

TRANSFER METHOD AND MOUNTING METHOD

FIELD OF TECHNOLOGY

The present invention relates to a transfer technology and a mounting technology using the same.

BACKGROUND TECHNOLOGY

Japanese Laid-open Patent Publication No. 2011-82242 (Patent Document 1) discloses a technology including the steps of: transferring a paste (an adhesive), which has applied to a lower end of a transferring pin, to a prescribed position of a substrate; and mounting (bonding) an electronic component to the same position.

PRIOR ART DOCUMENT

PATENT DOCUMENT

Patent Document 1: Japanese Laid-open Patent Publication No. 2011-82242

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

However, in the technology disclosed in Patent Document 1, the transferring pin corresponding to a size of the electronic component (i.e., an amount of the paste) is required, so the transferring pin must be exchanged for each electronic component. Further, the paste is transferred to the prescribed position of the substrate and the electronic component is mounted onto the same position, so they must be precisely aligned, and it is required much time for the precise alignment.

In case of including the step of transferring the paste to the substrate by using the transferring pin, productivity will be lowered. Further, in case of a transferring apparatus and a mounting apparatus in each of which high positioning accuracy is required, and they must have complex structures and their production costs must be increased.

An object of the present invention is to provide a technology capable of transferring a paste to an electronic component. The object and other objects of the present invention and new features thereof will be explained with reference to the descriptions of the specification and the attached drawings.

MEANS FOR SOLVING THE PROBLEMS

Typical inventions disclosed in the present application will be briefly explained as follows.

An example of the transfer method of the present invention comprises the steps of: (a) providing a paste to a first setting section; (b) providing an electronic component to a second setting section; (c) providing the first setting section and the second setting section by having a space therebetween such that the paste and the electronic component are facing each other; (d) warping the first setting section or the second setting section, which is composed of an elastic sheet, so that the paste and the electronic component are close to each other, and pressing the electronic component to the paste; and (e) separating the electronic component from the paste that has been provided to the first setting section so as to adhere the paste to the electronic component.

In the preferable transfer method, a thickness of the paste is equalized by using a squeegee in the step (a). With this method, the thickness of the paste can be controlled by adjusting a distance between the first setting section and the squeegee.

In the preferable transfer method, a plurality of the electronic components are provided to the second setting section in the step (b), and a plurality of the electronic components are collectively pressed to the paste in the step (d). In comparison with a method in which the paste is transferred for each electronic component, productivity can be improved by this method.

In the preferable transfer method, the paste is provided to a first surface of the first setting section in the step (a), the electronic component is provided to a second surface of the second setting section in the step (b), and the first setting section and the second setting section are provided with the space such that the first surface of the first setting section and the second surface of the second setting section are parallel to each other in the step (c). With this method, an amount of the paste to be transferred to the electronic component can be easily adjusted.

In the preferable transfer method, the sheet is made flat before performing the step (d), and the flat sheet is warped by pressing the sheet with a pressing section, which has an end surface and whose width is gradually reduced toward the end surface, in a state where the end surface is parallel to the flat sheet in the step (d). With this method, breaking the sheet by an edge of the end surface of the pressing section can be

prevented.

In the preferable transfer method, the first setting section is a table, the second setting section is the sheet, and the sheet is warped, toward the paste, from one side thereof, which is the opposite side to the side to which the electronic component has been provided in the step (d). With this method, the electronic component can be pressed onto the paste. More preferably, temperature of the paste provided to the table is maintained by a temperature control means, which is provided to the table. In this case, viscosity of the paste can be stabilized, and quality of transcription can be improved.

In the preferable transfer method, the first setting section is the sheet, the second setting section is a table, and the sheet is warped, toward the electronic component, from one side thereof, which is the opposite side to the side to which the paste has been provided in the step (d). With this method, the paste can be pressed onto the electronic component. Namely, the electronic component can be relatively pressed onto the paste.

In a preferable mounting method including the above described transfer method, the electronic component is mounted onto a substrate with the paste after performing the step (e). With this method, the electronic component can be mounted onto the substrate without transferring the paste to the substrate.

