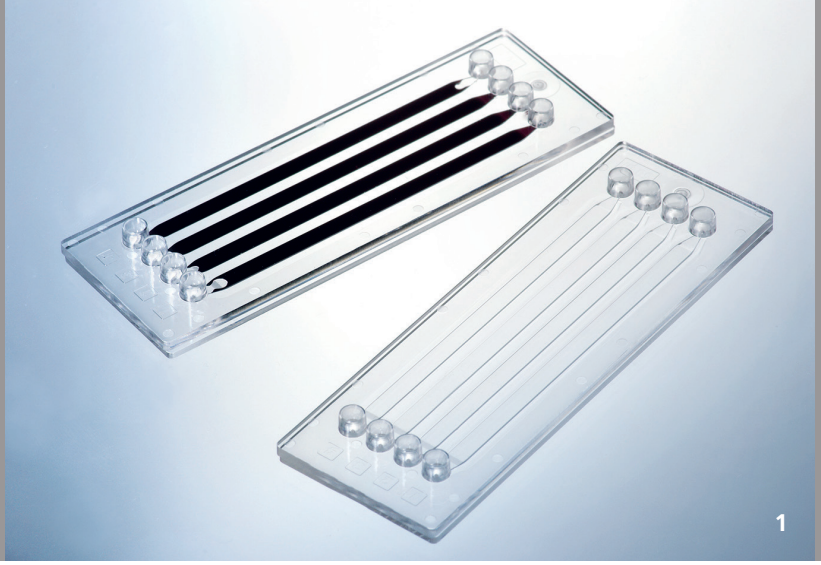

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MEDIA-TIGHT WELDING OF 50 µl REACTION CHAMBERS FROM TRANSPARENT POLY-CARBONATE

Task

Chips having the dimensions 1.5 x 75 x 25 mm, channel structures and made of transparent PC, PP, COC or COP polymers are widely used in analytics and microfluidics. The channels in them are made during the injection molding process; in the next step, adhesives are used to close them with a lid or a film. For approximately three years, laser radiation has been successfully tested to weld these chips, thereby providing an additional joining means with small, temperature-resistant, contour-adapted seams. The wavelength used is in the range of 2 µm, which exploits the intrinsic radiation absorption of transparent plastics. The challenge here is to encapsulate the microchannels in both a media-tight and damage-free manner.

Method

In a contact pressure device, the polycarbonate chip, which contains four reaction chambers each having a volume of 50 µl and a cross section of 2.8 × 0.35 mm, is welded along the individual chambers to a 1 mm thick polycarbonate cover by using a galvo scanner head. The wavelength of the thulium fiber laser is 1940 nm and the focal length of the F-theta focusing scanner lens 120 mm.

1 Media-sealed four-channel polycarbonate reaction chamber chip, channels 50 µl, 50 mm x 2.8 mm x 350 µm each.

Results

The seams could be produced at a laser power of 20 W and with the galvo scanner speed set to v = 15 mm/s. The focal depth of the laser beam is z_R = 4.3 mm due to the 5,5 mm raw beam diameter and the lens with 120 mm focal length. This is equivalent to a divergence half angle of only θ = 2.75 mm / 120 mm = 23 mrad.

Applications

Microfluidic chips with small channel spacing due to their complex structure often cannot be permanently bonded because high temperatures endanger the tightness of the adhesive bond. In these cases, NIR laser radiation can be used to seal the joint. If the upper joining partner has material thicknesses of about 1 mm, the focusing can be done with long-focal-length lenses and is thus resistant to changes in adjustment.

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