

Description

Title: Device for spraying an etching solution onto a substrate

Technical field

The invention relates to a device for spraying an etching solution onto a substrate.

Prior art

In methods for manufacturing semiconductor substrates, it is known practice to polish the edge of a substrate in order to remove excess material or to eliminate surface defects.

This polishing, which is of the chemical-mechanical type, is generally known as "Edge Polishing". This method consists in chemically modifying the surface of the substrate by means of an etching solution while mechanically etching said surface by means of an abrasive tool arranged next to the periphery of the substrate, which is fixed in place on a substrate holder.

The etching solution is sprayed in the region to be etched, between the surface of the periphery of the substrate and the abrasive tool, by means of one or more nozzles.

Each nozzle is held in a fixed position with respect to the substrate by means of a nozzle holder.

In order to allow maintenance of the installation, in particular cleaning or replacement of the nozzles, each nozzle is removable from the nozzle holder.

However, at present no means exists for precisely adjusting the orientation of the nozzle with respect to the holder.

This problem is all the more bothersome since the free volume around each nozzle and the holder thereof is very limited and does not allow an operator to easily handle the nozzle.

Indeed, faulty adjustment of a nozzle, resulting in the etching solution being sprayed onto a different location on the substrate than the edge to be polished, causes a significant reject rate among the polished substrates.

Brief description of the invention

An aim of the invention is to design a device that makes it possible to precisely orient the nozzle with respect to the substrate to be polished in spite of a limited free volume restricting access to the nozzle.

To this end, the invention provides a device for spraying an etching solution onto a peripheral surface of a substrate, comprising:

- at least one nozzle designed to spray said etching solution,
- a nozzle holder that is deformable between an adjusting position, in which the nozzle is able to pivot about an axis of the holder, and a fixing position, in which the nozzle is fixed with respect to the holder.

In certain embodiments, the nozzle holder comprises a slot extending radially with respect to the axis, said slot having, in the adjusting position, a first width designed to allow the nozzle to pivot about the axis and, in the fixing position, a second width less than the first width, designed to fix the holder around the nozzle by clamping.

The second width may be zero.

In certain embodiments, the nozzle holder comprises an annulus extending about the axis, said annulus being interrupted by the slot and being deformable by moving the edges of the slot towards one another.

In certain embodiments, the device also comprises a screw cooperating with the nozzle holder in order to vary the width of the slot.

In a particularly advantageous manner, the screw extends perpendicularly to the slot.

In certain embodiments, the device also comprises a shaft having a bearing surface in the form of a cylinder of revolution rigidly secured to the nozzle, the bearing surface being pivotable in a cylindrical opening in the nozzle holder in the adjusting position.

The device may also advantageously comprise a cover designed to prevent liquid passing between the bearing surface of the shaft and a surface defining the cylindrical opening in the nozzle holder.

In certain embodiments, the device also comprises a mechanism for altering the orientation of the nozzle with respect to the holder.

Said mechanism may advantageously comprise a peg secured to the nozzle parallel to the axis and a metric screw, screwed into the holder, that cooperates with said peg such that advancement or retraction of said metric screw with respect to the holder causes said peg to pivot with respect to the axis.

Brief description of the drawings

Further features and advantages of the invention will become apparent from the following detailed description, with reference to the appended drawings, in which:

[Fig 1] is an overall view of a device according to one embodiment of the invention with a nozzle for spraying the etching solution;

[Fig 2] is an overall view of a nozzle and its holder;

[Fig 3] is an exploded view of the assembly in Figure 2;

[Fig 4] is an exploded perspective view of the main components of the assembly in Figure 2.

Reference signs that are identical from one figure to another denote elements that are identical or have a similar function.

Detailed description of embodiments

Figure 1 is a perspective view of a device according to one embodiment of the invention.

Although only one nozzle 1 is depicted, the device may comprise a plurality of nozzles arranged so as to spray the etching solution at different locations on the edge of a substrate. Furthermore, the different nozzles may have different shapes and dimensions depending on their location within the device.

The nozzle 1 is fixed to a base 3 by way of a holder 2. The nozzle is removable from the holder 2, in order in particular to allow the nozzle to be cleaned or replaced. As will be described in detail below, the holder is designed to allow an operator to manually alter the orientation of the nozzle.

Each nozzle is fluidically connected to a device for supplying etching solution (not shown). The etching solution is typically a mixture of water and at least one acid, the composition of which is chosen depending on the material of the substrate to be polished.

The base 3 has a cylindrical overall shape, the diameter of which is generally less than the diameter of the substrate to be polished.

The lower part 30 of the base is designed to be rigidly fixed to the frame (not shown) of a polishing machine.

The upper part 31 of the base has a ring shape, to which the holder 2 is rigidly fixed. The location of the holder with respect to said ring is defined depending on the size of the nozzle in order that the etching solution is sprayed precisely at the edge of the substrate to be polished, said substrate itself being fixed in place with respect to the frame of the polishing machine by a substrate holder (not shown) arranged above the base supporting the nozzles. In the polishing machine, the free volume around the base 3 and the nozzle 1 is generally just enough for an operator's hand to pass through.

As can be seen more clearly in Figure 2 and in Figure 3, which presents an exploded view thereof, the nozzle 1 and its holder 2 form a rigid assembly designed to be secured to the base 3.

