

DESCRIPTION

Title of Invention: SEMICONDUCTOR MANUFACTURING APPARATUS,
COATER, AND MANUFACTURING METHOD OF SEMICONDUCTOR DEVICE

5 Technical Field

[0001]

The present disclosure relates to a semiconductor
manufacturing apparatus and is applicable to, for example, a
semiconductor manufacturing apparatus that applies paste
10 onto a semiconductor chip.

Background Art

[0002]

At one step of a manufacturing process for a
semiconductor device, a workpiece divided from a wafer is
15 picked up and the picked-up workpiece is bonded to a
semiconductor chip coated with paste adhesive (for example,
Japanese Unexamined Patent Application Publication No. 2022-
150045).

Citation List

20 Patent Literature

[0003]

PTL 1: Japanese Unexamined Patent Application Publication
No. 2022-150045

Summary of Invention

25 Technical Problem

[0004]

When paste is applied to an object to be coated, coating uniformity may be degraded.

[0005]

5 It is an object of the present disclosure to provide a technology with which coating uniformity can be enhanced. Other problems and novel features will be apparent from the description of the present specification and the accompanying drawings.

10 Solution to Problem

[0006]

Below is a brief description of a typical overview of the present disclosure.

A semiconductor manufacturing apparatus includes: a
15 coater having a syringe in which paste is stored, a nozzle holder provided at the tip of the syringe, a nozzle provided in the nozzle holder, and a heating unit for heating the nozzle holder and applying the paste onto an object to be coated; and a control unit so configured that a temperature
20 of the nozzle holder is adjusted by the heating unit and the paste is applied from the nozzle onto the object to be coated.

Advantageous Effects of Invention

[0007]

According to the present disclosure, coating uniformity can be enhanced.

Brief Description of Drawings

[0008]

5 FIG. 1 is a top view illustrating an outline of a die bonder in an embodiment.

FIG. 2 is a sectional view illustrating an outline of the die supply unit shown in FIG. 1.

10 FIG. 3 is a side view illustrating an outline of a preform unit shown in FIG. 1.

FIG. 4 is a side view illustrating an outline of the die supply unit and the bonding unit shown in FIG. 1.

FIG. 5 is a flowchart showing die bonding processing using the die bonder shown in FIG. 1.

15 FIG. 6 is a side view illustrating a coater and a preform stage.

FIG. 7 is a top view illustrating an example of a configuration of a substrate in an embodiment.

20 FIG. 8 is a top view illustrating an example of paste coating.

FIG. 9 is a drawing indicating a transition of a temperature of paste in a nozzle.

Description of Embodiments

[0009]

An embodiment will be described below with reference to the drawings. It should be noted that in the following description, the same components are indicated by the same reference numerals, and the repeated description thereof may
5 be omitted. It should be noted that to make the description more clearly, the drawings may be schematically represented for the widths, thicknesses, shapes, and the like of the respective portions as compared with the actual form. In addition, also between a plurality of mutual drawings, the
10 dimension relationships between the respective elements, the ratios between the respective elements, and the like do not always coincide with each other.

[0010]

A description will be given to a configuration of a
15 die bonder (die bonding apparatus) as an embodiment of a semiconductor manufacturing apparatus with reference to FIG. 1 to FIG. 4. FIG. 1 is a top view illustrating an outline of a die bonder in an embodiment. FIG. 2 is a sectional view illustrating an outline of the die supply unit shown in
20 FIG. 1. FIG. 3 is a side view illustrating an outline of the preform unit shown in FIG. 1. FIG. 4 is a side view illustrating an outline of the die supply unit and the bonding unit shown in FIG. 1.

[0011]

As shown in FIG. 1, the die bonder 1 roughly includes a wafer supply unit 10, a preform unit 90, a bonding unit 40, a transport unit 50, a substrate supply unit 60, a substrate carry-out unit 70, and a control unit (controller) 80. The Y2-Y1 direction is equivalent to the front-back direction of the die bonder 1; the X2-X1 direction is equivalent to the crosswise direction thereof; and the Z1-Z2 direction is equivalent to the vertical direction thereof. The wafer supply unit 10 is disposed on the front side of the die bonder 1 and the bonding unit 40 is disposed on the rear side thereof.

