WAFER DRYING APPARATUS

FIELD OF THE INVENTION

The invention relates to an apparatus suitable for a wafer washing process; more particularly, it is related to a wafer drying apparatus.

DESCRIPTION OF PRIOR ART

Refer to Fig. 1, which illustrates a conventional wafer washing and drying apparatus 100, including a cover part 10, a processing tank assembly 20 and a wafer holding device 30 (not shown). The cover part 10 is a movable element, having an air-filling device 11. The cover part 10 can form a sealed space with processing tank assembly 20 when the cover part 10 is right on top of the processing tank assembly 20. The processing tank assembly 20 includes a processing tank 21, a liquid supplying device 22, a liquid draining device 23 and an exhausting device 24. The wafer holding device 30 provides stability when the wafer 1 is in motion.

It is to be noted that the conventional wafer washing and drying device have the liquid draining and exhausting devices on both sides. When the wafer is washed, liquid is drained from the two sides taking away the residues on the wafer. However, since the water flow in the center is weak, it is harder to take away the residues in the center of the wafer. As a result, the washing effect is reduced. When washing is finished, dry air enters from the top and is exhausted from the two sides. The airflow in the center is also weaker, and thus the drying effect in the center of the wafer is also less than ideal.

Furthermore, when the wafer is washed and ascended to the cover part for the drying process, the wafer is separated from the wafer holding device and only supported by a supporting element so as to allow each portion of the wafer to

contact dry air. Besides the supporting element, there is no other fixing element. As a result, the wafer is easily unstable when the dry air is blown, which may in turn cause negative effect on the quality of the wafer.

In view of the disadvantages, the present invention provides an improved wafer drying apparatus, resolving the problems in the conventional art and increasing the efficiency of the operation.

SUMMARY OF THE INVENTION

The present invention provides an improved wafer drying apparatus to resolve the conventional problem with respect to the incompleteness of the washing and drying processes.

One object of the present invention is to provide a wafer washing and drying apparatus, capable of completely washing and drying each portion of the wafer so as to achieve better washing and drying effects.

Another object of the present invention is to provide a wafer drying apparatus, capable of stabilizing the wafer during the drying process without having any area that cannot be dried.

Yet another object of the present invention is to provide a wafer drying apparatus, capable of enhancing the operating effect of the overall machinery.

The wafer drying apparatus of the present invention includes a processing tank, a liquid supplying device, a bottom liquid draining device, a side liquid draining device and an exhausting device. The liquid supplying device is used to fill a processing liquid in the processing tank; the side liquid draining device provided at a single side of the processing tank is used to quickly drain the processing liquid out of the wafer drying apparatus when the wafer is washed, and thus the processing liquid is flowed in an uni-direction; the exhausting device used to drain the dry air out of the wafer drying apparatus is also provided at a single side of the

processing tank, and thus the dry air is flowed in an uni-direction. The bottom liquid draining device is used to drain the processing liquid out of the wafer drying apparatus completely when the drying process is complete.

The wafer drying apparatus of the present invention further includes a cover substantially covering the processing tank, wherein the cover defines an interior space above the processing tank, capable of containing at least one wafer therein; at least one holding device and at least one nozzle are provided within the cover. When the wafer is contained within the cover, the holding device can releasably hold the wafer, while the nozzle provides an air to dry the wafer.

The wafer drying apparatus of the present invention further includes a wafer holding device for moving the wafer. The wafer holding device includes a supporting element, a driving device for driving the supporting element and a wafer carrier capable of separately moving in relation to the supporting element. Since the supporting element and the wafer carrier can move in relation to each other as well as move separately, the wafer holding device only needs one driving device. No additional driving device is needed to control the movement of the wafer carrier.

The present invention provides the following advantages when compared with the conventional wafer drying apparatus. These advantages are: 1. The liquid draining and exhausting devices of the present invention are provided at one single side so as to allow the liquid and air to flow in an uni-direction, thereby resolving the disadvantages of having weaker flow in the center when the liquid and air flow are drained from the two sides, and thus the liquid and air flow may evenly pass through each portion of the wafer to enhance drying and washing effects. 2. The cover of the present invention is designed with a holding device so as to stabilize the wafer when the wafer is contained in the cover during the drying process, and the contact area between the holding device and the wafer is so small that it may

provide the fixing function without having any area that cannot be dried at the same time. 3. The wafer carrier of the present invention is designed to allow the supporting element and the wafer carrier to move in relation to each other, and thus unlike the conventional art where two driving devices are needed to control the supporting element and the wafer carrier respectively, only one driving device is needed to drive these two elements, thereby enhancing the operating effect of the overall machinery.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a schematic view of a conventional wafer drying apparatus;

