LIFTING METHOD FOR WAFER DRYING

TECHNICAL FIELD

[0001] Ther invention belongs to the technical field of fabrication of semiconductor integrated circuit chips, and particularly relates to a wafer drying and lifting method.

DESCRIPTION OF RELATED ART

[0002] Chemical mechanical planarization is a process for integrated circuits. With the development of technology, the requirements for the fabrication process are increased accordingly. In addition, because CMP is a wet process for wafer processing and a large amount of grinding fluid and different chemical reagents are used in the whole process, wafers need to be cleaned and dried at the final stage of the process to remove particles from the surface of the wafers, before entering the next process.

[0003] Existing integrated circuit equipment adopts a traditional spin-drying method to remove water from the surface of wafers by means of a centrifugal force generated during high-speed rotation. However, due to the difference in material and surface patterns of wafers, the spin-drying method sometimes leads to residual water, resulting an excessive quantity of particles on the wafers.

[0004] In recent years, a novel drying method based on the Marangoni effect emerges. This method removes water from the surface of a wafer by means of a gradient difference of the surface tension and may effectively lower the possibility of residual water and particles adhering to the surface of the wafer. By adopting such a method, the bottom of the wafer needs to be supported and lifted out of the liquid surface, and to avoid residual water at the bottom of the wafer, the contact area between a support base and the wafer should be as small as possible; in addition, because the support base is immersed in water for a long time, the support base is generally made of plastic to guarantee the corrosion resistance of the support base. With this existing method, the support base plays a role in supporting the wafer during the whole process of completely lifting

the wafer, from being immersed at the bottom of liquid to getting out of the liquid surface; and due to the high intensity of pressure caused by a small contact area between the support base and the bottom of the wafer, the support base is easily abraded under the high pressure and needs to be frequently replaced to guarantee the lifting accuracy, leading to high material consumption. Moreover, the liquid surface needs to be kept smooth in the process, at present, the support base drives the wafer by transferring a lifting force of an electric cylinder on the back side of a box to the wafer by means of a magnet, and a pedestal of the support base and the box slide under the action of the magnet, so the resistance in the lifting process is large; the magnetic force as non-rigid transmission has the risk of stall and even wafer falling, and friction of the support base and inner wall of the box will be caused in the sliding process, compromising the transmission accuracy, shortening the service life and leading to the generation of impurity particles. More importantly, in an actual working condition, the equipment needs to operate stably for a long time, the support base needs to be changed frequently, and the position of the support base needs to be corrected frequently. This greatly prolongs the maintenance time of the equipment, thus compromising the operating frequency of the equipment at the front and rear ends of a production line and resulting in a great economic loss.

SUMMARY OF THE INVENTION

[0005] To overcome the defects in the prior art, the invention provides a wafer drying and lifting method to prolong the service life of a lifting mechanism and achieve a good wafer drying effect.

[0006] The technical solution adopted by the invention to solve the above mentioned technical problems is as follows: a wafer drying and lifting method includes: a wafer located below a liquid surface to ascend, support mechanisms drive the wafer to ascend, wherein an ascending velocity of the wafer is V1, a lifting mechanism is located below the wafer and is not in contact with the wafer, the ascending velocity of the lifting mechanism is V2, and $V2 \leq V1$;

[0007] when a top of the wafer is close to the liquid surface, the support mechanisms separates

from the wafer while making sure the wafer keeps ascending, and enabling the lifting mechanism to ascend to come into contact with the wafer to further push the wafer upwards until the wafer is out of the liquid surface; and

[0008] by the lifting mechanism, the wafer further ascends until the wafer is completely lifted out of the liquid surface.

[0009] Further, an ascending velocity of the support mechanisms when the support mechanisms are separated from the wafer is V11, the ascending velocity of the lifting mechanism when the lifting mechanism comes into contact with the wafer is V21, and a velocity difference between V21 and V11 is $\geq$ 5 mm/s.

[0010] Further, the ascending velocity of the support mechanisms decreases until the support mechanisms stop, such that the support mechanisms are separated from the wafer.

[0011] Further, the wafer is located below the liquid surface, and the support mechanisms drive the wafer to ascend through a first stage and a second stage; in the first stage, the support mechanisms drive the wafer to ascend at a constant velocity; and in the second stage, the support mechanisms drive the wafer to ascend with deceleration.