[0012]

As shown in FIG. 2, the wafer supply unit 10 includes: a wafer holding stand 12 holding a wafer W; and a plunge-up unit 13 that plunges up a die D from the wafer W. The wafer W is glued (stuck) onto a dicing tape DT and the wafer W is divided into a plurality of dice D. The dicing tape DT is held on a wafer ring WR. The wafer W is, for example, a glass wafer or a semiconductor wafer and the die D is a glass chip or a semiconductor chip. A semiconductor chip is, for example, a logic chip, a memory chip, an image sensor chip, or the like. The die D is also referred to as workpiece.

[0013]

A wafer cassette (not shown) housing a plurality of wafer rings WR is loaded into a wafer cassette lifter (not shown). The wafer ring WR is taken out of a wafer cassette and supplied to the wafer holding stand 12 or is taken out
5 of the wafer holding stand 12 and housed into a wafer cassette.

[0014]

The wafer holding stand 12 includes: an expand ring 15 that holds the wafer ring WR; and a support ring 17 that
10 horizontally positions the dicing tape DT held on the wafer ring WR and having a plurality of dice D glued thereto. The plunge-up unit 13 is disposed inside the support ring 17. The control unit 80 moves the wafer holding stand 12 in the X1-X2 direction and in the Y1-Y2 direction by a wafer table,
15 not shown and moves the die D to a position (pick-up position) of the plunge-up unit 13.

[0015]

When the die D is plunged up, the wafer holding stand 12 moves down the expand ring 15 holding the wafer ring WR.
20 As a result, the dicing tape DT held on the wafer ring WR is stretched to widen a distance between the dice D, and the die D is plunged up from beneath the die D by the plunge-up unit 13; as a result, ease of picking up the die D is enhanced.

25 [0016]

As shown in FIG. 3, the preform unit 90 includes: a syringe 91; a drive unit (not shown) that moves the syringe 91 in the X1-X2 direction, the Y1-Y2 direction, and the Z1-Z2 direction; a preform camera 94 that recognizes a coating position of the syringe 91 and the like; and a preform stage 96. The preform unit 90 applies paste PA to a substrate S conveyed by the transport unit 50 or a semiconductor chip HT mounted on the substrate S by the syringe 91. The paste PA cited here is a liquid adhesive, for example, a resin paste.

10 The syringe 91 has a nozzle 92 at the tip thereof. The syringe 91 is filled therein with the paste PA and is so configured as to push out the paste PA from the tip of the nozzle 92 by air pressure onto the substrate S or the semiconductor chip HT mounted on the substrate S and apply

15 the paste PA thereto. The substrate S and the semiconductor chip HT mounted on the substrate S cited here are also referred to as a member of a semiconductor device. The semiconductor ship HT is, for example, a logic chip, a memory chip, an image sensor chip, or the like. The

20 substrate S is a wiring board, a lead frame, or the like.

[0017]

As shown in FIG. 4, the bonding unit 40 includes a bond head 41, a Y drive unit (not shown), a substrate recognition camera 44, and a bond stage 46. The bond head

25 41 is provided with a collet 42 that sucks and holds the die

D at the tip thereof. The Y drive unit moves the bond head 41 in the Y1-Y2 direction. The substrate recognition camera 44 picks up an image of a position recognition mark (not shown) on the substrate S and recognizes a bond position.

5 The bonding unit 40 picks up the die D from the wafer supply unit 10 and bonds the die D onto the conveyed substrate S or the semiconductor chip HT mounted on the substrate S. At this time, the bond head 41 corrects a pick-up position and posture based on picked-up image data of the wafer
10 recognition camera 24 and picks up the die D from the wafer W. Thereafter, the bond head 41 bonds the die D onto the substrate S or the semiconductor chip HT mounted on the substrate S based on picked-up image data of the substrate recognition camera 44.

15 [0018]

As shown in FIG. 1, the transport unit 50 includes a transport lane 52 as a transport path through which the substrate S is moved. Owing to the above-mentioned configuration, the substrate S is moved from the substrate
20 supply unit 60 to the coating position along the transport lane 52; after coating, moved to a bond position; after bonding, moved to the substrate carry-out unit 70; and transferred to the substrate carry-out unit 70.

[0019]

The control unit 80 is configured as a computer including CPU (Central Processing Unit) and a storage unit. The storage unit is configured as a computer-readable recording medium.

