# VACUUM CHUCK TABLE OF SEMICONDUCTOR DEVICE CUTTING APPARATUS CAPABLE OF SUPPLYING COOLING WATER

## BACKGROUND OF THE INVENTION

### Cross-references to Related Application

Priority to Korean utility model application number 2009-15344 filed on November 26, 2009, the entire disclosure of which is incorporated by reference herein, is claimed.

### Field of the Invention

**[001]** The present invention relates to the vacuum chuck table of a semiconductor device cutting apparatus capable of supplying cooling water and, more particularly, to the vacuum chuck table of a semiconductor device cutting apparatus, which is capable of cooling heat, generated in a semiconductor device molding body when cutting the semiconductor device molding body using a cutting blade, using cooling water.

### Background of the Related Art

**[002]** In general, a semiconductor device molding body is fabricated through a die bonding process of adhering a semiconductor chip to a circuit board or the mounting plate of a lead frame, a wire bonding process of connecting a chip pad,

provided on the semiconductor chip, and the lead frame or the leads of the circuit board, a molding process of surrounding internal circuits of the semiconductor chip and other components with a sealant.

**[003]** The fabricated semiconductor device molding body is conveyed to a semiconductor device cutting apparatus and then cut into semiconductor devices (that is, respective semiconductor chip units). The apparatus for cutting semiconductor devices is equipped with a vacuum chuck table configured to stably adsorb and support the semiconductor device molding body in order to cut the semiconductor device molding body into semiconductor chips using a cutting blade.

**[004]** However, in a semiconductor device molding body having a lead formed on its side, when the semiconductor device molding body is cut by the cutting blade, heat is generated from the side of the semiconductor device molding body. The existing vacuum chuck table does not have a function of cooling the semiconductor device molding body. Accordingly, a metallic lead is melt by heat generated in the semiconductor device molding body and so overlapped with other leads, resulting in failure such as smear or melting.

## SUMMARY OF THE INVENTION

**[005]** Accordingly, the present invention has been made in view of the above problems occurring in the prior art, and it is an object of the present invention to provide the vacuum chuck table of a semiconductor device cutting apparatus, which is capable of cooling heat, generated in a semiconductor device molding body when cutting the semiconductor device molding body using a cutting blade, using cooling water.

**[006]** To achieve the above object, according to the present invention, there is provided a vacuum chuck table provided in an apparatus for cutting a semiconductor device molding body and configured to support the semiconductor device molding body. The vacuum chuck table comprises a chuck base, support units adhered to a top surface of the chuck base and configured to support the semiconductor device molding body, and cooling water supply units configured to supply cooling water. A plurality of vacuum holes is formed in the support units. Air is adsorbed through the vacuum holes and so the semiconductor device molding body is adsorbed to the support units. The cooling water is supplied through the cooling water supply units, thereby removing heat generated when the semiconductor device molding body is cut.

**[007]** The support units may be made of rubber.

**[008]** The cooling water supply units may comprise a plurality of horizontal cooling water conduit lines formed in parallel to the

chuck base, and a plurality of vertical cooling water conduit lines respectively formed on the upper side of the horizontal cooling water conduit lines in a vertical direction and configured to supply the cooling water.

**[009]** Support unit grooves may be formed on the upper side of the respective support units. The support grooves allow cutting blades of the apparatus for cutting semiconductor devices to enter therein and to cut the semiconductor device molding body. The cooling water is supplied through the support grooves, thereby removing heat generated when the semiconductor device molding body is cut.

**[010]** The vacuum chuck table may further comprise a chuck base support body having a vacuum hole formed at its center and supporting the chuck base.

**[011]** The support unit may have a hardness of Hs10 to Hs55.

**[012]** The support unit may have a hardness of Hs60 to Hs95.

**[013]** To achieve the above object, according to the present invention, there is provided a vacuum chuck table provided in an apparatus for cutting a semiconductor device molding body and configured to support the semiconductor device molding body. The vacuum chuck table comprises a chuck base, second support units adhered to a top surface of the chuck base, first support units adhered to a top surface of the second support units, respectively, and configured to support the semiconductor device

molding body, the first support units being made of material having a lower hardness than material of the second support units, and cooling water supply units configured to supply cooling water. A plurality of vacuum holes is formed in each of the first and second support units. Air is adsorbed through the vacuum holes and so the semiconductor device molding body is adsorbed to the first support units. The cooling water is supplied through the cooling water supply units, thereby removing heat generated when the semiconductor device molding body is cut.