[0012] Further, the lifting mechanism drives the wafer to extend out of the liquid surface through a third stage and a fourth stage; in the third stage, the ascending velocity of the wafer driven by the lifting mechanism decreases; and in the fourth stage, the ascending velocity of the wafer driven by the lifting mechanism increases.

[0013] Further, in the fourth stage, an ascending acceleration of the wafer driven by the lifting mechanism is $\geq$ 20 mm/s^2.

[0014] Further, in the third stage, a decrease rate of the ascending velocity of the wafer is zigzag.

[0015] Further, each support mechanism includes a base body provided with a wafer slot, a mounting base arranged on a side surface of the base body and roller shafts movably arranged on the mounting base, the first grooves are formed in a drying box in a height direction, and the roller shafts are able to move upwards and downwards along the first grooves.

[0016] Further, the roller shafts roll or slide in the first grooves. Further, the lifting mechanism includes a sliding member, rotating shafts slidably arranged on the sliding member, and a support base; the second grooves are formed a drying box in a height direction; and the rotating shafts are able to move upwards and downwards along the second grooves.

[0017] Further, the support base is made of plastic.

[0018] Further, the support base includes a main body and a pointed end integrally arranged at an end of the main body, the pointed end has a width of 0.1-0.6 mm, and an included angle of a cross-section of the pointed end is 20‑45°.

[0019] Further, a top of the support base is straight or crescent, a maximum depth of the crescent is 0.2-1 mm, and the straight top is a flat surface or a surface with a rounded corner.

[0020] The wafer drying and lifting method based on the Marangoni effect provided by the invention adopts multiple modules for lifting, such that the operating time of the support base of the lifting mechanism is shortened, thus prolonging the service life of the support base, reducing the wastage and shortening the maintenance time; the support mechanisms may be in rolling fit with the drying box and the lifting mechanism may be in rolling fit with the drying box, such that the lifting resistance is reduced, reducing abrasion; by means of the crescent design of the support base, the support base may support the wafer more stability and prevent the wafer from falling off. Under the condition of satisfying the process based on the Marangoni effect, the invention reduces the wastage of a whole drive mechanism, improves the conveying stability of a device and avoids the influence of impurity particles produced by friction on the process environment.

[0021] The invention has the following beneficial effects: 1) the support mechanisms on the two sides and the lifting mechanism are controlled separately to realize different lifting modes in two stages; 2) in the first half of the lifting process of the wafer, the wafer is driven by the support mechanisms on the two sides, the support mechanisms work below the liquid surface, and the contact area with the wafer is large, such that the wafer is placed stably, and abrasion is small; in the second half of the lifting process of the wafer, the support base of the lifting mechanism starts

to work, and the operating time of the support base for each wafer is shortened by half, such that the wastage of the support base is small, and the service life of the support base will be longer; 3) the support base does not need to be replaced frequently, and a drying device may operate stably for a long time, such that the operating efficiency of equipment at the front end and rear end of a production line will not be reduced; 4) in the third stage, multi-stage deceleration is adopted to ensure that water adhering to the surface of the wafer may be completely taken away under the action of surface tension; 5) in the fourth stage, the wafer ascends sharply, such that residual water at the lower end of the wafer may be taken away by means of surface tension; 6) the support mechanisms undertake part of the lifting work of the wafer, and the wastage of the support base of the lifting mechanism in each process is reduced, thus prolonging the service life of the support base and reducing the maintenance and replacement frequency of the support base; 7) by setting the velocity difference between the support mechanisms and the lifting mechanism when the lifting mechanism replaces the support mechanisms to lift the wafer, the service life of the support mechanisms is prolonged and the lifting mechanism may better cooperate with the support mechanisms in the continuous lifting process of the wafer; 8) in the third stage, by multi-stage deceleration, the velocity may decrease smoothly to realize a good drying effect, the difficulty of coordination between the support mechanisms and the lifting mechanism is reduced, continuous ascending of the wafer is guaranteed, and the situation where impurity particles are left on the wafer due to pause of the wafer in the ascending process is avoided; 9) the roller shafts of the support mechanisms are in rolling fit or sliding fit with the first grooves in the drying box, and the rotating shafts of the lifting mechanism are in rolling fit or sliding fit with the second grooves in the drying box, such that the resistance is low, abrasion is small, and less impurity particles are produced; 10) the crescent top may prevent the wafer from falling off, ensuring that the wafer is stably supported by the support base; 11) the drive mechanism is located in an external environment and provides a lifting force by means of a magnet, thus reducing pollution caused by movements.

DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 is a schematic internal diagram of a wafer drying and lifting device in an initial state where support mechanisms are in contact with a wafer and a lifting mechanism is not in contact with the wafer according to the invention.

[0023] FIG. 2 is an enlarged view of part A in FIG. 1.

[0024] FIG. 3 is a sectional view of FIG. 1.

[0025] FIG. 4 is a schematic internal diagram of the wafer drying and lifting device in an ascending state where the support mechanisms are in contact with the wafer and the lifting mechanism is not in contact with the wafer according to the invention.

[0026] FIG. 5 is an enlarged structural view of part B in FIG. 4.

[0027] FIG. 6 is a schematic internal diagram of the wafer drying and lifting device in the ascending state where the support mechanisms are not in contact with the wafer and the lifting mechanism is in contact with the wafer according to the invention.

[0028] FIG. 7 is an enlarged structural view of part C in FIG. 6.

[0029] FIG. 8 is a schematic diagram of the support mechanism according to the invention.

[0030] FIG. 9 is a schematic diagram of part of the matching structure of the support mechanism and a drying box according to the invention.

[0031] FIG. 10 is a schematic diagram of the lifting mechanism according to the invention.

[0032] FIG. 11 is a schematic diagram of part of the matching structure of the lifting mechanism and the drying box according to the invention.

[0033] FIG. 12 is a front view of a support base in a case where a pointed end is a flat surface according to the invention.

[0034] FIG. 13 is a side view of the support base according to the invention.

[0035] FIG. 14 is a front view of the support base in a case where the pointed end is a rounded corner according to the invention.

[0036] FIG. 15 is a side view of the support base in a case where the pointed end is crescent according to the invention.

[0037] FIG. 16 illustrates a position curve of the wafer in an ascending process according to the invention.

[0038] FIG. 17 illustrates velocity curves of the support mechanisms and the lifting mechanism according to the invention.

[0039] Wherein: 1- wafer; 2- support mechanism; 21- base body; 211- wafer slot; 22- mounting base; 23- roller shaft; 3- lifting mechanism; 31- sliding member; 32- rotating shaft; 33- support base; 331- main body; 332- pointed end; 4- drying box; 41- first groove; 411- convex portion; 412- groove body; 413- vertical track; 42- second groove; 43- liquid surface.

DETAILED DESCRIPTION OF EMBODIMENTS

[0040] To allow those skilled in the art to have a better understanding of the technical solutions of the invention, the technical solutions in the embodiments of the invention will be clearly and completely described below in conjunction with accompanying drawings of these embodiments. Obviously, the embodiments described below are merely illustrative ones, and are not all possible ones of the invention. All other embodiments obtained by ordinarily skilled in the art based on the following ones without creative labor should also fall within the protection scope of the invention.

[0041] A wafer drying and lifting device includes a drying box 4 provided with an opening in the top, a wafer 1, support mechanisms 2 located on two sides of the wafer 1, and a lifting mechanism 3 located below the wafer 1 and between the support mechanisms 2 on the two sides.

[0042] As shown in FIGS. 8 and 9, each support mechanism 2 includes a base body 21 provided with a wafer slot 211, a mounting base 22 arranged on a side surface of the base body 21, and roller shafts 23 movably arranged on the mounting base 22; and first grooves 41 are formed in the drying box 4 in a height direction of it, and the roller shafts 23 are able to move upwards and downwards along the first grooves 41. Specifically, the roller shafts 23 roll or slide in the first

grooves 41 to prevent the support mechanism 2 from deflecting in a horizontal direction.

[0043] In this embodiment, the base body 21 is round, the concaved wafer slot 211 is formed in a thickness direction of the base body 21, the mounting base 22 includes two parallel base bodies fixedly connected to a back side of the base body 21, and two roller shafts 23 are movably arranged on each base body. Specifically, the roller shafts 23 may be connected to the base bodies by means of bearings, such that the roller shafts 23 are rotatable with respect to the mounting base 22. In other embodiments, the number of the roller shafts 23 may be arbitrarily and is not specifically limited.

