
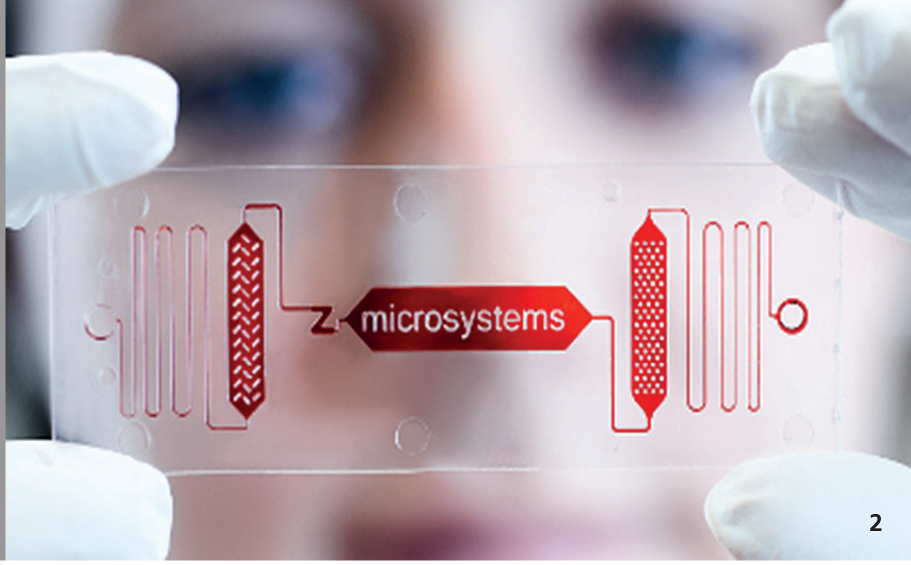

Subject to alterations in specifications and other technical information. 08/2018.

ABSORBER-FREE LASER WELDING OF MICROFLUIDIC COMPONENTS

Task

An essential element of most microfluidic components is the substrate. Special fluidic structures are embedded in it and ensure a defined transport of investigated fluids. After the preparation of the substrate, for example, by injection molding, the fluidic structures are initially open and must be closed with a cover layer (Figure 1). Since the substrates are small and often equipped with temperature- and vibration-sensitive components, only a few joining methods are able to securely connect the cover layer and the substrate without impairing the integrity of individual components. In principle, laser transmission welding is well suited for this joining task, but presupposes previously defined optical properties of the parts to be joined. These properties are adjusted by special absorbers, the use of which is often critical in analytical applications.

Method

A laser source is employed which exploits the intrinsic absorption capacity of the plastics so that laser transmission welding can be used generally or in analytical applications – those that place high demands on the hygiene and transparency of the parts to be joined. The selective deposition of the radiation energy is achieved by a sharp focusing of the radiation.

Results

Using a thulium fiber laser ($\lambda = 1.94$ µm), the institute was able to tightly seal the substrate and the cover layer, both made from a cyclic olefin copolymer (Topas®), without needing additives (Figure 2). Due to its high quality ($M^2 < 1.1$), the laser beam can be focused very small, so that parts can be welded – even in the interstices of close-fitting channels – without affecting the channel cross-section.

Applications

The method is particularly suitable for microfluidic applications in the field of analytics. There, the use of additives is critical insofar as they can interact when they contact the fluids tested in the component. In optical measuring methods such as fluorescence measurement, the actual measurement signal may be superimposed on the intrinsic fluorescence of the additives.

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1 Components of a microfluidic component before joining.

2 Tightly welded component filled with test fluid, source: z-microsystems.

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