

Aqlaser, Changing the World with Light

About the Company

Aqlaser is a venture-certified company founded in 2016 currently operating headquarters and research centers in Daejeon and Anyang and Seongnam, Gyeonggi-do.

Aqlaser specializes in laser-based semiconductor bonding machines by pursuing the highest level of accuracy and quality. Aqlaser has 16 experts with 18-30 years of experience in the fields of laser, optics, machinery and software processes, and operates laser bonding and cutting machines used for manufacturing advanced semiconductor packages. In particular, Aqlaser holds 10 patents related to large-area high-power optical systems for laser bonding and bonding and cutting technologies and equipment, and completed the application for more than 20 patents.

Background

The conventional methods of semiconductor package bonding are hot air application (mass reflow) and thermal compression with ceramic heaters. However, the conventional convection oven heating heats the entire product and causes serious warpage. Moreover, thermal compression bonding with a ceramic heater is difficult to apply to ultra-precision bonding of 1-2um or less and fine pitch bonding of 30um or less.

The advanced packaging market is going through the following changes and trends.

1. Heterogeneous integration (HI) packaging technology: capable of manufacturing multi-functional small form factors (structures) with excellent electrical and thermal performance

2. The semiconductor industry's shift to a multi-functional and highly-integrated device manufacturing paradigm to produce low-power and high-performance products: competition intensifying in HI packaging technology where boundaries between front-end and back-end processes are ambiguous.

3. Advanced packaging technology market expected to grow in the future: 2.5D/3D additive manufacturing technology is expected to grow 27% annually despite the current share of 5-6% in 2020.

4. Major developed countries actively supporting the development of back-end packaging technologies: need to encourage comprehensive businesses centered on back-end processing → Intel, TSMC, AMD, and Samsung installed advanced packaging (AVP) teams and SK Hynix established specialized departments (market expected to blossom in 2025)

About the Product

All semiconductor components existing in the world need electricity for operation. For that, the printed circuit board (PCB) and the semiconductor chip are thermally bonded using a bonding material (mainly metal). To overcome the limitations of conventional hot air ovens and ceramic compression bonding machines, Aqlaser in line with the latest developments in advanced semiconductor packaging has developed a technology that enables selective bonding of connecting only the required areas and devices by adjusting the bonding size.

In particular, Aqlaser's technology is differentiated by the ability to adjust the distribution of laser energy, enabling a more uniform temperature distribution during the process compared to conventional laser technology. Currently, the beam can be extended from 8 mm to over

300 mm (12 in.), and the laser output can reach up to 20 kW.

Aqlaser's products include a laser-assisted bonding machine for mass production and a laser thermal compression bonding machine for ultra-precision and 3D bonding. Developed in 2014 and continuously upgraded, Aqlaser's LAB machine is noted as an alternative processing system that resolves the shortcomings of existing processing technologies. The company has developed its laser TC bonding machine since 2012, which has emerged as an effective solution capable of tackling the problems of existing semiconductor circuit miniaturization processes involving AI, GPU, flip chips, and 3D additive structures.

Competitive Edge and Business Strategy

The main strength of Aqlaser's product comes from its ability to minimize thermal deformation compared to conventional technologies. It is an optimal solution for refining the process precision and enabling miniaturization as it can bond by selectively applying heat/pressure only on the required devices and areas, rather than heating the entire product.

Aqlaser's technology is eco-friendly as it reduces power consumption by more than 20% compared to existing technologies, and the product size is also reduced by more than 50%.

The company's competitive advantage lies in the management's high expertise in semiconductor bonding and the ability to provide customized solutions based on the various processing technologies it has already acquired. Aqlaser's own optical engine technology, which is optimized for the process, also brings a major advantage. By strategically collaborating with a global foundry (IDM) and an outsourced production company (OSAT), Aqlaser plans to run field trials and create references and standards for successful market entry.

Future Plans

In Korea

- Cooperation with an affiliate of Korea's major company

specializing in semiconductor display

- Signing of a memorandum of understanding for cooperation on building laser application facilities for advanced semiconductor packaging in North America
- Collaboration for partnership with a global semiconductor manufacturer operating in North America
- Joined as a member of a material parts and equipment association
- Negotiating with Korea's major display manufacturer for development of a laser bonding process
- Development of micro-LED laser bonding processes and equipment

Worldwide

- Cooperation with a global semiconductor manufacturer/investor operating in North America
- Working toward a partnership for investment and market entry
- Cooperation with a global semiconductor manufacturer operating in North America
- Testing in process for next-generation advanced semiconductor packaging
- Cooperation with a Taiwanese semiconductor packaging manufacturer
- Testing in process for next-generation advanced semiconductor packaging
- Cooperation with a Chinese micro-LED packaging manufacturer
- Selling and evaluating a wafer-level laser-assisted bonding machine

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* The opinions expressed in this article are the author's own and do not reflect the views of KOTRA.