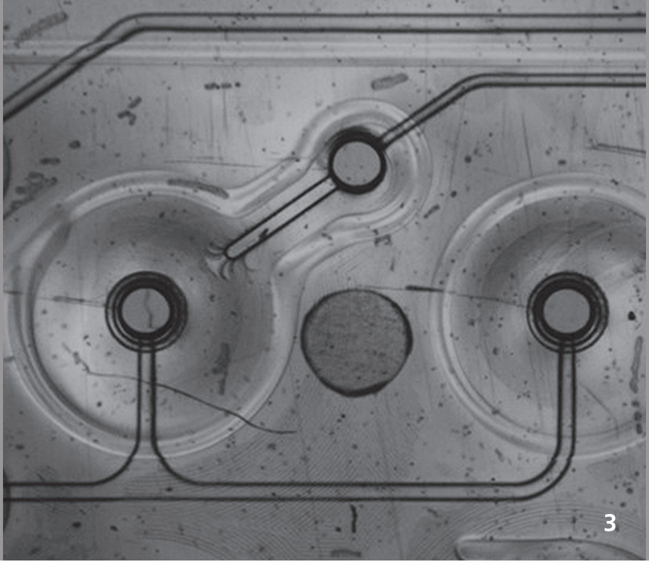

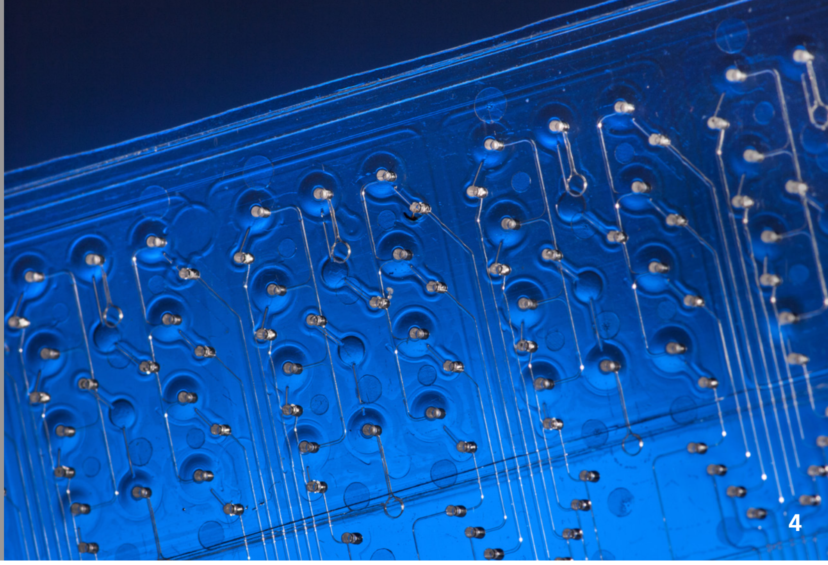

ENCAPSULATION OF MICROFLUIDIC CHIPS MADE OUT OF CYCLOOLEFIN COPOLYMERS

Task

Commonly used in the life science sector, among others, microfluidic chips make it possible to transport, mix and filter even the smallest amounts of liquid down to the picoliter range. These chips are commonly used as microreactors or blood glucose meters. Encapsulating the microchannels in a media-tight manner, however, poses a great challenge for conventional joining technology since the channels have such small structural dimensions in the micrometer range. Absorber-free laser transmission welding with beam sources in the NIR range opens up new perspectives here due to its high flexibility. By using short focal length focusing optics, Fraunhofer ILT is able to melt the plastic in a defined manner, which avoids excessive melt ejection and, thus, prevents blockage from forming in the channels themselves.

Method

In a joint project with m2p-labs GmbH in Baesweiler, Fraunhofer ILT welded the basic body of a microfluidic bioreactor to a film of cycloolefin copolymers (COC) in media-tight manner using laser transmission welding. A thulium fiber laser with an emission wavelength of 1940 nm is used as the beam source. In this wavelength range, plastics have a natural absorption, which means that absorber material, such as soot, does not need to be used. This way, the transparency of the component is not affected.

Results

The exact guidance of the laser beam along the channel structure ensures media-tight encapsulation. Since the seam width is only 150 µm, the thermal load on the component remains low. In addition, a thermal penetration depth < 1 mm also prevents damage to other channel structures on the back of the component.

Applications

In addition to the encapsulation of microfluidic components, absorber-free laser transmission welding is particularly suitable for applications where high transparency is required and absorbers cannot be used for biocompatibility reasons, e.g. in medical technology.

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3 Measurement of the seam geometry using a polarization microscope.
4 Tightly welded COC components.