

A Chip Alignment Mounting Device and Method Thereof

Technical Field

The invention relates to the technical field concerning semiconductor device packaging, in particular to a chip alignment mounting device and method thereof.

Background

With the continuous development of modern information technology and consumer electronics, integrated circuit chips are increasingly developing towards high density, high performance, lightness, thinness and shortness. However, chips manufactured with traditional packaging and interconnect technologies such as TO, DIP, PLCC, QFP, etc., are difficult to meet the ever-increasing demand for chip performance. As a result, advanced packaging technologies, such as flipchip, fan-out packaging and 3D packaging, which integrate semiconductor packaging and assembly technology, emerge to reduce device packaging size, improve interconnect density, improve the performance of integrated circuit chips, and reduce product prices.

For the existing advanced packaging technologies, semiconductor chips are usually mounted on multiple predetermined mounting positions (arranged in lines or rows on the X-Y plane formed on the substrate surface) on the surface of a substrate such as lead frames, strips, base wafers, and substrate plates. In order to improve the yield, it is necessary to improve the mounting accuracy of semiconductor chips on the substrate, and reduce the position deviation of semiconductor chips in X and Y directions. In addition, in order to reduce the packaging cost incurred from large-scale production of semiconductor chips, advanced packaging technology requires shortening the mounting time of each chip.

In the known chip mounting device and method, by vacuum suction or a clamp, the substrate is usually first fixed on a horizontal substrate carrying mechanism which drives the substrate to move in the X direction on the X-Y plane of the substrate surface, then moves a row of predetermined mounting positions arranged along the Y direction on the substrate into the X position of the predetermined mounting positions and finally fixes them. At the same time, the chips located on the chip feed mechanism are picked up by the chip bonding mechanism which moves back and forth in the Y direction above the substrate carrying mechanism and transported one by one to above a row of predetermined mounting positions in the mounting area. After the X-Y position error provided by

the vision alignment system is corrected, the chip is mounted on the predetermined mounting positions on the substrate to complete mounting the chips.

One of the defects of this kind of chip mounting device and method is that the chip bonding mechanism will translate. In a chip mounting cycle, the chip bonding mechanism will accelerate and decelerate at least twice in the process from picking up the chip from the chip feed mechanism to mounting the chips on the predetermined mounting positions of the substrate and returning from the mounting area to the chip feed mechanism. Frequent position movement and speed increase and decrease are not conducive to shortening the time of chip mounting and controlling the precision of chip mounting. In addition, the second defect of this type of chip mounting device and method is that in a chip mounting cycle, the chip bonding mechanism will pick up the chip from the chip feed mechanism, the chip bonding mechanism will transport the chip to the predetermined mounting positions, the visual imaging mechanism will image and align the chip, and the chip bonding mechanism will mount the chips at the predetermined mounting positions in series, that is, the previous process can be completed before the next process, making the process sequence of chip mounting position single and fixed, and further increasing the total time required for chip mounting.

Therefore, in order to improve the mounting accuracy and production efficiency of semiconductor chips on the substrate at the same time, it is necessary to propose a new chip alignment mounting device and method thereof to solve the technical problem that the existing devices and methods cannot quickly complete aligning and mounting chips and substrates.

Summary

The chip alignment mounting device and method thereof provided by the invention can quickly and accurately complete aligning and mounting the semiconductor chip and the substrate for the deficiency of the prior art.

In the first aspect, the invention provides a chip alignment mounting device, including a feed mechanism, a substrate carrying mechanism, a chip feed mechanism, a chip flip mechanism and a chip bonding mechanism, wherein:

The feed mechanism mentioned above provides the substrate not mounted with chips to the substrate carrying mechanism located in the substrate loading area, and removes the substrate mounted with chips from the substrate carrying mechanism in the substrate loading area;

The substrate carrying mechanism mentioned above loads and fixes the substrate, and drives the substrate to move on the first plane parallel to the X-Y plane. The motion range of the substrate

includes the substrate loading area and the mounting area. The substrate carrying mechanism can transport each predetermined mounting positions on the substrate to the mounting position in the mounting area;

The chip feed mechanism provides the chips to the chip flip mechanism at the chip feed position of the chip alignment mounting device;

The chip flip mechanism can make a first rotation around the first rotation axis parallel to the X-Y plane to pick up the chips from the chip feed position, then deliver the chips to the chip transfer position through the first rotation and finally provide the chip bonding mechanism with the chips;

The chip bonding mechanism can make a second rotation around the second rotation axis parallel to the Z direction to pick up the chips from the chip transfer position, and mount the chips on the predetermined chip mounting positions of the substrate at the mounting position through the second rotation;

The X-Y plane is the plane on which the substrate surface is fixed by the substrate carrying mechanism, and the Z direction is perpendicular to the X-Y plane; the mounting position, the chip feed position and the chip transfer position are all fixed positions.

Alternatively, the chip flip mechanism has a plurality of first rotation arms which extend along the radial direction of the first rotation axis on the second plane perpendicular to the first rotation axis, and the ends of the plurality of first rotation arms are provided with a chip picking mechanism capable of telescopic motion along the direction of the first rotation arms and perpendicular to the first rotation axis. When the chip flip mechanism rotates around the first rotation axis, each chip picking mechanism rotates in the order of “chip feed position--chip carrying waiting position--chip transfer position--no chip waiting position--chip feed position”, wherein the chip carrying waiting position is used for the chip picking mechanism to wait after it obtains the chips from the chip feed position, and the no chip waiting position is used for the chip picking mechanism to wait after it transfers the chips at the chip transfer position.