**[014]** The first support units and the second support units may be made of rubber material.

**[015]** The cooling water supply units may comprise a plurality of horizontal cooling water conduit lines formed in parallel to the chuck base, and a plurality of vertical cooling water conduit lines respectively formed on the upper side of the horizontal cooling water conduit lines in a vertical direction and configured to supply the cooling water.

**[016]** Support unit grooves are formed on the upper side of the respective support units. The support grooves allow cutting blades of the apparatus for cutting semiconductor devices to enter therein and to cut the semiconductor device molding body. The cooling water is supplied through the support grooves, thereby removing heat generated when the semiconductor device molding body is cut.

**[017]** The vacuum chuck table may further comprise a chuck base support body having a vacuum hole formed at its center and supporting the chuck base.

**[018]** The first support unit may have a hardness of Hs10 to Hs55.

**[019]** The second support unit may have a hardness of Hs60 to Hs95.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[020]** Further objects and advantages of the invention can be more fully understood from the following detailed description taken in conjunction with the accompanying drawings in which:

**[021]** FIG. 1 is a perspective view showing the vacuum chuck table of a semiconductor device cutting apparatus capable of supplying cooling water according to a first embodiment of the present invention;

**[022]** FIG. 2 is a plan view showing the vacuum chuck table of the semiconductor device cutting apparatus according to the first embodiment of the present invention;

**[023]** FIG. 3 is a cross-sectional view of the vacuum chuck table taken along line D-D in FIG. 2;

**[024]** FIG. 4 is a detailed top view of a support unit in the vacuum chuck table according to the first embodiment of the present invention;

**[025]** FIG. 5 is a cross-sectional view of the first support unit taken along line K-K in FIG. 4;

**[026]** FIG. 6 is a perspective view showing the vacuum chuck table of a semiconductor device cutting apparatus capable of supplying cooling water according to a second embodiment of the present invention;

**[027]** FIG. 7 is a cross-sectional view of the vacuum chuck table taken along line B-B in FIG. 6; and

**[028]** FIG. 8 is a diagram showing an example in which the vacuum chuck table of the semiconductor device cutting apparatus according to the first embodiment of the present invention is used.

**[029]** <Description of reference numerals of principal elements in the drawings>

**[030]** 110: semiconductor device molding body

**[031]** 200: vacuum chuck table 210: cooling water supply unit

**[032]** 211: horizontal cooling water conduit line

**[033]** 212: vertical cooling water conduit line

**[034]** 220: chuck base 230: chuck base support body

**[035]** 240, 250: support unit 241: support unit grooves

**[036]** 300: cutting blade 400: vacuum hole

**[037]** 500: cooling water

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[038]** Hereinafter, some embodiments of the present invention are described in detail with reference to the accompanying drawings.

**[039]** FIG. 1 is a perspective view showing the vacuum chuck table of a semiconductor device cutting apparatus capable of supplying cooling water according to a first embodiment of the present invention. FIG. 2 is a plan view showing the vacuum chuck table of a semiconductor device cutting apparatus according to the first embodiment of the present invention. FIG. 3 is a cross-sectional view of the vacuum chuck table taken along line D-D in FIG. 2.

**[040]** As shown in FIGS. 1 to 3, the vacuum chuck table 200 includes a chuck base 220, support units 240 each placed on a top surface of the chuck base 220 and configured to support semiconductor device molding bodies 110, cooling water supply units 210 configured to supply cooling water, and a chuck base support body 230 configured to support the chuck base 220 and to have a big vacuum hole 400 formed at its center.

**[041]** The chuck base 220 forms the body of the vacuum chuck table 200 and has a plurality of the vacuum holes 400 formed therein. The vacuum holes 400 are configured to penetrate the chuck base 220.