EFFECTS OF THE INVENTION

Effects obtained by the typical invention of the present application will be briefly explained. Namely, the solving

means of the present invention is capable of transferring the paste to the electronic component.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic explanation view of an embodiment of a mounting method (transfer method) relating to the present invention.

Fig. 2 is a schematic explanation view of the mounting method (transfer method) which shows a step following the step shown in Fig. 1.

Fig. 3 is a schematic explanation view of the mounting method (transfer method) which shows a step following the step shown in Fig. 2.

Fig. 4 is a schematic explanation view of the mounting method (transfer method) which shows a step following the step shown in Fig. 3.

Fig. 5 is a schematic explanation view of the mounting method (transfer method) which shows a step following the step shown in Fig. 4.

Fig. 6 is a schematic explanation view of the mounting method (transfer method) which shows a step following the step shown in Fig. 5.

Fig. 7 is a schematic explanation view of another embodiment of a mounting method (transfer method) relating to the present invention.

Fig. 8 is a schematic explanation view of the mounting method (transfer method) which shows a step following the step shown in Fig. 7.

Fig. 9 is a schematic explanation view of the mounting

method (transfer method) which shows a step following the step shown in Fig. 8.

Fig. 10 is a schematic explanation view of the mounting method (transfer method) which shows a step following the step shown in Fig. 9.

Fig. 11 is a schematic explanation view of the mounting method (transfer method) which shows a step following the step shown in Fig. 10.

EMBODIMENTS OF THE INVENTION

In the following embodiments of the present invention, the description will be divided into a plurality of sections if required, but they are basically not independent of each other, one section relates to modified examples, details, etc. of a part or all of another section. Thus, a same symbol is applied to structural members having the same function, and explanation will not be repeated. Further, numbers of structural members (including numbers of pieces, numeric values, quantities, ranges, etc.) are not limited to the described numbers except in case that the number is especially specified and that the number is theoretically clearly limited, so the numbers may be smaller or greater than the described ones. Further, as to shapes of structural members, the shapes include substantially similar shapes except in case that the shape is especially specified and that the shape is theoretically clearly excluded.

(First Embodiment)

An embodiment of a mounting method including a transfer method relating to the present invention will be explained with reference to Figs. 1-6. Figs. 1-6 are schematic

explanation views of the mounting method. In the present embodiment, the transfer method of the present invention is applied to a mounting step (bonding step) included in a method for producing semiconductor machines (electronic machines). Namely, a paste 11 is transferred to electronic components 13 (see Fig. 5), and the components 13 are mounted onto a substrate 16 (see Fig. 6). Semiconductor chips (e.g., IC chips, LED chips) may be used as the electronic components 13. The substrate 16 may be a ceramic substrate, a printed substrate, a lead frame, etc.

Firstly, as shown in Fig. 1, a table 10 for transcription is prepared as a paste setting section (a first setting section) to which the paste 11 will be provided. The table 10 has a flat surface 10a (an upper surface in the drawing) and is fixed. The paste 11 is dispensed from a dispenser, not shown in the drawing, and provided (mounted) onto the surface 10a. In the present embodiment, an anisotropic conductive paste is employed as the paste 11. In the anisotropic conductive paste, electrically conductive particles are included in thermosetting resin. Solder particles, resin particles whose surfaces are coated with thin metallic films, etc. may be employed as the electrically conductive particles. Further, a temperature control means (not shown in the drawing) may be provided to the table 10. By the temperature control means, temperature of the paste 11 on the table 10 can be maintained at prescribed temperature, so that viscosity of the paste 11 can be stabilized and quality of transcription can be improved.