Alternatively, the chip bonding mechanism has a plurality of second rotation arms which extend along the radial direction of the second rotation axis on the third plane perpendicular to the second rotation axis; the ends of the plurality of second rotation arms are provided with chip bonding heads perpendicular to the second rotation arms and parallel to the direction of the second rotation axis. When the chip bonding mechanism rotates around the second rotation axis, each chip

bonding head rotates in the order of “chip transfer position--chip flux dipping position--chip uplooking imaging position--chip mounting position--chip transfer position”, wherein the chip flux dipping position completes the chip flux dipping, and the chip uplooking imaging position completes the chip feature photographing and position calculation.

Alternatively, the chip alignment mounting device also includes a pre-alignment imaging mechanism, a uplooking imaging mechanism and / or a downlooking imaging mechanism, wherein,

the pre-alignment imaging mechanism fixed in the + Z direction of the chip feed position photographs in the -Z direction, and images the chip on the chip feed position;

the uplooking imaging mechanism fixed in the - Z direction of the chip uplooking imaging position photographs in the + Z direction, and images the chip on the uplooking imaging position;

the downlooking imaging mechanism photographs in the -Z direction for the +Z direction of the predetermined mounting positions and images the predetermined mounting positions or the chip already mounted;

the +Z direction is along the Z direction from the back surface of the substrate in contact with the substrate carrying mechanism to the front surface of the substrate with a predetermined mounting position, and the -Z direction is along the Z direction from the front surface of the substrate with a predetermined mounting position to the back surface of the substrate in contact with the substrate carrying mechanism.

Alternatively, the feed mechanism includes a feed mechanism, a feed conveying mechanism, a blanking conveying mechanism and a blanking mechanism, wherein,

the feed mechanism is distributed along the Z direction and is arranged to transport the substrate not mounted with chips to the X-Y plane along the Z direction;

the feed conveying mechanism is distributed parallel to the X-Y plane and is arranged to receive the substrate not mounted with chips from the feed mechanism and transport it to the substrate carrying mechanism;

the blanking conveying mechanism is distributed parallel to the X-Y plane, and is arranged to receive the substrate mounted with chips from the substrate carrying mechanism and transport it to the blanking mechanism;

the blanking mechanism is distributed along the Z direction, and is arranged to send the substrate mounted with chips out of the X-Y plane along the Z direction and separate it from the chip alignment mounting device.

Alternatively, the feed mechanism is arranged to lift the substrate not mounted with chips to the substrate feed area along the Z direction, and the feed conveying mechanism can transport the substrate not mounted with chips to the substrate feed area parallel to the X-Y plane along the Z direction;

The feed conveying mechanism is arranged to transport the substrate not mounted with chips from the substrate feed area through the first substrate waiting area parallel to the X-Y plane to the substrate loading area;

The substrate carrying mechanism is arranged to load the substrate not mounted with chips from the substrate loading area, and to transport all the predetermined mounting positions to the mounting position for mounting the chips;

The blanking conveying mechanism is arranged to transport the substrate from the substrate loading area through the second substrate waiting area parallel to the X-Y plane to the substrate storage area parallel to the X-Y plane;

The blanking mechanism is arranged to send the substrate mounted with chips out of the X-Y plane from the substrate storage area along the Z direction and separate it from the chip alignment mounting device;

Wherein, the feed conveying mechanism and the blanking conveying mechanism share a guide rail, and the substrate feed area, the first substrate waiting area, the substrate loading area, the second substrate waiting area and the substrate storage area are located on the same side of the guide rail, and are sequentially distributed along the guide rail.

On the other hand, the invention provides a chip alignment mounting method, which includes:

Step 1: the feed mechanism transfers the substrate not mounted with chips to the substrate carrying mechanism which fixes the substrate not mounted with chips, and transports it to the chip mounting area;

Step 2: the chip feed mechanism transports the chips to the chip feed position;

Step 3: the chip flip mechanism rotates for the first time, so that each chip picking mechanism installed on the chip flip mechanism enters the chip feed position, chip carrying waiting position, chip transfer position and no chip waiting position respectively;

Step 4: the chip bonding mechanism rotates for the second time, so that each chip bonding head installed on the chip bonding mechanism enters the chip transfer position, chip flux dipping position, uplooking imaging position and mounting position respectively;

Step 5: the chip flip mechanism transfers the chips at the chip transfer position to the chip bonding mechanism which mounts the chips on the substrate at the mounting position, and the chip feed mechanism delivers the next chip to the chip feed position;

Step 6: the chip flip mechanism continues to rotate so that each chip picking mechanism rotates in the order of “chip feed position--chip carrying waiting position--chip transfer position--no chip waiting position--chip feed position”. At the same time, the chip bonding mechanism continues to rotate so that each bonding head rotates in the order of “chip transfer position--chip flux dipping position--uplooking imaging position--mounting position--chip transfer position”. The chip picking mechanism of the chip flip mechanism rotates synchronously with the bonding head of the chip bonding mechanism;

Step 7: repeat steps 5 to 6 until all the predetermined mounting positions on the substrate are mounted with chips;

Step 8: the substrate carrying mechanism sends the substrate which has been mounted with chips out of the mounting area, releases the fixation of the substrate, and transfers the substrate to the feed mechanism.

Alternatively, the chip picking mechanism of the chip flip mechanism is arranged to expand along the radial direction of the first rotation axis in the plane perpendicular to the surface of the substrate and the chip bonding head of the chip bonding mechanism is arranged to expand in a direction parallel to the second rotation axis. When the chip flip mechanism and the chip bonding mechanism transfer at the chip transfer position, the chip picking mechanism extends and/ or the chip bonding head extends out to transfer.

Alternatively, step 2 also includes a pre-alignment imaging mechanism to photograph and image a chip at the chip feed position, obtain the first position deviation of the chip relative to the chip feed position, and then correct the position deviation by the chip feed mechanism;

Step 4 also includes photographing and imaging the chips at the uplooking imaging position by the uplooking imaging mechanism and obtaining the second position deviation of the chip relative to the uplooking imaging position; photographing the predetermined chip position of the substrate or the chip already mounted by the downlooking imaging mechanism and obtaining the third position deviation of the predetermined chip position relative to the mounting position; combining the second position deviation and the third position deviation by the substrate carrying mechanism to correct the position deviation.

