Laser welding systems

Welding of parts / materials
GEFASOFT provides different kinds of laser-welding-systems. Depending on your request, we have the proper system for your necessities.

Laser welding of plastics
First of all the welding of plastics can be divided into 2 different processes? the laser butt welding and the laser transmission welding. During the laser butt welding two laser absorbing materials are butt joint welded with by applying pressure. Although the laser energy can be applied together with the force at one time or seperately the laser and the force after another. Is the material melted first and joint by force after that, one can call this transition phase.
Because the laser butt welding is limiting the product design a lot, this process is less important for industrial solutions. However the leading process is the laser transmission welding, in which the product consists of a transparent and an absorbing join partner. Thereby a percentage of the laser energy passes the transparent join partner and finally couples into the absorbing partner completely. This kind of process can be divided again into the so called contour welding, mask welding, Simultaneous welding and Quasi simultaneous welding.

Contour welding
Using the contour welding the welding contour is followed only one time with a low speed. The force introduction is performed locally at the same place and time as the lighting by the laser. Because the laser beam needs to be moved only slowly, the process is suitable especially for complicated welding geometries and can be used in a flexible way. Because of mechanically moving the laser together with the clamping element, the realization for example with a robot is quite cost-intensive. A serious disadvantage of this process is, that there is enforced tensioning to the material due to the local force and energy introduction. A typical application is the welding of rear lights in the automobile industry.

Mask welding
Mask welding works with a plane exposure or a moving laser line. Thereby the radiation besides the welding contour is absorbed by a mask. Due to the homogeneous and simulations heating of the welding area, short process times can be realized. A disadvantage is the need of much energy which also requires a powerful laser source and a complex cooling of the welding mask. Furthermore this process is less flexible, because it is not possible to modify the application of energy locally. If the welding geometry needs to be changed, the welding mask needs to be modified.

Simultaneous welding
A very popular process in the past is the simultaneous welding. Thereby the welding contour of the product is lighted from many laser sources simultanously. Typically this is realized by many optical fibers, which are placed directly above along the welding contour.
Again this process can achieve especially short process times, because of the homogeneous and simulations heating of the welding area. The implementation of such welding tools is quite complex, inflexible as well as maintenance and cost-intensive.

Quasi-simultaneous welding
The quasi-simultaneous welding is most modern, most flexible and in many cases the cheapest laser welding process. Because of this, the laser welding of plastics is getting more and more important for the industrial manufacturing and replaces conventional joining technologies in many fields.
In this process the laser beam is moved by a scanning system or Galvo head. Thereby the welding contour is running fast and many times in a row. The result is an almost homogeneous temperature along the welding rip at all times.
The exposure is performed quasi-simultaneous.
Because the welding contour is set in software only and the laser parameters can be adjusted locally along the contour, the process can be used very flexible. Furthermore the initial costs for a system like this are comparatively low. This is the reason, why this is GEFASOFT’s preferred process.
Compared to the simultaneous welding and mask welding, the process time can be longer, but the real process time can be reduced by a proper product design or other methods in most cases.

Advantages
Contactless energy input
Flexible welding geometries
Good possibilities for automation and integrability
Optical high-quality welding seam
Material properties remain after welding
No material consumption (e.g. glue)
No vibrations

Metal welding

Basicly, the Laser-metal-welding can be devided in heat-conduction-welding and deep-penetration-welding. With heat-conduction-welding, up to 1 mm welding depth is possible. Using a more powerfull lassource results in metal vapor that increases the welding depth and turns the process into deep-penetration-welding.

Both procedures can be used to realize random geometries with highest precision. Compared to conventional processes, the warpage of the material is minor through the small heat-affected-zone. Laser-metal-welding is usually performed by direct diode- or fiberlasers. Inert gas protects the welding seam from corotion.

Media

Machine models

During the last years GEFASOFT has developed 3 standard laser welding machine concepts, based on former customized machines. These machines fulfil most of the requirements in application and integration.

**Shutter**

exchangeable tooling set (consisting of one fixture and one clamping tool)
working area up to 450 x 250 mm
automatic shutter door (protection against moving press and radiation)
compact layout (1400 x 940 mm)
all devices (laser, cooler, etc.) are integrated

PDF Datasheet can be downloaded [HERE](#)

**Rotary table**
rotary table with two stations
loading/unloading station
welding station (further stations possible)

two fixtures, one clamping tool (exchangeable)
optimized cycle time
working area up to 450 x 250 mm
duration for rotation of 180°: 1.5 s
protection due to light curtain and partition
compact layout (1500 x 1200 mm)
all devices (laser, cooler, etc.) are integrated

PDF Datasheet can be downloaded [HERE]

Conveyor

ideal for small products and high quantities
carriers are transported on a conveyor
several stations possible (e.g. laser welding, optical inspection, MES, laser marking, etc.)
exchangeable carriers and clamping tool
optimized cycle times
product size up to 100 x 100 mm possible
compact layout (1800 x 930 mm)
all devices (laser, cooler, etc.) are integrated

PDF Datasheet can be downloaded [HERE]

Media