

surface to which a semiconductor die to be picked up is applied; a suctioning opening provided in the suction surface of the stage; a cap configured to slide along the suction surface to open and close the suctioning opening; and an opening pressure switch mechanism configured to switch a pressure of the suctioning opening between a first pressure that is near vacuum and a second pressure that is near an atmospheric pressure, and when the semiconductor die is picked up, the cap is caused to slide by a predetermined distance in an opening direction, every time the pressure of the suctioning opening is switched from the first pressure to the second pressure, after the pressure of the suctioning opening is switched from the second pressure to the first pressure.

[0011]

Preferably, the semiconductor die pick-up apparatus according to the present invention is configured such that when the semiconductor die is picked up, the cap is caused to slide by the predetermined distance in the opening direction while ~~every time the pressure of the suctioning opening is switched from the first pressure to the second pressure after a suction pressure of the suction surface is maintained to be vacuum, and the pressure of the suctioning opening is switched from the second pressure to the first pressure.~~

[0012]

Preferably, the semiconductor die pick-up apparatus according to the present invention is configured such that the cap is provided for the stage such that a surface of the cap

derivative signal being obtained by derivation of a signal of the amount of suctioned air flow detected by the flow rate sensor.

[0017]

It is also preferable that the semiconductor die pick-up apparatus according to the present invention includes: a sheet displacement detection sensor provided near an end surface of the suctioning opening with which a tip end of the cap is brought into contact when the suctioning opening is closed, and configured to detect displacement of the dicing sheet with respect to the suction surface in an approaching and departing direction when the cap is caused to slightly slide to slightly open the suctioning opening, the dicing sheet being positioned above the suction opening that is slightly opened, and if the sheet displacement detected by the sheet displacement detection sensor is a predetermined threshold value or smaller when the pressure of the suctioning opening is switched from the second pressure to the first pressure after a predetermined time elapses after the suction pressure is set to vacuum, the dicing sheet is separated from the semiconductor ~~chip~~ die by making the suction pressure open to air and switching the pressure of the suctioning opening from the first pressure to the second pressure, and again setting the suction pressure to vacuum and switching the pressure of the suctioning opening from the second pressure to the first pressure after the predetermined time

of the cap in a width direction aligns with a position of the semiconductor die in the width direction; a first separation step of separating the dicing sheet from the semiconductor die ~~chip~~ by causing the cap to slightly slide to slightly open the suctioning opening, causing the surface of the cap to advance up to a predetermined height higher than the suction surface, then setting the suction pressure to be vacuum, and switching, after a predetermined time elapses, the pressure of the suctioning opening from the second pressure to the first pressure, the dicing sheet being positioned above the slightly opened suction opening; and a second-separation step of separating a portion of the semiconductor die from the front surface of the dicing sheet by causing the cap to slide, in a state in which a surface of the cap advances up to a predetermined height higher than the suction surface, by a predetermined distance in the opening direction every time the pressure of the suctioning opening is switched from the first pressure to the second pressure after a suction pressure of the suction surface is maintained to be vacuum and the pressure of the suctioning opening is switched from the second pressure to the first pressure, the portion of the semiconductor die being positioned immediately above the suctioning opening opened by the sliding.

[0019]

Preferably, in the semiconductor die pick-up method according to the present invention, the opening pressure switch mechanism switches the pressure of the suctioning opening between the first pressure and the second pressure more than once before causing the cap to slide by the predetermined distance in the opening direction.

[0020]

Preferably, in the semiconductor die pick-up method according to the present invention, the semiconductor die pick-up apparatus includes: a sheet displacement detection sensor provided near an end surface of the suctioning opening with which a tip end of the cap is brought into contact when the suctioning opening is closed, and configured to detect displacement of the dicing sheet with respect to the suction surface in an approaching and departing direction when the cap is caused to slightly slide to slightly open the suctioning opening, the dicing sheet being positioned above the suction opening that is slightly opened, and the first separation step includes: a first separation determination step of determining, when the pressure of the suctioning opening is switched from the second pressure to the first pressure after a predetermined time elapses after the suction pressure is set to vacuum, that the dicing sheet positioned above the slightly opened suction opening is separated from the semiconductor die chip if the sheet displacement detected by the sheet displacement detection

sensor exceeds a predetermined threshold value, and that the dicing sheet positioned above the slightly opened suction opening is unseparated from the semiconductor ~~die~~chip if the sheet displacement detected by the sheet displacement detection sensor is the predetermined threshold value or smaller; and a first retry step of separating, when the dicing sheet positioned above the slightly opened suction opening is determined to be unseparated from the semiconductor ~~die~~chip in the first separation determination step, the dicing sheet from the semiconductor ~~chip~~die by making the suction pressure open to air and switching the pressure of the suctioning opening from the first pressure to the second pressure, and again setting the suction pressure to vacuum and switching the pressure of the suctioning opening from the second pressure to the first pressure after the predetermined time elapses, the dicing sheet being positioned above the slightly opened suction opening. It is also preferable that the sheet displacement detection sensor uses, as a light source, light of a wavelength whose light transmission rate through the dicing sheet is in a range from 0% to 30%, and that the sheet displacement detection sensor employs a reflection-type optical fiber using an LED of a short wavelength from 0 nm to 300 nm as a light source.

