SUBSTRATE BUFFER CLAMP

Inventors: Shih Pu Chen, Padeh City (TW); Zheng Hua Zhang, Padeh City (TW); Dong Da Lin, Padeh City (TW)

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ABSTRACT
A substrate clamp includes a bar supporter having a end for connecting and fixing a substrate bearing apparatus; an arm extending from another end of the bar supporter and profiling an angle with the side wall of the bar supporter; and a buffer layer arranged on the side wall of the bar supporter. The present substrate clamp can effectively decrease the split problem of the glass substrate causing from the shocking and sliding in the clamping or moving of the manufacturing processes and enhance the product yield.
FIG. 1A (Prior Art)

FIG. 1B (Prior Art)
FIG. 5A

FIG. 5B
SUBSTRATE BUFFER CLAMP

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

The present invention generally relates to a substrate bearing apparatus, and more particularly relates to a clamp used in a substrate bearing apparatus in the manufacturing processes of the display panel.

[0002] 2. Description of the Prior Art

In the manufacturing processes of the display panel, the split problem of the glass substrate or the panel is always an important one of the problems need to overcome. Once the glass substrate or the panel is splitting, the glass substrate or the panel cannot be usable or reworked. Especially, accordingly the requirement of the trend of large-scale and thin film Liquid crystal display panel (LCD panel), the difficulty of the related manufacturing technology becomes higher, such as the control of the thin cell gap, stacking and aligning of the panel, the movement and position of the large-scale panel, and the wide view problem, so as the splitting probability is increasing and the yield is decreasing. Wherein, the transportation of the glass substrate or the panel is one of main reasons causing the splitting damage of the glass substrate or the panel, no matter in the process or the movement in the factory, the product yield can be improved by overcoming the splitting problem of the glass substrate and the panel.

For example, referring to FIG. 1A, it is a top view illustrating the clamp used in the sputtering machine for bearing a substrate in accordance with the prior technology. As the glass substrate 20 formed the membrane thereon in the sputtering machine, the glass substrate 20 is set on a bearing apparatus, such as a quartz substrate 30, and a clamp 100 is used to fix the glass substrate 20 on the quartz substrate 30. During the whole processes of the membrane formation, the glass substrate 20 is sputtered and shock and further the glass substrate 20 may be moved to the different position or rotate to different direction to form another membrane of the different material on the glass substrate 20 in the sputtering machine. Referring to FIG. 1B, it is the cross-section view illustrating the clamp according to the A-A cross-section of FIG. 1A. Under the long time clamping and shock of the substrate bearing apparatus and the clamp 100 in the process, it easily causes the loosening of the quartz substrate 30. Hence, as the clamp 100 supporting and holding the glass substrate 20, owing to the loosening of the quartz substrate 30, the difficult positioning of the glass substrate 20, and the difficult control of the supporting force of the clamp 100, it will easily cause the clamp 100 colliding the glass substrate 20 and the quartz substrate 30. Hence, it is important to solve those problems on the yield of the display panel.

SUMMARY OF THE INVENTION

One of objects of the present invention is to provide a substrate clamp that can effectively decrease the split problem of the glass substrate causing from the shocking and sliding because of the clamping or moving in the manufacturing processes.

In order to improve the damage problem of the substrate bearing apparatus and the glass substrate causing from the hitting of the substrate clamp, one of objects of the present invention is to provide a substrate clamp that utilize a buffer material in the contacting area between the substrate clamp and the glass substrate to reduce the hitting force therebetween so as to substantially decrease the probability of the split of the glass substrate.

Accordingly, the present invention provides A substrate clamp for a substrate bearing apparatus comprising: a bar supporter, wherein a end of the bar supporter is used for connecting and fixing with the substrate bearing apparatus; an arm extending from another end of the bar supporter and profiling an angle with a sidewall of the bar supporter; and a buffer layer arranged on the sidewall of the bar supporter.

