# PROCESS FOR SIMPLIFICATION OF A FINISHING SEQUENCE AND STRUCTURE OBTAINED BY THE PROCESS

The field of the invention is the formation of structures comprising a thin layer made of a semi conducting material on a support substrate, by transferring the thin layer from a donor substrate to the support substrate.

Such structures are usually obtained by the use of a transfer process including steps to:

- create a weakened zone within the thickness of a donor substrate;
- bring the donor substrate into intimate contact with a support substrate;
- detach the donor substrate at the weakened zone, to transfer part of the donor substrate onto the support substrate;
- treat the said part of the donor substrate transferred onto the support substrate to form the said thin layer, the said treatment consisting of a sequence of finishing operations.

The invention more particularly relates, but is not limited, to the formation of structures with a particularly thin layer, in other words the thickness of the thin layer is typically less than 1000 Angstroms, and in particular less than 500 Angstroms.

SMART CUT ® type processes are an example of a transfer process for making structures of this type comprising a thin layer of semi conducting material on a

support substrate. They correspond to a preferred embodiment of the invention.

The structures thus formed may for example be of the SeOI (Semiconductor On Insulator) type. Remember that in this case, an oxide layer is inserted between the support substrate and the thin layer.

Structures obtained by such processes are used for applications in the microelectronics, optics and / or optronics fields.

After the donor substrate has been detached at the weakened zone, in order to transfer a part of the donor substrate onto the support substrate, it is found that a treatment of the said part transferred onto the support substrate is necessary so as to create the said thin layer. Such a treatment is designed particularly to:

- thin the part of the donor substrate transferred onto the support substrate, to bring it to the target thickness required for the thin layer;

- reduce the surface roughness, particularly to satisfy surface condition specifications associated with structures used in the application fields mentioned above;

- guarantee good quality in term of defects (surface defects, defects passing through the upper layer of the SeOI structure, etc.), and also to satisfy specifications for the application fields mentioned above.

This type of treatment of the structure obtained directly after detachment typically consists of a sequence of finishing operations. This sequence judiciously leads to one or several steps aimed at thinning the structure obtained after detachment, with

one or several steps aimed at smoothing the free surface of the said structure.

Thinning of the part of the donor substrate transferred onto the support substrate after detachment, to form the target thickness required for the thin layer may typically be implemented by one or several sacrificial oxidation and / or polishing operations.

However, a polishing operation is usually not desirable. Such an operation reduces the uniformity of the thickness of the transferred layer. Thus, when a polishing operation is built into the finishing sequence, it is impossible to guarantee that the standard deviation of the thickness of the transferred layer is less than 5 Å over the entire thin layer.

Application of a sacrificial oxidation operation is limited. Such an operation tends to make some pre-existing defects pass through (leading to the formation of HF type defects), particularly when a large part of the thickness of the transferred layer is eliminated.

In order to limit the formation of such defects, an intermediate thermal annealing operation is usually made between two sacrificial oxidation steps, each of these two steps being designed only for limited thinning.

As an example of such a thermal annealing, a fast thermal annealing is typically done under a controlled atmosphere using a mode commonly called RTA (Rapid Thermal Annealing).

As already mentioned by the Applicant in document WO 03/009366, the finishing treatment step may be based on a "basic" sequence (that could be repeated) including a sequence consisting of a sacrificial oxidation operation followed by an RTA operation. The Applicant has

observed that a single RTA operation cannot be efficient, particularly in terms of reducing the surface roughness, when it is implemented on the surface obtained directly after detachment.

In document WO 2005/013318, the Applicant has proposed to combine a step to create a weakened zone formed by co-implantation with a finishing treatment step based on a "basic" sequence (that may possibly be repeated) including an RTA operation followed by a sacrificial oxidation operation.