[0044] In this embodiment, each first groove 41 includes a convex portion 411 with an I-shaped cross-section and groove bodies 412 located on two sides of the convex portion 411, vertical tracks 413 are formed on side walls, facing the groove bodies 412, of the convex portion 411, the roller shafts 23 move in the vertical tracks 413, and the mounting base 22 is inserted into the groove bodies 412.

[0045] As shown in FIGS. 10 and 11, the lifting mechanism 3 includes a sliding member 31, rotating shafts 32 movably arranged on the sliding member 31, and a support base 33. Second grooves 42 are formed in the drying box 4 in the height direction of it, and the rotating shafts 32 are able to move upwards and downwards along the second grooves 42. Specifically, the rotating shafts 32 roll or slide in the second grooves 42 to prevent the sliding member 31 from deflecting in the horizontal direction.

[0046] In this embodiment, the cross-section of the sliding member 31 is U-shaped, two rotating shafts 32 are movably arranged on each of two sides of it, and the rotating shafts 32 may be connected to the sliding member 31 by means of bearings, such that the rotating shafts 32 are rotatable with respect to the sliding member 31. In other embodiments, the number of the rotating shafts 32 may be arbitrarily and is not specifically limited.

[0047] In this embodiment, the second grooves 42 are identical in structure with the first grooves 41 and each include a convex portion with an I-shaped cross-section and groove bodies

located on two sides of the convex portion, wherein vertical tracks are formed on side walls, facing the groove bodies, of the convex portion, the rotating shafts 32 move in the vertical tracks, and the sliding member 31 is inserted into the groove bodies.

[0048] Positions of the support mechanisms 2 and the lifting mechanism 3 are fixed by means of a magnet on a back side of the drying box 4. The magnet is connected to a motor and a drive mechanism. When the magnet is driven by the drive mechanism to move, the support mechanisms 2 and the lifting mechanism 3 move, that is, the roller shafts 23 of the support mechanisms 2 move in the first grooves 41, and the rotating shafts 32 of the lifting mechanism 3 move in the second grooves 42.

[0049] As shown in FIGS. 12-15, the support base 33 is made from plastic. Specifically, the support base 33 may be made from a hydrophilic material (quartz or ceramic) or a hydrophobic material (PEEK, polysulfone or PVDF). The support base 33 includes a main body 331 and a pointed end 332 integrally arranged at the top of the main body 331. A cross-shaped structure is formed when the pointed end 332 comes into contact with a side wall of the wafer 1. The width of the pointed end 332 is 0.1-0.6 mm, that is, s in FIG. 12 is 0.1-0.6 mm. The pointed end 332 may be a flat surface or a rounded corner. An included angle of the cross-section of the pointed end 332 is 20‑45°, that is, α in FIGS. 12 and 14 is 20‑45°. The top of the pointed end 332 is straight or crescent. The height from the bottom to the top of the crescent is 0.2-1mm, that is, h in FIG. 15 is 0.2-1 mm. The crescent top may prevent the wafer 1 from falling off, thus ensuring that the wafer 1 is stably supported by the support base 33.

[0050] The drying box 4 is full of ultra-clean water with a smooth liquid surface 43 to realize the Marangoni effect. In an initial stage, the wafer 1 is completely immersed below the liquid surface 43; and at this moment, the wafer 1 is fixed by the support mechanisms 2 on the two sides to be prevented from falling off, the top of the support base 33 of the lifting mechanism 3 in the middle is located below a lower edge of the wafer 1 and is not in contact with the wafer 1, as shown in FIGS. 1-3. That is, in the initial stage, the support mechanisms 2 on the two sides bear

force, and the lifting mechanism 3 in the middle does not bear force.

[0051] In the first half of the ascending process of the wafer 1, the wafer 1 is driven to ascend by the support mechanisms 2 on the two sides before the support mechanisms 2 on the two sides reach upper limit positions (the upper limit positions are located below the liquid surface), the lifting mechanism 3 in the middle moves upwards at the same time, the top of the support base 33 is lower than the lower edge of the wafer 1 and is not in contact with the wafer 1, as shown in FIGS. 4 and 5. Of course, the lifting mechanism 3 may keep stationary.

[0052] In the second half of the ascending process of the wafer 1, the support mechanisms 2 on the two sides stop ascending when reaching the upper limit positions, the lifting mechanism 3 in the middle moves upwards or further moves upwards to lift the wafer 1, and at this moment, the wafer 1 is driven by the lifting mechanism 3 in the middle, as shown in FIGS. 6 and 7, until it is completely lifted out of the liquid surface 43 to reach a set height.

