

CLAIMS

1. A flip chip bonder, comprising:

a base body;

a bonding stage for suctioning and fixing a bonding target;

a plurality of vertical-position adjustment support mechanisms attached to the base body, and respectively configured to support the bonding stage at a plurality of supporting points in a vertical direction, and to adjust positions of the respective supporting points in the vertical direction, the supporting points being provided on a side opposite of a surface for suctioning and fixing the bonding target of the bonding stage; and

a connecting member configured to connect the base body with the bonding stage, wherein

the connecting member is configured as a leaf spring mechanism substantially in a trapezoidal shape having a first side and a second side parallel to each other, the leaf spring mechanism comprising a first flexible portion adjacent to and extending along the first side, a second flexible portion adjacent to and extending along the second side, and a rigid portion between the first flexible portion and the second flexible portion, and

the connecting member is disposed between the base body and the bonding stage such that the first side and the second side are parallel to one of the first axis and the second axis.

~~restrains movement of the bonding stage relative to the base body in directions along a first axis and a second axis, the first axis being a direction along the surface of the bonding stage, the second axis being a~~

~~direction along the surface of the bonding stage but perpendicular to the first axis; and~~

~~_____ allows first twisting of the bonding stage relative to the base body about the first axis, second twisting of the bonding stage relative to the base body about the second axis, and movement of the bonding stage relative to the base body in the vertical direction.~~

2. The flip chip bonder according to claim 1, wherein

the connecting member:

restrains movement of the bonding stage relative to the base body in directions along a first axis and a second axis, the first axis being a direction along the surface of the bonding stage, the second axis being a direction along the surface of the bonding stage but perpendicular to the first axis; and

_____ allows first twisting of the bonding stage relative to the base body about the first axis, second twisting of the bonding stage relative to the base body about the second axis, and movement of the bonding stage relative to the base body in the vertical direction.

~~the connecting member is configured as a leaf spring mechanism substantially in a trapezoidal shape having a first side and a second side parallel to each other, the leaf spring mechanism comprising a first flexible portion adjacent to and extending along the first side, a second flexible portion adjacent to and extending along the second side, and a rigid portion between the first flexible portion and the second flexible portion, and~~

~~the connecting member is disposed between the base body and the bonding stage such that the first side and the second side are parallel to one of the first axis and the second axis.~~

3. The flip chip bonder according to claim 2, wherein

the first side of the leaf spring mechanism is shorter than the second side,

the first side of the leaf spring mechanism is attached to a first position on the side opposite of the surface of the bonding stage, the first position being displaced by a first distance from a gravity center of the bonding stage, and

the second side of the leaf spring mechanism is attached to a second position on the base body on a surface facing the bonding stage, the second position being provided on a side opposite of the first position across the gravity center and displaced by a second distance from the gravity center, the second distance being longer than the first distance.

4. The flip chip bonder according to claim 1, further comprising:

a plurality of pressurized springs configured to respectively press the supporting points of the bonding stage onto the corresponding vertical-position adjustment support mechanisms, wherein

each of the vertical-position adjustment support mechanisms comprises a cam mechanism in contact with the corresponding supporting point.

5. The flip chip bonder according to claim 2, wherein

a plurality of pressurized springs configured to respectively press the supporting points of the bonding stage onto the corresponding vertical-position adjustment support mechanisms, wherein

each of the vertical-position adjustment support mechanisms comprises a cam mechanism in contact with the corresponding supporting point.

6. The flip chip bonder according to claim 3, wherein

a plurality of pressurized springs configured to respectively press the supporting points of the bonding stage onto the corresponding vertical-position adjustment support mechanisms, wherein

each of the vertical-position adjustment support mechanisms comprises a cam mechanism in contact with the corresponding supporting point.

7. The flip chip bonder according to claim 1, further comprising:

a control unit configured to operate the vertical-position adjustment support mechanisms, wherein

the control unit comprises:

a flatness map indicating flatness of each of sections on the bonding stage; and

a flatness correction unit configured to correct a height and an inclination of the bonding stage based on the flatness map according to a position of bonding.

8. The flip chip bonder according to claim 2, wherein

a control unit configured to operate the vertical-position adjustment support mechanisms, wherein

the control unit comprises:

a flatness map indicating flatness of each of sections on the bonding stage; and

a flatness correction unit configured to correct a height and an inclination of the bonding stage based on the flatness map according to a position of bonding.

9. The flip chip bonder according to claim 3, wherein

a control unit configured to operate the vertical-position adjustment support mechanisms, wherein

the control unit comprises:

a flatness map indicating flatness of each of sections on the bonding stage; and

a flatness correction unit configured to correct a height and an inclination of the bonding stage based on the flatness map according to a position of bonding.

10. The flip chip bonder according to claim 1, further comprising:

a control unit configured to operate the vertical-position adjustment support mechanisms, wherein

the control unit comprises:

an expected deformation amount map indicating an expected deformation amount of each of sections on the bonding stage due to a pressing force when a bonding tool is pressed against the bonding stage; and

a deformation amount correction unit configured to correct a height and an inclination of the bonding stage by the expected deformation amount of the bonding stage according to a pressed position and the pressing force during bonding.

11. The flip chip bonder according to claim 2, wherein

a control unit configured to operate the vertical-position adjustment support mechanisms, wherein

the control unit comprises:

an expected deformation amount map indicating an expected deformation amount of each of sections on the bonding stage due to a pressing force when a bonding tool is pressed against the bonding stage; and

a deformation amount correction unit configured to correct a height and an inclination of the bonding stage by the expected deformation amount of the bonding stage according to a pressed position and the pressing force during bonding.

