

Method and device for treating semiconductor bars with a liquid or a gas

Description

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The present invention relates to methods and devices for treating semiconductor bars, in particular silicon bars, with a liquid or a gas.

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During production of polycrystalline silicon ingots, semiconductor material grows on an arrangement of thin semiconductor starting material, currently silicon, in a process reactor. For this purpose, silicon bars having square or round diameters of about 10 mm and standard lengths of up to 3.2 m are currently used. Silicon grows onto such silicon bars in a process reactor, so that the bar diameter increases and, consequently, silicon material is gained.

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The quality and the yield of the deposited silicon are also determined by the fact that the surfaces of the thin bars used as starting material are free from particles, organic and metallic contamination. Thus, in accordance with the present prior art it is necessary to subject the thin bars to a cleaning process, said cleaning process typically comprising an acid standard process of silicon etching. If need be, the bars may be pre-cleaned in advance by means of ultrasonic cleaning, possibly with added surfactants. Following a rinsing step, the entire surface of the silicon is etched in an acid mixture of HF (hydrofluoric acid) and HNO₃ (nitric acid), so that any adhering foreign bodies and metal ions that have diffused into the upper layers are removed. Subsequently, the silicon bars are intensely rinsed and dried.

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It is known, for example, to perform such a cleaning process for silicon chunks in a classic basin operation, wherein the chunks are inserted into baskets which are then transported through process baths in the process sequence mentioned. A comparable method currently constitutes the prior art in the cleaning of thin silicon bars. Since the bars react in a very sensitive manner to impact, they are individually fixed within a product barrel, specifically in such a manner that generally the bars are placed, on the circumference of several discs centrically seated on a driving axle, into milled bar slots and protected against falling out. Here, the milled slot is generally slightly larger than the diameter of the bars. This ensures that upon each rotation of the product barrel within the process basin the thin bars are bathed on all sides once per revolution, and that, therefore, no shading effects occur at the points of support.

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In addition, it is known to fill a barrel of a length of approx. 3.10 m, similar to an industrial galvanizing barrel having registers or planar product carriers, with silicon bars approx. 3 m in length or to stack the silicon bars therein. In this case, too, the thin silicon bars may be inserted into holding devices.

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In the known methods of treating thin silicon bars, the thin silicon bars are processed in batch operation, i.e. the barrels are first of all charged manually or automatically and are then transported, by means of automation, from bath to bath, where the actual process takes place in the immersion process, with the support of barrel rotation within the basin.

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In addition, methods and devices wherein wafers are transported through liquids by means of continuous means have been known from the prior art, reference being made in this respect to WO 2005/093788 A1, WO 2008/143518 A1 and WO 2010/009865 A1, for example.

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It is the object of the present invention to provide methods and devices for treating semiconductor bars with a liquid or a gas, and a method of producing semiconductor bars treated accordingly, which enable integration into automated installations in a simple manner.

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This object is achieved by methods as claimed in claims 1 and 12 and by a device as claimed in claim 13.

Embodiments of the invention provide a method for treating semiconductor bars with a liquid or a gas, comprising:

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transporting at least one semiconductor bar by means of at least two revolving continuous means which are arranged in parallel and are spaced apart from one other at right angles to a transport direction and which have portions of the semiconductor bar supported thereon which are spaced apart from one other in the longitudinal direction of the semiconductor bar, while the semiconductor bar is being treated with a liquid or a gas.

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Embodiments of the invention provide a method for producing a semiconductor bar treated with a liquid or a gas, said method utilizing a corresponding method of treating a semiconductor bar.

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Embodiments of the invention provide a device for treating semiconductor bars (20) with a liquid or a gas, comprising:

at least two revolving continuous means which are arranged in parallel and are spaced apart from one other at right angles to a transport direction and which are configured as supports for portions of at least one semiconductor bar which are spaced apart from one another in the longitudinal direction of the semiconductor bar,

a drive means for driving the continuous means so as to move a semiconductor bar, which is supported on the continuous means, together with the continuous means,

and a means for treating the semiconductor bar with a liquid or a gas while it is being moved with the continuous means.

