

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 present invention provide an improved bonding method or an improved bonding device, respectively, or an improved product, respectively.

According to a first aspect of the present invention, there is provided a method for bonding chips onto a semiconductor substrate or onto further chips, the method comprises: bonding the chips onto the semiconductor substrate or the further chips by means of a direct bond, 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.

Disclosed herein is 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.

According to a second aspect of the present invention, there is provided a chip stack of chips, wherein the chips are bonded to one another by means of a direct bond, and wherein a bond head bonds the chips onto the semiconductor substrate or further chips such that the chips are bonded at first in the center and then to the outside.

According to a third aspect of the present invention, there is provided a semiconductor substrate comprising chips, wherein the chips are bonded onto the semiconductor substrate by means of a direct bond, and wherein a bond head bonds the chips onto the semiconductor substrate or further chips such that the chips are bonded at first in the center and then to the outside.

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

Claims

1. A method for bonding chips (7) onto a semiconductor substrate (11') or onto further chips, the method comprises:
bonding the chips (7) 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.
2. The method according to claim 1, wherein the direct bond occurs at bond surfaces (7b) of the chips (7), wherein the bond surfaces (7b) are hybrid bond surfaces.
3. The method according to one of the preceding claims, wherein the chips (7) are positioned and a self alignment of the chips (7) occurs.
4. The method according to one of the preceding claims, wherein to produce the chips (7), a substrate (11) is fixed onto a carrier (15) and the substrate (11) is then separated into the chips (7).
5. The method according to claim 4, wherein the carrier (15) comprises a tape.
6. The method according to claim 4 or 5, wherein a bond surface (7b) of the substrate (11) is cleaned prior to the fixation of the substrate (11) onto the carrier (15).
7. The method according to claim 4, 5 or 6, wherein the bond surfaces (7b) of the chips (7) are cleaned during the removal from the carrier (15) and/or during the transport to further positions.
8. The method according to claim 7, wherein the bond surfaces (7b) of the chips (7) are cleaned continuously during the removal from the carrier (15) and/or during the transport to further positions.

9. The method according to claim 7 or 8, wherein the bond surfaces (7b) of the chips (7) are cleaned during the removal from the carrier (15) and/or during the transport to bond positions.
10. The method according to any one of claims 4 to 9, wherein the chips (7) are separated by means of mechanical separating means, wherein grooves (12) were introduced into the bond surface (7b) of the substrate (11) beforehand.
11. A chip stack of chips, wherein the chips are bonded to one another by means of a direct bond, and
wherein a bond head (9) bonds the chips (7) onto the semiconductor substrate (11') or further chips such that the chips (7) are bonded at first in the center and then to the outside.
12. A semiconductor substrate (11') comprising chips, wherein the chips are bonded onto the semiconductor substrate (11') by means of a direct bond, and
wherein a bond head (9) bonds the chips (7) onto the semiconductor substrate (11') or further chips such that the chips (7) are bonded at first in the center and then to the outside.