The Applicant has also observed (and presented in international application deposited on December 28 2004 as No. IB2004/004390 not yet published) that it is preferable to transfer a thick layer and then thin this thick layer, rather than attempt to transfer a thin layer directly, if it is required to form "thin layer on support substrate" structures with a particularly thin layer (thickness less than 1000 Angstroms, and particularly less than 500 Angstroms).

It follows from the above that a finishing treatment of a thick layer requires several sacrificial oxidation operations (each designed for limited thinning only), with RTA smoothing operations being inserted between the sacrificial oxidation operations.

It will easily be understood that the use of a large number of finishing operations has an adverse effect on the global cost of the process.

Furthermore, the formation of a structure with a specified final thickness leads to additional calibration of equipment that depends on the residual thickness of the layer to be treated. For example, calibration of the lamps of an RTA type furnace (necessary to guarantee

uniform heating of a wafer) is calibrated as a function of the thickness of the upper layer of an SeOI structure.

Thus, if a finishing treatment is necessary for a transferred layer with a thickness of the order of 2000 Angstroms immediately after detachment, it may be necessary to perform several RTA smoothing operations between several thinning operations, to obtain a final thin layer with a thickness of 500 Angstroms. It may then be necessary to adapt each RTA smoothing operation to each thickness (initial, intermediate, final) being treated. Such an adaptation can increase the complexity of a finishing treatment with multiple operations.

Therefore, an attempt is made to simplify the finishing operation as much as possible, without compromising the quality of the final structures.

In the context of forming a thin layer structure, the finishing operation sequence selected as being preferred consists of repeating the sequencing of a rapid thermal annealing operation with a sacrificial oxidation operation. This preferred sequence, also called RTA/Sacrox/RTA/Sacrox (where "Sacrox" denotes a sacrificial oxidation) has the advantage of being high performance in terms of quality. But it has the disadvantage of including a large number of operations.

A first purpose of the invention is to simplify the finishing step, particularly by reducing the necessary number of operations without correspondingly risking compromising the quality of the final structure.

Another purpose of the invention is intended more precisely to authorise the use of a finishing treatment simpler than the preferred RTA/Sacrox/RTA/Sacrox

sequence, particularly when forming a thin layer structure.

To achieve this, the invention discloses a process for the formation of a structure comprising a thin layer made of a semi conducting material on a substrate, including steps to create a weakened zone within the thickness of a donor substrate, to bring the donor substrate into intimate contact with a support substrate, to detach the donor substrate at the weakened zone to transfer part of the donor substrate onto the support substrate, to treat the said part of the donor substrate transferred onto the support substrate to form the said thin layer, the said treatment consisting of a sequence of finishing operations; the process being characterised in that:

- detachment is achieved by the application of a heat treatment to develop weakening of the weakened zone, without initiating thermal detachment of the said part of the donor substrate; and application of an energy pulse provoking self-maintained detachment of the said part of the donor substrate;

- and in that the sequence of finishing operations is a sequence simplified by eliminating the first or the last operation of a sequence consisting of repeating the sequencing of a smoothing operation of the free surface of the said part of the donor substrate transferred onto the support substrate, with a thinning operation of the said part of the donor substrate transferred onto the support substrate.

Some preferred but non-limitative aspects of this process are as follows:

- the simplified sequence is obtained by eliminating the first operation, and consists of a thinning operation inserted between two smoothing operations;

- the simplified sequence is obtained by eliminating the last operation, and consists of a smoothing operation inserted between two thinning operations;

- the smoothing operation is a thermal annealing;

- the thermal annealing is a rapid thermal annealing RTA;

- the two smoothing operations by rapid thermal annealing RTA are merged into a single batch annealing operation with a smoothing effect equivalent to at least two rapid thermal annealing RTA operations, performed before the thinning operation;

- the thinning operation is a sacrificial oxidation operation;

- the thermal budget of the treatment for development of weakening corresponds to 60% or more (and preferably 80% or more) of the thermal budget leading to a purely thermal detachment;

- the heat treatment for development of weakening is an isothermal annealing at 350°C for a duration of between two and three hours;

- the weakened zone is created by implantation of species in the thickness of the donor substrate, the said implantation being applied by implantation of a single species or by co-implantation of at least two different species;

- the thinning done during the sequence of finishing operations is designed such that the thickness of the thin layer formed on the support substrate is less than 1000 Angstroms, and particularly less than 500 Angstroms.