The term "semiconductor bar" here is understood to mean a thin, elongate process product comprised of a semiconductor material, the length of which is many times larger than its other dimensions, for example its diameter or its thickness and width. For example, a bar is understood to mean a process product whose length is at least 50 times larger than its other dimensions.

Embodiments of the present invention enable in an advantageous manner that semiconductor bars are continuously treated with a liquid or a gas in an in-line process. In embodiments of the invention, the semiconductor bars may be continuously guided, in an in-line process, through several process stations where the semiconductor bars are treated with various liquids and/or gases. For example, the bars may be continuously transported through several process baths in an in-line process. By means of such a continuous system, immersion processes and spraying processes may be implemented.

In embodiments of the invention, the continuous means are configured to form supports for several semiconductor bars transported one behind the other by means of the continuous means. The semiconductor bar(s) may be arranged essentially at right angles to the transport direction in the longitudinal direction during transport. In embodiments of the invention, the continuous means may be chains, chain links of the chains being configured to serve as supports for one or more semiconductor bars to be transported. This enables a particularly simple structure and particularly easy transport of the semiconductor bars. In alternative embodiments the continuous means may be implemented by revolving bands or belts which have corresponding supports provided thereon for one or more semiconductor bars to be transported.

In embodiments of the invention, the semiconductor bar(s) is/are moved through a liquid bath with utilization of the revolving continuous means, the continuous means being

guided such that the semiconductor bar(s) is/are initially immersed into the liquid bath at an angle of between 1° and 90° relative to the surface of the liquid bath, is/are then moved through the liquid bath and is/are subsequently extracted from the liquid bath at an angle of between 1° and 90° relative to the surface of the liquid bath. While they are being moved
5 through the liquid bath, the semiconductor bars may be subjected to ultrasound from above and from below. An ultrasonic source for acting upon the semiconductor bar from above and an ultrasonic source for acting upon the semiconductor bar from below may be arranged one behind the other in the liquid bath in the transport direction, so that interferences caused by the ultrasonic waves generated by the ultrasonic sources can be
10 avoided.

In embodiments of the invention, the semiconductor bars are handed over, during treatment with a gas or a liquid, from the at least two revolving continuous means arranged in parallel and spaced apart from one other to at least two further revolving continuous means
15 arranged in parallel and spaced apart from one other at right angles to the transport direction, which are arranged such that other portions of the semiconductor bar which are spaced apart from one other in the longitudinal direction of the semiconductor bar are supported on the further continuous means. Thus, the points of support of the semiconductor bars on the continuous means change, so that uniform treatment without
20 any shading effects may be achieved. This can be easily achieved in embodiments in that the bar supports are located in the longitudinal axis of the semiconductor bars in an offset manner.

In embodiments of the invention, the treatment of the semiconductor bars, while they are
25 transported by means of continuous means, may include one or more random treatments which include cleaning in a liquid bath to which a surfactant may be added, and subsequent rinsing, cleaning with utilization of spray nozzles, etching in a liquid bath, and drying while using drying nozzles.

In embodiments of the invention, the method and the device are configured such that the at least one semiconductor bar is subjected to several different treatments at different treatment stations while being transported by continuous means associated with said different treatment stations, the semiconductor bar being handed over from the continuous means of a upstream treatment station as seen in the transport direction to the continuous
30 means of a downstream treatment station as seen in the transport direction. In accordance with embodiments of the invention, semiconductor bars may thus be subjected to several successive treatments so as to produce semiconductor bars which may then be used, for example, for semiconductor ingot production, wherein semiconductor material is grown
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onto the semiconductor bars treated accordingly. In embodiments, the produced semiconductor bars may thus be used as a starting material for so-called semiconductor ingot production, for example production of polycrystalline silicon ingots.

5 Embodiments of the present invention thus relate to methods and devices wherein a semiconductor bar is subjected to a plurality of treatments in succession while being transported by several continuous means which include cleaning in a liquid bath having a surfactant added to it, while using ultrasound, rinsing the cleaned semiconductor bar while using spray nozzles, etching the rinsed semiconductor bar, cleaning the etched
10 semiconductor bar while using a liquid bath and/or spraying means, and drying the cleaned semiconductor bar.

