Description

Apparatus for etching a semiconductor wafer

The invention relates to an apparatus for etching a semiconductor wafer similar to an etching cell, having a basic body, on the upper side of which the semiconductor wafer can be attached with its one side, sealed from the outside in the edge region by means of a peripheral seal.

An apparatus of this type is described in the international application WO 92/02948. In the case of this known apparatus, a trough-shaped basic body is provided with a peripheral groove, in which an O-ring is inserted. The known apparatus additionally has an annular cover, which has a further O-ring, likewise in a peripheral groove. For etching a semiconductor wafer on one side, the latter is placed between the basic body and the cover, and the basic body and the cover are then braced by screws, which are fitted in aligning through-holes of the basic body and of the cover. After bracing the basic body and the cover, one side of the semiconductor wafer is sealed with respect to the outside and is consequently sealed during etching with respect to the etching medium; the other side, to be etched, of the semiconductor wafer is free to be accessed by the etching medium, apart from the edge region covered by the cover.

The invention is based on the object of proposing an apparatus for etching a semiconductor wafer which is of a comparatively simple and consequently low-cost construction and subjects the semiconductor wafer to virtually no mechanical stress at all.

To achieve this object, in the case of an apparatus of the type specified at the beginning,

according to the invention the seal comprises two spaced-apart, peripheral sealing lips, and a negative-pressure line opens out in the region between the sealing lips.

A major advantage of the apparatus according to the invention for etching a semiconductor wafer is that it comprises just the basic body, as a single body, so that a second cover part, fitting the basic body, is not required. A further advantage of the apparatus according to the invention is that the attachment of the semiconductor wafer to the apparatus takes place simply by producing a negative pressure between the sealing lips. To be regarded as additional advantages are that the semiconductor wafer is held in a stress-free manner, by virtue of being secured by means of the peripheral sealing lips, and that the semiconductor wafer is completely exposed on its side to be etched and can consequently be optimally utilized.

The apparatus according to the invention is suitable for etching semiconductor wafers on one and two sides. For etching on two sides - simultaneously - the basic body advantageously has a large through-hole, is thus designed to a certain extent as an annular body.

For etching a semiconductor wafer on one side, the basic body advantageously has a base on its side facing away from the one upper side.

In the case of an embodiment of the apparatus according to the invention which can be manufactured at particularly low cost, the basic body is cast from flexible material, and the peripheral sealing lips are cast on. In this case, no additional technical production measures are needed for attaching the sealing lips to the basic body.

The apparatus according to the invention for

etching a semiconductor wafer on one side can be manufactured at particularly low cost if the basic body comprises an essentially annular casting of the flexible material, into which a disc-shaped base part, forming the base, is snap-fitted.

To avoid a positive pressure within the basic body of the apparatus according to the invention during etching on one side, according to a development of the invention at least one outlet channel is led through the basic body to the outside from the region within the seal formed by the sealing lips. If a further outlet channel is provided, a purging process, for example with an ultra-high-purity gas, can proceed via this channel during etching.

The outlet channel may be led to the outside on different sides, for example also in the region of the disc-shaped base part of the basic body of the apparatus according to the invention; it is regarded as particularly advantageous if the outlet channel runs in the annular casting. It is known per se from the international patent application mentioned above to connect the interior space of the basic body to the ambience via a bore and a pipe or a tube.

The spring-contact means may be of various designs in the case of the apparatus according to the invention, for example it may be designed as a resilient contact plate on the basic body. However, it is regarded as particularly advantageous for design and production reasons if an electrical spring-contact means held on the basic body has at least one contact leaf spring which is arranged on the basic body between the peripheral sealing lips.

In order to achieve good electrical contact-making with respect to the semiconductor wafer to be etched, four contact leaf springs are arranged

uniformly distributed over the circumference of the peripheral sealing lips.

An electrical connection device for the spring-contact means may likewise be of various designs, for example comprise a conductor which is led to the outside within the basic body and is connected to the contact plate mentioned above. For simple manufacture, it appears to be particularly advantageous if an electrical connection device of the spring-contact means has at least one metal contact sheet, which is embedded into the basic body and has at its outer end an externally accessible contact prong and bears at its inner end contact pins with lateral slits, into which the contact leaf springs can be introduced.

For further explanation of the invention,

Figure 1 shows a plan view of an exemplary embodiment of the apparatus according to the invention for etching a semiconductor wafer on one side,

Figure 2 shows a view of the connection side of the exemplary embodiment according to Figure 1,

Figure 3 shows a section through the exemplary embodiment according to Figure 1 along the line III-III of Figure 2,

Figure 4 shows a section through the same exemplary embodiment along the line IV-IV of Figure 3 and

Figure 5 shows an enlarged detail from a cross-section in the region of the peripheral sealing lips.

As Figure 1 shows, the apparatus according to the invention has a casting 1, which is cast from flexible material. As can be seen in particular from Figures 1, 4 and 5, two sealing lips 2 and 3 are cast onto the casting 1. The sealing lips 2 and 3 are peripherally formed and arranged at a distance a, as Figure 5 shows. It can be seen in particular from

Figures 3 and 4 that there has been led into the region between the sealing lips 2 and 3 a negative-pressure line 4, which comprises a piece of line 5, running approximately in the centre plane of the casting 1, and a further piece of channel 6, running at right angles with respect to the said piece of line and ending in the region between the sealing lips 2 and 3.