5 [0020]

The storage unit readably stores: a control program that monitors and controls operation of each of the above-mentioned parts of the die bonder 1; a process recipe prescribing the procedure, condition, and the like of die bonding processing described later; and the like. The process recipe is a combination of individual procedures for die bonding processing described later so that the control unit 80 is caused to execute each procedure to obtain a predetermined result and functions as a program.

15 [0021]

The CPU is so configured as to read a control program from the storage unit and execute the control program and further read a process recipe. The CPU is so configured so as to control a coating operation of the preform unit 90, a heating operation of the nozzle 92, and the like in accordance with the contents of the read process recipe.

[0022]

Subsequently, a description will be given to die bonding processing (workpiece mounting method, manufacturing method of semiconductor device) using a die bonder in an

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embodiment with reference to FIG. 5. FIG. 5 is a flowchart showing die bonding processing using the die bonder shown in FIG. 1. In the description here, a case where the die D comprised of a glass chip is bonded to the substrate S mounted with the semiconductor chip HT will be taken as an example.

[0023]

(Wafer Carry-in Step: Step S1)

The wafer cassette with a wafer ring WR housed therein is loaded into a wafer cassette lifter. The control unit 80 exercises control so that a wafer ring WR is taken out of the loaded wafer cassette and carried into the wafer holding stand 12.

[0024]

15 (Substrate Carry-in Step: Step S2)

A transport jig with the substrate S mounted with the semiconductor chip HT housed therein is loaded into the substrate supply unit 60. After the loading, the control unit 80 exercises control so that the substrate S is conveyed by the transport unit 50 and carried into the preform stage 96 provided in the preform unit 90.

[0025]

(Preform Step: Step S3)

The control unit 80 exercises control so that an image of a surface of the semiconductor chip HT mounted on the

substrate S before coating of the paste PA is acquired from the preform camera 94 and a surface to be coated with the paste PA is checked. When the surface to be coated does not involve any problem, the control unit 80 exercises control so that a position to be coated with the paste PA is checked in the substrate S supported by the preform stage 96 and the position is determined.

[0026]

The control unit 80 exercises control so that the paste PA is applied to the semiconductor chip HT mounted on the substrate S from the nozzle 92 at the tip of the syringe 91 in a frame shape (ring shape). The paste PA is, for example, a highly viscous adhesive (high in viscosity), such as an ultraviolet (UV) curing adhesive. After the coating, the control unit 80 exercises control so that an image of the applied paste PA is picked up with the preform camera 94. The control unit 80 exercises control so that it is confirmed based on an image obtained by imaging whether the paste PA is precisely applied and the applied paste PA is inspected (appearance inspection). When the coating does not involve any problem, the control unit 80 exercises control so that the substrate S is conveyed to the bond stage 46 provided in the bonding unit 40 by the transport unit 50.

[0027]

(Bond Step: Step S4)

(Positioning of Die)

After Step S1, the control unit 80 exercises control so that a wafer table pitch operation is performed to move
5 the wafer holding stand 12 so that a desired die D can be
picked up from the wafer W. The control unit 80 exercises
control so that positioning and surface inspection of the
die D are performed based on image data obtained as the
result of an image of the die D being picked up by the wafer
10 recognition camera 24. The control unit 80 exercises
control so that the image data is processed and an amount of
deviation (X, Y, θ directions) of the die D on the wafer
holding stand 12 from a die position reference point of the
die bonder 1 is computed and positioning is thereby
15 performed. For the die position reference point, a
predetermined position of the wafer holding stand 12 is held
in advance as initial setting of the apparatus. The control
unit 80 exercises control so that the image data is
processed and a surface inspection of the die D is thereby
20 performed.

[0028]

(Positioning of Substrate)

After Step S3, the control unit 80 exercises control
so that an image of the substrate S placed on the bond stage
25 46 is picked up with the substrate recognition camera 44 to

obtain image data. The control unit 80 exercises control so that the image data is processed and an amount of deviation (X, Y, θ directions) of the substrate S from a substrate position reference point of the die bonder 1 is thereby
5 computed. For the substrate position reference point, the control unit 80 holds in advance a predetermined position of the bonding unit 40 as initial setting of the apparatus.

