

CLAIMS

1. A method (200) of mounting components (150) on a substrate (160) on a substrate base (190) provided at a substrate position (165), the method comprising:

5 providing (210) a bonding head (110) displaceable relative to the substrate (160) along first (170) and second (175) movement axes, the second movement axis (175) being substantially perpendicular to the first movement axis (170);

10 providing (220) a pick-up member (180) having a contact surface (185), in which the pick-up member (180) is disposed on the bonding head (110), and in which the contact surface (185) is configured and arranged to be releasably attachable to components (150), and the contact surface (185) is further configured and arranged to be rotatable about the second movement axis (175);

15 providing (230) a first engagement member (120, 121, 121a, 122), disposed on the bonding head (110), configured and arranged to apply a force along a third movement axis (177) to the bonding head (110) such that the contact surface (185) rotates about the second movement axis (175), the third movement axis (177) being substantially perpendicular to the first movement axis (170) and substantially perpendicular to the second movement axis (175);

20 providing (240) a first adjustment member (130, 131, 133, 133a) in a first adjustment position (132) for rigid engagement with the first engagement member (120, 121, 121a, 122);

moving (250) the bonding head (110) to the first adjustment position (132);

rigidly engaging (260) the first engagement member (120, 121, 121a, 122) with the first adjustment member (130, 131, 133, 133a);

25 moving (270) the bonding head (110) along the first movement axis (170), relative to the first adjustment member (130, 131, 133, 133a), whereby a force is applied along the third movement axis (177) to rotate the contact surface (185) about the second movement axis (175);

releasing (280) the first engagement member (120, 121, 121a, 122) from the first adjustment member (130, 131, 133, 133a); and

moving (290) the bonding head (110) toward the substrate position (165), the bonding head (110) maintaining (203) the rotation of the contact surface (185) about the second movement axis (175).

2. A method according to Claim 1, the method further comprising:

5 configuring and arranging the bonding head (110) to be displaceable relative to the substrate (160) along the third movement axis (177);

configuring and arranging the contact surface (185) so as to be rotatable about the third movement axis (177);

10 providing a second engagement member (121b), disposed on the bonding head (110), configured and arranged to apply a force along the second movement axis (175) to the bonding head (110) such that the contact surface (185) rotates about the third movement axis (177);

15 providing a second adjustment member (133b) in a second adjustment position (137), the second adjustment member (133b) being configured and arranged to rigidly engage the second engagement member (121b);

moving the bonding head (110) into the second adjustment position (137);

rigidly engaging the second engagement member (121b) with the second adjustment member (133b);

20 moving (270) the bonding head (110) along the first movement axis (170), relative to the second adjustment member (133b), whereby a force is applied along the second movement axis (175) to rotate the contact surface (185) about the third movement axis (177);

releasing the second engagement member (121b) from the second adjustment member (133b); and

25 moving (290) the bonding head (110) to the substrate position (165), the bonding head (110) maintaining the rotation of the contact surface (185) about the third movement axis (177).

30 3. A method according to Claim 1 or 2, in which the bonding head (110) is configured and arranged to maintain (203) rotation of the contact surface (185) using an elastic member (119), a spring member (119), a magnetic member, an electrical member, an electromagnetic

member, a vacuum member, a gas-powered member, a friction member, a hydraulic member, an inductive member, or any combination thereof.

4. A method according to Claim 1, 2 or 3, the method further comprising (200):

providing an inclination sensor, configured and arranged to measure the rotation of the contact surface (185) about the first (170) and/or second (175) and/or third movement axis (177);

providing a processor, configured and arranged to determine the degree of displacement along the first movement axis (170) to obtain a desired rotation about the first (170) and/or second (175) and/or third (177) movement axis; and

further configuring and arranging the processor to stop displacement along the first movement axis (170) when the desired inclination of the contact surface (185) is reached.

5. A method according to any preceding claim, the method further comprising (200):

providing an inclination sensor, configured and arranged to measure an inclination of the substrate (160); and

providing a processor, configured and arranged to determine the degree of displacement along the first movement axis (170) to obtain a desired rotation about the first (170) and/or second (175) and/or third (177) movement axis using the measured inclination of the substrate (160).