Alternatively, the step 1 also includes:

The feed mechanism lifts the substrate not mounted with chips to the substrate feed area;

The feed conveying mechanism of the feed mechanism obtains the substrate not mounted with chips from the substrate feed area, and transports the substrate to the substrate loading area through the first substrate waiting area;

The substrate carrying mechanism loads the substrate not mounted with chips from the substrate loading area and transports the substrate to the mounting area, and finally transports the substrate from the mounting area to the substrate loading area after mounting chips at all predetermined mounting positions of the substrate not mounted with chips;

The blanking conveying mechanism of the feed mechanism receives the substrate from the substrate loading area and transports the substrate to the substrate storage area through the second substrate waiting area;

The blanking mechanism obtains the substrate mounted with chips from the substrate storage area and sends out the chip alignment mounting device.

In the chip alignment mounting device and method thereof provided by the invention, a chip flip mechanism with a plurality of chip picking mechanisms for obtaining chips in rotation from a chip feed mechanism, and a chip bonding mechanism with a plurality of chip bonding heads for obtaining chips from a plurality of chip picking mechanisms in rotation are arranged, so that the steps including chip picking, downlooking imaging, pre-alignment imaging, uplooking imaging, flux dipping and mounting can be carried out in parallel, thus improving the production efficiency of semiconductor chips.

Brief Description of the Drawings

In order to explain the technical scheme in the embodiment of the invention more clearly, the drawings needed in the description of the embodiment will be briefly introduced. Obviously, the drawings in the following description are only some embodiments of the invention. For ordinary technical personnel in this field, other drawings can be obtained according to these drawings without paying creative labor.

Figure 1 is a schematic diagram of a chip alignment mounting device provided by an embodiment of the invention;

Figure 2 is the uplooking structure diagram of the chip alignment mounting device provided by an embodiment of the invention;

Figure 3 is a flow diagram of the chip alignment mounting method provided by another embodiment of the invention.

Detailed Description

In order to make the purpose, technical scheme and advantages of the embodiment of the invention clearer, the technical scheme in the embodiment of the invention will be described clearly and completely in combination with the drawings in the embodiment of the invention. Obviously, the described embodiment is only a part of the embodiment of the invention. Based on the embodiment of the invention, all other embodiments obtained by ordinary technical personnel in this field without creative labor are within the scope of protection of the invention.

The embodiment of the invention provides a chip alignment mounting device including a substrate carrying mechanism, a chip feed mechanism, a chip flip mechanism, a chip bonding mechanism, an alignment imaging mechanism and a feed mechanism.

The substrate carrying mechanism loads and fixes the substrate, and drives the substrate to move in the plane parallel to the X-Y plane. The motion range of the substrate includes the substrate loading area and the mounting area. Specifically, the substrate carrying mechanism can fix the substrate by vacuum suction or a clamp. In addition, the substrate carrying mechanism can perform precise translational movement in the mounting area on the X-Y plane formed on the substrate surface, thereby accurately transporting each predetermined mounting position on the substrate to a fixed mounting position. In particular, the X-Y plane is the plane where the substrate surface is fixed by the substrate carrying mechanism, and the Z direction is perpendicular to the X-Y plane.

The chip feed mechanism loads a plurality of chips and feeds the chips to the chip flip mechanism at the chip feed position of the chip alignment mounting device.

The chip flip mechanism picks up the chips from the chip feed mechanism at a fixed chip feed position and transmits the picked chips to the chip bonding mechanism. Specifically, the chip flip mechanism can rotate around the rotation axis parallel to the X-Y plane, so that multiple chip picking mechanisms on the chip flip mechanism can alternately reach the fixed chip feed position to pick up the chip, and can alternately reach a fixed chip transfer position to transfer the chips to the chip bonding mechanism.

The chip bonding mechanism obtains the chips at a fixed chip transfer position, then transports the chips to above the predetermined mounting position of the substrate, and finally mounts the chips in the predetermined mounting position. Specifically, the chip bonding mechanism can rotate

around the rotation axis parallel to the Z direction for the second time, so that a plurality of chip bonding heads on the chip bonding mechanism can obtain the chips from the fixed chip transfer position in rotation, and rotate to above the predetermined mounting position of the substrate for mounting.

The alignment imaging mechanism includes but is not limited to a pre-alignment imaging mechanism, a uplooking imaging mechanism, and a downlooking imaging mechanism. The pre-alignment imaging mechanism is fixed in the +Z direction of the chip feed position and photographs in the -Z direction for imaging the chips at the chip feed position. The uplooking imaging mechanism is fixed in the -Z direction of the chip uplooking imaging position, and photographs in the +Z direction for imaging the chips at the chip uplooking imaging position. The downlooking imaging mechanism is fixed in the +Z direction of the mounting position, and photographs in the -Z direction for imaging the predetermined mounting position or the mounted chips. The results of photographing and imaging the chip by the pre-alignment imaging mechanism, the uplooking imaging mechanism and the downlooking imaging mechanism are used in the chip alignment mounting device of the embodiment of the invention to correct the mounting position of the chip or substrate. The +Z direction is along the Z direction from the back of the substrate in contact with the substrate carrying mechanism to the front of the substrate with a predetermined mounting position, and the -Z direction is along the Z direction from the front of the substrate with a predetermined mounting position to the back of the substrate in contact with the substrate carrying mechanism.