[0021]

Preferably, in the semiconductor die pick-up method according to the present invention, the semiconductor die

CLAIMS

1. A semiconductor die pick-up apparatus comprising:

a stage having a suction surface for suctioning a back surface of a dicing sheet with a front surface to which a semiconductor die to be picked up is applied;

a suctioning opening provided in the suction surface of the stage;

a cap configured to slide along the suction surface to open and close the suctioning opening; and

an opening pressure switch mechanism configured to switch a pressure of the suctioning opening between a first pressure that is near vacuum and a second pressure that is near an atmospheric pressure, wherein

when the semiconductor die is picked up, the cap is caused to slide by a predetermined distance in an opening direction, every time the pressure of the suctioning opening is switched from the first pressure to the second pressure- after the pressure of the suctioning opening is switched from the second pressure to the first pressure.

2. The semiconductor die pick-up apparatus according to claim 1, wherein

when the semiconductor die is picked up, the cap is caused to slide by the predetermined distance in the opening direction ~~every time the pressure of the suctioning opening is switched from the first pressure to the second pressure after~~ while a suction

pressure of the suction surface is maintained to be vacuum, and
~~the pressure of the suctioning opening is switched from the~~
~~second pressure to the first pressure.~~

3. The semiconductor die pick-up apparatus according to claim 1 or 2, wherein

the cap is provided for the stage such that a surface of the cap is allowed to freely advance from the suction surface, and

when the semiconductor die is picked up, the dicing sheet is separated from the semiconductor die by causing the cap to slightly slide to slightly open the suctioning opening, causing the surface of the cap to advance up to a predetermined height higher than the suction surface, then setting the suction pressure to be vacuum, and switching, after a predetermined time elapses, the pressure of the suctioning opening from the second pressure to the first pressure, the dicing sheet being positioned above the slightly opened suction opening.

4. The semiconductor die pick-up apparatus according to claim 1 or 2, wherein

the opening pressure switch mechanism switches the pressure of the suctioning opening between the first pressure and the second pressure more than once before causing the cap to slide by the predetermined distance in the opening direction.

positioned above the suction opening that is slightly opened,
wherein

if the sheet displacement detected by the sheet displacement detection sensor is a predetermined threshold value or smaller when the pressure of the suctioning opening is switched from the second pressure to the first pressure after a predetermined time elapses after the suction pressure is set to vacuum, the dicing sheet is separated from the semiconductor die chip by making the suction pressure open to air and switching the pressure of the suctioning opening from the first pressure to the second pressure, and again setting the suction pressure to vacuum and switching the pressure of the suctioning opening from the second pressure to the first pressure after the predetermined time elapses, the dicing sheet being positioned above the slightly opened suction opening.

9. The semiconductor die pick-up apparatus according to claim 8, wherein

the sheet displacement detection sensor uses, as a light source, light of a wavelength whose light transmission rate through the dicing sheet is in a range from 0% to 30%.

10. The semiconductor die pick-up apparatus according to claim 9, wherein

the sheet displacement detection sensor employs a reflection-type optical fiber using an LED of a short wavelength from 0 nm to 300 nm as a light source.

11. A semiconductor die pick-up method comprising:

a step of preparing a semiconductor die pick-up apparatus including: a stage having a suction surface for suctioning a back surface of a dicing sheet having a front surface to which a semiconductor die to be picked up is applied; a suctioning opening provided in the suction surface of the stage; a cap provided for the stage such that a surface of the cap is allowed to freely advance from the suction surface, and configured to slide along the suction surface to open and close the suctioning opening; and an opening pressure switch mechanism configured to switch a pressure of the suctioning opening between a first pressure that is near vacuum and a second pressure that is near an atmospheric pressure;

a positioning step of moving the stage in a direction along the suction surface, so that a tip end of the cap in a closed state aligns with one end of a semiconductor die to be picked up, and that a position of the cap in a width direction aligns with a position of the semiconductor die in the width direction;

a first separation step of separating the dicing sheet from the semiconductor ~~die~~^{chip} by causing the cap to slightly slide to slightly open the suctioning opening, causing the surface

13. The semiconductor die pick-up method according to claim 11, wherein

the semiconductor die pick-up apparatus includes: a sheet displacement detection sensor provided near an end surface of the suctioning opening with which a tip end of the cap is brought into contact when the suctioning opening is closed, and configured to detect displacement of the dicing sheet with respect to the suction surface in an approaching and departing direction when the cap is caused to slightly slide to slightly open the suctioning opening, the dicing sheet being positioned above the suction opening that is slightly opened, and

the first separation step includes:

a first separation determination step of determining, when the pressure of the suctioning opening is switched from the second pressure to the first pressure after a predetermined time elapses after the suction pressure is set to vacuum, that the dicing sheet positioned above the slightly opened suction opening is separated from the semiconductor die ~~chip~~ if the sheet displacement detected by the sheet displacement detection sensor exceeds a predetermined threshold value, and that the dicing sheet positioned above the slightly opened suction opening is unseparated from the semiconductor die ~~chip~~ if the sheet displacement detected by the sheet displacement

detection sensor is the predetermined threshold value or smaller; and

a first retry step of separating, when the dicing sheet positioned above the slightly opened suction opening is determined to be unseparated from the semiconductor ~~die chip~~ in the first separation determination step, the dicing sheet from the semiconductor ~~die chip~~ by making the suction pressure open to air and switching the pressure of the suctioning opening from the first pressure to the second pressure, and again setting the suction pressure to vacuum and switching the pressure of the suctioning opening from the second pressure to the first pressure after the predetermined time elapses, the dicing sheet being positioned above the slightly opened suction opening.

14. The semiconductor die pick-up method according to claim 11, wherein

the semiconductor die pick-up apparatus includes: a collet configured to suction a semiconductor die; a suctioning mechanism connected to the collet, and configured to suction air from a surface of the collet; and a flow rate sensor configured to detect an amount of air flow suctioned by the suctioning mechanism, and

the second-separation step includes:

a second separation determination step of determining that a portion of the semiconductor die positioned