In the embodiment illustrated, the holder 2 is fixed to the base 3 by way of a fixing lug 23 having an L-shaped profile, the vertical arm of which is screwed to the holder 2 and the horizontal arm of which is screwed to the base 3. However, alternatively, the shape of the holder 2 could be altered so as to allow the holder to be fixed directly to the base 3, for example by means of screws.

The holder 2 comprises an annulus, the inner surface 200 of which defines a cylindrical opening 201 extending about an axis X.

Said annulus is not continuous but is interrupted by a slot 20 that extends substantially radially with respect to the axis X.

When no mechanical load is exerted on the annulus, the slot has a first width. The annulus is deformable, however, allowing the two edges of the slot to be brought into contact or at least to be moved towards one another, reducing the width of the slot to a second width that is zero or less than the first width.

This moving together of the two edges of the slot is made possible by the screwing of a screw 21, which extends substantially perpendicularly to the slot 20, through said edges.

The deformation of the annulus is reversible, meaning that unscrewing of the screw causes the edges of the slot to move apart, with the width of the slot returning to the first width.

Furthermore, the nozzle 1 is rigidly secured to a shaft 24, which has a bearing surface 240 in the form of a cylinder of revolution, the axis of which is coaxial with the axis X.

The diameter of the bearing surface 240 is less than the diameter of the opening defined by the annular surface 200 when the width of the slot is equal to the first width, that is to say when the screw 21 is unscrewed or at least partially unscrewed. In this position, known as the adjusting position, the bearing surface 240 may pivot in the opening 201 about the axis X.

An operator handling the nozzle 1, which is rigidly fixed to the shaft 24, can thus orient the nozzle in the desired direction.

Once the desired orientation has been obtained, the operator screws the screw 21 into the holder 2, this having the effect of moving the edges of the slot 20 towards one another and reducing the section of the opening 201. This screwing thus causes the surface 200 to be clamped to the bearing surface 240, resulting in the shaft 24 and the nozzle 1 being prevented from rotating with respect to the holder 2.

Advantageously, the slot and the screw are positioned on the holder such that the screw is easily accessible to the operator in spite of the reduced free space around the nozzle.

Thus, the immobilization and release of the nozzle, which merely requires the screw to be screwed or unscrewed, is particularly simple and ergonomic. The maintenance operation is also quicker than in the case of existing devices.

In a particularly advantageous manner, the device also comprises a cover 22 fixed to the holder 2 so as to prevent liquid passing between the bearing surface 240 and the surface 200.

Although the connections between the various components of the holder are ensured by screws in the embodiment illustrated, other rigid fixing means (interlocking, welding, bonding, riveting, etc.) may optionally be used, depending on whether it is necessary to be able to undo the various connections or not.

Figure 4 is another exploded view, which presents the main components of the nozzle and its holder.

In certain embodiments, the angle of the nozzle with respect to the holder can be altered by an adjusting mechanism (not shown).

This mechanism comprises a metric screw extending into a part of the cylindrical opening in the holder and cooperating with a peg extending from the shaft parallel to the axis X such that advancement or retraction of the screw causes the peg (and thus the nozzle, which is rigidly secured to the peg) to pivot about the axis X in one direction or the opposite direction. Each advancement of the metric screw, measured in millimetres per turn, is therefore associated with a respective angular position of the peg with respect to the holder.

Consequently, if the optimal orientation of the nozzle is predetermined depending on the advancement of the metric screw with respect to a reference position, the operator can alter the orientation of the nozzle by means of the metric screw, before screwing the clamping screw in order to prevent the nozzle from rotating with respect to its holder.

In this way, easy and precise adjustment of the orientation of each nozzle is obtained.

As a result, the reject rate of the substrates exiting the polishing machine is considerably reduced.

Claims

1. Device for spraying an etching solution onto a peripheral surface of a substrate, comprising:
 - at least one nozzle designed to spray said etching solution,
 - a nozzle holder that is deformable between an adjusting position, in which the nozzle is able to pivot about an axis of the holder, and a fixing position, in which the nozzle is fixed with respect to the holder,said nozzle holder comprising a variable-width slot extending radially with respect to the axis, said slot having, in the adjusting position, a first width designed to allow the nozzle to pivot about the axis and, in the fixing position, a second width less than the first width, designed to fix the holder around the nozzle by clamping.
2. Device according to Claim 1, wherein the second width is zero.
3. Device according to either of Claims 1 and 2, wherein the nozzle holder comprises an annulus extending about the axis, said annulus being interrupted by the slot and being deformable by moving the edges of the slot towards one another.
4. Device according to one of Claims 1 to 3, also comprising a screw cooperating with the nozzle holder in order to vary the width of the slot.
5. Device according to Claim 4, wherein the screw perpendicularly to the slot.
6. Device according to one of Claims 1 to 5, also comprising a shaft having a bearing surface in the form of a cylinder of revolution rigidly secured to the nozzle, the bearing surface being pivotable in a cylindrical opening in the nozzle holder in the adjusting position.
7. Device according to Claim 6, also comprising a cover designed to prevent liquid passing between the bearing surface of the shaft and a surface defining the cylindrical opening in the nozzle holder.
8. Device according to one of Claims 1 to 7, also comprising a mechanism for altering the orientation of the nozzle with respect to the holder.
9. Device according to Claim 8, wherein said mechanism comprises a peg secured to the nozzle parallel to the axis and a metric screw, screwed into the holder, that cooperates with said peg such that advancement or retraction of said metric screw with respect to the holder causes said peg to pivot with respect to the axis.