

## Method and Device for Bonding Chips

The invention relates to a method and a device for bonding chips.

Chip-to-wafer (C2W) or chip-to-chip (C2C) processes are described in the prior art via solder balls or copper pillars with solder caps. However, the solder balls or copper pillars with solder caps, respectively, are extremely large and increase the thickness of the chips produced in this way.

Embodiments of the invention disclose an improved bonding method or an improved bonding device, respectively, or an improved product, respectively. According to an aspect of the present invention, there is provided a device for bonding chips onto a semiconductor substrate or further chips, wherein the chips can be bonded onto the semiconductor substrate or the further chips by means of a direct bond, and wherein a bond head bonds the chips onto the semiconductor substrate or the further chips such that the chips are bonded at first in the center and then to the outside, wherein the device includes a fixing device for convexly forming a chip due to mass inertia so that the center of the bond surface of the chip contacts the semiconductor substrate or the further chips, an ejector device with depressions for positioning and/or fixing the chips, and a mask with an aperture, wherein the mask can be moved across the ejector device, which is located with the chips, until the aperture is located above the chip, which is to be bonded next.

All combinations of at least two features specified in the description, the claims and/or the figures also fall within the scope of the invention. In the case of specified value ranges, values within the mentioned boundaries shall also be considered as being disclosed as threshold values and shall be capable of being claimed in any combination.

According to embodiments of the invention, provision is made for a method for bonding chips onto a substrate, in particular semiconductor substrate, or onto further chips, wherein the chips are bonded onto the substrate or the further chips by means of a direct bond. A direct bond is understood to be a bond, which forms directly via the interaction of two surfaces, without forming a liquid phase. According to another term definition, a direct bond is understood to be a bond, in the case of which no additional materials need to be used. A direct bond is in particular understood to be a metal-metal solid body bond, in particular diffusion bond, a prebond or a fusion bond resulting from the prebond, respectively, or a hybrid bond, i.e. a bond, which is based on fusion bond portions and metal bond portions.

According to embodiments of the invention, provision is furthermore made for a device for bonding chips onto a substrate or further chips, wherein the chips can be bonded onto the substrate or the further chips by means of a direct bond.

## CLAIMS

1. A device for bonding chips (7) onto a semiconductor substrate (11') or further chips,

wherein the chips (7) can be bonded onto the semiconductor substrate (11') or the further chips by means of a direct bond,

wherein a bond head (9) bonds the chips (7) onto the semiconductor substrate (11') or the further chips such that the chips (7) are bonded at first in the center and then to the outside,

wherein the device comprises

a fixing device for convexly forming a chip (7) due to mass inertia so that the center of the bond surface of the chip (7) contacts the semiconductor substrate (11') or the further chips,

an ejector device (1, 1') with depressions (2) for positioning and/or fixing the chips (7), and

a mask (23) with an aperture (24), wherein the mask (23) can be moved across the ejector device (1, 1'), which is located with the chips (7), until the aperture (24) is located above the chip (7), which is to be bonded next.

2. The device according to claim 1, wherein lead-throughs (3), in particular holes, are located on bottom surfaces of the depressions (2), wherein a lifting device (4) can lift the chips (7) through the lead-throughs (3) to make the chips (7) accessible for a gripper (5).

3. The device according to claim 1, wherein a depth (t) of the depressions (2) corresponds to a height of the chips (7).

4. The device according to claim 2, wherein the gripper (5) fixes the chip (7) on the fixing surface (22) located opposite to a bond surface (7b).

5. The device according to any one of the preceding claims comprising the bond head (9) for fixing, transporting and bonding the chips (7).