[0029]

(Pick-up and Bond)

10 The control unit 80 exercises control so that: the bond head 41 is horizontally moved to directly above the die D to be picked up and moved down; and a chuck position of the bond head 41 is corrected from the computed amount of deviation of the die D, and the die D is vacuum chucked by
15 the collet 42. The control unit 80 exercises control so that the die D is bonded to a predetermined spot of the semiconductor chip HT mounted on the substrate S on the bond stage 46 by the bond head 41 that chucks the die D from the wafer W. The control unit 80 exercises control so that an
20 image of the die D bonded to the semiconductor chip HT is picked up with the substrate recognition camera 44 and an inspection is performed based on image data obtained as the result of imaging with respect to whether the die D is bonded in a desired position and the like.

25 [0030]

(Substrate Carry-out Step: Step S5)

The control unit 80 exercises control so that the substrate S with the die D bonded thereto is conveyed from the bonding unit 40 to the substrate carry-out unit 70 by the transport unit 50. The control unit 80 exercises control so that the substrate S is taken out of the substrate carry-out unit 70 and housed into a transport jig and the substrate S is carried out.

[0031]

A detailed description will be given to the preform unit 90 with reference to FIG. 6. FIG. 6 is a side view illustrating a coater and a preform stage.

[0032]

The preform unit 90 includes the syringe 91, the nozzle 92, the nozzle holder 92a, a holding member 93, a support member 95, and the preform stage 96. The syringe 91 houses the paste PA. The syringe 91 has the nozzle holder 92a at the tip thereof. The nozzle holder 92a holds the nozzle 92 therein. The holding member 93 holds the nozzle holder 92a. The holding member 93 has a function of a heater block as well and includes an embedded heating unit 93a. The heating unit 93a is formed of, for example, a resistance heating electric heater. The support member 95 supports the holding member 93 and has a function of adjusting an inclination. The support member 95 is

vertically and horizontally moved by a drive unit, not shown, and the syringe 91 can be thereby moved.

[0033]

The holding member 93 has a temperature sensor, not shown, in proximity to the nozzle holder 92a and the control unit 80 controls the heating unit 93a based on a temperature of the temperature sensor. Heat of the heating unit 93a is transmitted to the entire nozzle 92 through the nozzle holder 92a by thermal conduction and the paste PA in the nozzle 92 is heated and kept at a proper temperature.

[0034]

The syringe 91, the nozzle 92, the nozzle holder 92a, the holding member 93, and the support member 95 constitute a coater. The preform stage 96 may be included in the coater.

[0035]

To apply the paste PA to the semiconductor chip HT, the paste PA is put into the syringe 91 and such pressurized gas as air is supplied from, for example, an air pulse type dispenser (not shown) for a certain period of time from above the syringe 91 and a predetermined quantity of the paste PA is thereby discharged. For example, the discharge pressure of the paste PA is a predetermined pressure and the moving speed of the nozzle 92 is a predetermined speed. At the time of coating, with the nozzle 92 brought close to the

semiconductor chip HT, the syringe 91 is two-dimensionally scanned with a single stroke (drawing operation) within the XY plane.

[0036]

5 A description will be given to application of the paste PA with reference to FIG. 7 and FIG. 8. FIG. 7 is a top view illustrating an example of a configuration of a substrate in an embodiment. FIG. 8 is a top view illustrating an example of paste coating.

10 [0037]

 As shown in FIG. 7, a plurality of product areas (hereafter, referred to as attachment areas P) that finally makes one package is formed in a lattice pattern in a substrate S. The semiconductor chip HT is mounted
15 (attached) in each attachment area P. In the following description, a case where attachment areas P are arranged in eight columns with four attachment areas P per column will be taken as an example. The attachment area P is also referred to as tab.

20 [0038]

 The control unit 80 exercises control so that the paste PA is sequentially applied to the semiconductor chips HT by the syringe 91 downward from the attachment area P on the first row on the first column (CN=1, RN=1) at the upper
25 right of the substrate in which the attachment areas P are

arranged in a lattice pattern. After the paste PA is applied to the semiconductor chip HT in the attachment area P on the fourth row on the first column (CN=1, RN=4) at the lower right, the control unit 80 exercises control so that
5 the substrate S is moved and surface inspection and positioning are performed on the second column from the right. Thereafter, the control unit 80 exercises control so that the paste PA is sequentially applied downward from the uppermost position (first row) on the second column from the
10 right (CN=2, RN=1). Thereafter, the control unit 80 exercises control so that the paste is similarly applied to the third column, the fourth column, ..., the eighth column. The control unit 80 exercises control so that the paste PA is applied to all the attachment areas P in the substrate S
15 by the continuous coating operation mentioned above.