The feed mechanism includes feed mechanism, feed conveying mechanism, blanking conveying mechanism and blanking mechanism. The feed mechanism distributed along the Z direction is arranged to transport the substrate not mounted with chips to the X-Y plane along the Z direction. The feed conveying mechanism distributed parallel to the X-Y plane is arranged to receive the substrate not mounted with chips from the feed mechanism, and then send it to the substrate loading area of the chip mounting device according to the embodiment of the invention. The blanking conveying mechanism distributed parallel to the X-Y plane is arranged to receive the substrate mounted with chips from the substrate loading mechanism and transmit it to the blanking mechanism. The blanking mechanism distributed along the Z direction is arranged to receive the substrate mounted with chips and transmitted from the blanking conveying mechanism, send out the X-Y plane along the Z direction, and separate it from the chip alignment mounting device.

Specifically, the substrate not mounted with chips is delivered by the feed mechanism in the substrate feed area to the feed conveying mechanism which transfers the substrate not mounted with chips from the substrate feed area to the substrate loading area. Specifically, the substrate mounted with chips is transmitted from the substrate loading area to the substrate storage area and delivering it to the blanking mechanism, and the blanking mechanism receives the substrate mounted with chips in the substrate storage area.

Figure 1 is a schematic diagram of a chip alignment mounting device provided by an embodiment of the invention. As shown in the figure, the substrate 150 is located on the surface of the substrate carrying mechanism (not shown), and the surface of the substrate 150 has a plurality of predetermined mounting positions arranged in rows. In particular, in the embodiment of the invention, the surface of the predetermined mounting position of the substrate 150 is the X-Y plane, and the direction of the surface perpendicular to the substrate 150 from the back of the substrate 150 to the front is the Z direction.

Specifically, the substrate carrying mechanism (not shown) loads and fixes the substrate 150 by vacuum suction or a clamp. The substrate carrying mechanism (not shown) can drive the substrate 150 to precisely translate in the X or Y direction, so as to sequentially translate the predetermined mounting positions to the mounting positions of the mounting area. In addition, the substrate carrying mechanism (not shown) can move to a substrate loading area other than the mounting area on the X-Y plane, and load the substrate not mounted with chips in the substrate loading area and/or remove the substrate that has been mounted. Typically, the substrate loading area is located in the -Y direction of the mounting area of the substrate 150.

The chip feed mechanism 111 loads the chip 112 to be mounted, and transfers the chip 112 to the chip flip mechanism 120 at the fixed chip feed position.

The chip flip mechanism 120 has a cross structure and can rotate around the first rotation axis in the X-Z plane. The first rotation axis is the rotation axis parallel to the Y direction passing through the center of the chip flip mechanism 120. The chip flip mechanism 120 has four first rotation arms, which extend on the plane perpendicular to the first rotation axis and parallel to the X-Z plane. Four chip picking mechanisms are installed at the four ends of the four first rotation arms: the first chip picking mechanism 121, the second chip picking mechanism 122, the third chip picking mechanism 123, and the fourth chip picking mechanism 124, which can enter the chip feed position, the chip carrying waiting position, the chip transfer position and the no chip waiting

position successively with the rotation of the cross structure of the chip flip mechanism 120. Typically, both the chip feed position and the chip transfer position are fixed positions. Preferably, the chip carrying waiting position and the no chip waiting position are also fixed positions.

Furthermore, the first chip picking mechanism 121, the second chip picking mechanism 122, the third chip picking mechanism 123 and the fourth chip picking mechanism 124 can extend or retract along the radial direction of the cross structure of the chip flip mechanism 120. Specifically, the extending and retracting directions of the four chip picking mechanisms are all in the plane of X-Z. The extending or retracting motions of the first chip picking mechanism 121 and the third chip picking mechanism 123 are on the same straight line with opposite directions, while the extending or retracting motions of the second chip picking mechanism 122 and the fourth chip picking mechanism 124 are all in the same straight line with opposite directions. The four chip picking mechanisms can extend or retract on the X-Z plane to pick and transfer chips.

Furthermore, a pre-alignment imaging mechanism 141 located above the chip 112 at the fixed chip feed position along the + Z direction, and photographing and imaging the chip 112 at the fixed chip feed position in the - Z direction is installed above the chip feed mechanism 111 along the + Z direction.

The chip bonding mechanism 130 also has a cross structure and can rotate around a second rotation axis in a plane parallel to the X-Y plane, and the second rotation axis is a rotation axis parallel to the Z direction passing through the center of the chip bonding mechanism 130. The chip bonding mechanism 130 has four second rotation arms which extend along the radial direction of the second rotation axis. Four bonding heads are installed at the four ends of the cross structure of four second rotation arms: the first bonding head 131, the second bonding head 132, the third bonding head 133 and the fourth bonding head 134. The chip bonding mechanism 130 can rotate on the surface parallel to the X-Y plane, so that the first bonding head 131, the second bonding head 132, the third bonding head 133 and the fourth bonding head 134 rotate to the chip transfer position, flux dipping position, uplooking imaging position and mounting position in turn. Preferably, these four positions are all fixed positions. In particular, the flux dipping mechanism 170 for gluing the chips is provided in the -Z direction of the flux dipping position.

In particular, the first bonding head 131, the second bonding head 132, the third bonding head 133 and the fourth bonding head 134 can extend and retract in a straight line along the Z direction and parallel to the second rotation axis, so as to realize the functions such as chip transfer, chip flux

dipping and chip mounting.

In particular, the uplooking imaging mechanism 142 photographing and imaging the chips rotated to the uplooking imaging position carried by the bonding head of the chip bonding mechanism 130 along the + Z direction is installed along the - Z direction of the uplooking imaging position of the chip bonding mechanism 130.

In particular, the downlooking imaging mechanism 143 photographing and imaging the predetermined mounting position of the substrate 150 or the chip already mounted along the - Z direction is installed in the + Z direction of the chip bonding mechanism 130.

