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Method for producing a semiconductor wafer

The invention relates to a method for producing a semiconductor wafer, in particular a silicon wafer, which is provided with an epitaxial layer. The invention relates in particular to the treatment of the semiconductor wafer following deposition of the epitaxial layer.

It is known that the surface of a freshly deposited epitaxial layer tends to undergo reactions with suitable molecules in the atmosphere. The manufacturers of electronic components who subject such semiconductor wafers to further processing have an interest in ensuring that the surface of the semiconductor wafer is in a defined condition, i.e. the semiconductor wafers which are to be further processed have surfaces in a uniform condition.

The object of the invention is to provide a semiconductor wafer having a surface which is in such a defined condition. A further object of the invention is to allow the production of the semiconductor wafer to be incorporated into existing methods without particular difficulty and without particular costs.

The invention relates to a method for producing a semiconductor wafer by deposition of an epitaxial layer on a substrate wafer in a deposition reactor, wherein the semiconductor wafer, following the deposition of the epitaxial layer, undergoes treatment in an ozone-containing atmosphere.

The invention is preferably integrated into existing deposition processes in which, in addition to one or more deposition reactors, closeable chambers for loading and unloading (load lock stations) are also provided. Of

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course, the treatment may also take place in an additionally provided treatment chamber. The temperature of the ozone-containing atmosphere is 10°C to 50°C, preferably room temperature. The duration of the treatment is preferably 5 min to 20 min. The treatment results in a thin oxide film, which has a uniform quality desired by component manufacturers for all semiconductor wafers processed in this way, being formed on the surface of the epitaxial layer.

It is particularly advantageous if it is ensured that the semiconductor wafer remains in a nonoxidizing atmosphere following the deposition of the epitaxial layer and prior to the treatment in the ozone-containing atmosphere. It is particularly preferred for the semiconductor wafer to be conveyed from the deposition reactor into the treatment chamber in a nitrogen atmosphere.

The ozone-containing atmosphere is preferably provided by UV radiation or using a commercially available ozonizer which is fed with air, particularly preferably with oxygen. The ozone-containing gas emitted by the ozonizer is fed into the treatment chamber, displacing the atmosphere which has hitherto been present in the chamber. Alternatively, this atmosphere may also be sucked out before the ozone-containing gas enters the treatment chamber.

According to a particularly preferred embodiment of the method, a rack holding a plurality of substrate wafers is loaded into a first chamber (load lock station) and is placed under a nonreactive gas atmosphere, preferably a nitrogen atmosphere. Then, the wafers are conveyed into the deposition reactor under the atmosphere which has been established and, in this reactor, are coated with the epitaxial layer individually or in small numbers. Then, the semiconductor wafers formed are conveyed into

a second chamber (load lock station) under a nonreactive, in particular nonoxidizing atmosphere, and are collected in a further rack. As soon as the rack has been filled, the semiconductor wafers undergo the treatment in the ozone-containing atmosphere in the second chamber. During this period, it is possible for the first chamber to be reloaded with substrate wafers and for the first of these substrate wafers to be epitaxially coated. Naturally, it is also possible for the semiconductor wafers to be conveyed back into the first chamber following the coating and for the treatment in the ozone-containing atmosphere to be carried out in this chamber. During this period, substrate wafers can be conveyed from the second chamber into the deposition reactor and coated.

The method described makes it possible to produce epitaxial semiconductor wafers with a uniform surface. Compared to wet chemical processes, which are able to provide a similar surface, this method is distinguished by costs which are at least 80% lower.

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Patent claims:

1. A method for producing a semiconductor wafer by deposition of an epitaxial layer on a substrate wafer in a deposition reactor, wherein the semiconductor wafer, following the deposition of the epitaxial layer, undergoes treatment in an ozone-containing atmosphere.

2. The method as claimed in claim 1, wherein the semiconductor wafer undergoes the treatment in the ozone-containing atmosphere in a load lock station which is connected to the deposition reactor.

3. The method as claimed in claim 1, wherein the semiconductor wafer undergoes the treatment in the ozone-containing atmosphere in a treatment chamber which is connected to the deposition reactor.

4. The method as claimed in one of claims 1 to 3, wherein the semiconductor wafer is exposed to the ozone-containing atmosphere at an ambient temperature of 10°C to 50°C.

5. The method as claimed in one of claims 1 to 4, wherein the semiconductor wafer is held in a nonoxidizing atmosphere following the deposition of the epitaxial layer and prior to the treatment in the ozone-containing atmosphere.

6. The method as claimed in one of claims 1 to 5, wherein the semiconductor wafer undergoes the treatment in the ozone-containing atmosphere together with other semiconductor wafers.