Fig. 2 illustrates a perspective view of an embodiment of the wafer drying apparatus in accordance with the present invention;

Fig. 3 illustrates a three-dimensional view of the wafer holding device for an embodiment of the wafer drying apparatus in accordance with the present invention;

Fig. 3A illustrates a side view of a side of the wafer holding device for an embodiment of the wafer drying apparatus of the present invention and the driving device for driving the movement of the supporting element thereon;

Fig. 3B illustrates a side view of a side of the wafer holding device for an embodiment of the wafer drying apparatus in accordance with the present invention;

Fig. 3C illustrates a perspective view of an embodiment of the wafer drying apparatus in accordance with the present invention having a fixing element provided on the wafer holding device so that the supporting element and the wafer carrier can move in relation to each other as well as move separately,

Figs. 4A-4H illustrate perspective views of a flow chart of a preferred embodiment in accordance with the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Refer to Figs. 2 and 3. In accordance with one embodiment of the present invention, the wafer drying apparatus 200 includes a processing tank 202, a liquid supplying device 204, a side liquid draining device 206 and an exhausting device 208. The liquid supplying device 204 is used to fill a processing liquid into the processing tank 202; the side liquid draining device 206 is used to drain the processing liquid out of the wafer drying apparatus 200; the side liquid draining device 206 is provided at a single side of the processing tank 202 so as to force the processing liquid to flow in an uni-direction. The exhausting device 208 is also provided at a single side of the processing tank 202 so as to let the dry air flowing out of the wafer drying apparatus 200 in the uni-direction.

The wafer drying apparatus 200 of the present invention may further include a cover 210, substantially covering the processing tank 202, wherein the cover 210 defines an interior space above the processing tank 202 so as to contain at least one wafer therein. At least one holding device 212 and at least one nozzle 214 are provided within the cover 210. When the wafer is contained in the cover, the holding device 212 can releasably hold the wafer, while the nozzle 214 can provide an air to dry the wafer.

Refer to Figs. 3 and 3A. The wafer drying apparatus 200 (Refer to Fig. 2) of the present invention may further include a wafer holding device 300 for moving the wafer. The wafer holding device 300 includes a supporting element 302, a driving device 304 for driving an arm 308 to control the movement of the supporting element 302 and a wafer carrier 306 that can be separated from and move in relation to the supporting element 302. Since the supporting element 302 and the wafer carrier 306 can move in relation to each other or move separately, the wafer holding device 300 only needs one driving device without providing any

additional driving device on the wafer carrier 306.

Refer to Figs. 4A to 4H, which illustrate the operating methods of the wafer drying apparatus in accordance with the present invention. Refer to Fig. 4A, the wafer 1 is firstly placed on the wafer holding device 300 (as shown in Fig. 3). As shown in Fig. 4B, the wafer 1 is descended into the processing tank 202 for washing. As shown in Fig.4C, the cover 210 is moved to form a sealed space above the covered processing tank 202. The nozzle 214 starts to provide a mixture gas consisted of Nitrogen (N_2) and Isopropyl Alcohol (IPA), and the exhausting device 208 will let the mixture gas out of the wafer drying apparatus 200. The cover of the present invention includes a plurality of nozzles 214, arranged in three rows. These nozzles and the adjacent nozzles are intertwinedly arranged. An air providing device 402 is connected to the nozzles 214. An outlet of the nozzles 214 is in radial shape (not shown) without having any thin film to allow the nozzle 214 to spray evenly-distributed air through the air providing device 402. The nozzles 214 made of flexible materials have a predefined angle and have an adjustment device for adjusting the direction of the air spray.

Refer to Figs. 4C and 4D. As shown in Fig. 4C, the processing liquid continues to fill the processing tank 202 from the bottom liquid supplying device 204 and the overflowed processing liquid is drained from the side liquid draining device 206. After the wafer 1 is cleaned, the wafer holding device 300 (Refer to Fig. 3) is ascended into the cover 210, as shown in Fig. 4D. The wafer carrier 306 is stopped after ascended to a fixed height. The supporting element 302 continually pushes the wafer 1 upward until it is completely in the cover 210. An automatic controlling device controls the relational or separate movement between the supporting element 302 and the wafer carrier 306. In this embodiment, a computer is implemented as the automatic controlling device. Alternatively, as

shown in Figs. 3B and 3C, the supporting element 302 and the wafer carrier 306 are moved in relation to each other through a fixing element 310. In this embodiment, a hook is implemented as the fixing element 310.