[0053] A wafer drying and lifting method includes the following steps:

[0054] As shown in FIG. 16, to guarantee the drying effect and prevent impurity particles from being retained on the surface of the wafer 1, the ascending process of the wafer 1 is continuous.

[0055] First, liquid is contained in the drying box 4, the wafer 1 is located below the liquid surface, and the support mechanisms 2 on the two sides of the wafer 1 drive the wafer 1 to ascend, wherein an ascending velocity of the wafer 1 is V1, and the lifting mechanism 3 is located below the wafer 1 and is not in contact with the wafer 1, in other words, the wafer 1, the support mechanisms 2 and the lifting mechanism 3 are all located below the liquid surface 3, only the support mechanisms 2 drive the wafer 1 to ascend, and the lifting mechanism 3 does not drive the wafer 1 to ascend; and an ascending velocity of it is V2, and $V2 \leq V1$.

[0056] Specifically, in this embodiment, V1=V2, only the support mechanisms 2 on the two sides drive the wafer 1 to ascend; and in the ascending process of the wafer 1, the lifting mechanism 3 in the middle is not in contact with the bottom of the wafer 1, and the relative positions remain unchanged.

[0057] Second, when the top of the wafer 1 is closed to the liquid surface and does not extend out of the liquid surface, the support mechanisms 2 are separated from the wafer 1 under the condition that the wafer 1 keeps ascending, and the lifting mechanism 3 ascends to come into contact with the wafer 1 to further push the wafer 1 upwards out of the liquid surface. That is to say, even if the support mechanisms 2 are separated from the wafer 1, the wafer 1 does not stop ascending when the lifting mechanism 3 replaces the support mechanisms 2, and the wafer 1 ascends continuously. Specifically, an ascending velocity when the support mechanisms 2 are separated from the wafer 1 is V11, an ascending velocity when the lifting mechanism 3 comes into contact with the wafer 1 is V21, and a velocity difference between V21 and V11 is $\geq$ 5 mm/s. The velocity difference between V21 and V11 may be adjusted flexibly according to specific conditions as long as the velocity difference is greater than or equal to 5 mm/s.

[0058] More specifically, in the process of separating the support mechanisms 2 from the wafer 1, the ascending velocity of the support mechanisms 2 on the two sides decreases to stop before the support mechanisms 2 on the two sides reach the upper limit positions (the upper limit positions are located below the liquid surface 43), such that realize separating from the wafer 1.

[0059] In this embodiment, the support mechanisms 2 drive the wafer 1 to ascend by a first stage I and a second stage II; in the first stage I, the support mechanisms 2 drive the wafer 1 to ascend at a constant velocity, and at this moment, the wafer 1 completely immersed below the liquid surface 43 starts to extend out of the liquid surface; and in the second stage II, the support mechanisms 2 drive the wafer 1 to slow down, such that the wafer 1 gradually extends out of the liquid surface. To guarantee the drying effect of the wafer, 1, the ascending velocity decreases gradually after extending out of the liquid surface, as shown in FIG. 17. That is, in the second stage II, the velocity of the lifting mechanism 3 in the middle is set according to the actual condition to ensure that it comes into contact with the bottom of the wafer 1 at the moment the support mechanisms 2 on the two sides stop completely, so as to further push the wafer 1 to ascend, thus avoiding a pause of the wafer 1 in the ascending process. In the second stage II, the velocity

of the support mechanisms 2 on the two sides is always lower than the velocity of the lifting mechanism 3 in the middle, that is, V21≥V11, and V21–V11≥5 mm/s.

[0060] In this embodiment, the lifting mechanism 3 drives the wafer 1 to extend out of the liquid surface by a third stage III and a fourth stage IV, and in this process, the wafer 1 is supported merely by the support base 33; in the third stage III, the ascending velocity of the wafer 1 driven by the lifting mechanism 3 decreases; and in the fourth stage IV, the ascending velocity of the wafer 1 driven by the lifting mechanism 3 increases. More specifically, in the third stage III, the decrease rate of the ascending velocity of the wafer 1 is zigzag; and in the fourth stage IV, an ascending acceleration of the wafer 1 driven by the lifting mechanism 3 is ≥ 20 mm/s^2, such that the wafer 1 is accelerated sharply when the wafer 1 is about to completely extend out of the liquid surface, and residual water at the lower end of the wafer 1 is taken away by means of surface tension. In the fourth stage IV, the lifting mechanism 3 in the middle is accelerated sharply until the wafer 1 completely extends out of the water surface, and the bottom of the wafer 1 is supported by the support base 33 and moved out of the water surface, such that no water is left at the bottom of the wafer 1.