6. A method according to any preceding claim, the method further comprising (200):

providing a temperature sensor, configured and arranged to measure a temperature and/or a relative temperature of a bonding head support carrier (101) and/or a bonding head mounting (102) and/or the bonding head (110) and/or the inclination sensor and/or the contact surface (185); and

providing a processor, configured and arranged to determine the degree of displacement along the first movement axis (170) to obtain a desired rotation about first (170) and/or second (175) and/or third (177) movement axes using the measured temperature of the contact surface (185).

7. A method according to any preceding claim, the method further comprising (200):

providing a temperature sensor, configured and arranged to measure a temperature and/or a relative temperature of the substrate (160) and/or substrate base, and

providing a processor, configured and arranged to determine the degree of displacement along the first movement axis (170) to obtain a desired rotation about the first (170) and/or second (175) and/or third (177) movement axis using the measured temperature of the substrate (160).

8. A method according to any preceding claim, further comprising a method of controlling the rotation of the contact surface (185) of the pick-up member (180) comprising:

measuring the inclination and/or rotation of the bonding head (110) relative to the substrate (160) and/or to the contact surface (185) and/or a mounted component (150) relative to the substrate (160), in which at least the position of the bonding head is optically detectable by means of a reference mark,

determining a degree of compensation for a first and second compensation of the inclination and/or rotation from the measurements;

moving the bonding head (110) to a first position to be compensated with the degree of compensation;

rigidly engaging (260) the first engagement member (120) with the first adjustment member (130);

applying the first compensation;

moving the bonding head (110) to a second position to be compensated with the degree of compensation;

rigidly engaging the second engagement member (122) with the first adjustment member (130);

applying the second compensation;

where the reference mark is used to determine the first and second degrees of compensation.

9. An apparatus (100) for mounting components (150) on a substrate (160) provided on a substrate position (165), the apparatus comprising:

a bonding head (110) displaceable relative to the substrate (160) along first (170) and second (175) movement axes, the second movement axis (175) being substantially perpendicular to the first movement axis (170);

5 a pick-up member (180) having a contact surface (185), the pick-up member (180) being disposed on the bonding head (110), the contact surface (185) being configured and arranged to be releasably attachable to components (150), and the contact surface (185) further being configured and arranged to be rotatable about the second movement axis (175);

10 a first engagement member (121, 121a), disposed on the bonding head (110), configured and arranged to apply a force along a third movement axis (177) to the bonding head (110) such that the contact surface (185) rotates about the second movement axis (175), the third movement axis (177) being substantially perpendicular to the first movement axis (170) and substantially perpendicular to the second movement axis (175);

15 a first adjustment member (133, 133a) in a first adjustment position (132) for rigid engagement with the first engagement member (121, 121a);

in which further:

the bonding head (110) is displaceable into the first adjustment position (132), the first engagement member (121, 121a) being rigidly engaged with the first adjustment member (133, 133a);

20 during engagement, the bonding head (110) is displaceable along the first movement axis (170), relative to the first adjustment member (133, 133a), whereby a force is applied along the third movement axis (177) to rotate the contact surface (185) about the second movement axis (175);

25 the first engagement member (121, 121a) is detachable or repeatably detachable from the first adjustment member (133, 133a); and

the bonding head (110) is displaceable toward the substrate position (165), the contact surface (185) being configured and arranged to maintain (203) rotation about the second movement axis (175).

10. An apparatus according to Claim 9, in which:

the bonding head (110) is further configured and arranged to be displaceable relative to the substrate (160) along the third movement axis (177);

the contact surface (185) is further arranged to be rotatable about the third movement axis (177);

5 the apparatus (100) further comprising:

a second engagement member (121b), disposed on the bonding head (110), configured and arranged to apply a force along the second movement axis (175) to the bonding head (110) such that the contact surface (185) rotates about the third movement axis (177);

10 a second adjustment member (133b) in a second adjustment position (137), the second adjustment member (133b) being configured and arranged to rigidly engage the second engagement member (121b);

in which further:

15 the bonding head (110) is displaceable into the second adjustment position (137), the second engagement member (122) being rigidly engaged with the second adjustment member (133b);

20 the bonding head (110) is displaceable along the first movement axis (170), relative to the second adjustment member (133b), whereby a force is applied along the second movement axis (175) to rotate the contact surface (185) about the third movement axis (177);

the second engagement member (122) is releasable or re-releasable from the second adjustment member (133b); and

25 the bonding head (110) is further configured and arranged to maintain (203) rotation of the contact surface (185) about the third movement axis (177) after release from the second adjustment member (133b).