According to another aspect, the invention relates to an SeOI structure with a thin layer made of a semi conducting material on a support substrate, an insulating layer being inserted between the thin layer and the substrate, the thickness of the thin layer being less than 1000 Angstroms, and particularly less than 500 Angstroms, characterised in that the density of HF defects in the thin layer is less than 0.3/cm², and in particular is less than 0.2/cm².

Some preferred but non-limitative aspects of this structure are as follows:

- the surface roughness of the thin layer as measured by scanning over a surface with an area equal to 10*10 µm² is less than 5 Å RMS, over the entire surface;
- the standard deviation of the thickness of the thin layer is less than 5 Å, over the entire surface.

Other aspects, purposes and advantages of this invention will become clear after reading the following detailed description of preferred embodiments of it, given as a non-limitative example with reference to the appended figures, wherein:

- Figure 1 is a map illustrating the presence of through defects in a thin layer of a structure obtained by use of a process according to the state of the art, particularly at the edge of the wafer;
- Figure 2 is a map illustrating the small number of through defects in a thin layer obtained by the use of one possible embodiment of the process according to the invention;
- Figures 3a to 3d illustrate the different steps in the process according to the invention;

- Figure 4 is a diagram illustrating the gain in terms of roughness obtained by the use of one possible embodiment of the process according to the invention.

As mentioned above, when forming a thin layer structure (thickness less than 1000 Angstroms, and particularly less than 500 Angstroms), the sequence of finishing operations selected as being preferred consists of repeating the sequence of a rapid thermal annealing (RTA) operation with a sacrificial oxidation operation. This preferred sequence is also denoted RTA/Sacrox/RTA/Sacrox.

As mentioned below, it appears impossible to simplify this finishing step without the risk of compromising the surface roughness, of seeing through type defects appearing.

- A first simplification could consist of eliminating the last operation in the preferred RTA/Sacrox/RTA/Sacrox sequence to use a first simplified RTA/Sacrox/RTA sequence.

But this first simplified sequence is not satisfactory, particularly for the formation of a structure with a thin layer. This simplified RTA/Sacrox/RTA sequence could generate "HF" type defects with a depth greater than the thickness of the thin layer of the final structure (so-called through defects).

As shown in Figure 1, these defects are located particularly in a dense zone Zd located at the edge of the wafer.

These through defects reveal the presence of holes on the surface of the transferred layer, at the dense zone, directly after detachment. And the roughness of

this dense zone after detachment is greater than the roughness of the remainder of the wafer.

This phenomenon varies in intensity, depending on operating conditions of the steps of forming the weakened zone and of detachment. And obviously, the thinner the thin layer of the final structure, the more the phenomenon becomes problematic.

The dense zone Zd corresponds to the zone at the edge of the wafer at which detachment is initiated. Therefore, it is a rougher zone than the remainder of the wafer, and this cannot be completely cured by the first RTA smoothing operation.

The extensive thinning, also done during a single sacrificial oxidation operation so that the end result obtained is a thin layer with a specified fine thickness, leads to the formation of HF type through defects. In general, such through defects cannot be cured by RTA type annealing. Specifically, the defects formed by the thinning operation cannot be cured by the final RTA smoothing operation.

- A second simplification could consist of eliminating the first operation in the preferred RTA/Sacrox/RTA/Sacrox sequence, to replace it with a second simplified RTA/Sacrox/RTA sequence.