**[042]** The plurality of vacuum holes 400 is formed in the support units 240. A vacuum inhaler (not shown) sucks air through the vacuum holes 400, and so the semiconductor device molding bodies 110 are adsorbed to the support units 240.

**[043]** The support units 240 provide the vacuum chuck table with stability such that the semiconductor device molding bodies are not pushed by a lateral cutting pressure.

**[044]** The support units 240 each are configured to have the vacuum holes 400 formed therein and are coupled with the chuck base 220. The vacuum holes 400 of the support units 240 correspond to the respective vacuum holes 400 of the chuck base 220. Support unit grooves 241 are formed on the upper side of the support units 240. The support grooves 241 have the cutting blades of the semiconductor device cutting apparatus to enter therein and to cut a semiconductor device molding body 110. Further, cooling water is supplied through the support grooves 241, thereby removing heat generated when the semiconductor device molding body 110 is cut.

**[045]** The chuck base 220 preferably is made of iron, and the support units 240 may be made of rubber. The support units 240 may have the hardness of Hs10 to Hs55 or Hs60 to Hs95.

**[046]** The cooling water supply units 210 includes a plurality of horizontal cooling water conduit lines 211 formed in parallel to the chuck base 220 and a plurality of vertical cooling water conduit lines 212 formed vertically to the chuck base 220. The vertical cooling water conduit lines 212 are formed on the upper side of the respective horizontal cooling water conduit lines 211 and configured to supply the cooling water. The vertical cooling

water conduit lines 212 are formed within the chuck base 220 and the support units 240. The cooling water supplied through the cooling water supply units 210 is used to remove heat generated when the semiconductor device molding body 110 is cut.

**[047]** FIG. 4 is a detailed top view of the support unit 240 in the vacuum chuck table according to the first embodiment of the present invention, and FIG. 5 is a cross-sectional view of the first support unit taken along line K-K in FIG. 4.

**[048]** As shown in FIGS. 4 and 5, the cooling water is supplied through the horizontal cooling water conduit lines 211 and arrived at the support unit grooves 241 through the vertical cooling water conduit lines 212. The cooling water arrived at the support unit grooves 241 is used to remove heat generated when the cutting blades of the semiconductor device cutting apparatus cut the semiconductor device molding body 110. As shown in FIG. 4, the support unit grooves 241 are formed to surround each of the vacuum holes 400.

**[049]** FIG. 6 is a perspective view showing the vacuum chuck table of a semiconductor device cutting apparatus capable of supplying cooling water according to a second embodiment of the present invention, and FIG. 7 is a cross-sectional view of the vacuum chuck table taken along line B-B in FIG. 6.

**[050]** As shown in FIGS. 6 and 7, the vacuum chuck table of the semiconductor device cutting apparatus according to the second

embodiment further includes second support units 250 as compared with the first embodiment. The vacuum chuck table 200 according to the second embodiment includes a chuck base 220, second support units 250 coupled to the top surface of the chuck base 220, first support units 240 respectively adhered to the top surface of the second support units 250 and configured to support a semiconductor device molding body 110, cooling water supply units 210 configured to supply cooling water, and a chuck base support body 230 configured to have a big vacuum hole 240 formed at its center and to support the chuck base 220. Here, material constituting the first support units 240 has a lower hardness than material constituting the second support units 250.

**[051]** The chuck base 220, the first support units 240, the cooling water supply units 210, and the chuck base support body 230 have the same construction as those of the first embodiment, and a description thereof is omitted for simplicity. A plurality of vacuum holes 400 is formed in each of the second support units 250. The vacuum holes 400 of the second support units 250 are coupled to the respective vacuum holes 400 of the first support units 240. A vacuum inhaler (not shown) sucks air through the vacuum holes 400, and so the semiconductor device molding body 110 is adsorbed to the first support units 240. Furthermore, a plurality of vertical cooling water conduit lines 212 for supplying the cooling water is formed within each of the second

support units 250. Vertical Horizontal cooling water conduit lines 212 are formed within each of the first support unit 240 and coupled with the respective horizontal cooling water conduit lines 211. Accordingly, the cooling water is supplied through the horizontal cooling water conduit lines 211 and the vertical Horizontal cooling water conduit lines 212.