CLAIMS

1. A method (200) of adjusting a rotation of a contact surface (185) before mounting components (150) on a substrate (160) on a substrate base (190) provided at a substrate position (165), the method comprising:

5 providing (210) a bonding head (110) displaceable relative to the substrate (160) along first (170) and second (175) movement axes, the second movement axis (175) being substantially perpendicular to the first movement axis (170);

10 providing (220) a pick-up member (180) having the contact surface (185), in which the pick-up member (180) is disposed on the bonding head (110), and in which the contact surface (185) is configured and arranged to be releasably attachable to components (150), and the contact surface (185) is further configured and arranged to be rotatable about the second movement axis (175);

15 providing (230) a first engagement member (120, 121, 121a, 122), disposed on the bonding head (110), configured and arranged to apply a force along a third movement axis (177) to the bonding head (110) such that the contact surface (185) rotates about the second movement axis (175), the third movement axis (177) being substantially perpendicular to the first movement axis (170) and substantially perpendicular to the second movement axis (175);

20 providing (240) a first adjustment member (130, 131, 133, 133a) in a first adjustment position (132) for rigid engagement with the first engagement member (120, 121, 121a, 122);

moving (250) the bonding head (110) to the first adjustment position (132);

rigidly engaging (260) the first engagement member (120, 121, 121a, 122) with the first adjustment member (130, 131, 133, 133a);

25 moving (270) the bonding head (110) along the first movement axis (170), relative to the first adjustment member (130, 131, 133, 133a), whereby a force is applied along the third movement axis (177) to rotate the contact surface (185) about the second movement axis (175);

30 releasing (280) the first engagement member (120, 121, 121a, 122) from the first adjustment member (130, 131, 133, 133a); and

moving (290) the bonding head (110) toward the substrate position (165), the bonding head (110) maintaining (203) the rotation of the contact surface (185) about the second movement axis (175).

2. A method according to Claim 1, the method further comprising:

5 configuring and arranging the bonding head (110) to be displaceable relative to the substrate (160) along the third movement axis (177);

configuring and arranging the contact surface (185) so as to be rotatable about the third movement axis (177);

10 providing a second engagement member (121b), disposed on the bonding head (110), configured and arranged to apply a force along the second movement axis (175) to the bonding head (110) such that the contact surface (185) rotates about the third movement axis (177);

15 providing a second adjustment member (133b) in a second adjustment position (137), the second adjustment member (133b) being configured and arranged to rigidly engage the second engagement member (121b);

moving the bonding head (110) into the second adjustment position (137);

rigidly engaging the second engagement member (121b) with the second adjustment member (133b);

20 moving (270) the bonding head (110) along the first movement axis (170), relative to the second adjustment member (133b), whereby a force is applied along the second movement axis (175) to rotate the contact surface (185) about the third movement axis (177);

releasing the second engagement member (121b) from the second adjustment member (133b); and

25 moving (290) the bonding head (110) to the substrate position (165), the bonding head (110) maintaining the rotation of the contact surface (185) about the third movement axis (177).

3. A method according to Claim 1 or 2, in which the bonding head (110) is configured and arranged to maintain (203) rotation of the contact surface (185) using an elastic member (119),
30 a spring member (119), a magnetic member, an electrical member, an electromagnetic

member, a vacuum member, a gas-powered member, a friction member, a hydraulic member, an inductive member, or any combination thereof.

4. A method according to Claim 1, 2 or 3, the method further comprising (200):

providing an inclination sensor, configured and arranged to measure the rotation of the contact surface (185) about the first (170) and/or second (175) and/or third movement axis (177);

providing a processor, configured and arranged to determine the degree of displacement along the first movement axis (170) to obtain a desired rotation about the second (175) and/or third (177) movement axis; and

further configuring and arranging the processor to stop displacement along the first movement axis (170) when the desired inclination of the contact surface (185) is reached.

5. A method according to any preceding claim, the method further comprising (200):

providing an inclination sensor, configured and arranged to measure an inclination of the substrate (160); and

providing a processor, configured and arranged to determine the degree of displacement along the first movement axis (170) to obtain a desired rotation about the second (175) and/or third (177) movement axis using the measured inclination of the substrate (160).