This second simplified sequence is not satisfactory either. Apart from possible problems of through defects, this second simplified sequence can also generate roughness problems, particularly at the edge of the wafer.

As mentioned above, a dense rough zone is observed at the edge of the wafer immediately after detachment.

The use of a single RTA smoothing operation cannot compensate for this edge roughness at the dense zone Zd.

It will be observed that these roughness problems encountered with this second simplified sequence are closely related to problems caused by surface holes that arise with the first simplified sequence.

Returning to the description of this invention, Figures 3a - 3c show the different steps in one possible embodiment of the process according to the invention.

Thus, Figure 3a shows a donor substrate 1, for example a silicon substrate oxidised on its surface 4, subject to implantation shown diagrammatically by arrows, of species to create a weakened zone 3 within the thickness of the donor substrate 1.

The implantation of atomic species may be a simple implantation (i.e. implantation of a single atomic species), for example such as an implantation of hydrogen, helium or rare gases.

The implantation of atomic species may also be a co-implantation of atomic species (i.e. successive or simultaneous implantation of at least two different atomic species), for example a co-implantation of hydrogen and helium.

Some examples of implantation conditions include the following:

- Implantation of hydrogen alone:

In general, the dose is between 5 and 7 x $10^{16}$ $cm^{-2}$, and the energy is between 10 and 200 keV. Preferably, the dose is 5.7 x $10^{16}$ $cm^{-2}$ and the energy is 37 keV.

- Co-implantation of helium and hydrogen:

In general, for helium the dose is between 0.5 x $10^{16}$ $cm^{-2}$ and 3 x $10^{16}$ $cm^{-2}$ and the energy is between 10 and 200 keV (preferably dose between 1 x $10^{16}$ $cm^{-2}$ and 2 x $10^{16}$ $cm^{-2}$ and energy about 50 keV); and for hydrogen the dose is between 0.5 x $10^{16}$ cm-2 and 3 x $10^{16}$ $cm^{-2}$ and the energy is between 10 and 200 keV (preferably dose between 1 x $10^{16}$ $cm^{-2}$ and 2 x $10^{16}$ $cm^{-2}$, and energy about 30 keV).

Figure 3b shows the step during which the donor substrate 1 is brought into intimate contact with a support substrate 7 through its face 4.

The donor substrate 1 is then detached at the weakened zone 3, to transfer part of the donor substrate 1 onto the support substrate 7.

In the framework of the state-of-the-art processes, the detachment step generally consists of thermal annealing during which a spontaneous detachment occurs. In other words, it is a purely thermal detachment.

Note that it has also been proposed to do a purely mechanical detachment, particularly by making a blade move along the weakened zone 3.

This invention proposes to use another detachment mode, namely a detachment made by:

- application of a heat treatment so as to enable development of the weakening of the weakened zone 3, without initiating thermal detachment,
- and application of an energy pulse so as to provoke self-maintained detachment of a part 5 of the donor substrate 1 delimited between the face 4 and the weakened layer 3, with regard to the remainder 6 of the donor substrate.

Further details on this detachment mode are given in international applications by the Applicant published under numbers WO 2005/043615 and WO 2005/043616.

Unlike a purely thermal detachment, the heat treatment applied herein to develop weakening is interrupted before detachment is initialised.

In general, the weakening development heat treatment applied within the framework of the invention is designed to apply a thermal budget (duration and temperature pair) close to the thermal budget necessary to result in a purely thermal detachment.

Thus the thermal budget applied in the context of the invention corresponds to 60% or more, and preferably 80% or more, of the thermal budget leading to a purely thermal detachment.

For example, the heat treatment to develop weakening is done in the form of an isothermal annealing at 350°C for a duration of between two and three hours.

It will be noted that the heat treatment to develop weakening applied during detachment will also enable consolidation of the bonding interface between the donor substrate and the support substrate in intimate contact.