Alternatively, in multiple embodiments of the invention, the chip flip mechanism 120 may include more than 4 or less than 4 chip picking mechanisms, and the chip bonding mechanism 130 may also include more than 4 or less than 4 chip bonding heads. Preferably, the chip flip mechanism 120 includes 4 chip picking mechanisms, and the chip bonding mechanism 130 (including 4 bonding heads). Therefore, the 4 chip bonding processes of chip obtaining, dipping, photographing and mounting can be carried out simultaneously. Furthermore, multiple chip picking mechanisms and multiple bonding heads can correspond one to one, which is beneficial to debugging, alignment, and fault diagnosis of the whole machine.

The feed mechanism 161 which can load a plurality of substrates not mounted with chips transports the substrate 150 with chips to be mounted to the substrate feed area along the + Z direction. The feed conveying mechanism 162 is located between the substrate feed area and the substrate loading area, and translates along the guide rail 165. Specifically, the feed conveying mechanism 162 first transports the substrate 150 from the substrate feed area to the first substrate waiting area (not shown) between the substrate feed area and the substrate loading area. When the first substrate carrying mechanism (not shown) moves to the substrate loading area in an unloaded state, the feed conveying mechanism 162 transports the substrate 150 from the first substrate waiting area (not shown) to the substrate carrying mechanism located in the substrate loading area. Then, the substrate carrying mechanism fixes and transports the substrate 150 from the substrate loading area to the mounting area, and the chip bonding mechanism 130 mounts the chips on the predetermined mounting position 151 of the substrate 150.

The blanking conveying mechanism 163 located between the substrate loading area and the substrate storage area translates along the guide rail 165. Specifically, after the chips are mounted, the substrate carrying mechanism transports the substrate 150 back to the substrate loading area,

and the blanking conveying mechanism 163 first transports the substrate 150 mounted with chips to the second substrate waiting area (not shown) between the substrate loading area and the substrate storage area, and then transports the substrate 150 to the substrate storage area. The blanking mechanism 164 removes the substrate 150 mounted with chips from the substrate storage area along the - Z direction and store it in different Z-direction positions.

Preferably, the substrate feed area and the substrate storage area are located on both sides of the substrate loading area, wherein the substrate feed area is located in the - X direction of the substrate loading area, and the substrate storage area is located in the + X direction of the substrate loading area. The feed conveying mechanism 162 and the blanking conveying mechanism 163 share the guide rail 165 for translation.

Figure 2 shows the uplooking structure diagram of the chip alignment mounting device provided by an embodiment of the invention. As shown in the figure, the uplooking plane is the X-Y plane. The chip flip mechanism 220 and the chip bonding mechanism 230 can rotate in a plane perpendicular to and parallel to the uplooking plane, respectively. The substrate 250 is located in the mounting area 251 via the substrate carrying mechanism 280, and the chip bonding mechanism 230 can transport the chip to the mounting position 252 and mount the chip on the predetermined mounting position of the substrate 250.

The substrate feed area 281 and the substrate storage area 285 are respectively located on both sides of the substrate loading area 283, wherein the substrate feed area 281 is located in the - X direction of the substrate loading area 283, and the substrate storage area 285 is located in the + X direction of the substrate loading area 283.

The feed mechanism 261 can load a plurality of substrate 250 not mounted with chips, and transport the substrate 250 with chips to be mounted to substrate feed area 281. The feed conveying mechanism 262 located between the substrate feed area 281 and the substrate loading area 283 translates along the guide rail 265. Specifically, the feed conveying mechanism 262 first transports the substrate 250 from the substrate feed area 281 to the first substrate waiting area 282 between the substrate feed area 281 and the substrate loading area 283. When the substrate carrying mechanism 280 moves to the substrate loading area 283 in an unloaded state, the feed conveying mechanism 262 transports the substrate 250 from the first substrate waiting area 282 to the substrate carrying area 280 located in the substrate loading area 283. Then, the substrate carrying mechanism 280 fixes the substrate 250 and transports the substrate 250 from the substrate loading area 283 to the

mounting area 251, and the chip bonding mechanism 230 mounts the chip on the predetermined mounting position of the substrate 250.

The blanking conveying mechanism 263 located between the substrate loading area 283 and the substrate storage area 285 translates along the guide rail 265. Specifically, after the chip is mounted, the substrate carrying mechanism 280 transports the substrate 250 back to the substrate loading area 283, and the blanking conveying mechanism 263 first transports the substrate 250 mounted with chips to the second substrate waiting area 284 between the substrate loading area 283 and the substrate storage area 285, and then transports the substrate 250 to the substrate storage area 285. The blanking mechanism 264 removes and stores the substrate 250 mounted with chips from the substrate storage area 283. Preferably, the feed conveying mechanism 262 and the blanking conveying mechanism 263 share the guide rail 265 for translation.

In the chip alignment mounting device provided by the embodiment, the chip flip mechanism and the chip bonding mechanism respectively have a plurality of chip picking mechanisms and a plurality of chip bonding heads, so that the chip obtaining, flux dipping, uplooking photographing, chip mounting and other processes can be carried out simultaneously, thus improving the efficiency of the chip alignment mounting process.

