

PROCESS FOR MANUFACTURING A COMPOSITE STRUCTURE

FIELD OF THE INVENTION

The present invention relates to a method for
5 manufacturing a composite structure. The invention also
relates to a composite structure.

BACKGROUND OF THE INVENTION

A method, illustrated in figure 1, for
10 manufacturing a composite structure comprising, from
its rear face to its front face, a supporting substrate
1, a covering layer 2, at least one dielectric layer 3
and a useful layer 4, and known from the prior art (see
for example the document EP 1780794), comprises the
15 following steps:

a) providing a donor substrate 5 and the
supporting substrate 1;

b) forming at least the dielectric layer 3
comprising:

20 - a first surface in contact with the donor
substrate 5,

- a second surface opposite to the first surface,

- a peripheral surface connecting the first and
second surfaces together;

25 the dielectric layer 3 has a contour Cz;

c) forming the covering layer 2 arranged so as to
cover the second surface of the dielectric layer 3;

d) forming a weakened zone 6 in the donor
substrate 5 delimiting the useful layer 4 in contact
30 with the first surface of the dielectric layer 3;

e) assembling the supporting substrate 1 and the donor substrate 5, so that the supporting substrate 1 and the covering layer 2 are in contact along a contact surface 7 having a contour Cs;

5 f) breaking the donor substrate 5 along the weakened zone 6.

Hereinafter, the assembly formed by the useful layer 4, the dielectric layer 3 and the covering layer 2 will be designated by the term stack of layers 8.

10 At the end of step f), the stack of layers is transferred onto the supporting substrate 1 in order to form the composite structure.

As illustrated in Figure 2, the composite structure has a peripheral ring 9.

15 This peripheral ring 9 is situated in a peripheral zone of the supporting substrate 1, and in which, in the absence of sufficient adhesion between the supporting substrate 1 and the donor substrate 5, the transfer of the stack of layers 8 does not take
20 place.

Thus a step is observed at the limit separating the peripheral ring from the stack of transferred layers.

Moreover, the flanks of the covering layer 2 and
25 dielectric layer 3 are exposed at the step and therefore not protected from any chemical attacks.

Consequently the chemical attack may generate particles via delamination of the useful layer 4.

When only the dielectric layer 3 or the covering
30 layer 2 is formed, for example the dielectric layer 3,

this step is also observed. A creep of the useful layer 4 is generally executed so as to cover or encapsulate the dielectric layer 3 at the step.

5 However, the applicant has found that, when there is a covering layer 2 and at least one dielectric layer 3, the step of breaking at the edge of the substrate is atypical. Figure 3 thus shows the steps obtained on such a substrate after the breaking step f).

10 When there are several intermediate layers present, the breaking step does not lead to a single step but on the contrary to several steps. It appears in fact that the break propagates at the periphery of the substrate, not along the weakened zone but at the interface between the dielectric layer 3 and the
15 covering layer 2.

The main drawback of this manufacturing method is therefore that it leads to an atypical break at the edge of the substrate.

20 This is in particular the case when the composite structure comprises, from its rear face towards its front face, a silicon substrate, a silicon dioxide layer, a silicon nitride layer, a silicon dioxide layer and a silicon layer.

25 Moreover, the presence of several steps makes it impossible for the creep to take place by heat treatment of the useful layer 4 so as to protect the covering layer 2 and the dielectric layer 3 at the step.

This is because, during heat treatment, dewetting of the useful layer 4 rather than creep is observed.

5 Embodiments of the invention seek to provide a method for manufacturing a composite substrate that makes it possible to execute a step of creep of the useful layer 4 so as to cover the exposed surface of the covering layer 2 and of the dielectric layer 3 at the step.

10

BRIEF DESCRIPTION OF THE INVENTION

An aspect of the present invention provides a method for manufacturing a composite structure comprising, from its rear face towards its front face, 15 a supporting substrate, a covering layer, at least one dielectric layer and a useful layer, said method comprising the following steps:

a) providing a donor substrate and the supporting substrate;

20 b) forming the dielectric layer such that the dielectric layer has a contour contained within a peripheral surface of the donor substrate, the dielectric layer comprising:

- a first surface in contact with the donor substrate, 25

- a second surface opposite to the first surface,

- a peripheral surface connecting the first and second surfaces together;

30 c) forming the covering layer after forming the dielectric layer, the covering layer arranged so as to cover the second surface and the peripheral surface of the dielectric layer;

d) forming a weakened zone in the donor substrate delimiting the useful layer in contact with the first surface of the dielectric layer;

5 e) assembling the supporting substrate and the donor substrate such that the supporting substrate and the covering layer are in contact along a contact surface having a contour, and such that the contour of the dielectric layer fits within the contour of the contact surface; and

10 f) breaking the donor substrate along the weakened zone;

Thus, after the transfer step f), the stack of layers is transferred onto the supporting substrate.