**[052]** The second support units 250 are made of hard rubber having the hardness of, preferably, Hs60 to Hs95. The second support units 250 are respectively coupled to the lower side of the first support units 240 for adsorbing and supporting the semiconductor device molding body 110. Accordingly, the second support units 250 provide the vacuum chuck table 200 with stability in order to prevent the semiconductor device molding body 110 from being pushed by a lateral cutting pressure.

**[053]** The first support units 240 are made of soft rubber having the hardness of, preferably, Hs10 to Hs55. The semiconductor device molding bodies 110 are arranged and seated on the top surface of the first support units 240. The first support units 240 adsorb and support the semiconductor device molding bodies 110. Since the first support units 240 are made of the soft material, shock occurring when the semiconductor device molding bodies are seated and adsorbed to the first support units 240 can be minimized.

**[054]** Further, the first support units 240 and the second support units 250 are adhered together by resin adhesive material. Accordingly, an adhesive property when the first support units 240 and the second support units 250 are adhered together can be improved because they are made of the same rubber material.

**[055]** Meanwhile, the semiconductor device molding body 110 is made of plastic, etc. and can be bent about 1 ㎜. When the semiconductor device molding body 110 bent as described above is adsorbed to a flat surface, the bent semiconductor device molding body 110 is restored to its original position and subject to a bending force in a direction opposite to the direction in which the semiconductor device molding body 110 is bent. In other words, assuming that the semiconductor device molding body has been bent about 1 ㎜, the semiconductor device molding body is restored to its original position about 1 ㎜ when it is adsorbed to the flat surface. Accordingly, there is a possibility that during the restoration process, the semiconductor device molding body 110 may be damaged by excessive force applied thereto.

**[056]** However, in the embodiments of the present invention, the first support units 240 made of soft material accommodate some of the bending phenomenon of the semiconductor device molding body 110 when the semiconductor device molding body is adsorbed. Accordingly, excessive force can be prevented from being applied to the semiconductor device molding body 110 when it is adsorbed.

**[057]** In more detail, assuming that the semiconductor device molding body 110 has been bent 1 ㎜, the semiconductor device molding body 110 can be adsorbed to the top surface of the first support unit 240 in the state in which the semiconductor device molding body 110 is bent about 0.5 ㎜ due to the softness of the first support units 240. Accordingly, although the semiconductor device molding body 110 has been bent 1 ㎜, if the semiconductor device molding body 110 can be restored to its original position by only about 0.5 ㎜ when being is adsorbed to the top surface of the first support unit 240, the semiconductor device molding body 110 is not subject to excessive force.

**[058]** Furthermore, the semiconductor device molding bodies 110 bent as described above are arranged and placed on the flat surface. When the bent semiconductor device molding body 110 starts being adsorbed to the top surface of the first support unit 240, a specific part of the semiconductor device molding body 110 is brought in contact with the flat surface. In this state, when the semiconductor device molding body 110 is restored to its original position, part of the portion of the semiconductor device molding body 110, which comes in contact with the flat surface and has less frictional force against the flat surface, can slide, and so the position of the semiconductor device molding body can be changed. If the arrangement state of the semiconductor device molding bodies 110 is broken because of

the change in the position of the semiconductor device molding bodies 110, the accuracy of cutting can be lowered when a cutting process is performed after the semiconductor device molding bodies 110 are adsorbed to the flat surface.

**[059]** The first support unit 240 is made of soft material as described above. Accordingly, the first support unit 240 has a small amount of restoration and high frictional force against the semiconductor device molding body 110 before adsorption. Since the semiconductor device molding body 110 can be prevented from sliding when it is adsorbed to the first support unit 240, a change in the position of the semiconductor device molding body 110 can be prevented. If a change in the position of the semiconductor device molding body 110 is prevented as described above, the accuracy of cutting can be improved.