[0061] Next, the wafer 1 is driven by the lifting mechanism 3 to further ascend until the wafer 1 is completely lifted out of the liquid surface.

[0062] The above specific embodiments are used for explaining the invention rather than limiting the invention. Any modifications and transformations made to the invention based on the spirit of the invention and the protection scope of the claims should also fall within the protection scope of the invention.

WHAT IS CLAIMED IS:

1. A wafer drying and lifting method, characterized by comprising:

driving, by support mechanisms, a wafer located below a liquid surface to ascend, wherein an ascending velocity of it is V1, a lifting mechanism is located below the wafer and is not in contact with the wafer, an ascending velocity of it is V2, and V2≤V1;

separating, when a top of the wafer is close to the liquid surface, the support mechanisms from the wafer under a condition that the wafer keeps ascending, and enabling the lifting mechanism to ascend to come into contact with the wafer to further push the wafer upwards to extend out of the liquid surface; and

driving, by the lifting mechanism, the wafer to further ascend until the wafer is completely lifted out of the liquid surface.

2. The wafer drying and lifting method according to Claim 1, characterized in that an ascending velocity of the support mechanisms when the support mechanisms are separated from the wafer is V11, an ascending velocity of the lifting mechanism when the lifting mechanism comes into contact with the wafer is V21, and a velocity difference between V21 and V11 is ≥ 5 mm/s.

3. The wafer drying and lifting method according to Claim 1, characterized in that an ascending velocity of the support mechanisms decreases until the support mechanisms stop, such that separated from the wafer.

4. The wafer drying and lifting method according to Claim 1 or 3, characterized in that the wafer is located below the liquid surface, and the support mechanisms drive the wafer to ascend by a first stage and a second stage; in the first stage, the support mechanisms drive the wafer to ascend at a constant velocity; and in the second stage, the support mechanisms drive the wafer to slow down.

5. The wafer drying and lifting method according to Claim 1, characterized in that the lifting mechanism drives the wafer to extend out of the liquid surface by a third stage and a fourth

stage; in the third stage, the ascending velocity of the wafer driven by the lifting mechanism decreases; and in the fourth stage, the ascending velocity of the wafer driven by the lifting mechanism increases.

6. The wafer drying and lifting method according to Claim 5, characterized in that in the fourth stage, an ascending acceleration of the wafer driven by the lifting mechanism is $\geq$ 20 mm/s^2.

7. The wafer drying and lifting method according to Claim 5, characterized in that in the third stage, a decrease rate of the ascending velocity of the wafer is zigzag.

8. The wafer drying and lifting method according to Claim 1, characterized in that the support mechanisms comprises a base body provided with a wafer slot, a mounting base arranged on a side surface of the base body and roller shafts movably arranged on the mounting base, first grooves are formed in a drying box in a height direction, and the roller shafts are able to move upwards and downwards along the first grooves.

9. The wafer drying and lifting method according to Claim 8, characterized in that the roller shafts roll or slide in the first grooves.

10. The wafer drying and lifting method according to Claim 1, characterized in that the lifting mechanism comprises a sliding member, rotating shafts slidably arranged on the sliding member, and a support base; second grooves are formed in a drying box in a height direction; and the rotating shafts are able to move upwards and downwards along the second grooves.

11. The wafer drying and lifting method according to Claim 10, characterized in that the support base is made from plastic.

12. The wafer drying and lifting method according to Claim 10, characterized in that the support base comprises a main body and a pointed end integrally arranged at an end of the main body, the pointed end has a width of 0.1-0.6 mm, and an included angle of a cross-section of the pointed end is 20‑45°.

13. The wafer drying and lifting method according to Claim 12, characterized in that a top

of the support base is a straight or a crescent, a maximum depth of the crescent is 0.2-1 mm, and a top surface of the straight is a flat surface or a surface with a rounded corner.