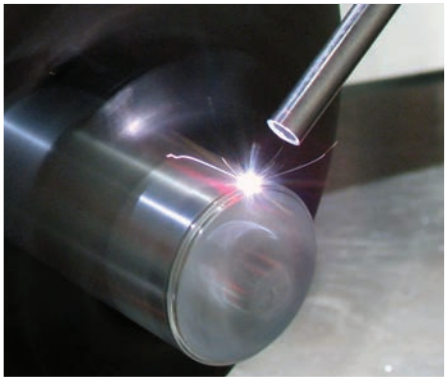


Micro Laser Welding



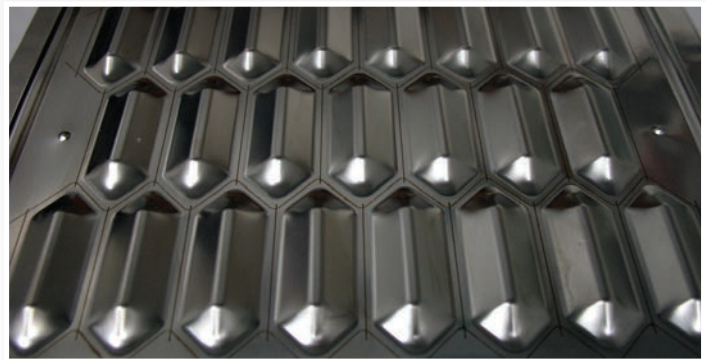
Laser Micro Welding

Weld penetration depth, surface width and interface width are precisely controlled by the energy density, peak power intensity and duty cycle. Pulse shaping is used to prevent defects at weld start and stop positions. An inert shield gas atmosphere can be provided to meet stringent weld requirements for high quality/ low oxidation.

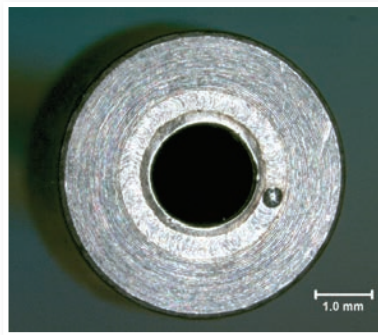
Very fine weld feature sizes ($<50 \mu\text{m}$) can be achieved in thin materials (down to $25 \mu\text{m}$ thickness) with reasonable gap tolerance. Both similar and dissimilar metals have been welded successfully. Very high welding speeds ($>60 \text{ m/min}$) have been achieved for welding of thin stainless steel materials.

AREAS OF EXPERTISE

Laser micro welding is conducted using a combination of small focus spot size ($< 50 \mu\text{m}$) and high peak power. Continuous wave single-mode fiber laser, and pulsed Nd:YAG and disk laser sources are available at Fraunhofer for seam and spot welding applications.



Laser Micro Welding of Stainless Steel Sheets



*Surface of Stainless Steel Tube
Microweld*



*Weld Section Produced on
Stainless Steel at 50 m/min*

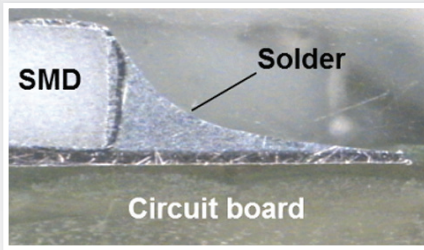
ADVANTAGES

- Welding of heat sensitive parts
- Small heat affected zone and low distortion
- Very small weld sizes
- Welding of dissimilar metals
- Hermetic sealing

APPLICATION EXAMPLES

- Seam welding of medical tubes
- Packaging of thermal batteries
- Sealing of platinum electrode pads
- Spot welding of electrical battery joints
- Medical implant joining
- Welding of highly reflective material (gold, silver, copper)

Laser Soldering

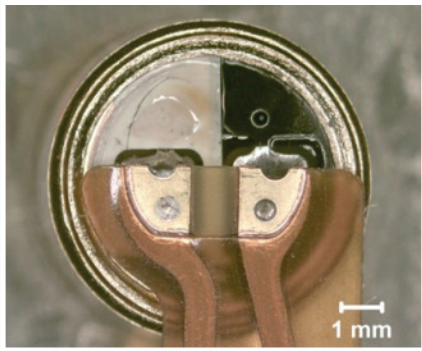


Cross-section of Laser Soldered Joint

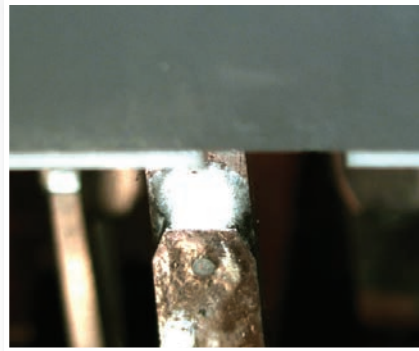
AREAS OF EXPERTISE

In laser soldering, the laser beam provides controlled heating of the solder material and joint area which causes solder to reflow and form the joint.

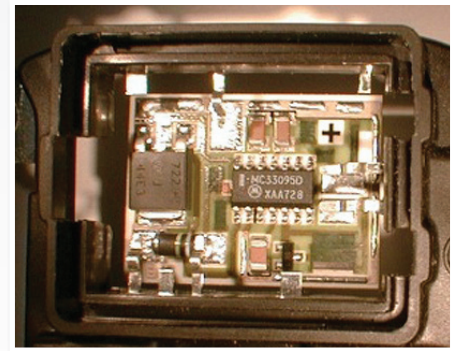
Fraunhofer has suitable laser sources with small spot sizes (down to <0.1 mm) and can perform high quality soldering using lead based and lead-free solders. Tailored heat cycles by laser pulse shaping are available. Special laser soldering heads have been developed for custom power electronic board soldering.



Laser Soldered Mobile Phone Electronic Component



Laser Soldered Joint for Automotive Power Electronic Board



Laser Soldered Components of Automotive Power Electronic Board

ADVANTAGES

- Odd shaped parts which have joints that are not easily accessible with a reflow solder system.
- Applications that provide a sealed receptacle, such as small SMD circuit boards
- Heat sensitive electronic parts which cannot be soldered in a reflow oven
- Service of electronic circuit boards due to the high flexibility of the laser soldering system
- Joining fine wire bonds as small as 150 μ m replacing conventional silver-epoxy bonding.

APPLICATIONS

- Soldering of electronic power boards
- Miniature solder joint prototyping
- Heat sensitive electronic parts
- Selective soldering