Successively, as shown in Fig. 2, a thickness of the paste 11 are controlled, and then the paste 11 is provided to the table

10. Concretely, the paste 11 is mounted on the surface 10a of the table 10, and the paste 11 is flatly spread by moving a squeegee 12, in a state where the paste 11 is mounted on the surface 10a of the table 10, so as to equalize the thickness (make a thin film shape of the paste 11). In this state, a planar size of the paste 11 which is flatly provided on the table is larger than an occupying area (see Fig. 3) of a plurality of the components 13 provided on a sheet 14. By adjusting a distance (a pressing amount of the squeegee 12) between the surface 10a of the table 10 and the squeegee 12 (a front end), the thickness of the paste 11 can be controlled. By equalizing the thickness of the paste 11, an amount of the paste 11 to be transferred to the electronic components 13 can be easily controlled.

Successively, as shown in Fig. 3, the sheet 14 is an elastic sheet and prepared as a component setting section (a second setting section) to which the electronic components 13 are provided. Each of the electronic components 13 has a surface 13b (a lower surface in the drawing), in which external connection terminal electrodes 13a (see Fig. 6) are provided, and the opposite surface 13c (an upper surface). The sheet 14 has a surface 14a (a lower surface in the drawing) and the opposite surface 14b (an upper surface). In the drawing, the surfaces 13c of the electronic components 13 contact the surface 14a of the sheet 14, so the electronic components 13 are provided (stuck) to the sheet 14.

In the present embodiment, firstly, the sheet 14 (e.g., a dicing sheet) is stuck to a semiconductor wafer so as to provide a plurality of semiconductor chips, i.e., the electronic components 13, to the sheet 14. In this step, the sheet 14 is flat,

and the semiconductor wafer is stuck to a center part of the sheet 14. By using a sheet holding unit, e.g., grip ring unit (including an inner ring and an outer ring for pinching an outer circumferential part of the sheet 14), the sheet 14 can be hold in a flat and tensed state. Next, the semiconductor wafer is diced together with the sheet 14, and the sheet 14 is expanded, so that a plurality of the electronic components 13 are provided to the center part of the sheet 14.

As shown in Fig. 3, a transfer head 15 is prepared as a pressing section. The head 15 is capable of reciprocally moving (up-and-down movement in the drawing) by a known driving means, e.g., linear motor, ball screw means. With this structure, the head 15 is capable of moving close to and away from the fixed table 10. The head 15 has an end surface 15a (a lower surface in the drawing) and a tapered surface 15b (a chamfered part), and its width is gradually reduced toward the end surface 15a. By employing such the head 15, breaking the sheet 14 by an edge of the end surface 15a of the head 15 can be prevented by the shape of the head 15 when the head 15 presses the sheet 14.

Successively, as shown in Fig. 3, the paste 11 and the electronic components 13 are provided such that they face each other with forming a space between the table 10 and the sheet 14. The space is formed in a state where the surface 10a of the table 10 and the surface 14a of the sheet 14 are parallel to each other. With this structure, when the electronic components 13 are pressed onto the paste 11 formed into a thin film, an amount of the paste 11 to be transferred to the electronic components 13 can be easily controlled. Further, a space is

formed between the sheet 14 and the head 15 such that the surface 14b of the sheet 14 and the end surface 15a of the head 15 are parallel to each other.

Therefore, as shown in Fig. 3, the sheet 14 on which the electronic components 13 have been provided is located above the table 10 on which the thin film paste 11 has been provided, and the head 15 is located above the sheet 14. In the present embodiment, the table 10, the sheet 14 and the head 15 are located at prescribed positions (i.e., standby positions) in this state, and this state is called a standby state.

Successively, as shown in Fig. 4, the sheet 14 is warped so that the paste 11 and the electronic components 13 are moved close to each other, and then the electronic components 13 are pressed onto the paste 11. Concretely, the head 15 is downwardly moved, from the state shown in Fig. 3, toward the paste 11, so as to press the sheet 14 from one side, which is the opposite side of the side to which the electronic components 13 are provided, so that the sheet 14 is warped by the head 15. With this action, the electronic components 13 can be pressed onto the paste 11. At this time, the sheet 14 is pressed and warped, by the head 15, in a state where the end surface 15a of the head 15 is parallel to the flat sheet 14. the amount of the paste 11 to be transferred to the electronic components 13 can be easily controlled by adjusting a moving amount of the head 15.

