SAWJIG CLAMPER

FIELD OF THE INVENTION

The present invention relates to a clamping assembly. More particularly, the present invention relates to a clamping assembly to prevent substrates from being warped when loaded on a sawjig.

BACKGROUND OF THE INVENTION

In the semiconductor industry, semiconductor devices are soldered onto a substrate in an array form, and encapsulated by molding or other means. Each of the devices is then singulated into an individual package by sawing the substrate or other means.

Common substrate singulate machines load the pre-sawn substrate onto a base plate, commonly known as a sawjig, before being singulated. To prevent the pre-sawn substrate from skidding on the sawjig, the sawjig commonly includes an suction device that firmly holds the pre-sawn substrate in place.

The pre-sawn substrate has a tendency to warp. Such warpage commonly results in poor sawing performance. The known technique of applying suction does not satisfactorily remove such warpage.

SUMMARY OF INVENTION

It is an object of the present invention to provide a clamping assembly for relieving warpage of the substrate when it is loaded on a sawjig.

According to one aspect of the present invention, there is provided a clamping assembly for a pre-sawn substrate, said assembly comprising:

clamp means mounted on a base plate and for sawing a pre-sawn substrate to the base plate, where the clamp means is in a first configuration;

a gripper being operable to carry the pre-sawn substrate and to load the substrate onto the base plate;

clamp releasing means operable to align with the clamp means and to move the clamp means into a second configuration to allow the substrate be loaded onto the base plate.

According to an alternative aspect of the present invention, there is provided a system for use to singulate a pre-sawn substrate having a plurality of encapsulated components mounted thereon, the system comprising:

a base plate for loading the substrate having a plurality of clamp means;

a gripper for carrying the pre-sawn substrate having a plurality clamp releasing assemblies aligned with the clamps; and

a machine arm attached to the gripper operable to move the gripper to couple with the base plate;

wherein said clamp means and said clamp releasing means are configured according to any one of the preceding claims.

According to a further alternative aspect of the present invention, there is provided a method for loading a pre-sawn substrate on a base plate, comprising the steps of:

carrying a pre-sawn substrate on a gripper;

locating said gripper in alignment with a base plate;

moving the gripper and the base plate to be in a first relative configuration;

transferring the substrate to the base plate when the gripper and the base plate are in the first relative configuration; and

moving the gripper and the base plate to a second relative configuration wherein moving the gripper and the base plate to be in a second configuration, and the second relative configuration clamps the substrate to the base plate.

BRIEF DESCRIPTION OF DRAWINGS

Further features of the present invention will readily be apparent from the following detailed description of non-limitative examples, with reference to the accompanying drawings, in which:-

FIG. 1a is a top plan view of a base plate for loading a substrate;

FIG. 1b is a cross sectional view of a clamp for mounting on a base plate of FIG. 1a;

FIG. 2a is a cross sectional view of a gripper taken along a central longitudinal axis:

FIG. 2b is another cross sectional view of the same gripper as in FIG. 2a; and

FIGs. 3a-c are diagrams for showing an example of stages for clamping a substrate onto a base plate.

Where the same reference numeral appears in more than one of the accompanying drawings, it is used to denote the same element.

DETAILED DESCRIPTION

FIG. 1a illustrates a top plan view of a base plate 100 for installation on a semiconductor manufacturing device. The base plate 100 is a support for a pre-sawn substrate having a plurality of encapsulated electronic components mounted thereon. The base plate 100 has a guide in the form of a pair of notches 110, each located at opposing ends of the base plate 100. The base plate is configured with a plurality of suction holes 120 within a central region, in fluid communication with an air pump (not shown). Once the base plate 100 is loaded with the substrate, the air pump starts withdrawing air to attract the substrate onto the base plate 100. A gasket 130, having a plurality of holes 135 corresponding with the suction holes 120, may be used to prevent air leakage. The gasket 130 may be made of silicone material or the like.

Surrounding the longitudinal edge of the base plate 100 are a plurality of recesses 160 for accommodating clamps 150. FIG. 1b illustrates an enlarged cross sectional view of one of the clamps 150. The body of the clamp 150 includes a first portion 152 and a second portion 154. A support 155 mounted on a bottom surface 162 of the recess 160 is used for securing the clamp 150 via a pivot 158, such that the clamp 150 is able to move about the pivoted axis. The first portion 152 is an extended

portion of a first end of the clamp 150 for holding down a substrate 300 while the clamp 100 is in a first configuration 180. The second portion 154 is another extended portion, of a second end of the clamp 150, against which a spring 175 is used to maintain the clamp 150 in the first configuration 180. The spring 175 may be a compression spring or a torsion spring for pushing the second portion 154 away from the bottom surface 162. A stopper 170 located below the first portion 152 a protrudes upwards from the bottom surface 162 for limiting the motion of the clamp 150.

FIG. 2a and 2b illustrate two cross-sectional views of a gripper 200 for carrying a substrate. The gripper 200 has a support plate 210 attached to a machine arm 220. A set of locators 215 corresponding with the notches 110 of the base plate 100 of FIG. 1a is provided for aligning the base plate 100 with the gripper 200. The support plate 210 is coupled to a pressing plate 230 via a pressing assembly 235. The pressing assembly 235 may include a set of suspensions to absorb force when the pressing plate 230 is pressed against the base plate 100.

