

art, and are disclosed for example in DE 10 2009 030 294 A1, DE 694 13 311 T2 and EP 1 004 400 A1.

The fixing of the wafer on a chuck for the edge and/or edge-notch polishing may, however, leave behind surface damage, for example in the form of imprints, on the side on which the fixing is carried out.

In an aspect, there is provided a method for polishing at least one semiconductor wafer while supplying a polishing agent comprising the following steps in the order of: a) performing a first simultaneous double-side polishing of the front side and the back side of the at least one semiconductor wafer with first upper and lower polishing pads; b) edge polishing, notch polishing, or edge and notch polishing a surface of the at least one semiconductor wafer; c) performing a second simultaneous double-side polishing of the front side and the back side of the at least one semiconductor wafer with second upper and lower polishing pads, the upper and lower polishing pads for the first simultaneous double-side polishing being harder and less compressible than the upper and lower polishing pads for the second simultaneous double-side polishing, and; d) performing single-side polishing of the front side of the at least one semiconductor wafer.

~~It is therefore~~Embodiments of the object of the present invention seek to provide an improved polishing method for polishing at least one semiconductor material wafer, including edge-notch polishing (ENP), which ensures semiconductor material wafers with both an optimal surface geometry and with a desired roughness and freedom from defects of the surface of the semiconductor material wafer.

~~The object is achieved by~~In an embodiment, there is provided a method for polishing at least one semiconductor material wafer while supplying a polishing agent, comprising, in the order indicated, first simultaneous double-side polishing of the

front side and the back side with a first polishing pad, edge-notch polishing, second simultaneous double-side polishing of the front side and the back side with a second polishing pad, and single-side polishing of the front side, wherein the upper
5 and lower polishing pads for the first simultaneous double-side polishing are harder and less compressible than the upper and lower polishing pads for the second simultaneous double-side polishing.

10 The method according to the invention, used in order to achieve the object, will be explained in detail below together with a figure. All the polishing steps in the method according to the invention are chemical-mechanical polishing steps (CMP steps).

Patent Claims:

1. A method for polishing at least one semiconductor material wafer while supplying a polishing agent, comprising, in the order indicated,
 - a) first simultaneous double-side polishing of the front side and the back side with a first polishing pad,
 - b) edge-notch polishing,
 - c) second simultaneous double-side polishing of the front side and the back side with a second polishing pad, and
 - d) single-side polishing of the front side, wherein the upper and lower polishing pads for the first simultaneous double-side polishing are harder and less compressible than the upper and lower polishing pads for the second simultaneous double-side polishing.
2. The method as claimed in claim 1, wherein the polishing pads for the first simultaneous double-side polishing consist of a foamed polymer with a hardness of at least 80 Shore A and a compressibility of at most 3%, and in that the polishing pads for the second simultaneous double-side polishing consist of a polymer-impregnated fiber non-woven with a hardness of less than 80 Shore A and a compressibility of more than 3%.
3. The method as claimed in claim 1, wherein the polishing pads for the first simultaneous double-side polishing consist of a foamed polymer with a hardness of at least 80 Shore A and a compressibility of at most 3%, and in that the polishing pads for the second simultaneous double-side polishing consist of a foamed polymer having a hardness of less than 80 Shore A and having a compressibility of more than 3% during the second polishing step.

4. The method as claimed in in one of claims 1 to 3, wherein the front side of the at least one semiconductor material wafer is polished on the upper polishing pad during the first simultaneous double-side polishing.
5. The method as claimed in one of claims 1 to 4, wherein the polishing agent for the first simultaneous double-side polishing contains a strong alkali, for example KOH, and the polishing agent for the second simultaneous double-side polishing does not contain a strong alkali.
6. The method as claimed in one of claims 1 to 5, wherein material abrasion of from 8 μm to 12 μm per side takes place during the first simultaneous double-side polishing, and material abrasion of no more than 2 μm per side takes place during the second simultaneous double-side polishing.
7. The method as claimed in one of claims 1 to 6, wherein material abrasion of no more than 1 μm takes place during the single-side polishing of the front side.
8. The method as claimed in one of claims 1 or 2, wherein the polishing temperature of the second simultaneous double-side polishing is in the range of 20°C to 60°C.

