



LASER-INTEGRATED BONDING MACHINE FOR HEAVY RIBBON BONDING

Task

In power electronics systems, bond connections constitute the central electrical connection between the semi-conductor elements as well as between the substrates and connection terminals. These bond connections are responsible for the reliability and operational readiness of the drive of electric vehicles. Within the scope of the project funded by the Federal Ministry of Education and Research (BMBF) »Robust Bonds in E-Vehicles«, the Fraunhofer ILT developed, along with partners, an alternative laser-based process for creating these bonds without ultrasonic welding.

Method

For this, laser beam micro welding is used as the actual joining process. In particular for copper materials, it creates more possibilities for the use of the bonding technology. Based on the use of modern laser beam sources with very good beam quality, this process can join copper and aluminum materials very precisely and reproducibly. In addition to the design of the connection zone between the wire and ribbons, the laser process is expanded by the addition of an oscillation welding process, which reaches higher bonding powers in comparison to joining without oscillation. In contrast to conventional ultrasonic bonding, surface quality and cleaning processes are less exacting. In addition, the process is less dependent upon the substructure and vibration behavior.

Result

To combine the laser beam bonding process with the well-known bonding technology, a conventional bonding machine was equipped with a laser welding unit. This allows joints to be made by means of quickly scanned laser radiation. The primary use of this plant is ribbon bonding, among others, of DCB substrates and copper terminals in the housings of power electronics.

Applications

Particularly in the sector of power electronics, but also wherever high currents have to be transported over small connections, as, for example, in battery technology, the use of copper ribbons is being tested as a powerful alternative to aluminum ribbons. In this context, laser beam micro welding creates new possibilities for such bonding needs.

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3 Bond head of the »Laser Bonder«, consisting of bonding tool and optic head.

4 Laser-welded Cu ribbon on DCB substrate and terminal.