In an embodiment of the invention, a chip alignment mounting method is provided, which includes: step 1: the feed mechanism transfers the substrate not mounted with chips to the substrate carrying mechanism, and the substrate carrying mechanism fixes the substrate not mounted with chips, and transports it to the mounting area; step 2, the chip feed mechanism transports the chips to the chip feed position; step 3: the chip flip mechanism rotates for the first time, so that the first chip picking mechanism installed on the chip flip mechanism enters the chip feed position, the second chip picking mechanism enters the chip carrying waiting position, the third chip picking mechanism enters the chip transfer position, and the fourth chip picking mechanism enters the no chip waiting position; step 4, the chip bonding mechanism rotates for the second time, so that the first bonding head installed on the chip bonding mechanism enters the chip transfer position, the second bonding head enters the chip flux dipping position, the third bonding head enters the uplooking imaging position, and the fourth bonding head enters the mounting position; step 5: the chip flip mechanism transfers the chips to the chip bonding mechanism at the chip transfer position, the chip bonding mechanism mounts the chips on the substrate at the mounting position, and the chip feed mechanism transports the next chip to the chip feed position; step 6, the chip flip mechanism

continues to rotate, so that each chip picking mechanism rotates in the order of “chip feed position--chip carrying waiting position--chip transfer position--no chip waiting position--chip feed position”. Meanwhile, the chip bonding mechanism continues to rotate, so that each bonding head rotates in the order of “chip transfer position--chip flux dipping position--uplooking imaging position--mounting position--chip transfer position”. The chip picking mechanism of the chip flip mechanism rotates roughly in synchronization with the bonding head of the chip bonding mechanism; step 7, repeat steps 5 to 6 until all the predetermined mounting positions on the substrate are mounted with chips; step 8: the substrate carrying mechanism sends the substrate mounted with chips out of the mounting area, releases the fixation of the substrate and transfers the substrate to the feed mechanism.

Figure 3 shows a flow diagram of a chip alignment mounting method according to an embodiment of the invention. As shown in the figure: S31 indicates that the feed mechanism transfers the substrate not mounted with chips to the substrate carrying mechanism, and the substrate carrying mechanism fixes the substrate not mounted with chips, and transports it to the mounting area. Specifically, S31 also includes: the feed mechanism sends the substrate not mounted with chips to the substrate feed area; the feed conveying mechanism obtains the substrate located in the substrate feed area, fixes the substrate, and transports the substrate to the first substrate waiting area; when the substrate carrying mechanism in the substrate loading area is unloaded, the feed conveying mechanism transfers the substrate from the first substrate waiting area to the substrate carrying mechanism which fixes the substrate not mounted with chips by vacuum suction or a clamp, and transports it to the mounting area.

In particular, after the feed conveying mechanism transports the substrate not mounted with chips from the substrate feed area to the first substrate waiting area, the feed mechanism transports the next substrate not mounted with chips to the substrate feed area. After transferring the substrate not mounted with chips to the substrate carrying mechanism, the feed conveying mechanism returns to the substrate feed area to obtain the next substrate not mounted with chips.

S32 indicates that the chip feed mechanism transports the chips to the chip feed position; specifically, S32 also includes: the pre-alignment imaging mechanism photographs and images the chip at the fixed chip feed position, obtains the first position deviation of the chip relative to the chip feed position, and then corrects the position deviation by the chip feed mechanism, thus improving the chip picking accuracy.

S33 indicates that the chip flip mechanism rotates for the first time, so that the first chip picking mechanism installed on the chip flip mechanism enters the chip feed position, the second chip picking mechanism enters the chip carrying waiting position, the third chip picking mechanism enters the chip transfer position, and the fourth chip picking mechanism enters the no chip waiting position.

S34 indicates that the chip bonding mechanism rotates for the second time, so that the first bonding head installed on the chip bonding mechanism enters the chip transfer position, the second bonding head enters the chip flux dipping position, the third bonding head enters the uplooking imaging position, and the fourth bonding head enters the mounting position.

Specifically, S33 and S34 are carried out at the same time. When the first chip picking mechanism of the chip flip mechanism obtains the chip from the chip feed mechanism, the third chip picking mechanism transfers the chip to the first bonding head of the chip bonding mechanism, and the second chip picking mechanism and the fourth chip picking mechanism enter the chip carrying waiting position and the no chip waiting position respectively. Typically, when the third chip picking mechanism transfers the chip to the first bonding head, the third chip picking mechanism can extend, the first bonding head can extend, or both can extend at the same time. At the same time, the fourth bonding head mounts the chip carried to the predetermined mounting position at the mounting position, the uplooking imaging mechanism photographs and images the chip carried by the third bonding head from bottom to top, and the second bonding head extends out, sends the chip carried to the flux dipping mechanism, and retracts after completing the flux dipping process.

Specifically, S34 also includes: the uplooking imaging mechanism photographs and images the chip at the uplooking imaging position, and obtains the second position deviation of the chip relative to the uplooking imaging position.

S35 indicates that after the chip flip mechanism transfers the chip to the chip bonding mechanism at the chip transfer position, the chip bonding mechanism mounts the chip on the substrate at the mounting position, and the chip feed mechanism transports the next chip to the chip feed position. Specifically, S35 also includes: the downlooking imaging mechanism photographs and images the predetermined mounting position of the substrate or the chip that has been mounted, obtains the mounting position data, identifies the position deviation of the predetermined mounting position relative to the mounting position, and then combines the second position deviation data of

the uplooking imaging mechanism to correct the position deviation of the substrate carrying mechanism, thus further improving the mounting accuracy.

S36 indicates that the chip flip mechanism continues to rotate, so that each chip picking mechanism rotates in the order of “chip feed position--chip carrying waiting position--chip transfer position--no chip waiting position--chip feed position”. At the same time, the chip bonding mechanism continues to rotate, so that each bonding head rotates in the order of “chip transfer position--chip flux dipping position--uplooking imaging--mounting position--chip transfer position”. The chip picking mechanism of the chip flip mechanism rotates roughly in synchronization with the bonding head of the chip bonding mechanism.