A number of pushers 250 corresponding with the clamps 150 extend from the major surface of the support plate 210 for forcing each clamp 150 to a second configuration 185. Each pushers 250 in this embodiment is spring mounted to absorb some of the pushing force while pushing against a clamp 150.

A holding means 260 may include a pair of gripper arms 265 for gripping the two longitudinal sides of the pressing plate 230. Both gripper arms 265 are movable in two opposing directions. In a gripping configuration, the gripper arms 265 hold a substrate against the pressing plate 230. In a releasing configuration 269, the gripper

arms 265 release the substrate. To hold the substrate against the pressing plate 230, an alternative holding mechanism may be used. This mechanism can be a vacuum assembly connected to an air pump to provide a suction force to secure the substrate on the pressing plate 230.

Further, it is preferred that the clamping features may be provided at the base plate 100 and the gripper 200, for example, by way of additional parts that may be installed thereon easily, or in a replacement base plate 100 and gripper 200 form. No major modifications need to be made to the semiconductor manufacturing device to incorporate the gripping and clamping function.

FIG. 3a-c illustrates an example of the process of clamping a substrate 300 on the base plate 100 of FIG. 1a. FIG. 3a shows that the machine arm 220 of the gripper 200 has moved to a predetermined position and is ready to load the substrate 300 on the base plate 100. The substrate 300 is held on the press plate 230 by the gripper arms 265 when the gripper arms 265 are in the gripping configuration 267. The clamps 150 of the base plate 100 are in the first configuration 180.

FIG. 3b shows the machine arm 220 lowered to the gripper 200. To ensure the gripper 200 is aligned with the base plate 100, the second guiding means 215 is matched with the notch 110. Each of the pushers 250 pushes the second portion 154 of a corresponding clamp 150 down, the clamp 150 thereby being arranged in a second configuration 185. This moves the first portion 152 of the clamp 150 out of the way, such that the substrate 300 can be lowered into contact with the gasket 130. The air pump corresponding with the base plate 100 begins to create an air vacuum and

make the substrate 300 adhere tightly on the gasket 130, then the holding means 260 releases the substrate 300.

FIG. 3c shows the machine arm 220 lifting up the gripper 200 and the substrate 300 is loaded on the base plate 100. The clamp 150 is restored to the first configuration 180 and the substrate 300 is held down on the gasket 130 on the base plate 100 by the first portion 152 of the clamp 150.

It is understood by those skilled in the art that even though numerous characteristics and advantages of various preferred embodiments of the present invention have been set forth in the foregoing description, this disclosure is illustrative only. Other modifications may be made, especially in the structure, arrangement of parts and/or steps within the principles of the invention to the full extent indicated by the broad general meaning of the appended claims without departing from the scope of the invention.

CLAIMS

1. A clamping assembly for a pre-sawn substrate, said assembly comprising:

clamp means mounted on a base plate and for securing a pre-sawn substrate to the base plate, when the clamp means is in a first configuration;

a gripper being operable to carry the pre-sawn substrate and to load the substrate onto the base plate; and

clamp releasing means operable to align with the clamp means and to move the clamp means into a second configuration to allow the substrate be loaded onto the base plate;

wherein the clamp releasing means is mounted on the gripper.

2. A clamping assembly according to claim 1, wherein the clamp releasing means is operable to push against the clamp means to move the clamp means to the second configuration.

3. A clamping assembly according to claim 1 or 2, wherein the clamp means further comprises spring means to maintain the clamp in the first configuration, and the clamp releasing means is operable to provide an opposing force against the elastic force of the spring means to place the clamp means into the second configuration.

4. A clamping assembly according to any one of the preceding claims, wherein the clamp means is pivotable between the first and second configurations.

5. A system for use to singulate a pre-sawn substrate having a plurality of encapsulated components mounted thereon, the system comprising:

a base plate for loading the pre-sawn substrate;

a plurality of clamps for securing the pre-sawn substrate to the base plate when the clamps are in first configurations;

a gripper for carrying the pre-sawn substrate;

a machine arm attached to the gripper and operable to move the gripper to load the substrate onto the base plate; and

a plurality of clamp releasing assemblies for moving the clamps to second configurations to allow the substrate to be loaded onto the base plate.

6. A system according to claim 5,

wherein the plurality of clamps releasing means are operable to move the clamps into the second configurations as the machine arm moves the gripper to load the substrate onto the base plate.

7. A method for loading a pre-sawn substrate on a base plate, comprising the steps of:

carrying a pre-sawn substrate on a gripper;

locating said gripper in alignment with a base plate;

moving the gripper and the base plate to be in a first relative configuration;

transferring the substrate to the base plate when the gripper and the base plate are in the first relative configuration; and

moving the gripper and the base plate to a second relative configuration;

wherein moving the gripper and the base plate to the second relative configuration clamps the substrate to the base plate.

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ABSTRACT

A clamping assembly for relieving warpage of a substrate by clamping the substrate on a base plate is provided. A gripper loading the substrate onto the base plate is fitted with clamping releasing means operable to align with and release clamping means on the base plate. A system incorporating a plurality of said clamping assembly is also provided to improve sawing of an encapsulated substrate.

FIGs. 3a - c