12. The flip chip bonder according to claim 3, wherein

a control unit configured to operate the vertical-position adjustment support mechanisms, wherein

the control unit comprises:

an expected deformation amount map indicating an expected deformation amount of each of sections on the bonding stage due to a pressing force when a bonding tool is pressed against the bonding stage; and

a deformation amount correction unit configured to correct a height and an inclination of the bonding stage by the expected deformation amount of the bonding stage according to a pressed position and the pressing force during bonding.

13. The flip chip bonder according to claim 1, wherein

the bonding stage comprises:

a first layer having a low thermal conductivity;

a second layer having higher thermal conductivity than that of the first layer and substantially the same thermal expansion rate as the first layer;

a third layer configured by a material similar to that of the second layer; and

a heater disposed between the second layer and the third layer.

14. The flip chip bonder according to claim 2, wherein

the bonding stage comprises:

a first layer having a low thermal conductivity;

a second layer having higher thermal conductivity than that of the first layer and substantially the same thermal expansion rate as the first layer;

a third layer configured by a material similar to that of the second layer; and

a heater disposed between the second layer and the third layer.

15. The flip chip bonder according to claim 3, wherein

the bonding stage comprises:

a first layer having a low thermal conductivity;

a second layer having higher thermal conductivity than that of the first layer and substantially the same thermal expansion rate as the first layer;

a third layer configured by a material similar to that of the second layer; and

a heater disposed between the second layer and the third layer.

16. A method of correcting flatness of a bonding stage of a flip chip bonder, the method comprising the steps of:

preparing a flip chip bonder comprising:

a base body;

a bonding stage for suctioning and fixing a bonding target;

a plurality of vertical-position adjustment support mechanisms attached to the base body, and respectively configured to support the bonding stage at a plurality of supporting points in a vertical direction, and to adjust positions of the respective supporting points in the vertical direction, the supporting points being provided on a side opposite of a surface for suctioning and fixing the bonding target of the bonding stage;

a connecting member configured to connect the base body with the bonding stage; and

a control unit configured to operate the vertical-position adjustment support mechanisms;

preparing a flatness map indicating flatness of each of sections on the bonding stage within the control unit; and

correcting a height and an inclination of the bonding stage based on the flatness map according to a position of bonding by causing the control unit to operate the plurality of vertical-position adjustment support mechanisms.

17. The method of correcting flatness of a bonding stage according to claim 16, wherein

the connecting member is configured as a leaf spring mechanism substantially in a trapezoidal shape having a first side and a second side parallel to each other, the leaf spring mechanism comprising a first flexible portion adjacent to and extending along the first side, a second flexible portion adjacent to and extending along the second side, and a rigid portion between the first flexible portion and the second flexible portion, and

the connecting member is disposed between the base body and the bonding stage such that the first side and the second side are parallel to one of the first axis and the second axis.

~~the connecting member:~~

~~restrains movement of the bonding stage relative to the base body in directions along a first axis and a second axis, the first axis being a direction along the surface of the bonding stage, the second axis being a~~

direction along the surface of the bonding stage but perpendicular to the first axis; and

_____ allows first twisting of the bonding stage relative to the base body about the first axis, second twisting of the bonding stage relative to the base body about the second axis, and movement of the bonding stage relative to the base body in the vertical direction.

18. A method of correcting a deformation amount of a bonding stage of a flip chip bonder, the method comprising the steps of:

preparing a flip chip bonder comprising:

a base body;

a bonding stage for suctioning and fixing a bonding target;

a plurality of vertical-position adjustment support mechanisms attached to the base body, and respectively configured to support the bonding stage at a plurality of supporting points in a vertical direction, and to adjust positions of the respective supporting points in the vertical direction, the supporting points being provided on a side opposite of a surface for suctioning and fixing the bonding target of the bonding stage;

a connecting member configured to connect the base body with the bonding stage; and

a control unit configured to operate the vertical-position adjustment support mechanisms;

preparing an expected deformation amount map indicating an expected deformation amount of each of sections on the bonding stage due to a pressing

force when a bonding tool is pressed against the bonding stage within the control unit; and

correcting a height and an inclination of the bonding stage by the expected deformation amount of the bonding stage according to a pressed position and the pressing force during bonding by causing the control unit to operate the plurality of vertical-position adjustment support mechanisms.

19. The method of correcting a deformation amount of a bonding stage of a flip chip bonder according to claim 18, wherein

the connecting member is configured as a leaf spring mechanism substantially in a trapezoidal shape having a first side and a second side parallel to each other, the leaf spring mechanism comprising a first flexible portion adjacent to and extending along the first side, a second flexible portion adjacent to and extending along the second side, and a rigid portion between the first flexible portion and the second flexible portion, and

the connecting member is disposed between the base body and the bonding stage such that the first side and the second side are parallel to one of the first axis and the second axis.

~~the connecting member:~~

~~restrains movement of the bonding stage relative to the base body in directions along a first axis and a second axis, the first axis being a direction along the surface of the bonding stage, the second axis being a direction along the surface of the bonding stage but perpendicular to the first axis; and~~

_____ allows first twisting of the bonding stage relative to the base body about the first axis, second twisting of the bonding stage relative to the base body about the second axis, and movement of the bonding stage relative to the base body in the vertical direction.