S37 indicates to repeat S35 to S36 until all the predetermined mounting positions on the substrate are mounted with chips;

S38 indicates that the substrate carrying mechanism sends the substrate mounted with chips out of the mounting area, releases the fixation of the substrate and transfers the substrate to the feed mechanism. Specifically, S38 also includes: after all the predetermined mounting positions on the substrate are mounted, the substrate carrying mechanism sends the substrate mounted with chips out of the mounting area, transports it to the substrate loading area, and releases the fixation of the substrate. The blanking conveying mechanism moves to the substrate loading area, obtains and fixes the substrate mounted, then transports it to the substrate storage area through the second substrate waiting area, and finally returns to the substrate loading area after releasing the fixation of the substrate mounted and sends out the substrate mounted in the substrate storage area.

The chip alignment mounting method provided by the embodiment enables the following processes to be completed in the same mounting cycle in parallel, thus improving the mounting efficiency: the chip feed mechanism transports the chip to the chip feed position, the chip picking mechanism obtains the chip from the chip feed mechanism, the chip picking mechanism transfers the chip to the bonding head, the chip dips flux, the uplooking imaging mechanism photographs and images the chip, the chip is mounted and the substrate carrying mechanism moves to the next predetermined mounting position. In addition, the chip feed position, chip transfer position, chip flux dipping position, uplooking imaging position and mounting position in the embodiment are all fixed positions of rotation, which reduces the motion error and improves the chip mounting accuracy. Meanwhile, the feed and blanking process of the substrate is simplified, which also improves the efficiency and reliability of the overall mounting.

In summary, the chip alignment mounting device and method thereof provided by the embodiments of the invention enable the chip bonding mechanism to reciprocate at a fixed start and end position, the substrate to move a short distance each time for mounting, and the vision system of the fixed position to photograph and correct it as well as to improve the chip alignment accuracy and mounting efficiency.

The above is only the specific implementation mode of the invention, but the protection scope of the invention is not limited to this. Any change or replacement that can be easily thought of by any technical personnel familiar with the technical field within the technical scope disclosed by the invention shall be included in the protection scope of the invention. Therefore, the protection scope of the invention shall be subject to the protection scope of the claim.

Claims

1. A chip alignment mounting device, including a feed mechanism, a substrate carrying mechanism, a chip feed mechanism, a chip flip mechanism and a chip bonding mechanism, is characterized in that:

the feed mechanism mentioned above provides a substrate not mounted with chips to the substrate carrying mechanism located in a substrate loading area, and removes the substrate mounted with chips from the substrate carrying mechanism in the substrate loading area;

the substrate carrying mechanism mentioned above loads and fixes the substrate, and drives the substrate to move on a first plane parallel to an X-Y plane, wherein the motion range of the substrate includes the substrate loading area and a mounting area, the substrate carrying mechanism can transport each predetermined mounting positions on the substrate to a mounting position in the mounting area;

the chip feed mechanism mentioned above provides the chips to the chip flip mechanism at a chip feed position of the chip alignment mounting device;

the chip flip mechanism mentioned above can make a first rotation around a first rotation axis parallel to the X-Y plane to pick up the chips from the chip feed position, then deliver the chips to a chip transfer position through the first rotation and finally provide the chip bonding mechanism with the chips;

the chip bonding mechanism mentioned above can make a second rotation around a second rotation axis parallel to a Z direction to pick up the chips from the chip transfer position, and mount the chips on the predetermined chip mounting positions of the substrate at the mounting position through the second rotation;

the X-Y plane is the plane on which a substrate surface is fixed by the substrate carrying mechanism, and the Z direction is perpendicular to the X-Y plane; the mounting position, the chip feed position and the chip transfer position are all fixed positions,

the chip alignment mounting device also includes a pre-alignment imaging mechanism, an uplooking imaging mechanism and / or a downlooking imaging mechanism, wherein,

the pre-alignment imaging mechanism fixed in a + Z direction of the chip feed position photographs in a -Z direction, and images the chip on the chip feed position;

the uplooking imaging mechanism fixed in the - Z direction of a chip uplooking imaging position photographs in the + Z direction, and images the chip on the chip uplooking imaging position;

the downlooking imaging mechanism fixed in the + Z direction of the mounting position photographs in the -Z direction, and images the predetermined mounting positions or

the chip already mounted;

wherein, the +Z direction is along the Z direction from a back surface of the substrate in contact with the substrate carrying mechanism to a front surface of the substrate with a predetermined mounting position, and the -Z direction is along the Z direction from the front surface of the substrate with the predetermined mounting position to the back surface of the substrate in contact with the substrate carrying mechanism.

2. The chip alignment mounting device in Claim 1 is characterized in that: the chip flip mechanism has a plurality of first rotation arms which extend along a radial direction of the first rotation axis on a second plane perpendicular to the first rotation axis, and the ends of the plurality of first rotation arms are provided with a chip picking mechanism capable of telescopic motion along a direction of the first rotation arms and perpendicular to the first rotation axis, when the chip flip mechanism rotates around the first rotation axis, each chip picking mechanism rotates in an order of “the chip feed position--a chip carrying waiting position--the chip transfer position--a no chip waiting position--the chip feed position”, wherein

the chip carrying waiting position is used for the chip picking mechanism to wait after it obtains the chips from the chip feed position, and the no chip waiting position is used for the chip picking mechanism to wait after it transfers the chips at the chip transfer position.

3. The chip alignment mounting device in Claim 2 is characterized in that: the chip bonding mechanism has a plurality of second rotation arms which extend along a radial direction of the second rotation axis on a third plane perpendicular to the second rotation axis; the ends of the plurality of second rotation arms are provided with chip bonding heads perpendicular to the second rotation arms and parallel to the direction of the second rotation axis, when the chip bonding mechanism rotates around the second rotation axis, each chip bonding head rotates in an order of “the chip transfer position--a chip flux dipping position--the chip uplooking imaging position--the chip mounting position--the chip transfer position”, wherein the chip flux dipping position completes the chip flux dipping, and the chip uplooking imaging position completes the chip uplooking photographing and imaging.