**[060]** Meanwhile, the first support unit 240 has a thickness of, preferably, 0.1 ㎜ to 1.0 ㎜. As described above, the first support units 240 are made of rubber material having the hardness of Hs10 to Hs55. The thickness of the first support units 240 preferably is increased with an increase in the hardness of the rubber material.

**[061]** However, if the first support units 240 have a thickness more than 1.0 ㎜ although they have the hardness of Hs55, when the cutting process is performed on the semiconductor device molding bodies which have been adsorbed and supported, the

semiconductor device molding bodies 110 can be pushed by the lateral cutting pressure of the cutting blades because the first support units 240 are made of soft material. Accordingly, the accuracy of cutting can be lowered.

**[062]** Furthermore, if the first support units 240 have a thickness less than 0.1 ㎜ although they have the hardness of Hs10, the bending of the semiconductor device molding bodies 110 cannot be sufficiently accommodated, the semiconductor device molding bodies 110 cannot be safely seated, and an adsorption shock of the semiconductor device molding bodies 110 cannot be sufficiently absorbed.

**[063]** The plurality of vacuum holes 400 is formed to penetrate the top and bottom surfaces of the chuck base 220 and the second support units 250 in order to adsorb and support the semiconductor device molding bodies 110 which are seated and arranged on the top surface of the first support units 240. The plurality of vacuum holes 400 is formed such that the semiconductor device molding bodies 110 are cut by the cutting blades and the vacuum holes 400 can adsorb the respective semiconductor devices of a semiconductor chip unit. That is, the positions and the number of vacuum holes 400 correspond to those of the respective semiconductor devices of a semiconductor chip unit.

**[064]** The plurality of vacuum holes 400 formed in the first support units 240 communicates with the plurality of respective vacuum holes 400 formed in the second support units 250. Since the vacuum holes 400 formed in the first support units 240 communicate with the vacuum holes 400 formed in the second support units 250, a plurality of air ducts penetrating from the bottom surface of the chuck base 220 to the top surface of the first support units 240 is formed.

**[065]** In the preferred embodiment of the present invention, the plurality of vacuum holes 400 formed in the second support units 250 is formed to penetrate the top and bottom surfaces of the chuck base 220 and the second support units 250. The big vacuum hole 400 formed at the center of the chuck base support body 230 is coupled to the vacuum holes 400 formed in the second support units 250. Although the vacuum inhaler (not shown) is illustrated to be coupled to the vacuum hole 400 formed in the chuck base support body 230, the present invention is not limited to the example in which the vacuum hole 400 is coupled to the vacuum inhaler (not shown).

**[066]** FIG. 8 is a diagram showing an example in which the vacuum chuck table of the semiconductor device cutting apparatus according to the first embodiment of the present invention is used. As shown in FIG. 8, the semiconductor device molding bodies 110 can be cut by the cutting blades 300 of the

semiconductor device cutting apparatus. If heat is generated in the cutting process, cooling water 500 is spouted, and so cools the heated semiconductor device molding bodies 110 and the heated cutting blades 300 of the semiconductor device cutting apparatus.

**[067]** As described above, the present invention is advantageous in that it can remove heat, occurring when the semiconductor device molding bodies are cut by the cutting blades of the semiconductor device cutting apparatus, using cooling water.

**[068]** Since the heated semiconductor device molding bodies are cooled, the defective proportion, such as smear or melting which is generated because metallic leads melted by heat overlap with other leads, can be significantly reduced.

**[069]** Further, productivity can be increased because the defective proportion is reduced.

**[070]** Accordingly, the present invention is very useful in terms of the industry because the heated semiconductor device molding bodies are cooled and so the defective proportion, such as smear or melting which is generated because metallic leads melted by heat overlap with other leads, can be significantly reduced.

**[071]** Although some preferred embodiments of the present invention have been described, the present invention is not to be restricted by the embodiments but only by the appended claims. It is to be appreciated that those skilled in the art can change

or modify the embodiments without departing from the scope and spirit of the present invention.