The sheet 14 is warped in a state where the outer circumferential part of the sheet 14 is located at a standby position. In the present embodiment, the grip ring is fixed and the sheet 14 (the outer circumferential part) is held by the grip

ring, so the outer circumferential part of the sheet 14 is located at the standby position. With this structure, the center part of the sheet 14 can be protruded toward the paste 11 in the state where the outer circumferential part of the sheet 14 is located at the standby position. Namely, the electronic components 13 can be protruded from the sheet 14, so that they can be pressed onto the paste 11. Note that, the outer circumferential part of the sheet 14 may be held at the standby position by using, for example, vacuum suction means.

A plurality of the electronic components 13 are collectively pressed onto the paste 11. In comparison with a case of transferring the paste 11 to the electronic components 13 individually, productivity can be improved by this action. In the present embodiment, a size of the end surface 15a of the head 15 is larger than an occupying area (a planar area) of a plurality of the components 13 provided on the sheet 14. By employing such the head 15, the paste 11 can be collectively transferred (applied) to a plurality of the electronic components 13.

Successively, as shown in Fig. 5, the paste 11 is applied to the electronic components 13 by separating the electronic components 13 from the paste 11 provided on the table 10. Concretely, the head 15 is upwardly separated (upwardly moved) from the table 10 so as to restore the warped sheet 14 to the standby state. Namely, the electronic components 13 stuck on the sheet 14 are separated from the paste 11 provided on the table 10. At this time, the paste 11 is required to be adhered on the surfaces 13b of the electronic components 13 in which the terminal electrodes 13a are provided.

As described above, the paste 11 can be transferred to the electronic components 13 stuck on the sheet 14. Note that, success or failure of the transcription of the paste 11 to the electronic components 13 may be confirmed by analyzing image data obtained by a camera.

Successively, as shown in Fig. 6, the electronic components 13 are mounted onto the substrate 16 with the paste 11. Concretely, an anisotropic conductive paste, in which solder particles 11b (electrically conductive particles) are included in thermosetting resin 11a, is used as the paste 11. Firstly, the electronic components 13 are disposed on the substrate 16 in a state where electric terminal electrodes 16a (patterns) of the substrate 16 and the terminal electrodes 13a of the electric components 13 are facing each other. Next, the solder particle 11b are melted at a temperature of about 160 °C by a heater. The melted solder particles 11b gradually flocculate between the terminal electrodes 13a and the terminal electrodes 16a. Next, the temperature of the heater is reduced to about 140 °C so as to harden the thermosetting resin 11a.

By the above described method, the electronic components 13 can be mounted onto the substrate 16. The terminals 13a of the electronic components 13 are electrically connected to the terminal electrodes 16a of the substrate 16 by the paste 11 (the solder particles 11b). In comparison with a mounting method including steps of: aligning the paste 11 with prescribed positions (the terminal electrodes 16a) of the substrate; transferring the paste to the prescribed positions; aligning the terminal electrodes 13a of the electronic components 13 with the prescribed positions; and mounting the

electronic components, number of aligning actions can be reduced in the mounting method of the present embodiment, so that productivity and accuracy can be improved.

Note that, an anisotropic conductive paste, in which resin particles whose surfaces are coated with thin metallic films (electrically conductive particles) are included in the thermosetting resin 11a, may be used as the paste 11. In this case, the electronic components 13 is pressed onto the substrate 16 with heating by a heater after disposing the electronic components 13 on the substrate 16, so that the thermosetting resin 11a can be harden in a state where the electrically conductive particles are sandwiched between the terminal electrodes 13a and the terminal electrodes 16a.

(Second Embodiment)

An embodiment of the mounting method including the transfer method relating to the present invention will be explained with reference to Figs. 7-11. Figs. 7-11 are schematic explanation views of the mounting method. In the first embodiment (see Fig. 3), the paste setting section to which the paste 11 is provided is the table 10, and the component setting section to which the electronic components 13 are provided is the sheet 14. On the other hand, in the present embodiment (see Fig. 9), the paste setting section is a sheet 30, and the component setting section is a table 31. Different points will be mainly explained below.