Figure 3c shows the actual detachment of a part of the donor substrate 5 with regard to the remainder 6 of donor substrate 1, using application of an input energy pulse, preferably with short duration and limited amplitude. The part 5 is thus transferred onto the support substrate 7.

For example, this energy input may be composed of a mechanical stress shown diagrammatically by arrow 10 in Figure 3c.

One non-limitative way of making this mechanical input is to use equipment similar to that conventionally used to separate the wafers after application of a purely thermal detachment (the term automatic separation machine is also used). The mechanical force applied by such separation equipment may be sufficient to cause self-maintained detachment.

The detachment obtained is self-maintained particularly in the sense that, unlike a purely mechanical detachment, there is no movement of a tool along the weakened zone.

Since the detachment is self-maintained, there is no real propagation of a fracture wave in steps that could generate surface ripples. Furthermore, since there is no movement of any tool along newly created surfaces, there is no degradation to the surface condition of the surfaces thus exposed.

Thus, these surfaces have a relatively smooth surface condition, and the free face 9 of the thin layer 5 transferred onto the donor substrate in particular has much lower roughness than it has with classical solutions using spontaneous detachment during thermal annealing (purely thermal detachment), or a purely mechanical detachment.

In particular, the Applicant has observed that the surface roughness of the free face 9 and the density of holes on the surface of the free face 9 are significantly reduced at the edge of the wafer, at the dense zone Zd shown in Figure 1.

The Applicant has thus observed that use of this detachment mode provides a means of making a simplified finishing treatment, and particularly a finishing

treatment according to either the first or second simplified sequences mentioned above, without compromising the surface roughness or generating any through type defects.

The invention thus proposes to combine:

- the detachment mode mentioned above combining:
  - "controlled" thermal weakening (particularly interrupted before detachment is initiated) and
  - local application of additional energy triggering "self-maintained" detachment along the weakened zone,
- with a treatment step for the structure obtained after detachment consisting of a sequence of simplified finishing operations.

Therefore with reference to Figure 3c, the structure obtained after detachment treated by the said simplified sequence is the structure including the support substrate 7 and the part 5 of the donor substrate 1 transferred onto the donor substrate 7.

In particular, the purpose of this sequence is to thin the part 5 to obtain the target thickness for the thin layer, to reduce the surface roughness and guarantee good quality in terms of defects. The end result after this treatment is the required final structure including the thin layer 8 (particularly with the target thickness) on the support substrate 7 (see Figure 3d).

According to one particular embodiment, the simplified sequence is the first simplified sequence mentioned above, namely the RTA/Sacrox/RTA sequence.

Note now that this first mode is advantageous in the framework of the formation of structures with a thin layer (thickness less than 1000 Angstroms and

particularly less than 500 Angstroms) particularly in that it provides a means of preventing the appearance of through defects.

In particular, the use of this first embodiment can lead to the formation of a 300 mm diameter SOI structure, for which the silicon thin layer is 350 Angstroms thick and for which the density of "HF" type defects is less than 0.3 defects / $cm^2$, or even less than 0.2 defects / $cm^2$.

The production of an RTA annealing immediately after "self-maintained" detachment provides a means of avoiding the appearance of holes that could open up after application of the sacrificial oxidation operation. The second RTA annealing can then complete the cure of residual defects, while slightly further reducing the surface roughness of the thin layer.

And use of this first embodiment can typically achieve a roughness of less than 5 A RMS (as measured by a 10*10 $\mu m^2$ scan).

Figure 2 is a map similar to that in Figure 1 illustrating the small number of through defects in a particularly thin layer (thickness 350 Angstroms) obtained by use of this first possible embodiment.

As a variant to this first embodiment, the invention also plans to use a single annealing operation, instead of two RTA annealing operations; this single annealing operation having an equivalent or even better smoothing effect than two RTA operations.

In other words, two RTAs are combined in a single furnace annealing operation used before the thinning operation, this annealing operation in the furnace

performing a smoothing effect equivalent to at least two RTAs.