In embodiments of the invention, handover takes places from a upstream treatment station as seen in the transport direction to an downstream treatment station as seen in the
15 transport direction while using a gripping means which picks up the semiconductor bar from the continuous means of the upstream treatment station as seen in the transport direction and places it onto the continuous means of the downstream treatment station as seen in the transport direction. Thus, it is possible to implement fast handover from the upstream treatment station as seen in the transport direction to the downstream treatment
20 station as seen in the transport direction, which is advantageous, in particular, if the upstream treatment station as seen in the transport direction is an etching bath.

Embodiments of the present invention thus address methods and devices for treating semiconductor bars with a liquid or a gas, whereby semiconductor bars treated accordingly
25 are produced. In embodiments, the semiconductor bars may be silicon bars, for example bars made of monocrystalline silicon. In other embodiments, the semiconductor material may be a different semiconductor, such as Ge, GaAs, InP, or GaN, for example.

In embodiments of the present invention, the semiconductor bars are thus not transported and treated by means of a shared holding device in a batch operation, but in an in-line
30 process with utilization of revolving continuous means, by means of which the semiconductor bars are transported through one or more treatment stations.

Embodiments of the present invention will be explained in more detail below with
35 reference to the accompanying drawings, wherein:

Fig. 1 shows a schematic cross-sectional side view of an installation for treating semiconductor bars;

Fig. 2 shows an enlarged schematic partial cross-sectional view of a first portion of the installation shown in Fig. 1;

5 Fig. 3 shows a view essentially corresponding to a schematic perspective view of the view shown in Fig. 2;

Figs. 4 and 5 show schematic cross-sectional views of further portions of the installation shown in Fig. 1;

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Fig. 6 shows a schematic perspective view of the installation shown in Fig. 1; and

Fig. 7 shows a schematic representation of an embodiment of a chain portion comprising a guide crank.

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An embodiment of an installation for treating semiconductor bars will be explained below with reference to Figs. 1 to 6. It is obvious to persons skilled in the art that the present invention is not limited to a corresponding installation, but may be applied to any installation where semiconductor bars are treated with at least one liquid and/or at least one gas. Alternative embodiments may thus comprise a smaller number of treatment stations or a larger number of treatment stations.

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It shall be noted at this point that, as is obvious to persons skilled in the art, the figures are schematic cross-sectional representations wherein respective elements may be omitted for illustration purposes, which requires no further explanation. In addition, only those features shown in the figures which are important for understanding the invention will be described below.

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In embodiments of the invention, the semiconductor bars may be silicon bars having square or round diameters of up to 10 mm and standard lengths of up to 3 m, as are used as a starting material for producing polycrystalline silicon ingots.

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As may be seen in Figs. 1 and 6, in particular, the installation comprises an input station 10, a first treatment station 12, a second treatment station 14, a third treatment station 16, and an output station 18. Each of said stations comprises at least two parallel continuous means spaced apart from one another at right angles to the transport direction, and by means of which silicon bars 20, which may be referred to as thin silicon bars, are transported. More precisely, in the embodiment shown the continuous means are formed

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by chains having chain links which are shaped correspondingly and represent receptacles for the silicon bars 20. In this respect, the chain links may comprise corresponding recesses, for example, into which the silicon bars are placed. In embodiments of the invention, the chain links may be configured such that the downstream portion, as seen in the transport direction, of a upstream chain link and the upstream portion, as seen in the transport direction, of an downstream chain link of two successive chain links serve as supports for a silicon bar.

As may best be seen in Fig. 3, the input station 10 comprises two corresponding chains 22 and 24 onto which the silicon bars 20 are placed in the input station. The chains of the different treatment stations may be referred to as a horizontal chain conveyance system.

In the conveyance by the chains of the individual treatment stations, the silicon bars 20 are supported by at least two chains running in parallel, and are kept in their positions and are kept apart by chain links shaped correspondingly, as was explained.

In the input station 10, the silicon bars are transported to the right by the chains 22 and 24 and are handed over to chains 26 and 28 of the first treatment station 12 at the right end of the input station 10. For the purpose of this handover, the chains 22 and 24 of the input station 10 overlap with the chains 26 and 28 of the first treatment station 12 in the transport direction, so that the handover takes place in the overlap area.