Firstly, as shown in Fig. 7, an elastic sheet 30 to which the paste 11 will be provided is prepared as the paste setting section. The sheet 30 has a surface 30a (an upper surface in the drawing) and an opposite surface 30b (a lower surface). For

example, a dicing sheet, a stretched sheet, etc. may be used as the sheet 30. The sheet 30 in the Fig. 7 is disposed on a table (not shown in the drawing). The paste 11 is provided (supplied) to the surface 30a of the sheet 30 by, for example, a dispenser (not shown in the drawing). In the present embodiment, the paste 11 is an anisotropic conductive paste.

Successively, as shown in Fig. 8, the thickness of the paste 11 are adjusted, and then the paste 11 is provided to the sheet 30. Concretely, the paste 11 is mounted on the surface 30a of the sheet 30, and the paste 11 is flatly spread by moving the squeegee 12, in a state where the paste 11 is mounted on the surface 30a of the sheet 30, so as to equalize the thickness (make a thin film shape of the paste 11). In this state, the paste 11 is provided to a center part of the sheet 30. At this time, the planar size of the paste 11 which is flatly provided on the sheet 30 is larger than an occupying area (see Fig. 9) of a plurality of the components 13 provided on the table 31.

Successively, as shown in Fig. 9, a table 31 for transcription is prepared as the component setting section to which the electronic components 13 will be provided. The table 31 has a surface 31a (a lower surface in the drawing) and is fixed. In the present embodiment, the surfaces 13c of the electronic components 13 and the surface 31a of the table 31 are facing each other, and the electronic components 13 are provided to the table 31 with a sheet 32 (e.g., a stick sheet such as dicing sheet, etc.). The sheet 32 to which the electronic components 13 have been stuck may be held on the surface 31a of the table 31 by, for example, vacuum suction means.

As shown in Fig. 9, the transfer head 15 is prepared as the pressing section. The head 15 has the end surface 15a (the upper surface in the drawing) and is capable of reciprocally moving (the up-and-down movement in the drawing) by the known driving means, e.g., linear motor, ball screw means. With this structure, the head 15 is capable of moving close to and away from the fixed table 31.

The paste 11 and the electronic components 13 are provided such that they are facing each other with forming a space between the table 31 and the sheet 30. The space is formed such that the surface 30a of the sheet 30 and the surface 31a of the table 31 are parallel to each other.

Therefore, as shown in Fig. 9, the electronic components 13 which have been provided to the surface 31a of the table 31 is located above the sheet 30 on which a thin film shape of the paste 11 has been formed, and the head 15 is located below the sheet 30. In the present embodiment, the table 31, the sheet 30 and the head 15 are located at prescribed positions (standby positions) in this state, and this state is called a standby state.

Successively, as shown in Fig. 10, the sheet 30 is warped so that the paste 11 and the electronic components 13 are moved close to each other, and then the electronic components 13 are pressed onto the paste 11. Concretely, the head 15 is upwardly moved toward the electronic components 13, so as to press the sheet 30 from one side, which is the opposite side of the side to which the electronic components 13 are provided, so that the sheet 30 is warped by the head 15. With this action, the electronic components 13 can be relatively pressed onto the paste 11.

The sheet 30 is warped in a state where an outer circumferential part of the sheet 30 is located at a standby position. The outer circumferential part of the sheet is held at the standby position by, for example, using vacuum suction means. With this structure, the center part of the sheet 30 can be protruded toward the electronic components 13, by the head 15, in the state where the outer circumferential part of the sheet 30 is located at the standby position. Namely, the electronic components 13 can be protruded from the sheet 14, so that they can be pressed onto the paste 11.

A plurality of the electronic components 13 are collectively pressed onto the paste 11. In comparison with the case of transferring the paste 11 to the electronic components 13 individually, productivity can be improved more by this action. In the present embodiment, the size of the end surface 15a of the head 15 is larger than the occupying area (the planar area) of a plurality of the components 13 provided on the table 31. By employing such the head 15, the paste 11 can be collectively transferred to a plurality of the electronic components 13.