For example, such a single annealing operation may consist of annealing in a furnace (also called "Batch Anneal". The simplified sequence then consists of a thermal batch annealing operation followed by a sacrificial oxidation operation.

For example, "Batch Annealing" may be done under a hydrogen and / or argon atmosphere for a duration of between five minutes and four hours.

According to one second possible embodiment, the simplified sequence is the second simplified sequence mentioned above, namely the Sacrox/RTA/Sacrox sequence.

Note that apart from the fact that this embodiment prevents the appearance of through defects, it also provides a means of achieving particularly low roughness at the edge of the wafer.

The use of the "self-maintained" detachment discussed above according to the invention, leads to a reduction in the density and depth of holes at the edge of the wafer. This reduction is accompanied by a reduction in the roughness at the edge of the wafer (the roughness at the centre only being slightly modified).

Since there are no longer any problems of holes and roughness at the edge of the wafer, it becomes possible to use the Sacrox/RTA/Sacrox sequence.

Figure 4 shows a measurement of the roughness R obtained by a scan across a 30*30 $\mu m^2$ area of the thin layer of the final structure, using an atomic force microscope AFM at the edge of the wafer (see round marks) and at the centre of the wafer (see square marks).

The thin layer is more precisely a silicon layer with an SOI structure with a thickness of 1000 Angstroms.

This Figure 4 compares the surface roughness of the thin layer during use of the simplified Sacrox/RTA/Sacrox finishing sequence following detachment conforming with that disclosed in the invention (case A, at the left in Figure 4) and following a purely thermal detachment (case B, at the right in Figure 4).

It can be seen that use of the invention does not provide any particular gain in roughness at the centre.

On the other hand, it can be seen that use of the invention has a beneficial effect at the edge of the wafer. The roughness at the edge of the wafer is not too high, so that the simplified Sacrox/RTA/Sacrox sequence can be used as a finishing sequence.

In any case, it will be noted that a homogeneous roughness is observed over the entire surface of the wafer after the simplified sequence has been used.

Within the framework of the invention, the rapid thermal annealing RTA operation is conventionally done for a duration of a few seconds or a few tens of seconds under a controlled atmosphere.

In order to make an RTA annealing of the structure obtained after detachment, the said structure is annealed at a high temperature, for example of the order of 900°C to 1300°C for 1 to 16 seconds.

The controlled atmosphere may be an atmosphere comprising a mix of argon and hydrogen, or an atmosphere of pure argon, or an atmosphere of pure hydrogen.

Within the framework of the invention, the sacrificial oxidation operation is broken down in a manner conventionally known in itself into an oxidation

step and a de-oxidation step, a heat treatment being inserted between the oxidation step and the de-oxidation step.

The oxidation step is preferably carried out at a temperature of between 700°C and 1100°C.

It may be done by a dry method (for example under gaseous oxygen) or a wet method (for example in an atmosphere containing water vapour).

The oxidation atmosphere may also contain hydrochloric acid, both in dry method and in wet method.

The oxidation step leads to the formation of an oxide layer on the surface of the thin layer.

The heat treatment may be carried out at constant or variable temperature. The heat treatment is preferably done at a temperature between 1100 and 1200°C under an oxidising atmosphere.

The de-oxidation step performed after the heat treatment removes the oxide layer formed during the oxidation step. For example, it is done by immersing the structure for a few minutes into a solution of 10% to 20% hydrofluoric acid.

In the above, we have mentioned sacrificial oxidation as being a preferred form of a thinning operation. However, the invention is absolutely not limited to this preferred form, and includes other types of thinning operations, for example such as dry etching (for example plasma etching) or wet etching operations (chemical bath adapted to etching, for example of silicon; in particular an SC1, KOH, TMAH, etc. bath).