4. The chip alignment mounting device in Claim 1 is characterized in that: the feed mechanism includes a substrate Z direction feed mechanism, a feed conveying mechanism, a blanking conveying mechanism and a blanking mechanism, wherein,

the substrate Z direction feed mechanism is distributed along the Z direction and is arranged to transport the substrate not mounted with chips to the X-Y plane along the Z direction;

the feed conveying mechanism is distributed parallel to the X-Y plane and is arranged to receive the substrate not mounted with chips from the substrate Z direction feed mechanism and transport it to the substrate carrying mechanism;

the blanking conveying mechanism is distributed parallel to the X-Y plane, and is arranged to receive the substrate mounted with chips from the substrate carrying mechanism and transport it to the blanking mechanism;

the blanking mechanism is distributed along the Z direction, and is arranged to send the substrate mounted with chips out of the X-Y plane along the Z direction and separate it from the chip alignment mounting device.

5. The chip alignment mounting device in Claim 4 is characterized in that: the substrate Z direction feed mechanism is arranged to transport the substrate not mounted with chips along the Z direction to a substrate feed area parallel to the X-Y plane along the Z direction;

the feed conveying mechanism is arranged to transport the substrate not mounted with chips from the substrate feed area through a first substrate waiting area parallel to the X-Y plane to the substrate loading area;

the substrate carrying mechanism is arranged to load the substrate not mounted with chips from the substrate loading area, and to mount all the predetermined mounting positions;

the blanking conveying mechanism is arranged to transport the substrate mounted with chips from the substrate loading area through a second substrate waiting area parallel to the X-Y plane to a substrate storage area parallel to the X-Y plane;

the blanking mechanism is arranged to send the substrate mounted with chips out of the X-Y plane from the substrate storage area along the Z direction and separate it from the chip alignment mounting device;

the feed conveying mechanism and the blanking conveying mechanism share a guide rail, and the substrate feed area, the first substrate waiting area, the substrate loading area, the second substrate waiting area and the substrate storage area are located on the same side of the guide rail, and are sequentially distributed along the guide rail.

6. A chip alignment mounting method of mounting a chip on a substrate by using the chip alignment mounting device of claim 5, characterized in that:

Step 1: the feed mechanism transfers the substrate not mounted with chips to the substrate carrying mechanism which fixes the substrate not mounted with chips, and transports it to the mounting area;

Step 2: the chip feed mechanism transports the chips to the chip feed position;

Step 3: the chip flip mechanism rotates for the first time, so that each chip picking mechanism installed on the chip flip mechanism enters the chip feed position, the chip carrying waiting position, the chip transfer position and the no chip waiting position respectively;

Step 4: the chip bonding mechanism rotates for the second time, so that each chip bonding head installed on the chip bonding mechanism enters the chip transfer position, the chip flux dipping position, the chip uplooking imaging position and the chip mounting position respectively;

Step 5: the chip flip mechanism transfers the chips at the chip transfer position to the chip bonding mechanism which mounts the chips on the substrate at the mounting position, and the chip feed mechanism delivers the next chip to the chip feed position;

Step 6: the chip flip mechanism continues to rotate, so that each chip picking mechanism rotates in an order of “the chip feed position-- the chip carrying waiting position-- the chip transfer position-- the no chip waiting position-- the chip feed position”, at the same time, the chip bonding mechanism continues to rotate, so that each bonding head rotates in an order of “the chip transfer position-- the chip flux dipping position-- the chip uplooking imaging position--the chip mounting position--the chip transfer position”, the chip picking mechanism of the chip flip mechanism rotates synchronously with the bonding head of the chip bonding mechanism;

Step 7: repeat steps 5 to 6 until all the predetermined mounting positions on the substrate are mounted with chips;

Step 8: the substrate carrying mechanism sends the substrate which has been mounted with chips out of the mounting area, releases fixation of the substrate, and transfers the substrate to the feed mechanism,

Step 2 also includes the pre-alignment imaging mechanism to photograph and image the chip at the chip feed position, obtain a first position deviation of the chip relative to the chip feed position, and then correct the first position deviation by the chip feed mechanism;

Step 4 also includes photographing and imaging the chips at the chip uplooking imaging position by the uplooking imaging mechanism and obtaining a second position deviation of the chip relative to the chip uplooking imaging position; photographing the predetermined chip mounting position of the substrate or the chip already mounted by the downlooking imaging mechanism and obtaining a third position deviation of the predetermined chip mounting position relative to the mounting position; combining the second position deviation and the third position deviation by the substrate carrying mechanism to correct the position deviation.

7. The chip alignment mounting method in Claim 6 is characterized in that: the chip

picking mechanism of the chip flip mechanism is arranged to expand along the radial direction of the first rotation axis in a plane perpendicular to the substrate surface and the chip bonding head of the chip bonding mechanism is arranged to expand in a direction parallel to the second rotation axis, when the chip flip mechanism and the chip bonding mechanism transfer at the chip transfer position, the chip picking mechanism extends and/ or the chip bonding head extends out to transfer.

8. The chip alignment mounting method in Claim 6 is characterized in that: step 1 also includes:

the substrate Z direction feed mechanism lifts the substrate not mounted with chips to the substrate feed area;

the feed conveying mechanism of the feed mechanism obtains the substrate not mounted with chips from the substrate feed area, and transports the substrate to the substrate loading area through the first substrate waiting area;

the substrate carrying mechanism loads the substrate not mounted with chips from the substrate loading area and transports the substrate to the mounting area, and finally transports the substrate from the mounting area to the substrate loading area after mounting chips at all predetermined mounting positions of the substrate not mounted with chips;

the blanking conveying mechanism of the feed mechanism receives the substrate from the substrate loading area and transports the substrate to the substrate storage area through the second substrate waiting area;

the blanking mechanism obtains the substrate mounted with chips from the substrate storage area and sends out the chip alignment mounting device.