

Micro Part Manufacturing Technology with Laser Glass Direct Bonding and Laser-induced Selective Etching

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- ⇒ Laser glass direct bonding: Laser sealing technology where two glass plates are directly welded without adhesive to seal
- ⇒ Laser-induced selective etching: creating micro 2.5D/3D structures by maskless laser direct patterning of desired patterns on the transparent brittle plate such as glass plates (fused silica, borosilicate) or sapphire followed by laser-induced selective etching with the area where laser is irradiated

Client / Market

- Device manufacturer requiring alternatives to MEMS process
- Medical device and component manufacturer
- Display, aerospace, sensor device manufacturer

Necessity of this Technology

- Existing glass bonding technology:
 - The existing technology using glass frit between two glass plates to bond and melting the frit with laser leads to significantly lower bond strength compared to direct bonding of the plates as moisture and air can penetrate the gap between the plates where the frit has been applied.
 - It is difficult to apply the conventional method of heating the entire area for bonding if the plate has patterns that are vulnerable to heat.
- Laser-induced selective etching:
 - It is difficult to drill a micro through hole of high aspect ratio on brittle materials like glass and quartz plates using mechanical machining.
 - Also, it is impossible to form a 3D embedded channel inside the plate.
 - Micro machining with laser ablation requires expensive high-powered system, and to adjust the taper angle, expensive trepanning optical system is required.

Technical Differentiation

- Laser glass direct bonding:
 - This technology uses tightly focused ultrashort pulsed laser beam to instantaneously melt local zone of the glass plate to directly bond the interface of two glass substrates, and it does not require adhesive, frit, or absorption layer, which means clean bonding and the bonded area remains transparent.
 - The bond strength is superior than bonding with heterozygous materials.
 - The size of welding seam from bonding is only dozens of micrometer and following the pre-machined pattern on the plate surface, bonding can be done locally with the direct writing method. Heat-sensitive device and circuit are protected while welding around the pattern.
- Laser-induced etching:
 - This technology uses less energy than ablation that it can be run with low-power laser system. The depth of machining on the transparent plate is determined by the focus point that various shape of 3D structures can be manufactured.

DESIRED PARTNERSHIP

Technology Transfer

Licensing

Joint Research

Other



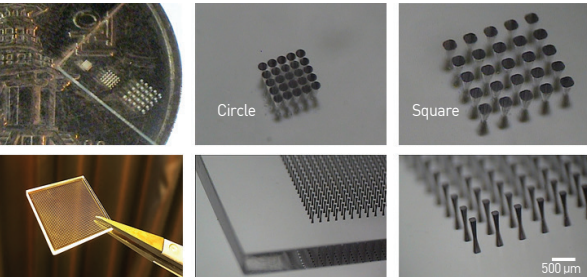
TECHNOLOGY READINESS LEVEL [TRL]

- Research, basic explanation
- Project concept or idea development
- Technology idea verification
- Prototype development
- Trial product production/evaluation in similar environment
- Pilot field demonstration
- Development and optimization of commercial model
- Commercial product demonstration
- Mass production and initial market launch

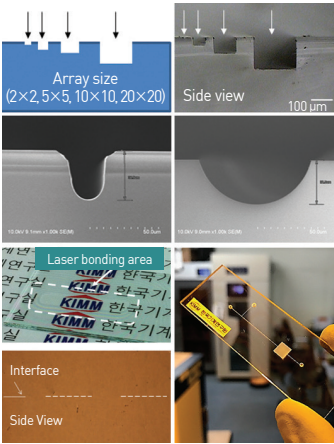
Excellence of Technology

- Laser glass direct bonding:
 - Enables hermetic sealing of MEMS components and organic component vulnerable to air and moisture
 - Possible to manufacture implantable subminiature sensor and medical components as the device can be manufactured using bio compatible glass-without using harmful adhesive
- Laser-induced selective etching:
 - Possible to process a through hole, blind hole with high aspect ratio through selective etching (aspect ratio over 1:10)

Manufacturing Through Hole Arrays with Laser-Induced Selective Etching on a 2 mm-thick Glass Plate



Lab-on-a-Chip Made with Laser-Induced selective Etching and Laser Direct Bonding Technology



Current Intellectual Property Right Status

PATENT

- Bonding Method of Multiple Member Using Ultra Short Pulse Laser (KR1453855)
- Bonding Device Using Laser and Bonding Method of Multiple Member Using the Device (KR1528344)

KNOW-HOW

- Ultrashort pulsed laser-induced glass selective etching technology (ultrashort pulsed laser direct writing technology and maskless etching process know-how)
- Ultrashort pulsed laser glass direct bonding know-how
- Bond strength and quality assessment know-how