6. A method according to any preceding claim, the method further comprising (200):

providing a temperature sensor, configured and arranged to measure a temperature and/or a relative temperature of a bonding head support carrier (101) and/or a bonding head mounting (102) and/or the bonding head (110) and/or the inclination sensor and/or the contact surface (185); and

providing a processor, configured and arranged to determine the degree of displacement along the first movement axis (170) to obtain a desired rotation about second (175) and/or third (177) movement axes using the measured temperature of the contact surface (185).

7. A method according to any preceding claim, the method further comprising (200):

providing a temperature sensor, configured and arranged to measure a temperature and/or a relative temperature of the substrate (160) and/or substrate base, and

providing a processor, configured and arranged to determine the degree of displacement along the first movement axis (170) to obtain a desired rotation about the second (175) and/or third (177) movement axis using the measured temperature of the substrate (160).

8. A method according to any of Claims 2 to 7, further comprising a method of controlling the rotation of the contact surface (185) of the pick-up member (180) comprising:

measuring the inclination and/or rotation of the bonding head (110) relative to the substrate (160) and/or to the contact surface (185) and/or a mounted component (150) relative to the substrate (160), in which at least the position of the bonding head is optically detectable by means of a reference mark;

determining a degree of compensation for a first and second compensation of the inclination and/or rotation from the measurements;

moving the bonding head (110) to the first adjustment position (132) to be compensated with the degree of compensation;

rigidly engaging (260) the first engagement member (120) with the first adjustment member (130);

applying the first compensation;

moving the bonding head (110) to the second adjustment position (137) to be compensated with the degree of compensation;

rigidly engaging the second engagement member (121b) with the second adjustment member (133b);

applying the second compensation;

where the reference mark is used to determine the first and second degrees of compensation.

9. An apparatus (100) for mounting components (150) on a substrate (160) provided on a substrate position (165), the apparatus comprising:

a bonding head (110) displaceable relative to the substrate (160) along first (170) and second (175) movement axes, the second movement axis (175) being substantially perpendicular to the first movement axis (170);

5 a pick-up member (180) having a contact surface (185), the pick-up member (180) being disposed on the bonding head (110), the contact surface (185) being configured and arranged to be releasably attachable to components (150), and the contact surface (185) further being configured and arranged to be rotatable about the second movement axis (175);

10 a first engagement member (121, 121a), disposed on the bonding head (110), configured and arranged to apply a force along a third movement axis (177) to the bonding head (110) such that the contact surface (185) rotates about the second movement axis (175), the third movement axis (177) being substantially perpendicular to the first movement axis (170) and substantially perpendicular to the second movement axis (175);

15 a first adjustment member (133, 133a) in a first adjustment position (132) for rigid engagement with the first engagement member (121, 121a);

in which further:

the bonding head (110) is displaceable into the first adjustment position (132), the first engagement member (121, 121a) being rigidly engaged with the first adjustment member (133, 133a);

20 during engagement, the bonding head (110) is displaceable along the first movement axis (170), relative to the first adjustment member (133, 133a), whereby a force is applied along the third movement axis (177) to rotate the contact surface (185) about the second movement axis (175);

25 the first engagement member (121, 121a) is detachable or repeatably detachable from the first adjustment member (133, 133a); and

the bonding head (110) is displaceable toward the substrate position (165), the contact surface (185) being configured and arranged to maintain (203) rotation about the second movement axis (175).

10. An apparatus according to Claim 9, in which:

the bonding head (110) is further configured and arranged to be displaceable relative to the substrate (160) along the third movement axis (177);

the contact surface (185) is further arranged to be rotatable about the third movement axis (177);

5 the apparatus (100) further comprising:

a second engagement member (121b), disposed on the bonding head (110), configured and arranged to apply a force along the second movement axis (175) to the bonding head (110) such that the contact surface (185) rotates about the third movement axis (177);

10 a second adjustment member (133b) in a second adjustment position (137), the second adjustment member (133b) being configured and arranged to rigidly engage the second engagement member (121b);

in which further:

15 the bonding head (110) is displaceable into the second adjustment position (137), the second engagement member (121b) being rigidly engaged with the second adjustment member (133b);

20 the bonding head (110) is displaceable along the first movement axis (170), relative to the second adjustment member (133b), whereby a force is applied along the second movement axis (175) to rotate the contact surface (185) about the third movement axis (177);

the second engagement member (121b) is releasable or re-releasable from the second adjustment member (133b); and

25 the bonding head (110) is further configured and arranged to maintain (203) rotation of the contact surface (185) about the third movement axis (177) after release from the second adjustment member (133b).