Other advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings wherein are set forth, by way of illustration and example, certain embodiments of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the accompanying advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1A is the top view of the clamp used in the sputtering machine for bearing a substrate in accordance with the prior technology;

FIG. 1B is the cross-section view according to the A-A cross-section of FIG. 1A;

FIG. 2 is the side view of the substrate clamp of an embodiment in accordance with the present invention;

FIG. 3 is the 3D view of the substrate clamp of an embodiment in accordance with the present invention;

FIG. 4A and FIG. 4B are partial cross-section views of the substrate clamp used in the substrate bearing apparatus of an embodiment in accordance with the present invention; and

FIG. 5A and FIG. 5B are side views of the substrate clamp of different embodiments in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 2, it is the side view illustrating the substrate clamp of an embodiment in accordance with the present invention. In the present embodiment, a substrate clamp 10 includes a bar supporter 12, wherein one end of the bar supporter 12 is connected and fixed to the substrate bearing apparatus. An arm 14 is extended from another end of the bar supporter 12 and an angle between the sidewall of the bar supporter 12 and the arm 14. Besides, there is a buffer layer 16 arranged on the sidewall of the bar supporter 12. The buffer layer 16 has a hardness smaller than the bar supporter 12 and used for reducing the colliding force between the glass substrate and the substrate clamp and the loosening problem. Further, in the present embodiment, there is a right angle profiling between the arm 14 and the sidewall of the bar supporter 12. Such as the region A shown
in FIG. 2, the terminal of the arm 14 is a chamfered edge. In the present invention, the arm 14 extending as the angle profiling with the sidewall of the bar supporter 12 will be parallel to the glass substrate bearing apparatus, but not only limited as the right angle shown in the present embodiment.

[0018] Referring to FIG. 3, it is the 3-D view illustrating the substrate clamp of an embodiment in accordance with the present invention. In the present embodiment, the substrate clamp 10 includes a bar supporter 12 that one end of the bar supporter 12 is used for connecting and fixing with the substrate bearing apparatus and an arm 14 is extending from another end of the bar supporter 12. Besides, there is a trench arranged on the sidewall of the bar supporter 12 and a buffer layer 16 is arranged in the trench. The buffer layer 16 is fixed in the trench on the bar supporter 12 by the thermal compression method, the fusion bonding method, or other mounting method. Wherein, the end of the bar supporter 12 connecting the substrate bearing apparatus is arranged a locking hole 18 for using a screwing element to connect and fix the substrate clamp 10 with the substrate bearing apparatus.

[0019] FIG. 4A and FIG. 4B are partial cross-section views illustrating the substrate clamp used in the substrate bearing apparatus of an embodiment in accordance with the present invention. Referring to FIG. 4A, in the present embodiment, the glass substrate 20 is set on a substrate bearing apparatus, such as the quartz substrate 30, for forming the membrane on the glass substrate 20 in the sputtering machine. In the whole sputtering process, the substrate clamp 10 fixed with the quartz substrate 30 is used for supporting and holding the glass substrate 20. During the sputtering process, the quartz substrate 30, the substrate clamp 10, and the glass substrate 20 may be all in the vibrating state. If necessary, the glass substrate 20 may be moved to the different place or rotated to the different direction for forming different membranes with different materials therein. In the present embodiment, there is a buffer layer 16 on the sidewall of the bar supporter 12 of the substrate clamp 10. The hardness of the buffer layer 16 is smaller than the bar supporter 12 and the buffer layer 16 is made of the elastic material. As the substrate clamp 10 clamping the glass substrate 20, the buffer layer 16 on the sidewall will direct contact the glass substrate 20 and the quartz substrate 30 so as to reduce the shock force between the substrate clamp 10 and the glass substrate 20 and between the substrate clamp 10 and the quartz substrate 30 to substantially reduce the split problem of the glass substrate 20.

[0020] Following the description mentioned above, referring to FIG. 4B, in the present invention, in the membrane formation process, the glass substrate 20 is set almost vertically. The present substrate clamp 10 not only fixes the glass substrate 20, but also utilize the buffer layer 16 to reduce the shock force between the region A that the substrate clamp 10 directly contacts the glass substrate 20 and the quartz substrate 30. The arm 14 extending from one end of the bar supporter 12 and parallel to the glass substrate 20 may further protect the glass substrate 20 sliding out of the bearing apparatus and the chamfered edge of the terminal of the arm 14 will not damage the glass substrate 20.

[0021] FIG. 5A and FIG. 5B are side views illustrating the substrate clamp of different embodiments in accordance with the present invention. As shown in FIG. 5A, in one embodiment, the buffer layer 16 is directly fixed the on the sidewall of the bar supporter 12. Further, the buffer layer can be arranged on the sidewall of the support extending to the arm to provide further protect to the glass substrate, such as not shown in the drawing. Referring to FIG. 5B, in another embodiment, the angle between the arm 14 and the bar supporter 12 may be larger than a right angle. The angle may be designed only if the arm 14 of the substrate clamp 10 is parallel to the glass substrate 20. As the glass substrate is putting in or taking out of the substrate bearing apparatus, the substrate clamp will open outward so as the glass substrate sucked by the robot arm can move in or move out. If the moving glass substrate is swaying and colliding the substrate clamp, the chamfered edge of the terminal of the arm of the substrate clamp can substantially decrease the split problem of the glass substrate.

