CLAIMS

WHAT IS CLAIMED IS:

1. A mask structure configured to prepare protrusions on a carrying surface of an electrostatic chuck, comprising a main mask plate and a side mask plate both made of a conductive metal, wherein:

the main mask plate is configured to form a patterned film layer corresponding to the protrusions on the carrying surface of the electrostatic chuck protrusion; and

the side mask plate is configured to shield a side surface of the electrostatic chuck to avoid forming a film layer on the side surface; and

a float lock assembly, the float lock assembly being configured to apply a unidirectional force facing the carrying surface of the electrostatic chuck to the main mask plate to fix the main mask plate on the carrying surface.

2. The mask structure according to claim 1, wherein the side mask plate is configured to be arranged around the side surface of a main body portion of the electrostatic chuck and cover an edge portion of the electrostatic chuck protruding from the side surface of the main body portion.

3. The mask structure according to claim 2, wherein the side mask plate includes a first body, a second body, a third body, and a fastener, wherein:

the first body is arranged on a side of a front surface of the edge portion of the electrostatic chuck; the second body is arranged on a side of a back surface of the edge portion of the electrostatic chuck; the third body is arranged around a side surface of the edge portion of the electrostatic chuck and electrically contact with the first body and the second body; and

the fastener is configured to fixedly connect the first body and the second body to the edge portion of the electrostatic chuck.

4. The mask structure according to claim 3, wherein a buffer is arranged between the first body and the edge portion of the electrostatic chuck and/or between the second body and the edge portion of the electrostatic chuck.

5. The mask structure according to any one of claims 1-4, further comprising a ring-shaped shield plate, the ring-shaped shield plate being arranged at the side mask plate and located on a side of a front surface of the main mask plate, and an inner edge of the ring-shaped shield plate extending to an inner side of an edge of the main mask plate.

6. The mask structure according to any one of claims 1-4, wherein a ring-shaped recess penetrating to a front surface of the side mask plate is arranged on an inner surface of the side mask plate, and an edge portion of the main mask plate is located in the ring-shaped recess.

7. The mask structure according to claim 1, further comprising:

a conductive elastic member, the conductive elastic member electrically connecting the main mask plate and the side mask plate, respectively.

8. The mask structure according to claim 1, wherein the float lock assembly includes a first connection member, a second connection member, and an elastic member, wherein:

a first through-hole is arranged in the main mask plate and penetrates along a thickness direction of the main mask plate, correspondingly, a second through-hole is arranged in a main body portion of the electrostatic chuck and penetrates along an opposite direction to a thickness direction of the main body portion, the first connection member penetrates the first through-hole and the second through-hole, a first flange is arranged at an end of the first connection member, and the first flange is stacked on a front surface of the main mask plate;

the second connection member penetrates the second through-hole, one end of the second connection member is detachably connected to the first connection member, a second flange is arranged at another end of the second connection member, the second flange is located on a side of a back surface of the main body portion of the electrostatic chuck and is arranged at an interval from the main body portion; and

the elastic member is arranged in the interval between the second flange and the main body portion of the electrostatic chuck and is configured to apply an elastic force to the second flange to cause the second flange to be away from the main body portion of the electrostatic chuck.

9. The mask structure according to claim 8, wherein the elastic member includes an elastic sheet or a compression spring.

10. The mask structure according to claim 9, wherein the elastic sheet includes a ring-shaped sheet and a plurality of pressing claws arranged at intervals along a circumferential direction of the ring-shaped sheet, wherein:

the ring-shaped sheet is sleeved on the second connection member and is stacked on the second flange; and

the plurality of pressing claws are arranged on the back surface of the main body portion of the electrostatic chuck.

11. The mask structure according to claim 8, wherein the second connection member is threadedly connected to the first connection member, and a tightening torque of the second connection member ranges from 0.1N•m to 0.4N•m.

12. The mask structure according to claim 8, wherein a radial gap exists between the first connection member and the first through-hole.

13. The mask structure according to claim 12, wherein the radial gap ranges from 0.1mm to 0.3mm.

14. The mask structure according to claim 1, wherein one or a plurality of float lock assemblies are included, and the plurality of float lock assemblies are distributed at different positions of the main mask plate.

15. The mask structure according to claim 1, wherein center through-holes are arranged at the main mask plate and the main body portion of the electrostatic chuck;

the mask structure further comprises a central fastener, the central fastener being arranged in and passing through the central through holes of the main mask plate and the main body portion of the electrostatic chuck and configured to fix the main mask plate at the main body portion of the electrostatic chuck.

16. The mask structure according to claim 1, wherein a plurality of process holes are arranged in the main mask plate in a one-to-one correspondence with the protrusions; a rib structure is arranged on the front surface of the main mask plate, located in an area other than an area where the process holes are located, and configured to increase strength and flatness of the main mask plate.

17. The mask structure according to claim 16, wherein the rib structure includes a ring-shaped rib using a center of the main mask plate as a center of a circle or a plurality of ring-shaped ribs with different radii, and when the plurality of ring-shaped ribs are included, a plurality of radial ribs are arranged between two adjacent ring-shaped ribs and distributed along a circumferential direction.

18. The mask structure according to claim 16, wherein a diameter of a process hole ranges from 1mm to 5mm.

19. The mask structure according to claim 16, wherein a center distance between two adjacent process holes ranges from 5mm to 15mm.

20. The mask structure according to claim 16, wherein:

a thickness of the rib structure is greater than or equal to 1mm;

a sum of thicknesses of the rib structure and the main mask plate is smaller than or equal to 5mm;

a thickness of the main mask plate is smaller than or equal to 1.5mm; and

a distance between the rib structure and an edge of any one of the process holes is greater than or equal to 2mm.

21. The mask structure according to claim 16, wherein:

a hollow portion is arranged at a center area of the main mask plate and is configured to form a conductive film for testing.

22. The mask structure according to claim 21, wherein the hollow portion includes an arc-shaped hollow portion and at least three stripe hollow portions, wherein:

a center of the arc-shaped hollow portion coincides with the center of the main mask plate; and

the at least the three stripe hollow portions are symmetrically arranged about the center of the arc-shaped hollow portion, an end of each of the strip hollow portions is connected to the arc-shaped hollow portion, and another end extends along a radial direction of the arc-shaped hollow portion.

23. The mask structure according to claim 1, wherein a thermal expansion coefficient of the conductive metal ranges from 3×10-6/℃ to10×10-6/℃.

24. The mask structure according to claim 1, wherein the thermal expansion coefficient of the conductive metal is the same as a thermal expansion coefficient of the electrostatic chuck.

25. The mask structure according to claim 23 or 24, wherein the conductive metal includes an iron-cobalt-nickel alloy or titanium.

26. The mask structure according to claim 23 or 24, wherein a plurality of protrusions are included, and the plurality of protrusions are distributed at intervals on the carrying surface.

27. An FCVA apparatus comprising a power source, a chamber, a graphite target, an electrostatic chuck, and a mask structure arranged in the chamber, wherein:

the power source is configured to cause the graphite target to generate carbon plasma through an effect of an arc; and

the mask structure includes the mask structure according to any one of claims 1-26 and is configured to guide deposited ions of the carbon plasma to move toward the carrying surface of the electrostatic chuck and cause the deposited ions that pass through to form the patterned film layer corresponding to the protrusions on the carrying surface of the electrostatic chuck.