Highlight

Aachen,
August 14, 2012

Assembly design rules for laser beam welding of polymer parts with minimized energy

Within PolyBright's WP4 the laser process itself is under investigation, arranged in nine tasks mainly by the welding technique. Technical aspects which follow the use of new fiber and diode laser sources are important for the practical realization assembly design for fiber laser welding.

To choose the overlap or butt weld configuration for a certain polymer junction, the optical penetration depth has to be estimated and compared with material thickness. For this, the optical material properties must be measured, usually carried out using spectrometers. The penetration depth a can be estimated by measuring the material thickness d as well as transmission T and reflection R at a certain wavelength:

$$a = d / \ln [(1-R) / T] \qquad [m].$$

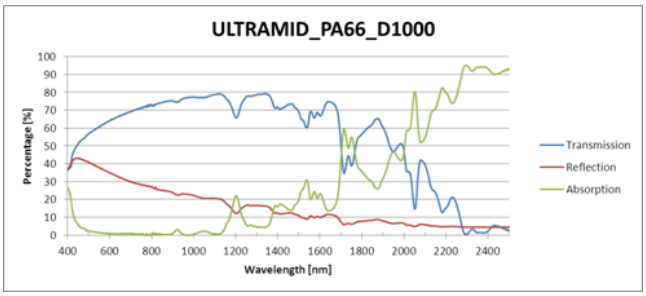
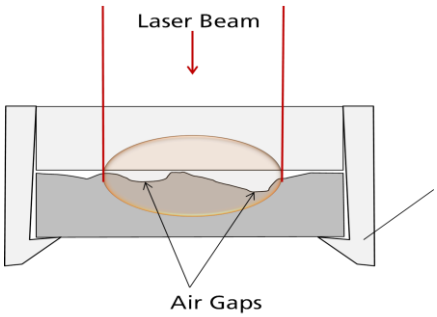
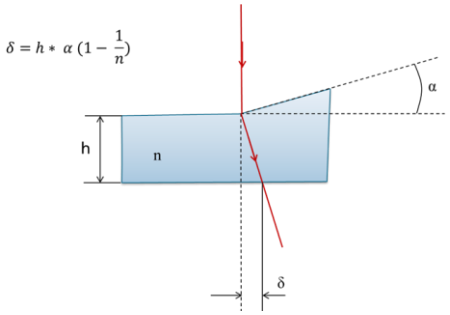


Figure 1: Principle of "snap fit" clamping to align two polymer parts prior to laser overlap welding. The snap fit ensures polymer expansion due to radiation absorption in the first step, almost closing the air gaps. Finally, laser welding is carried out in the second step.
This arrangement is intended to be used for spot welding applications.





The phenomenon of beam deflection by wedge-shaped upper parts takes place for welding microfluid parts. This holds for each

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welding means, even for mask welding purposes and it is recommended to avoid wedges. If gaps between joining partners cannot be avoided or reduced by mechanical means prior to the welding process, a proven means to overcome this disadvantage is multiple welding along the weld seam; practically two-fold welding is sufficient. To realise multiple welding, the joining partners are clamped during the first welding run by a snap fit to keep partners in position. After this run is completed, the snap fit is physically still present but doesn't fulfil a clamping anymore as this is now taken over by the welding zone

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