[0022] According, one of features is to utilize the chamfered edge design of the terminal of the arm of the substrate clamp and another of features is to utilize the buffer layer pad in the contacting region between the clamp and the glass substrate. The hardness of the buffer layer pad is smaller than the support of the clamp and the buffer layer pad is made of the material corresponding to the working environment. For example, the substrate clamp is used in the sputtering machine, the process temperature is about 250° C. in the process. The substrate clamp must be recyclable. After the cleaning the clamp in the strong acid or base solution, the substrate clamp can be used again. Hence, the substrate clamp must utilize the material against strong acid or base environment. In one embodiment, the substrate clamp can be made of the polybenzimidazole (PBI) material and the hardness is about HS105 (HS, Shores hardness). The buffer layer can be made of the kalrez material, such as kalrez4079 and the hardness is about HS55 to HS95. Therefore, the substrate clamp may apply to the sputtering machine in the high temperature environment and be recyclable for using again after the cleaning of the strong acid or base solution.

[0023] To sum up the foregoing, the substrate clamp of the present invention may effectively solve the split problem of the glass substrate caused by the shocking and sliding in the clamping or moving of the manufacturing processes. Further, the present invention provides a substrate clamp that utilizes a buffer material in the contacting area between the substrate clamp and the glass substrate to reduce the hitting force therebetween so as to substantially decrease the probability of the split of the glass substrate.

[0024] While the present invention is susceptible to various modifications and alternative forms, a specific example thereof has been shown in the drawings and is herein described in detail. It should be understood, however, that the invention is not to be limited to the particular form disclosed, but to the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the appended claims.

What is claimed is:

1. A substrate clamp for a substrate bearing apparatus comprising:

   a bar supporter, wherein a end of said bar supporter is used for connecting and fixing with said substrate bearing apparatus;
an arm extending from another end of said bar supporter and profiling an angle with a sidewall of said bar supporter.

2. The substrate clamp according to claim 1, wherein a terminal of said arm is a chamfered edge.

3. The substrate clamp according to claim 1, wherein said angle of said arm extending is to make said arm parallel to a substrate bearing on said substrate bearing apparatus.

4. The substrate clamp according to claim 1, wherein said buffer layer is fixed on said bar supporter by any one of the thermal compression method, the fusion bonding method, and other mounting method.

5. The substrate clamp according to claim 4, wherein said sidewall of said bar supporter is arranged a trench for arranging said buffer layer therein.

6. The substrate clamp according to claim 1, wherein said end of said bar supporter is arranged a locking hole for using a screwing element to connect and fix said substrate clamp with said substrate bearing apparatus.

7. The substrate clamp according to claim 1, wherein the hardness of said buffer layer is smaller than said bar supporter.

8. The substrate clamp according to claim 1, wherein said bar supporter is made of the polybenzimidazole.

9. The substrate clamp according to claim 1, wherein a hardness of said buffer layer is HS55 to HS95.

10. A substrate clamp, which is for a substrate in a substrate bearing apparatus, wherein said substrate clamp comprising:

a bar supporter, wherein a end of said bar supporter is for connecting and fixing with said substrate bearing apparatus;

an arm extending from another end of said bar supporter and profiling an angle with a sidewall of said bar supporter and parallel to said substrate; and

a buffer layer arranged on said sidewall of said bar supporter, wherein the hardness of said buffer layer is smaller than said bar supporter.

11. The substrate clamp according to claim 10, wherein a terminal of said arm is a chamfered edge.

12. The substrate clamp according to claim 10, wherein said buffer layer is fixed on said bar supporter by the thermal compression method, the fusion bonding method, or other mounting method.

13. The substrate clamp according to claim 12, wherein said sidewall of said bar supporter is arranged a trench for arranging said buffer layer therein.

14. The substrate clamp according to claim 10, wherein said end of said bar supporter is arranged a locking hole for using a screwing element to connect and fix said substrate clamp in said substrate bearing apparatus.

15. The substrate clamp according to claim 10, wherein said bar supporter is made of the polybenzimidazole.

16. The substrate clamp according to claim 10, wherein a hardness of said buffer layer is about HS55 to HS95.

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