[0039]

A description will be given to the paste PA discharge process. The paste PA is housed in the syringe 91. First, the support member 95 is moved and the nozzle 92 is thereby
20 moved to above the drawing start position WS shown in FIG. 8. As the result of the support member 95 moving down, the tip of the nozzle 92 is moved down from a relatively high position and arrives at a predetermined height (nozzle height) from the upper face of the substrate S at the time
25 when discharge is started. The nozzle height is, for

example, 100 to 200 μm . When the dispenser supplies compressed air here, the air pressure in the syringe 91 is drastically increased and discharge is gradually started. A drawing operation is started in synchronization therewith.

5 Specifically, as the result of the support member 95 being moved, the nozzle 92 is two-dimensionally horizontally moved. In general, the nozzle 92 returns to the drawing start position WS and the drawing operation is terminated there. When the dispenser stops supply of compressed air in

10 synchronization therewith, the air pressure in the syringe 91 is rapidly reduced but discharge is gradually weakened and stopped. Almost at the same time as the stop of discharge, the support member 95 moves up the nozzle 92. As the result of this operation, the paste PA is annularly

15 applied onto a periphery of a semiconductor chip as shown in FIG. 8, for example.

[0040]

The object to be coated is, for example, such a wire-bonded semiconductor chip HT as shown in FIG. 6 and FIG. 8.

20 It will be assumed that the paste PA is applied onto a peripheral area of the semiconductor chip HT, including a wire-bonded portion, as shown in FIG. 8. When the paste PA is a paste high in viscosity, an area (portion, spot) HS where a bonding wire BW is present and an area (portion,

25 spot) LS where the bonding wire BW is absent can be

different from each other in the height or width of the applied paste PA. The area HS cited here is an area where a bonding wire BW is disposed at narrower intervals than a predetermined interval and the coating face is high. The
5 area LS is an area where a bonding wire BW is disposed at wider intervals than a predetermined interval and the coating face is low.

[0041]

With respect to the paste PA applied from the area LS
10 to the area HS while the paste PA is being discharged, surface tension is produced between the paste PA and a bonding wire BW and the paste PA is only partly higher and wider. The height of the paste PA applied to the area LS is lower than the height of the paste PA applied to the area
15 HS; and the width of the paste PA applied to the area LS is narrower than the width of the paste PA applied to the area HS.

[0042]

In the present embodiment, a temperature of the nozzle
20 92 is adjusted by the heating unit 93a provided in proximity to the nozzle 92 and a temperature of the paste PA in the nozzle 92 is thereby adjusted. As a result, a viscosity of the paste PA in the nozzle 92 is adjusted.

[0043]

A description will be given to an example of temperature adjustment with reference to FIG. 9. FIG 9 is a drawing indicating a transition of a temperature of paste in a nozzle. In the graph shown in FIG. 9, the horizontal axis indicates time (t) and the vertical axis indicates temperature (T).

[0044]

It will be assumed that before application of the paste PA is started, a temperature of the paste PA in the nozzle 92 is a room temperature (TR). First, the control unit 80 exercises control so that at time (P0) a predetermined period of time before start of application of the paste PA (P1), heating of the nozzle 92 is started. When the nozzle 92 is heated to a predetermined temperature, the paste PA in the nozzle 92 is heated to a predetermined temperature (TH). The predetermined temperature (TH) cited here is a temperature at which a viscosity of the paste PA in the nozzle 92 becomes equal to a predetermined viscosity and is a temperature at which the paste PA is not cured, for example, 40 to 50°C. Before production start means before a coating operation is started; before a period of time required for a temperature of the nozzle 92 to arrive at a predetermined temperature from start of heating before a coating operation started, the nozzle 92 is not preferably heated.