As may be seen only schematically in the figures, the chains are guided over rollers and/or gearwheels, some or several of which may be driven to cause a movement of the chains by which the silicon bars are transported. It shall be noted at this point that the figures are purely schematic in this respect and that not all of the rollers and/or gearwheels are represented. For example, it is clear that separate rollers and/or gearwheels may be provided for each chain, such as chains 22, 24, 26, and 28, even though they are not depicted separately in the figures. Corresponding drive means for one or several of the rollers and/or gearwheels are provided, two drive means 19a and 19b being shown in Fig. 6 in a merely schematic manner.

In the embodiment shown, the first treatment station 12 comprises a liquid bath 50 and a spraying system 52. Chains 26, 28, 30, and 32 are provided for transporting the silicon bars through the liquid bath 50. Chains 34 and 36 are provided for transporting the silicon bars through the spraying system 52.

The chains 26 and 28 are guided downward by corresponding guide cranks (not shown) at an angle (which may be from 1° to 90°), and then pass into the horizontal. By means of said horizontal offset one achieves that the chains 26 and 28 with the silicon bars supported thereon are immersed below the liquid level of a liquid contained within the liquid bath 50 and are continued to be transported horizontally through the basin 50 and the liquid. The liquid in the basin 50 may be a cleaning liquid, such as water, for example.

As may further best be seen in Fig. 3, the silicon bars in the liquid bath 50 are handed over to two further chains 30 and 32. They are arranged at right angles to the transport direction, offset from the chains 26 and 28, so that the chains 30 and 32 have different areas of the silicon bars are supported thereon than do the chains 26 and 28. Thus, a shading effect in areas of the silicon bars may be prevented. The liquid bath 50 has an upper ultrasonic source 54 and a lower ultrasonic source 56 arranged therein, so that it is from below and from above that sound waves may impinge upon the silicon bars transported through the liquid bath in order to support the cleaning process. The first treatment station 12 depicted in Fig. 3 essentially corresponds to the treatment station depicted in Fig. 2; however, in Fig. 3, the upper and lower ultrasonic sources 54 and 56 are arranged one above the other, whereas in accordance with Fig. 2 the upper and the lower ultrasonic sources are arranged one behind the other in an offset manner in the transport direction, so that the ultrasonic waves impinge upon the silicon bars from above and from below in a consecutive manner so as to avoid interferences. If the ultrasonic sources are arranged one above the other, they may be operated alternately (in a pulsed manner), it being possible for each ultrasonic source to be operated for 5 seconds in each case, for example. The cleaning liquid in the liquid bath 50 may have surfactants added to it.

The chains 30 and 32 are guided, in the first treatment station, such that the silicon bars are conveyed from the liquid in the liquid bath 50 at an angle which in turn may range from 1° to 90° .

The first treatment station 12 further comprises a gripping means 58. In the embodiment shown, the gripping means comprises hooks 60 configured to pick up a silicon bar. The gripping means 58 is movable, by means of a maneuvering means (not depicted), such that a silicon bar can be picked up, by means of the gripping means 58, from the chains 30 and 32 and be placed onto the chains 34 and 36. By means of the chains 34 and 36, the silicon bar 20 is transported through the spraying system 52, which in the embodiment depicted is part of the first treatment station 12. The spraying system 52 is optional and is advantageous particularly if the cleaning agent in the liquid bath 50 has a surfactant added to it to support the cleaning. The spraying system 52 comprises spraying rails 62 having

corresponding spraying nozzles for producing spray cones 64. The spraying rails 62 are arranged above and below the transport path through which the silicon bars are transported by means of the chains 34 and 36. Thus, the silicon bars may be transported between the spraying rails 62, whereby spraying and washing of the silicon bars on all sides can be achieved. For handing over the silicon bars from the spraying system 52 to the second treatment station 14, again a corresponding gripping means 58' comprising hooks 60 may be provided, as may best be seen in Fig. 2. By means of this gripping means, the silicon bars may be picked up from the chains 34 and 36 and be placed upon the chains 38 and 40 of the second treatment station. Suction devices may be provided between the treatment stations, as are schematically designated by reference numeral 70 in the figures. The second treatment station represents an etching basin 72 having a corresponding etchant located therein. The chains 38 and 40 as well as two further chains spaced apart from one another at right angles to the transport direction, one of which is referred to by reference numeral 42 in Fig. 4, are configured to immerse the silicon bars into an etching liquid located in the etching bath 72 and to remove them therefrom. Again, the chains 38 and 40 on the one side and the subsequent chains 42 on the other side may be arranged such that they are mutually offset at right angles to the transport direction so as to prevent a shading effect on the silicon bars 20 during treatment thereof. A further suction means 74 may be provided above the etching basin.