It can be understood from the above that with the invention, a simplified sequence can be used as a

finishing sequence in each of these different embodiments.

Furthermore, note that no polishing operation is included in the finishing sequence in any of the different embodiments. It is thus possible to form thin layers, guaranteeing that the standard deviation of the thickness will be less than 5 A.

Obviously, the invention also covers "thin layer on support substrate" structures, and particularly SeOI structures obtained by use of the process according to the first aspect of the invention.

CLAIMS

1. Process for the formation of a structure comprising a thin layer (8) made of a semi conducting material on a substrate (7), including steps:

- to create a weakened zone (3) within the thickness of a donor substrate (1);

- to bring the donor substrate (1) into intimate contact with a support substrate (7);

- to detach the donor substrate (1) at the weakened zone (3) to transfer part (5) of the donor substrate (1) onto the support substrate (7);

- to treat the said part (5) of the donor substrate transferred onto the support substrate to form the said thin layer (8), the said treatment consisting of a sequence of finishing operations;

the process being characterised in that:

- detachment is achieved by:

  • the application of a heat treatment to develop weakening of the weakened zone (3), without initiating thermal detachment of the said part of the donor substrate,

  • and application of an energy pulse (10) provoking self-maintained detachment of the said part (5) of the donor substrate;

- and in that the sequence of finishing operations is a sequence simplified by eliminating the first or the last operation of a sequence consisting of repeating the sequencing of:

- a smoothing operation of the free surface (9) of the said part (5) of the donor substrate transferred onto the support substrate (7),
- with a thinning operation of the said part (5) of the donor substrate transferred onto the support substrate.

2. Process according to claim 1, characterised in that the said simplified sequence is obtained by eliminating the first operation, and consists of a thinning operation inserted between two smoothing operations.

3. Process according to claim 1, characterised in that the said simplified sequence is obtained by eliminating the last operation, and consists of a smoothing operation inserted between two thinning operations.

4. Process according to one of the above claims, characterised in that the smoothing operation is a thermal annealing.

5. Process according to the above claim, characterised in that the thermal annealing is a rapid thermal annealing RTA.

6. Process according to claim 5, in combination with claim 2, characterised in that the two smoothing operations by rapid thermal annealing RTA are merged into a single batch annealing operation with a smoothing effect equivalent to at least two rapid thermal annealing RTA operations, performed before the thinning operation.

7. Process according to one of the above claims, characterised in that the thinning operation is a sacrificial oxidation operation.

8. Process according to one of the above claims, characterised in that the thermal budget of the treatment for development of weakening corresponds to 60% or more, and preferably to 80% or more, of the thermal budget leading to a purely thermal detachment.

9. Process according to the above claim, characterised in that the heat treatment for development of weakening is an isothermal annealing at 350°C for a duration of between two and three hours.

10. Process according to any one of the above claims, characterised in that the weakened zone (3) is created by implantation of species in the thickness of the donor substrate (1), the said implantation being applied by implantation of a single species or by co-implantation of at least two different species.

11. Process according to one of the above claims, characterised in that the thinning done during the sequence of finishing operations is designed such that the thickness of the thin layer (8) formed on the support substrate (7) is less than 1000 Angstroms, and particularly less than 500 Angstroms.

12. SeOI structure with a thin layer (8) made of a semi conducting material on a support substrate (7), an insulating layer being inserted between the thin layer and the substrate, the thickness of the thin layer being less than 1000 Angstroms, and particularly less than 500 Angstroms, characterised in that the density of HF defects in the thin layer is less than $0.3/cm^2$, and in particular is less than $0.2/cm^2$.

13. Structure according to the above claim, characterised in that the surface roughness of the thin layer as measured by scanning over a surface with an area

equal to 10*10 μm² is less than 5 Å RMS, over the entire surface.

14. Structure according to one of the above two claims, characterised in that the standard deviation of the thickness of the thin layer is less than 5 Å, over the entire surface.