

Laser beam welding with high power diode lasers

Task

There are several examples where small metal parts cannot be weld joined satisfactorily, neither with conventional welding nor with CO₂- or Nd:YAG-laser beam welding, as, for example:

- butt seam of very thin sheets,
- parts with much differing thickness,
- materials inclined to crack formation,
- parts with complex 3D-shaped, joining faces.

In addition to these restrictions, CO₂- or Nd:YAG-laser beam welding requires rather precise preparation of the joining faces.



Fig. 1: Welding of a Cr-Ni-steel tank with 2,5 kW diode laser

Solution

High power diode lasers provide the key to the solution of the above problems. They are currently available with about 1,2 · 1,2 mm² spot size and power up to 4 kW, which makes them well suited for narrowly localized and controlled welding. Larger seam width compared to depth enables wider gaps to be bridged even without feed wire. Lower cooling rates and hence lower residual stresses extend the range for crack-free joining of hardenable steels.

Technological Data

- Beam power up to 4 kW
- Wave length 940 nm + 808 nm
- Minimum spot size 1,2 · 1,2 mm²
- Effectivity 40 % at 100 % power output
- Size 500 · 180 · 150 mm³
- Mass about 10 kg

Advantages

In addition to the technological advantages mentioned above there are advantages concerning economy and plant layout:

- 3- to 10-fold increased energetic efficiency,
- Low running cost,
- Extraordinarily compact shape,
- Excellent compatibility with robots, machine tools, and working stations.

Fraunhofer Institute for Material and Beam
Technology IWS Dresden

(Fraunhofer-Institut für Werkstoff- und
Strahltechnik IWS Dresden)

Winterbergstr. 28
01277 Dresden
Germany

Contact partner

Prof. Dr. Berndt Brenner
Phone +49 (0) 351 2583 207
E-mail berndt.brenner@iws.fraunhofer.de

Dr. Steffen Bonß
Phone +49 (0) 351 2583 201
E-mail steffen.bonss@iws.fraunhofer.de

Fax +49 (0) 351 2583 300
Internet <http://www.iws.fraunhofer.de>

Examples of application

The following examples are to indicate the potential field of application of high power diode lasers:

Offer

- Feasibility studies for laser beam welding of various materials and parts
- Development of technologies
- Building of pilot plants
- Development of systems in cooperation with our corporate partners

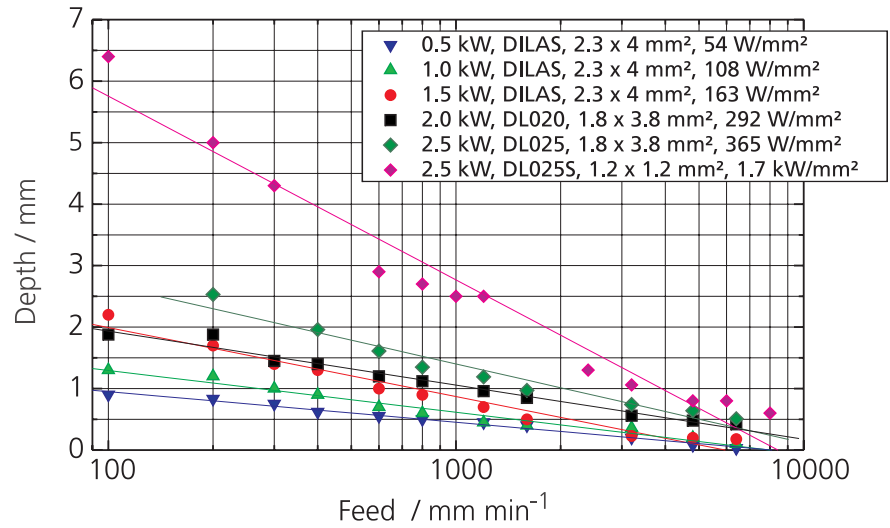


Fig. 2: Welding plot for mild steel: seams on 6 mm and 10 mm sheet

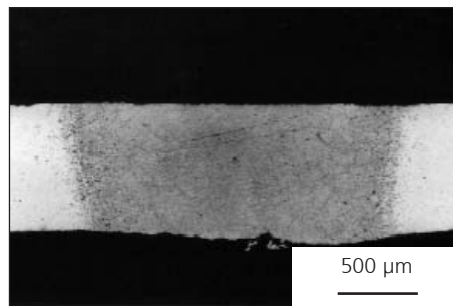


Fig. 3: Welding of aluminum thin sheet with very smooth seam



Fig. 4: Welding of steel tanks without filler

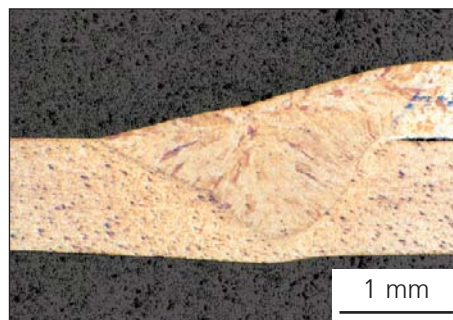


Fig. 5: Sealed lap joint as a precaution against corrosion

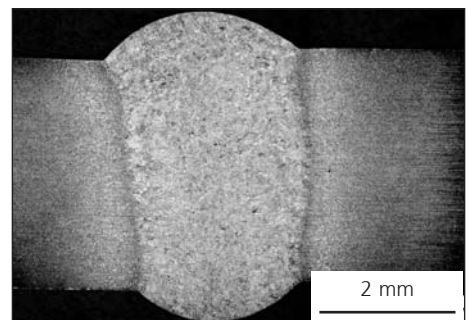


Fig. 6: Deep welding with filler, Cr-Ni-steel, 3mm-sheet, feed rate 120m/min