Transporting and immersing the silicon bars into the etching basin 72 may be effected by analogy with transporting and immersing the silicon bars into the liquid basin 50. The etching basin may have, e.g., an HF/HNO₃ mixture arranged therein for etching the silicon bars.

It is obvious to persons skilled in the art that the dwelling time of the silicon bars in the respective treatment stations and/or liquid baths depends on the lengths of the baths and the chain speeds, so that in embodiments of the invention these dwelling times may readily be controlled by adjusting the bath lengths and/or adjusting the chain speeds. As was illustrated above, the points of support of the bars on the chains change during the process in order to ensure uniform treatment and prevent shading effects on the silicon bars. This may be achieved in that handover between chain systems takes place during the process; the bar supports between the chain systems are located in a slightly offset manner in the longitudinal axis of the silicon bar.

At the end of the etching basin 72, the silicon bars are again lifted off from the chains 42 by a corresponding maneuverable gripping means 58 and are placed onto chains 44 of the third treatment station 16 which are parallel and spaced apart from one another at right

angles to the transport direction. The third treatment station again is a cleaning station. The chains 44 of the third treatment station may be guided such that the silicon bars are initially briefly immersed into a cleaning liquid, subsequently pass through a spraying system 80 comprising spraying rails 82, whereupon they pass through a drying system 84 comprising drying nozzles 86. The short immersion into a cleaning liquid, as is shown at 88 in Figs. 4 and 5, is useful in order to be able to effect a fast etch stop so as to avoid undefined subsequent etching due to adherent residual acid films or drops of acid. As is shown in Fig. 5, the third treatment station 16 may have an optional catch basin 90 arranged therein which may receive residues of etchant so as to prevent them from being carried over into the remaining basin of the third treatment station.

In order to be able to effect such a fast etch stop, utilization of a gripping means 58 which may be moved at a rate that is higher than that of the chain movement is also advantageous. Thus, the silicon bars may be immersed into the liquid faster in the third treatment station than would be the case if the silicon bars were handed over directly between the chains. In addition, carry-over of media between the individual treatment stations can be reduced by using gripping means.

By using independent implementation systems as are realized by the gripping means 58, the silicon bars may be rapidly lifted out of a upstream treatment station as seen in the transport direction and be placed into the subsequent treatment station. This is advantageous in particular if etching of the silicon bars takes place in the upstream treatment station as seen in the transport direction and if residues of the etchant are removed in the downstream treatment station as seen in the transport direction.

Following immersion of the silicon bars into the liquid at 88, they may again be transported horizontally through the spraying system 80 by the chains 44, so that the silicon bars may be sprayed from above and from below with the cleaning agent exiting the spraying rails 82. The spray used in the spraying systems may be water, for example, in each case.

Subsequently, the chains 44 comprising the silicon bars pass through the drying system 84. More precisely, said chains 44 comprising the silicon bars pass between the upper and lower air nozzle pipes 86, so that the bars have air blown onto them from above and from below and are dried as a result. However, it is obvious that other drying systems may also be used, such as IR radiators or the like, for example.

At the end of the third treatment station 16, the silicon bars 20 are handed over to chains 46 of the output station 18, which are spaced apart from one other at right angles to the transport direction, from where the silicon bars whose treatment has been terminated may then be removed (manually or by means of automation).