[0045]

During production (P1 to P2), the control unit 80 exercises control so that the nozzle 92 is continuously heated to keep a temperature of the paste PA in the nozzle 5 92 at the predetermined temperature (TH) and keep a viscosity of the paste PA in the nozzle 92 at a predetermined viscosity. During production cited here means a state in which a continuous coating operation is performed. In a continuous coating operation, discharge of 10 the paste PA and stop of discharge thereof are repeated. When a period of time from stop of discharge to start of discharge exceeds a predetermined time, that is not equivalent to a continuous coating operation. A coating operation with a plurality of attachment areas P in a single 15 substrate S shown in FIG. 7 is a continuous coating operation unless interrupted by any trouble or the like. When substrates S are continuously conveyed from the substrate supply unit 60 to the preform unit 90, a coating operation with these substrates S is a continuous coating 20 operation unless interrupted by any trouble or the like.

[0046]

After production termination (P2), the control unit 80 exercises control so that heating of the nozzle 92 is stopped. Production termination cited here means that a 25 continuous coating operation is stopped and the coater is

brought into a standby state. For example, when a transport
jig for housing substrates, loaded into the substrate supply
unit 60 is emptied and replacement with a transport jig with
substrates housed therein is required, the coating operation
5 is interrupted and a standby state is established. Also,
when the wafer ring WR held by the wafer holding stand 12 is
replaced and when a syringe 91 is replaced, a standby state
is established. When a standby period (P2 to P3) is short
as shown in FIG. 9, a temperature of the paste PA in the
10 nozzle 92 does not lower to a room temperature. Meanwhile,
when a standby period (P2 to P3) is long, a temperature of
the paste PA in the nozzle 92 lowers to a room temperature.
[0047]

By temporarily reducing a viscosity of the paste PA in
15 the nozzle 92 using a temperature adjustment function of the
nozzle 92, the fluidity thereof is increased to reduce an
influence of a bonding wire BW. As a result, the uniformity
of applied paste can be enhanced. Rather than the entire
syringe 91, only the tip portion of the nozzle 92 is
20 temporarily heated to reduce a viscosity of the paste PA.
In other words, since this is not temperature adjustment
(heating) of the entire syringe 91 or constant temperature
adjustment (heating) of the nozzle 92, deterioration of the
paste PA can be reduced.

25 [0048]

Since the nozzle 92 is heated before start of coating, an influence of thixotropy can be reduced. When coating is not performed for a predetermined period of time or longer, a phenomenon in which when coating is started, a quantity of coating is made unstable by an influence of thixotropy occurs. Thixotropy means a property in which under continuous application of certain force, a viscosity is gradually reduced and liquefaction occurs; and when a stationary state continues, a viscosity is increased and solidification occurs. As a result, as shown in FIG. 8, a quantity of paste becomes insufficient at a drawing start position WS and an area where paste is not applied can remain on the semiconductor chip HT. In not only an object to be coated having a coating face different in height but also even an object to be coated substantially constant in a distance between a coating face and a nozzle, an influence of thixotropy can be reduced. As a result, the uniformity of applied paste can be enhanced.

[0049]

Up to this point, a concrete description has been given to the disclosure made by the present disclosing party based on an embodiment but the present disclosure is not limited to the above-mentioned embodiment and can be variously modified, needless to add.

[0050]

For example, aside from a temperature of the nozzle 92, at least either of a moving speed of the nozzle 92 in the horizontal direction and a discharge pressure of paste may be controlled and a quantity of applied paste may be
5 thereby controlled.

[0051]

A distance from the tip of the nozzle 92 to a coating face may be detected by measurement and a temperature of the nozzle 92 may be thereby controlled. Information of a
10 distance from the tip of the nozzle 92 to a coating face may be inputted in advance and a temperature of the nozzle 92 may be controlled based thereon. A temperature of paste may be controlled any of on a tab-by-tab basis, on a tab column-by-tab column basis, and on a substrate-by-substrate basis.

15 [0052]

In the description of the present embodiment, a resistance heating type electric heater has been taken as an example of the heating unit; instead, an electric heater of an infrared heating type, induction heating type, or a
20 Peltier element is also acceptable.

[0053]

In the description of the present embodiment, a case where the paste PA is annularly applied onto the semiconductor chip HT has been taken as an example; instead,
25 the paste PA may be applied onto the semiconductor chip HT

in any other pattern than annularly (for example, in an X shape or a Z shape).

[0054]

In the description of the present embodiment, a case
5 where a glass chip is bonded to the semiconductor chip HT has been taken as an example; instead, a semiconductor chip (die) divided from a semiconductor wafer may be stacked on the semiconductor chip HT.

