

However, differences in temperature and in maturation within the material of the donor substrate and of the receiver substrate create a pattern of roughness on the exposed surface of the SeOI substrate obtained after detaching the donor substrate, and also limit control of detachment due to the energy released by the hot zones that have reached maturity. It is then necessary to use smoothing treatments, such as RTA (rapid thermal annealing), later on in order to decrease the high degree of roughness of the free surface of the structure after detachment, which results in higher production costs in addition to increasing the production time.

Thermal splitting also has several other drawbacks. In particular, when the donor substrate and/or the receiver substrate comprise electronic components, these components may be damaged when they are subjected to high temperatures, which substantially limits the fabrication of certain SeOI substrates.

BRIEF DESCRIPTION OF THE INVENTION

One object of the invention is to overcome the drawbacks described above.

The invention aims in particular to provide a process for fabricating a semiconductor-on-insulator substrate by transferring a layer from a donor substrate to a receiver substrate which allows the roughness of the exposed surface of the SeOI substrate obtained after detaching the donor substrate to be decreased.

Another object of the invention is to provide such a process allowing the constraints resulting from thermal splitting to be overcome, in particular to provide a more economical process that is compatible with the fabrication of a greater variety of SeOI substrates.

~~To this end, a~~An aspect of the present invention ~~seeks to provide~~s a process for fabricating a semiconductor-on-insulator structure, comprising the following steps:

- providing a donor substrate comprising a weakened zone delimiting a layer to be transferred;
- providing a receiver substrate;
- bonding the donor substrate to the receiver substrate, the layer to be transferred being located on ~~the a~~ bonding-interface side, by initiating a bonding wave at a first region on ~~the a~~ periphery of said interface and propagating said wave towards a second region on the periphery of said interface opposite the first region, ~~the a~~ propagation speed of the bonding wave ~~is being~~ lower in ~~the a~~ central portion of the interface than in ~~said a~~ peripheral portion of the interface;
- detaching the donor substrate along the weakened zone in order to transfer the layer to be transferred to the receiver substrate.

Said process being characterized in that the bonding is implemented in controlled conditions to increase ~~the speed a~~ difference ~~of in~~ propagation speed of said bonding wave between the peripheral portion and the central portion of the bonding interface.

According to ~~other aspects~~embodiments of the present invention, the proposed process has the following various features, which may be implemented alone or in technically feasible combinations thereof:

- the ~~difference~~ increase in the difference in propagation speed ~~of propagation~~ of the bonding wave is sufficient to form a gaseous inclusion in the second region on the periphery of the bonding interface;
- the detachment of the donor substrate is initiated at ~~the a~~ site of the gaseous inclusion;
- the controlled ~~bonding~~ conditions comprise the positioning of the donor substrate and/or the receiver substrate, prior to bonding, on a supporting surface of a holder, said supporting surface having a zone that is raised relative to the rest of the supporting surface, ~~the an~~ exposed surface of the donor substrate and/or of the receiver substrate that is intended to form the bonding interface being at least partially shaped to match the supporting surface of the holder so as to have a zone that is raised relative to the rest of the exposed surface;
- the raised zone of the exposed surface of the donor substrate and/or of the receiver substrate is raised relative to the rest of the exposed surface by 15 μm to 150 μm ;
- the controlled ~~bonding~~ conditions comprise the selective application of a plasma to ~~the an~~ exposed surface of the donor substrate and/or of the receiver substrate that is intended to form the bonding interface, ~~the an~~ amount of plasma applied to the peripheral portion of said exposed surface being larger than that applied to the central portion of said exposed surface;
- the weakened zone is formed by implanting atomic species into the donor substrate.

DESCRIPTION OF THE FIGURES

Other advantages and features of the invention will become apparent upon reading the following description given by way of illustrative and non-limiting example, with reference to the following appended figures:

[Fig. 1] schematically shows a view from above that illustrates the propagation of a bonding wave at the bonding interface;

[Fig. 2] is a haze graph obtained by means of laser diffraction at the surface of two semiconductor structures obtained after detachment and thermal smoothing by thermal annealing;

[Fig. 3A] is a view from above of a donor or receiver substrate illustrating the location of a gas inclusion;

[Fig. 3B] shows four substrates from above, with four gaseous inclusions at the bonding interface;

[Fig. 4] is a close-up view of a gas inclusion illustrating its dimensions;

[Fig. 5] is a photographic view from above of a holder, or "chuck";

[Fig. 6] is a diagram of the holder of Fig. 5;

CLAIMS

1. Process for fabricating a semiconductor-on-insulator structure, comprising the following steps:
 - 5 - providing a donor substrate comprising a weakened zone delimiting a layer to be transferred;
 - providing a receiver substrate;
 - bonding the donor substrate to the receiver substrate, the layer to be transferred being located on ~~the a~~ bonding- interface side, by initiating a
 - 10 bonding wave at a first region on ~~the a~~ periphery of said interface and propagating said wave towards a second region on the periphery of said interface opposite the first region, ~~the a~~ propagation speed of the bonding wave is-being lower in ~~the a~~ central portion of the interface than in ~~said a~~ peripheral portion of the interface;
 - 15 - detaching the donor substrate along the weakened zone in order to transfer the layer to be transferred to the receiver substrate, said process being characterized in that the bonding is implemented in controlled conditions to increase ~~the a speed~~ difference ~~of in~~ propagation speed of said bonding wave between the peripheral portion and the central
 - 20 portion of the bonding interface.
2. The Process according to Claim 1, wherein said ~~difference~~ increase in the difference in propagation speed ~~of propagation~~ of the bonding wave is sufficient to form a gaseous inclusion in the second region on the periphery of
 - 25 the bonding interface.
3. The Process according to Claim 2, wherein the detachment of the donor substrate is initiated at ~~the a~~ site of the gaseous inclusion.
4. The Process according to any one of the preceding claims, wherein the controlled ~~bonding~~ conditions comprise the positioning of the donor substrate and/or the receiver substrate-, prior to bonding, on a supporting surface of a holder-, said supporting surface having a zone that is raised relative to the rest of the supporting surface, ~~the an~~ exposed surface of the donor substrate and/or of the receiver substrate that is intended to form the bonding interface
 - 30 being at least partially shaped to match the supporting surface of the holder so as to have a zone that is raised relative to the rest of the exposed surface.
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5. The Process according to Claim 4, wherein the raised zone of the exposed surface of the donor substrate and/or of the receiver substrate is raised relative to the rest of the exposed surface by 15 μm to 150 μm .
- 5 6. The Process according to any one of ~~the preceding~~ claims 1 to 3, wherein the controlled ~~bonding~~ conditions comprise the selective application of a plasma to ~~the~~ an exposed surface of the donor substrate and/or of the receiver substrate that is intended to form the bonding interface, ~~the~~ an amount of plasma applied to the peripheral portion of said exposed surface being larger
- 10 than that applied to the central portion of said exposed surface.
7. The Process according to any one of the preceding claims, wherein the weakened zone is formed by implanting atomic species into the donor substrate.