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A schematic representation of an embodiment of a section of a chain 20 comprising a guide crank 100 is shown in Fig. 7. As is depicted, the individual chain links 120 comprise recesses 120a into which the silicon bars may be inserted. More precisely, the chain links in the embodiment shown have flanges or side cheeks at the ends arranged at right angles to the transport direction, which flanges or side cheeks have the recesses formed therein. Some of the chain links may have guide angles 122 mounted thereon. In embodiments of the invention, the guide angle may be mounted on two pins projecting from adjacent chain links. Alternatively or in addition to the recesses 120a mentioned, a recess 122a arranged in an upper portion of the guide angle may serve as a support for a silicon bar. Silicon bars may be simply inserted into the recesses from above in each case. The guide crank 100 comprises a chain guide 130 through which the guide angle 122 is guided. The chain 20 now follows the profile of the chain guide 130, a horizontal profile being depicted in Fig. 7. If the position of the guide profile changes over a radius, e.g. from the horizontal downward due to a slope of by, e.g., 20°, the chain will also follow this profile. Thus, the chain may be guided to transport the silicon bars as was described above.

The design described ensures that the chain is always freely accessible from above. In alternative embodiments, the side cheek comprising the guide angle may be pulled further upward at the top side and form a reception well for the bar, so that said bar will sink further into the well and so that there will be improved guidance at the front and at the back. In alternative embodiments, no additional guide angle needs to be provided. Rather, the chain may be guided by means of axle pins which stick out; it is possible for the chain to be located within a groove, for example, and the guides overlap the axle pins on both sides. The width of the guide should be as small as possible to avoid shading effects on the bar.

By means of a preferred embodiment, treatment of silicon bars and/or manufacturing of treated silicon bars which may serve as a starting material for silicon ingot production were described above. However, it is obvious that the invention is not limited to the treatment stations and treatments described accordingly. In addition, in alternative embodiments, more than two continuous means spaced apart from one another in the transport direction may be used for transporting the semiconductor bars.

Claims

1. Method of treating semiconductor bars with a liquid or a gas, comprising:

5 transporting at least one semiconductor bar by means of at least two revolving continuous means which are arranged in parallel and are spaced apart from one other at right angles to a transport direction and which have portions of the semiconductor bar supported thereon which are spaced apart from one other in the longitudinal direction of the semiconductor bar, while the semiconductor bar is
10 being treated with a liquid or a gas.
2. Method as claimed in claim 1, wherein the at least one semiconductor bar is arranged essentially at right angles to the transport direction during transport in the longitudinal direction.
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3. Method as claimed in claims 1 or 2, wherein the continuous means are chains, and wherein chain links of the chains are configured to serve as supports for one or more semiconductor bars to be transported.
- 20 4. Method as claimed in any of claims 1 to 3, wherein transporting the at least one semiconductor bar comprises moving the semiconductor bar at an angle of between 1° and 90° relative to the surface of a liquid bath so as to immerse the semiconductor bar into the liquid bath, moving the semiconductor bar through the liquid bath and moving the semiconductor bar at an angle of between 1° and 90°
25 relative to the surface of the liquid bath so as to remove the semiconductor bar from the liquid bath.
5. Method as claimed in claim 4, wherein the semiconductor bar is subjected to ultrasound from above and from below while it is being moved through the liquid
30 bath.
6. Method as claimed in claim 5, wherein an ultrasonic source for acting upon the semiconductor bar from above and an ultrasonic source for acting upon the semiconductor bar from below are arranged within the liquid bath, said ultrasonic
35 sources being arranged one behind the other in the transport direction, or said ultrasonic sources being arranged one above the other in an overlapping manner in the transport direction and being operated alternatingly.

7. Method as claimed in any of claims 1 to 6, wherein the at least one semiconductor bar is handed over, during treatment with a gas or a liquid, from the at least two revolving continuous means arranged in parallel and spaced apart from one other to at least two further revolving continuous means arranged in parallel and spaced apart from one other at right angles to the transport direction, which are arranged such that other portions of the semiconductor bar which are spaced apart from one other in the longitudinal direction of the semiconductor bar are supported on the further continuous means.
8. Method as claimed in any of claims 1 to 7, wherein the treatment of the at least one semiconductor bar includes at least one treatment selected from the following treatments:

 - cleaning in a liquid bath,
 - cleaning in a liquid bath having a surfactant added to it, and subsequent rinsing,
 - cleaning while using spray nozzles,
 - etching in a liquid bath, and
 - drying.
9. Method as claimed in any of claims 1 to 8, wherein the at least one semiconductor bar is subjected to several different treatments at different treatment stations while being transported by continuous means associated with said different treatment stations, the semiconductor bar being handed over from the continuous means of an upstream treatment station as seen in the transport direction to the continuous means of a downstream treatment station as seen in the transport direction.
10. Method as claimed in claim 9, wherein handover takes place while using a gripping means which picks up the semiconductor bar from the continuous means of the upstream treatment station as seen in the transport direction and places it onto the continuous means of the downstream treatment station as seen in the transport direction.
11. Method as claimed in claims 9 or 10, wherein the semiconductor bar is subjected to the following treatments in succession, while the semiconductor bar is being transported by several continuous means: cleaning in a liquid bath having a surfactant added to it, while using ultrasound, rinsing the cleaned semiconductor bar while using spray nozzles, etching the rinsed semiconductor bar, cleaning the

etched semiconductor bar while using a liquid bath and/or spraying means, and drying the cleaned semiconductor bar.

12. Method of producing semiconductor bars treated with a liquid or a gas, said method comprising a method of treating semiconductor bars as claimed in any of claims 1 to 11.

13. Device for treating semiconductor bars with a liquid or a gas, comprising:

at least two revolving continuous means which are arranged in parallel and are spaced apart from one other at right angles to a transport direction and which are configured as supports for portions of at least one semiconductor bar which are spaced apart from one another in the longitudinal direction of the semiconductor bar,

a drive means for driving the continuous means so as to move a semiconductor bar, which is supported on the continuous means, together with the continuous means,

and a means for treating the semiconductor bar with a liquid or a gas while it is being moved with the continuous means.

14. Device as claimed in claim 12, wherein the means for treating is configured to allow that the semiconductor bar, which is arranged, in the longitudinal direction, essentially at right angles to the transport direction, passes.

15. Device as claimed in claims 12 or 13, wherein the continuous means are chains, and wherein chain links of the chains are configured to serve as supports for one or more semiconductor bars to be transported.

16. Device as claimed in any of claims 12 to 14, wherein the means for treating the semiconductor bar with a liquid or a gas comprises a liquid bath, and wherein the continuous means comprise a first portion, which becomes immersed into the liquid bath at an angle of between 1° and 90° relative to the surface of the liquid bath, a second portion extending through the liquid bath, and a third portion which exits the liquid bath at an angle of between 1° and 90° relative to the surface of the liquid bath.

17. Device as claimed in claim 15, wherein the liquid bath has a first ultrasonic source arranged therein above a transport path of the semiconductor bar, and has a second ultrasonic source arranged therein below a transport path of the semiconductor bar.

18. Device as claimed in any of claims 12 to 16, comprising at least two further revolving continuous means which are arranged in parallel and are spaced apart from one other at right angles to a transport direction, and which are arranged such that following handover of the semiconductor bar from the two continuous means to the two further continuous means, other portions of the at least one semiconductor bar, which are spaced apart from one another in the longitudinal direction of the semiconductor bar, are supported on the further continuous means.

19. Device as claimed in any of claims 12 to 17, comprising one or more means for treating the at least one semiconductor bar, which are selected among the following:

- a means for cleaning in a liquid bath,
- a means for cleaning or rinsing while using spray nozzles,
- a means for etching in a liquid bath, and
- a means for drying.

20. Device as claimed in any of claims 12 to 18, comprising several treatment stations configured to subject the at least one semiconductor bar to several different treatments, the treatment stations comprising corresponding continuous means, and the device comprising at least one handover means configured to perform a handover of the semiconductor bar from the continuous means of a upstream treatment station as seen in the transport direction to the continuous means of a downstream treatment station as seen in the transport direction.

21. Device as claimed in claim 19, wherein the handover means comprises a gripping means configured to pick up the semiconductor bar from the continuous means of the upstream treatment station as seen in the transport direction and place it upon the continuous means of the downstream treatment station as seen in the transport direction.

22. Device as claimed in claims 19 or 20, comprising several treatment stations which are arranged one behind the other in the transport direction and through which the semiconductor bar is transported by respective continuous means and is subjected

to the following treatments: cleaning in a liquid bath, at least one ultrasonic source being arranged in the liquid bath, rinsing the cleaned semiconductor bar while using spray nozzles, etching the rinsed semiconductor bar, cleaning the etched semiconductor bar while using a liquid bath and/or spraying means, and drying the cleaned semiconductor bar.