[0055]

10 In the description of the present embodiment, a case where the paste PA is applied onto the semiconductor chip HT has been taken as an example; instead, the paste PA may be applied onto the substrate S. In this case, a semiconductor chip is bonded to the substrate S.

15 [0056]

In the description of the present embodiment, a case where a die D picked up from the wafer supply unit 10 by the bond head 41 is bonded to the semiconductor chip HT mounted on the substrate S has been taken as an example. Instead,
20 an intermediate stage may be provided between the wafer supply unit 10 and the bonding unit 40, and the die D picked up from the wafer supply unit 10 by a pick-up head is placed on the intermediate stage, and the die D may be picked up from the intermediate stage by the bond head 41 again and be

bonded to the semiconductor chip HT mounted on the substrate S.

Reference Signs List

[0057]

- 5 1: die bonder (semiconductor manufacturing apparatus)
- 80: control unit
- 91: syringe
- 92: nozzle
- 93a: heating unit

Claims

[Claim 1]

A semiconductor manufacturing apparatus comprising:
a coater that includes a syringe in which paste is
5 housed, a nozzle holder provided at the tip of the syringe,
a nozzle provided in the nozzle holder, and a heating unit
heating the nozzle holder and applies the past to an object
to be coated; and
a control unit so configured as to adjust a
10 temperature of the nozzle holder by the heating unit and
apply the paste from the nozzle onto the object to be
coated.

[Claim 2]

The semiconductor manufacturing apparatus according to
15 Claim 1,
wherein the control unit is so configured that during
a period for which a continuous coating operation is
performed and discharge and stop of discharge of the paste
from the nozzle are repeated, temperature adjustment of the
20 nozzle holder is maintained and during a standby period for
which the continuous coating operation is not performed,
heating of the nozzle holder is stopped.

[Claim 3]

The semiconductor manufacturing apparatus according to
25 Claim 2,

wherein the control unit is so configured that the nozzle holder is heated by the heating unit before coating of the object to be coated is started.

[Claim 4]

5 The semiconductor manufacturing apparatus according to Claim 2,

 wherein the standby period is a period for which a substrate is emptied from a transport jig for mounting substrates and replacement with a transport jig mounted with
10 substrates is performed.

[Claim 5]

 The semiconductor manufacturing apparatus according to Claim 1,

 wherein the object to be coated is a semiconductor
15 chip that is mounted on a substrate and connected with the substrate via a bonding wire.

[Claim 6]

 The semiconductor manufacturing apparatus according to Claim 5,

20 wherein the control unit is so configured that the coating is annularly performed in the peripheral portion of the object to be coated by the coater.

[Claim 7]

 The semiconductor manufacturing apparatus according to
25 Claim 6, further comprising:

a bond head,

wherein the control unit is so configured that a workpiece is placed on the paste applied onto the semiconductor chip by the bond head.

5 [Claim 8]

The semiconductor manufacturing apparatus according to Claim 7,

wherein the workpiece is a glass chip, and

wherein the paste includes an ultraviolet curing
10 adhesive.

[Claim 9]

A coater comprising:

a syringe housing paste;

a nozzle holder provided at the tip of the syringe;

15 a nozzle provided in the nozzle holder;

a heating unit heating the nozzle; and

a control unit so configured that a temperature of the nozzle is adjusted by the heating unit and the paste is applied from the nozzle onto an object to be coated.

20 [Claim 10]

The coater according to Claim 9,

wherein the control unit is so configured that during a period for which a continuous coating operation is performed, and discharge and stop of discharge of the paste
25 from the nozzle are repeated, temperature adjustment of the

nozzle holder is maintained and during a standby period for which the continuous coating operation is not performed, heating of the nozzle holder is stopped.

[Claim 11]

5 The coater according to Claim 10,
 wherein the control unit is so configured that the nozzle holder is heated by the heating unit before coating of the object to be coated is started.

[Claim 12]

10 The coater according to Claim 9,
 wherein the object to be coated is the semiconductor chip that is mounted on a substrate and is connected with the substrate via a bonding wire.

[Claim 13]

15 A manufacturing method of a semiconductor device comprising:

 a step of applying the paste to the object to be coated by the coater according to Claim 12; and

 a step of placing a die on the semiconductor chip.