**What is claimed is**:

1. A vacuum chuck table provided in an apparatus for cutting a semiconductor device molding body and configured to support the semiconductor device molding body, the vacuum chuck table comprising:

a chuck base;

support units adhered to a top surface of the chuck base and configured to support the semiconductor device molding body; and

cooling water supply units configured to supply cooling water,

wherein a plurality of vacuum holes is formed in the support units,

air is adsorbed through the vacuum holes and so the semiconductor device molding body is adsorbed to the support units, and

the cooling water is supplied through the cooling water supply units, thereby removing heat generated when the semiconductor device molding body is cut.

2. The vacuum chuck table as claimed in claim 1, wherein the support units are made of rubber.

3. The vacuum chuck table as claimed in claim 1 or 2, wherein the cooling water supply units comprise:

a plurality of horizontal cooling water conduit lines formed in parallel to the chuck base, and

a plurality of vertical cooling water conduit lines respectively formed on an upper side of the horizontal cooling water conduit lines in a vertical direction and configured to supply the cooling water.

4. The vacuum chuck table as claimed in claim 1, wherein support unit grooves are formed on an upper side of the respective support units, wherein the support grooves allow cutting blades of the apparatus for cutting semiconductor devices to enter therein and to cut the semiconductor device molding body, and the cooling water is supplied through the support grooves, thereby removing heat generated when the semiconductor device molding body is cut.

5. The vacuum chuck table as claimed in claim 1, further comprising a chuck base support body having a vacuum hole formed at its center and supporting the chuck base.

6. The vacuum chuck table as claimed in claim 1, wherein the support unit has a hardness of Hs10 to Hs55.

7. The vacuum chuck table as claimed in claim 1, wherein the support unit has a hardness of Hs60 to Hs95.

8. A vacuum chuck table provided in an apparatus for cutting a semiconductor device molding body and configured to support the semiconductor device molding body, the vacuum chuck table comprising:

a chuck base;

second support units adhered to a top surface of the chuck base;

first support units adhered to a top surface of the second support units, respectively, and configured to support the semiconductor device molding body, the first support units being made of material having a lower hardness than material of the second support units; and

cooling water supply units configured to supply cooling water,

wherein a plurality of vacuum holes is formed in each of the first and second support units,

air is adsorbed through the vacuum holes and so the semiconductor device molding body is adsorbed to the first support units, and

the cooling water is supplied through the cooling water supply units, thereby removing heat generated when the semiconductor device molding body is cut.

9. The vacuum chuck table as claimed in claim 8, wherein the first support units and the second support units are made of rubber material.

10. The vacuum chuck table as claimed in claim 8 or 9, wherein the cooling water supply units comprise:

a plurality of horizontal cooling water conduit lines formed in parallel to the chuck base, and

a plurality of vertical cooling water conduit lines respectively formed on an upper side of the horizontal cooling water conduit lines in a vertical direction and configured to supply the cooling water.

11. The vacuum chuck table as claimed in claim 8, wherein support unit grooves are formed on an upper side of the respective support units, wherein the support grooves allow cutting blades of the apparatus for cutting semiconductor devices to enter therein and to cut the semiconductor device molding body, and the cooling water is supplied through the support grooves,

thereby removing heat generated when the semiconductor device molding body is cut.

12. The vacuum chuck table as claimed in claim 8, further comprising a chuck base support body having a vacuum hole formed at its center and supporting the chuck base.

13. The vacuum chuck table as claimed in claim 8, wherein the first support unit has a hardness of Hs10 to Hs55.

14. The vacuum chuck table as claimed in claim 8, wherein the second support unit has a hardness of Hs60 to Hs95.

**ABSTRACT**

A vacuum chuck table is provided in an apparatus for cutting a semiconductor device molding body and configured to support the semiconductor device molding body. The vacuum chuck table comprises a chuck base, support units adhered to a top surface of the chuck base and configured to support the semiconductor device molding body, and cooling water supply units configured to supply cooling water. A plurality of vacuum holes is formed in the support units. Air is adsorbed through the vacuum holes and so the semiconductor device molding body is adsorbed to the support units. The cooling water is supplied through the cooling water supply units, thereby removing heat generated when the semiconductor device molding body is cut.