Patent Claims:

1. A method for polishing at least one semiconductor wafer while supplying a polishing agent comprising the following steps in the order of:
 - a) performing a first simultaneous double-side polishing of the front side and the back side of the at least one semiconductor wafer with first upper and lower polishing pads;
 - b) edge polishing, notch polishing, or edge and notch polishing a surface of the at least one semiconductor wafer;
 - c) performing a second simultaneous double-side polishing of the front side and the back side of the at least one semiconductor wafer with second upper and lower polishing pads, the upper and lower polishing pads for the first simultaneous double-side polishing being harder and less compressible than the upper and lower polishing pads for the second simultaneous double-side polishing, and;
 - d) performing single-side polishing of the front side of the at least one semiconductor wafer.
2. The method as recited in claim 1, wherein the polishing pads for the first simultaneous double-side polishing include a foamed polymer with a hardness of at least 80 Shore A and a compressibility of at most 3%.
3. The method as recited in claim 1, wherein the polishing pads for the second simultaneous double-side polishing include a foamed polymer having a hardness of less than 80 Shore A and having a compressibility of more than 3% during the second polishing step.
4. The method as recited in claim 1, wherein the front side of the at least one semiconductor wafer is polished on the

upper polishing pad during the first simultaneous double-side polishing.

5 5. The method as recited in claim 1, wherein the polishing agent for the first simultaneous double-side polishing contains a strong alkali.

10 6. The method as recited in claim 1, wherein material abrasion of from 8 μm to 12 μm per side takes place during the first simultaneous double-side polishing.

15 7. The method as recited in claim 1, wherein material abrasion of no more than 1 μm takes place during the single-side polishing of the front side.

8. The method as recited in claim 1, wherein the polishing temperature of the second simultaneous double-side polishing is in the range of 20° C. to 60° C.

20 9. The method as recited in claim 1, comprising: edge polishing.

10. The method as recited in claim 1, comprising: notch polishing.

25 11. The method as recited in claim 1, comprising: edge and notch polishing.

30 12. The method as recited in claim 1, wherein the polishing pads for the second simultaneous double-side polishing include of a polymer-impregnated fiber non-woven with a hardness of less than 80 Shore A and a compressibility of more than 3%.

35 13. The method as recited in claim 2, wherein the polishing pads for the second simultaneous double-side polishing

include of a polymer-impregnated fiber non-woven with a hardness of less than 80 Shore A and a compressibility of more than 3%.

- 5 14. The method as recited in claim 2, wherein the polishing pads for the second simultaneous double-side polishing include a foamed polymer having a hardness of less than 80 Shore A and having a compressibility of more than 3% during the second polishing step.
- 10 15. The method as recited in claim 1, wherein the polishing agent for the first simultaneous double-side polishing contains a KOH.
- 15 16. The method as recited in claim 1, wherein the polishing agent for the second simultaneous double-side polishing does not contain a strong alkali.
- 20 17. The method as recited in claim 5, wherein the polishing agent for the second simultaneous double-side polishing does not contain a strong alkali.
- 25 18. The method as recited in claim 1, wherein material abrasion of no more than 2 μm per side takes place during the second simultaneous double-side polishing.
- 30 19. The method as recited in claim 6, wherein material abrasion of no more than 2 μm per side takes place during the second simultaneous double-side polishing.
- 35 20. The method as recited in claim 1, wherein an average particle size of an abrasive in the second double-side polishing is in a range of from 5 to 50 nm, and wherein the abrasive comprises an aluminum oxide, a cerium oxide, a silicon oxide, or a mixture of two or more of any of these.