

One of the greatest challenges in bonding is in the bonding process itself, i.e. during the bond initiation up to the complete contacting of the contact faces of the substrates. The alignment of the two substrates with respect to one another can still change decisively here compared to the previous alignment. If the two substrate surfaces are first joined together, a separation is theoretically again possible, but is associated with high costs, low throughput and susceptibility to errors.

Embodiments of the present invention provide a device and a method for bonding two substrates, with which the bonding accuracy, in particular at the edge of the substrates, is increased.

According to an aspect of the present invention, there is provided a first holding device for holding the first substrate to a first holding surface; a second holding device for holding the second substrate to a second holding surface; at least one curvature changing element configured to change the curvature of the contact face of the first substrate and/or for changing the curvature of the contact face of the second substrate, said at least one curvature changing element controlling the change of the curvature of the contact face of the first substrate and/or of the contact face of the second substrate during bonding of the first substrate with the second substrate; a plurality of fixing elements formed on the first and second holding devices for fixing first and second substrates; and wherein at least one of the holding devices is made of silicon carbide or silicon nitride and is used for bonding.

All combinations of at least two features given in the description, in the claims and/or the drawings also fall within the scope of the invention. In stated value ranges, values lying inside the stated limits are also deemed to be disclosed as limiting values and can be claimed in any combination.

The idea underlying the invention is that both substrates are curved before the contacting or bonding and the curvature of at least one of the two substrates is changed by controlling the curvature during the bonding, in particular during the course of a bonding wave, preferably in fusion bonding. The curvature of the other (preferably upper) substrate is preferably also changed in a controlled manner.

The curvature also changes through automatic contacting of the substrates. The automatic contacting takes place in particular through the force of gravity acting on the substrate and/or other forces of attraction

Claims

1. A device for bonding a first substrate with a second substrate at mutually facing contact faces of the first and second substrates, said device comprising:
 - a first holding device for holding the first substrate to a first holding surface;
 - a second holding device for holding the second substrate to a second holding surface;
 - at least one curvature changing element configured to change the curvature of the contact face of the first substrate and/or for changing the curvature of the contact face of the second substrate, said at least one curvature changing element controlling the change of the curvature of the contact face of the first substrate and/or of the contact face of the second substrate during bonding of the first substrate with the second substrate;
 - a plurality of fixing elements formed on the first and second holding devices for fixing first and second substrates; and
 - wherein at least one of the holding devices is made of silicon carbide or silicon nitride and is used for bonding.
2. The device according to claim 1, wherein the fixing elements are electrostatic fixing elements.
3. The device according to claim 1, wherein the fixing elements are vacuum holes and are evacuated via lines.
4. The device according to claim 1, further comprising
 - multiple studs elevated from the first and second holding devices; and
 - spatial regions located between studs and acting as the fixing elements during an evacuation.
5. The device according to claim 4, wherein each stud has a diameter of less than 5 mm or a height of less than 2 mm.

6. The device according to claim 4, wherein each stud has a shape selected from pyramid, cylinder, cuboid, cone or spherical shell or has a hemispherical base body.
7. The device according to claim 4, further comprising lines permitting an evacuation of the spatial regions.
8. The device according to any one of claims 1 to 7, further comprising at least one sensor located in the first and second holding devices.
9. The device according to claim 8, wherein the sensor is selected from temperature sensors, pressure sensors, distance sensors or a combination thereof.
10. The device according to any one of claims 1 to 7, further comprising an edge element surrounding the fixing elements.
11. The device according to claim 1, wherein the curvature changing element comprises a fluid outlet configured to introduce fluid between the first and second holding devices and the substrate by which the substrate fixed to the first and second holding devices can be curved.
12. The device according to claim 1, wherein the curvature changing element is located in the centre of the first and second holding devices.
13. The device according to claim 1, wherein the curvature changing element is a pin which extends through the first and second holding devices and is configured to be displaceable normal to the first and second holding devices to curve the substrate fixed to the substrate holder.
14. The device according to any one of claims 1 to 7, wherein the fixing elements are arranged in at least one concentric zone.

15. The device according to claim 14, wherein the fixing elements are arranged in four concentric zones.
16. The device according to any one of claims 1 to 7, wherein the fixing elements arranged along a spiral.
17. The device according to any one of claims 1 to 7, wherein the fixing elements are divided into a plurality of zones constituted as hexagons.