Successively, as shown in Fig. 11, the paste 11 is applied to the electronic components 13 by separating the paste 11 from the electronic components 13 provided on the table 31. Concretely, the head 15 is downwardly separated (downwardly moved) from the table 31 so as to restore the warped sheet 30 to the standby state. Namely, the paste 11 provided on the sheet 30 is separated from the electronic components 13 provided on the table 31. At this time, the paste 11 is required to be adhered on the surfaces 13b of the electronic components 13 in which

the terminal electrodes 13a are provided.

As described above, the paste 11 can be transferred to the electronic components 13 provided on the table 31. Then, as shown in Fig. 6, the electronic components 13 are mounted onto the substrate 16 with the paste 11. In the present embodiment, the electronic components 13 can be transferred to the substrate 16 without transferring the paste 11 to the substrate 16, so that the productivity and the accuracy can be improved as well as the first embodiment.

The embodiment of the present invention has been explained in detail, but the present invention is not limited to the above described embodiment, and modifications thereof can be allowed without deviating the scope of the present invention.

In the above described embodiments, the components are semiconductor chips. The present invention can be applied to other electronic components which can be stuck on the sheet as components (e.g., chip-shaped components), so the present invention can be applied to other electronic components, e.g., semiconductor chips, resistor chips, capacitor chips, inductor chips.

In the above described embodiments, the anisotropic conductive paste is used as the paste. However, the paste is not limited to such paste, so other materials, e.g., solder, flux, may be used as the paste.

In the above described embodiments, the paste is transferred to a plurality of the electronic components collectively. Further, in the present invention, the paste may be transferred to the electronic components one by one.

CLAIMS

[Claim 1]

A transfer method comprising the steps of:

- (a) providing a paste to a first setting section;
- (b) providing an electronic component to a second setting section;
- (c) providing the first setting section and the second setting section by having a space therebetween such that the paste and the electronic component are facing each other;
- (d) warping the first setting section or the second setting section, which is composed of an elastic sheet, so that the paste and the electronic component are close to each other, and pressing the electronic component to the paste; and
- (e) separating the electronic component from the paste that has been provided to the first setting section so as to adhere the paste to the electronic component.

[Claim 2]

The transfer method according to claim 1,
wherein, in the step (a), a thickness of the paste is equalized by using a squeegee.

[Claim 3]

The transfer method according to claim 1 or 2,
wherein, in the step (b), a plurality of the electronic components are provided to the second setting section, and
in the step (d), a plurality of the electronic components are collectively pressed to the paste.

[Claim 4]

The transfer method according to any one of claims 1-3,
wherein, in the step (a), the paste is provided to a first
surface of the first setting section,

in the step (b), the electronic component is provided to a
second surface of the second setting section, and

in the step (c), the first setting section and the second
setting section are provided with the space such that the first
surface of the first setting section and the second surface of the
second setting section are parallel to each other.

[Claim 5]

The transfer method according to any one of claims 1-4,
wherein, before performing the step (d), the sheet is
made flat, and

in the step (d), the flat sheet is warped by pressing the
sheet with a pressing section, which has an end surface and
whose width is gradually reduced toward the end surface, in a
state where the end surface is parallel to the flat sheet.

[Claim 6]

The transfer method according to any one of claims 1-5,
wherein the first setting section is a table,
the second setting section is the sheet, and

in the step (d), the sheet is warped, toward the paste,
from one side thereof, which is the opposite side to the side to
which the electronic component has been provided.

[Claim 7]

The transfer method according to claim 6,
wherein temperature of the paste provided to the table is maintained by a temperature control means, which is provided to the table.

[Claim 8]

The transfer method according to any one of claims 1-5,
wherein the first setting section is the sheet,
the second setting section is a table, and
in the step (d), the sheet is warped, toward the electronic component, from one side thereof, which is the opposite side to the side to which the paste has been provided.

[Claim 9]

A mounting method including the transfer method of any one of claims 1-8,
wherein, after performing the step (e), the electronic component is mounted onto a substrate with the paste.