Refer to Figs. 4D to 4H. As shown in Fig. 4D, after the wafer 1 is ascended to the cover 210, the holding device 212 holds the wafer 1 at two corresponding sides. As shown in Fig. 4E, the supporting element 302 is descended to the same level as the wafer carrier 306. The processing liquid remained in the processing tank 202 is drained until it is completed out of the wafer drying apparatus 200 from the bottom liquid draining device 205. As shown in Fig. 4F, the supporting element 302 is ascended to the bottom of the wafer 1 to support the decending of the wafer 1. As shown in Fig. 4G, the supporting element 302 is descended to an appropriate height so as to connect with the wafer carrier 306 to carry the wafer 1 downward until the wafer 1 is completely contained in the processing tank 202. The nozzles 214 then stop supplying the dry air. As shown in Fig. 4H, the cover is moved away from top of the processing tank and the wafer 1 is ascended to the top of the processing tank 202 to complete the drying process.

The present invention has already been described in details through the embodiments and the accompanying drawings. However, those skilled in the art should know that these embodiments are for illustration purpose only, and are not meant to limit the present invention. Any modifications or changes made to the embodiment are within the scope and spirit of the present invention. The present invention is set forth in the attached claims.

BRIEF DESCRIPTION OF NUMERALS

1	wafer
100	wafer drying apparatus
10	cover part
11	air filling device
20	processing tank assembly
21	processing tank
22	liquid supplying device
23	liquid draining device
24	exhausting device
30	wafer holding device
31	supporting element
32	wafer carrier
200	wafer drying apparatus
202	processing tank
204	liquid supplying device
205	bottom liquid draining device
206	side liquid draining device
208	exhausting device
210	cover
212	holding device
214	nozzle
300	wafer holding device
302	supporting element
304	driving device
306	wafer carrier
308	arm
310	connecting element
402	air supplying device

CLAIMS

What is claimed is:

1. A wafer drying apparatus, comprising:

a processing tank;

a liquid supplying device filling said processing tank with a processing liquid;

a side liquid draining device draining said processing liquid out of said wafer drying apparatus;

at least one nozzle providing an air to said wafer so as to dry said wafer;

an exhausting device letting said air out of said wafer drying apparatus; and

a wafer holding device moving said wafer, said wafer holding device comprising:

a supporting element;

a driving device driving said supporting element; and

a wafer carrier capable of moving separately or in relation to said supporting element.

2. The wafer drying apparatus of claim 1, wherein said nozzle supplies a mixture gas consisted of Nitrogen (N_2) and Isopropyl Alcohol (IPA).

3. The wafer drying apparatus of claim 1, or 2, wherein said wafer carrier moves in relation to said supporting element through at least one fixing element.

4. The wafer drying apparatus of claim 3, wherein said fixing element is a hook.

5. The wafer drying apparatus of any one of the preceding claims, further

comprising a controlling device controlling a relational or separate movement between said wafer carrier and said supporting element.

6. The wafer drying apparatus of claim 5, wherein said controlling device is a computer.

7. The wafer drying apparatus of claim 5, or 6, wherein said controlling device automatically controls said relational or separate movement between said wafer carrier and said supporting element.

8. The wafer drying apparatus of any one of the preceding claims, wherein said driving device of said wafer holding device is a motor.

9. A wafer drying apparatus, comprising:

a processing tank;

a wafer holding device moving said wafer;

at least one nozzle providing an air to said wafer so as to dry said wafer;

an exhausting device letting said air out of said wafer drying apparatus;

a liquid supplying device filling said processing tank with a processing liquid; and

a side liquid draining device draining said processing liquid out of said wafer drying apparatus, wherein said liquid draining device is provided at a single side of said processing tank such that said processing liquid flows in an uni-direction.

10. The wafer drying apparatus of claim 9, wherein said exhausting device is provided at a single side of said processing tank such that said air flows in a

uni-direction.

11. The wafer drying apparatus of claim 10, wherein said exhausting device and said side liquid draining device are provided on the same side of said processing tank such that said processing liquid and said air flow in the same direction.

12. The wafer drying apparatus of any one of claims 9 to 11, wherein said nozzle provides a mixture gas consisted of Nitrogen (N_2) and Isopropyl Alcohol (IPA).

13. The wafer drying apparatus of any one of claims 9 to 12, wherein said wafer holding device comprises:

a supporting element ;

a driving device driving said supporting element; and

a wafer carrier capable of moving separately or in relation to said supporting element.

14. The wafer drying apparatus of claim 13, wherein said wafer carrier and said supporting element move in relation to each other through at least one fixing element.