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Abstract:

The invention relates to a method for producing a semiconductor wafer by deposition of an epitaxial layer on a substrate wafer in a deposition reactor. The semiconductor wafer, following the deposition of the epitaxial layer, undergoes treatment in an ozone-containing atmosphere.

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REPLACEMENT SHEET
Date : 27/6/00

Method for producing a semiconductor wafer

The invention relates to a method for producing a semiconductor wafer, in particular a silicon wafer, which is provided with an epitaxial layer. The invention relates in particular to the treatment of the semiconductor wafer following deposition of the epitaxial layer.

It is known that the surface of a freshly deposited epitaxial layer tends to undergo reactions with suitable molecules in the atmosphere. The manufacturers of electronic components who subject such semiconductor wafers to further processing have an interest in ensuring that the surface of the semiconductor wafer is in a defined condition, i.e. the semiconductor wafers which are to be further processed have surfaces in a uniform condition.

The object of the invention is to provide a semiconductor wafer having a surface which is in such a defined condition. A further object of the invention is to allow the production of the semiconductor wafer to be incorporated into existing methods without particular difficulty and without particular costs.

The invention relates to a method for producing a semiconductor wafer by deposition of an epitaxial layer on a substrate wafer in a deposition reactor, wherein the semiconductor wafer, following the deposition of the epitaxial layer, undergoes treatment in an ozone-containing atmosphere.

The invention is preferably integrated into existing deposition processes in which, in addition to one or more deposition reactors, closeable chambers for loading and unloading (load lock stations) are also provided. Of

REPLACEMENT SHEET
27 JUN 2000

Method For Producing a Semiconductor Wafer

Abstract:

The invention relates to a method for producing a semiconductor wafer by deposition of an epitaxial layer on a substrate wafer in a deposition reactor. The semiconductor wafer, following the deposition of the epitaxial layer, undergoes treatment in an ozone-containing atmosphere.

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05 DEC 2001

Patent claims:-:

1. A method for producing a semiconductor wafer comprising

depositing an epitaxial layer on a substrate semiconductor wafer in a deposition reactor;

following the depositing of the epitaxial layer, having the semiconductor wafer undergo treatment in an ozone-containing atmosphere;

transferring the semiconductor wafer into a load lock station in order to undergo the treatment in the ozone-containing atmosphere in said load lock station; and

said load lock station is connected to the deposition reactor.

2. A method for producing a semiconductor wafer comprising

depositing an epitaxial layer on a substrate semiconductor wafer in a deposition reactor;

following the depositing of the epitaxial layer, having the semiconductor wafer undergo treatment in an ozone-containing atmosphere;

providing a treatment chamber which is connected to the deposition reactor; and

said semiconductor wafer undergoing the treatment in the ozone-containing atmosphere in said treatment chamber.

3. The method as claimed in claim 1, comprising

exposing the semiconductor wafer to the ozone-containing atmosphere at an ambient temperature of 10°C to 50°C.

4. The method as claimed in claim 1, comprising

holding the semiconductor wafer in a nonoxidizing atmosphere following the depositing of the epitaxial layer and prior to the treatment in the ozone-containing atmosphere.

5. The method as claimed in claim 1, wherein the semiconductor wafer undergoes the treatment in the ozone-containing atmosphere together with other

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semiconductor wafers.

6. The method as claimed in claim 4, wherein said nonoxidizing atmosphere is an inert gas atmosphere.

7. The method as claimed in claim 6, wherein the inert gas atmosphere is selected from the group consisting of nitrogen, helium, neon and argon.

8. The method as claimed in claim 7, wherein the inert gas atmosphere is nitrogen.

9. The method as claimed in claim 4, wherein the nonoxidizing atmosphere is a reducing gas atmosphere.

10. The method as claimed in claim 9, wherein the reducing gas atmosphere is hydrogen.

11. The method as claimed in claim 2, comprising

exposing the semiconductor wafer to the ozone-containing atmosphere at an ambient temperature of 10°C to 50°C.

12. The method as claimed in claim 2, comprising

holding the semiconductor wafer in a nonoxidizing atmosphere following the depositing of the epitaxial layer and prior to the treatment in the ozone-containing atmosphere.

13. The method as claimed in claim 2, wherein the semiconductor wafer undergoes the treatment in the ozone-containing atmosphere together with other semiconductor wafers.

14. The method as claimed in claim 12, wherein said nonoxidizing atmosphere is an inert gas atmosphere.

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15. The method as claimed in claim 14, wherein the inert gas atmosphere is selected from the group consisting of nitrogen, helium, neon and argon.

16. The method as claimed in claim 15, wherein the inert gas atmosphere is nitrogen.

17. The method as claimed in claim 12, wherein the nonoxidizing atmosphere is a reducing gas atmosphere.

18. The method as claimed in claim 17, wherein the reducing gas atmosphere is hydrogen.

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