Fraunhofer
USA
Center for Laser Applications

Laser Plastic Welding

Laser Welded Automotive Display

Colored Flexible Plastic Coupons

AREAS OF EXPERTISE

We have more than 15 years of experience in developing laser plastic welding processes for welding of both amorphous polymers such as PS, PC, Acrylics and semi-crystalline polymers such as Nylon, PE and PP. The unique capabilities of laser processing has solved some of the problems associated with conventional plastic joining such as poor surface finish and requirements for special venting of gases produced during Joining. The laser process offers improved sealing capability with good joint strengh and fast cycle times.

For laser plastic welding to work, the upper part should have high transmission properties for the selected laser beam wavelength while the lower part should have higher absorption properties to facilitate heating the interface. The weld is "hidden" between the two overlapping plastics without effecting the part surface.

ADVANTAGES

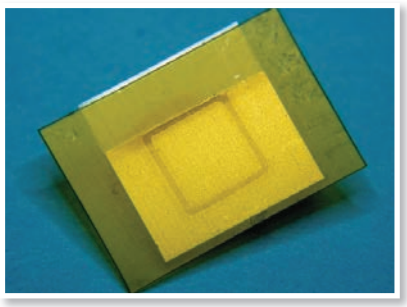
- Bonding of dissimilar materials
- Excellent joint appearance
- Low heat input resulting in less distortion of welded parts
- High joint strength and high burst pressure for sealed joints

APPLICATIONS

- Plastic manifold welding
- Automotive part packaging
- Microfluidic parts welding
- Electronics packaging for heat sensitive components

METAL-TO-POLYMER BONDING

Fraunhofer has thoroughly investigated and developed a unique laser bonding process for joining of dissimilar materials. Biocompatible polymers such as polyurethane or polymide can be laser bonded to titanium or stainless steel. Laser heating has high spatial and temporal control to maintain the critical specific bonding temperature required to establish chemical bonds between the materials and to avoid degradation of the polymers.



Metal-to-Polymer Bonding

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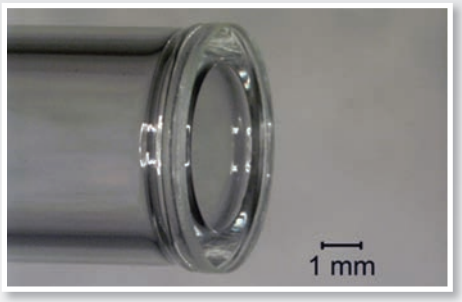
Laser Glass Welding

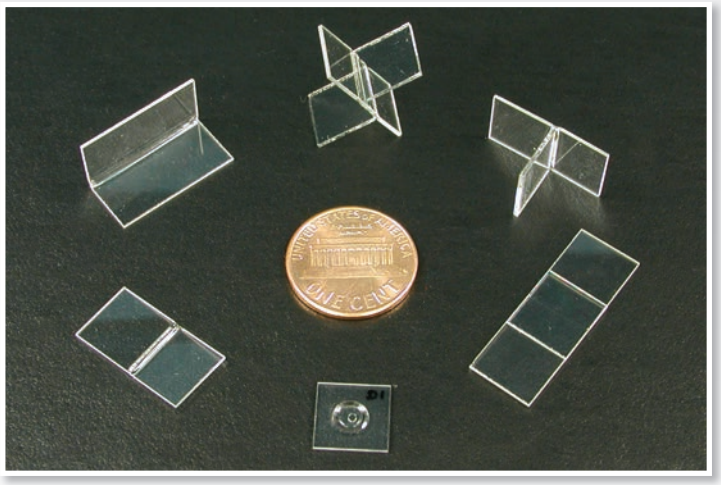


Laser Welding of Glass Tubes

AREAS OF EXPERTISE

Laser welding of glass has been developed for borosilicate glass using CO_2 laser. Due to the crack susceptibility of glass, the process requires careful development.

Two measures are applied to reduce the risk of cracking in laser welding without having to preheat the entire sample. First, welding is performed with a defocused beam to reduce the temperature gradient within the heated zone. Second, a multiple scan strategy with high speed is selected to evenly heat the material along the joint line. Also, in some applications, pre and post-heating are effective countermeasures.

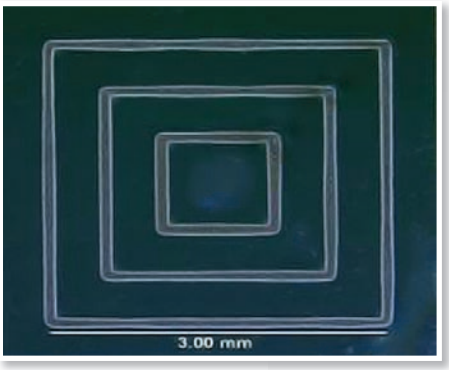


Laser Welded Glass Wafers in Different Joint Configurations

A number of joints such as butt, penetration overlap, T- and fillet edge joints have been successfully achieved. Cross-sections of welded joints show a very smooth transition between the joined glass wafers. Joints have been tested positively for hermetic sealing. Localized welding of glass with high surface quality has been achieved.

APPLICATIONS

- Localized joining
- High sterile surface quality
- Hermetic sealing
- Non-contact



Glass to Silicon Bonding

GLASS-TO-SILICON BONDING

Localized laser bonding of glass-to-silicon has been successfully established using low power Nd:YAG and diode lasers. Compared to anodic bonding, no voltage or area heating is required to facilitate the bonding process.

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