The casting 1 is provided with a relatively large through-hole 7, which is closed by a disc-shaped base part 8; the base part 8 is snap-fitted into a peripheral groove 9 of the casting 1, so that the casting 1 forms with the disc-shaped base part 9 a trough-like basic body 10.

Before etching a semiconductor wafer on one side, the said wafer is placed against the peripheral sealing lips 2 and 3, in the direction of the arrow P according to Figure 4, and is securely held on the basic body 10 by sucking out air via the negative-pressure line 5. Since the etching takes place at elevated temperature, without further measures a positive pressure would form in the space 11 between the semiconductor wafer (not shown) and the disc-shaped base part 8 and could lead to the semiconductor wafer being damaged. In order to avoid this, an outlet channel 12, which leads from the outer connection pipe 13 into the interior of the basic body 10, into the region 11, is provided - as Figure 3 clearly shows. Via this outlet channel 12, the region 11 is connected to the ambient air, so that atmospheric pressure always prevails in it; as a result, positive pressure, with the risk of damage to the semiconductor wafer, is avoided.

As can be seen in particular from Figures 1 and 5, attached to the basic body 10 in the region between the sealing lips 2 and 3 there is a spring-contact

means, which comprises contact leaf springs 14, 15, 16 and 17. Each of these contact leaf springs 14 to 17 is of a corrugated design and consequently bears with some points in a contact-making manner against the semiconductor wafer to be etched when the latter is securely held by the sealing lips 2 and 3 with negative pressure in the negative-pressure line 4. Electric potential can be applied to the contact leaf springs 14 to 17 by means of an electrical connection device, the electrical connection device having in the exemplary embodiment represented two metal contact sheets 18 and 19 (see Figure 3). Each of these metal contact sheets is provided at its outer end with a contact prong 20 and 21, respectively; in the interior of the basic body 10, in which the metal contact sheets 18 and 19 are cast, there are attached on the metal contact sheets contact pins 22, 23 and 24, 25, of which only the contact pin 22 can be seen in Figure 5. As this figure shows in particular, each of the contact pins 22 to 25 is provided with a transverse slit 26, into which the respective contact leaf spring can be introduced from the side.

Electric potential of a so-called potentiostat is applied via the contact prongs 20 and 21 of the metal contact sheets 18 and 19 during the electrochemical etching of a semiconductor wafer, the said potentiostat also being connected to a mating electrode and a reference electrode, as disclosed in a basic arrangement by European Patent Application EP 0 253 420 A1.

Since, during etching, the apparatus according to the invention is preferably in a vertical arrangement, with the contact prongs 20 and 21, the negative-pressure line 4 and the outlet channel 12 upwards, through-holes 27 are provided in the basic

body 10 for suspending and transporting purposes.



Patent claims

1. Apparatus for etching a semiconductor wafer similar to an etching cell, having

- a basic body, on the upper side of which the semiconductor wafer can be attached with its one side, sealed from the outside in the edge region by means of a peripheral seal,

characterized in that

- the seal comprises two spaced-apart, peripheral sealing lips (2, 3) and

- a negative-pressure line (4) opens out in the region between the sealing lips (2, 3).

2. Apparatus according to Claim 1,

characterized in that

- for etching the semiconductor wafer on one side, the basic body (10) has a base (8) on its side facing away from the one upper side.

3. Apparatus according to Claim 1,

characterized in that

- for etching the semiconductor wafer on two sides, the basic body has a large through-hole.

4. Apparatus according to one of the preceding claims, characterized in that

- the basic body (10) is cast from flexible material and the peripheral sealing lips (2, 3) are cast on.

5. Apparatus according to Claim 4,

characterized in that

- the basic body (10) comprises an essentially annular casting (1) of the flexible material, into which a disc-shaped base part (8) is snap-fitted.

6. Apparatus according to one of the preceding claims, characterized in that

- at least one outlet channel (12) is led through the basic body (10) to the outside from the region within

the seal formed by the sealing lips (2, 3).

7. Apparatus according to Claim 6, characterized in that

- the outlet channel (12) runs in the annular casting (1).

8. Apparatus according to one of the preceding claims, characterized in that

- an electrical spring-contact means held on the basic body (10) has at least one contact leaf spring (14, 15, 16, 17)

- which is arranged on the basic body (10) between the peripheral sealing lips.

9. Apparatus according to Claim 8, characterized in that

- four contact leaf springs (14, 15, 16, 17) are arranged uniformly distributed over the circumference of the peripheral sealing lips (2, 3).

10. Apparatus according to Claim 8 or 9, characterized in that

-an electrical connection device of the spring-contact means (14, 15, 16, 17) has at least one metal contact sheet (18, 19), which

- is embedded into the basic body (10) and has at its outer end an externally accessible contact prong (20, 21) and

- bears at its inner end contact pins (22, 23, 24, 25) with lateral slits (26), into which the contact leaf springs (14, 15, 16, 17) can be introduced.