15. The wafer drying apparatus of claim 14, wherein said fixing element is a hook.

16. The wafer drying apparatus of claim 14, further comprising a controlling device controlling a relational or separate movement between said wafer carrier and said supporting element.

17. The wafer drying apparatus of claim 16, wherein said controlling device is a computer.

18. The wafer drying apparatus of claim 16, or 17, wherein said controlling device automatically controls said relational or separate movement between said wafer carrier and said supporting element.

19. The wafer drying apparatus of any one of claims 13 go 18, wherein said driving device of said wafer holding device is a motor.

20. A wafer drying apparatus used in a washing device in a semiconductor manufacturing process, said wafer drying apparatus comprising:

a processing tank;

a wafer holding device moving said wafer;

a cover substantially covering said processing tank, wherein said cover defines an interior space above said processing tank so as to contain at least one wafer therein;

at least one holding device provided in said cover, when said wafer is contained within said cover, said at least one holding device releasably holds said wafer;

at least one nozzle provided in said cover for providing an air to said wafer so as to dry said wafer;

an exhausting device letting said air out of said wafer drying apparatus;

a liquid supplying device filling said processing tank with a processing liquid; and

a side liquid draining device draining said processing liquid out of said wafer drying apparatus.

21. The wafer drying apparatus of claim 20, wherein said side liquid draining device is provided at a single side of said processing tank such that said processing liquid flows in an uni-direction.

22. The wafer drying apparatus of claim 20, or 21, wherein said exhausting device is provided at a single side of said processing tank such that said air flows in an uni-direction.

23. The wafer drying apparatus of any one of claims 20 to 22, wherein said exhausting device and said side liquid draining device are provided on the same side of said processing tank such that said processing liquid and said air flow in the same direction.

24. The wafer drying apparatus of any one of claims 20 to 23, wherein said nozzle provides a mixture gas consisted of Nitrogen (N_2) and Isopropyl Alcohol (IPA).

25. The wafer drying apparatus of any one of claims 20 to 24, wherein said wafer holding device comprises:

a supporting element;

a driving device driving said supporting element; and

a wafer carrier capable of separately moving in relation to said supporting element.

26. The wafer drying apparatus of claim 25, wherein said wafer carrier and said supporting element can move in relation to each other through at least one fixing element.

27. The wafer drying apparatus of claim 26, wherein said fixing element is a hook.

28. The wafer drying apparatus of any one of claims 25 to 27, further comprising a controlling device controlling said relational or separate movement between said wafer carrier and said supporting element.

29. The wafer drying apparatus of any one of claims 25 to 28, wherein said controlling device is a computer.

30. The wafer drying apparatus of any one of claims 25 to 29, wherein said controlling device automatically controls said relational or separate movement of said wafer carrier and said supporting element.

31. The wafer drying apparatus of any one of claims 25 to 30, wherein driving device of said wafer holding device is a motor.

32. The wafer drying apparatus of any one of claims 20 to 31, wherein said holding device is shaped as column.

33. The wafer drying apparatus of any one of claims 20 to 32, wherein at least two holding devices are provided at two corresponding sides on said cover, respectively.

34. The wafer drying apparatus of any one of claims 20 to 33, comprising a plurality of nozzles arranged intertwinedly.

35. The wafer drying apparatus of any one of claims 20 to 34, further comprising a plurality of nozzles arranged in three rows, and said nozzles and adjacent nozzles arranged intertwinedly.

36. The wafer drying apparatus of any one of claims 20 to 35, further comprising an air providing device connected to said nozzle, wherein said nozzle does not have a thin film such that said air providing device allows said nozzle to provide evenly distributed air spray.

37. The wafer drying apparatus of any one of claims 20 to 36, wherein said nozzle has a predetermined angle.

38. The wafer drying apparatus of any one of claims 20 to 37, wherein said nozzle is made of a flexible material.

39. The wafer drying apparatus of any one of claims 20 to 38, wherein said nozzle further comprises an adjustment device adjusting a direction of said air spray.

40. The wafer drying apparatus of any one of claims 20 to 39, wherein an outlet of said nozzle is in radial shape.

41. A wafer drying apparatus, comprising:

a processing tank;

a wafer holding device moving said wafer;

at least one nozzle providing an air to said wafer so as to dry said wafer;

an exhausting device letting said air out of said wafer drying apparatus, wherein said exhausting device is provided at a single side of said processing

tank such that said air flows in an uni-direction;

a liquid supplying device filling said processing tank with a processing liquid; and

a side liquid draining device draining said processing liquid out of said wafer drying apparatus.