15 The stack of transferred layers comprises a central portion and a peripheral portion.

The central portion of the stack comprises the useful layer, the dielectric layer and the covering layer.

20 The peripheral portion comprises only the useful layer and the covering layer.

It is then observed that a simple step is obtained. The peripheral portion corresponds to the transfer of a stack comprising a single intermediate layer.

25 Thus the fracture step leads to a single step at the peripheral ring.

Consequently the composite structure obtained allows creep of a useful layer, by executing a heat treatment for example, so as to encapsulate the covering layer, in particular at the single step.

5 According to one embodiment, the supporting substrate comprises:

- a top surface onto which the covering layer, the dielectric layer and the useful layer are transferred;

10 - a bottom surface opposite to the top surface;
 - a peripheral zone connecting the bottom surface and the top surface;

 the contour of the contact surface and the peripheral zone of the supporting substrate delimit an essentially annular surface of width L_c and steps b) and e) are executed so that the contour of the dielectric layer and the peripheral zone of the supporting substrate delimit an essentially annular surface with a width of between 105% and 150%,
15 preferably between 110% and 140%, even more preferentially between 115% and 130%, of the width L .
20

 According to one embodiment, the dielectric layer is formed in two steps b1) and b2):

25 b1) deposition of a layer of dielectric material on the donor substrate;

 b2) partial removal of the layer of dielectric material so that the residual layer of dielectric material forms the dielectric layer.

According to one embodiment, the dielectric layer comprises silicon nitride, to a thickness of between 10 and 80 nm.

5 According to one embodiment, the covering layer comprises silicon dioxide, to a thickness greater than 80 nm.

According to one embodiment, the donor substrate comprises at least one of the following materials: silicon, germanium, silicon germanium alloy.

10 According to one embodiment, step f) is followed by a heat treatment step intended to encapsulate the covering layer and the dielectric layer with the useful layer.

15 According to one embodiment, the donor substrate comprises an additional layer, the additional layer being in contact with the dielectric layer, the additional layer having the same chemical composition as the covering layer.

20 According to one embodiment, the donor substrate comprises silicon, the additional layer comprises silicon dioxide, the dielectric layer comprises silicon nitride and the covering layer comprises silicon dioxide.

25 The invention also relates to a composite structure comprising, from its rear face to its front face, a supporting substrate, a covering layer, at least one dielectric layer and a useful layer, the dielectric layer having:

30 - a first surface in contact with the useful layer;

- a second surface in contact with the covering layer;

- a peripheral surface connecting the first surface and the second surface, said composite structure being remarkable in that the covering layer covers in its entirety the peripheral surface of the dielectric layer, so that the useful layer and the covering layer encapsulate the dielectric layer.

The transferred stack of layers comprises a central portion and a peripheral portion.

The central portion of the stack comprises the useful layer, the dielectric layer and the covering layer.

The peripheral portion comprises only the useful layer and the covering layer.

Thus a simple step is observed and the peripheral portion corresponds to a stack comprising a single intermediate layer.

Consequently the composite structure obtained allows creep of the useful layer, by execution of a heat treatment for example, so as to encapsulate the covering layer at the single step.

According to one embodiment, the useful layer comprises at least one of the following materials: silicon, germanium, silicon germanium alloy.

According to one embodiment, the useful layer comprises a monocrystalline material.

According to one embodiment, the covering layer comprises silicon dioxide.

According to one embodiment, the dielectric layer comprises silicon nitride.

According to one embodiment, the covering layer has:

- 5 - a first surface in contact with the supporting substrate,
- a second surface in contact with the dielectric layer,
- a peripheral surface connecting the first and
- 10 second surfaces of the covering layer,
- the useful layer covering the peripheral surface of the covering layer.

According to one embodiment, the additional layer is interposed between the useful layer and the

15 dielectric layer, the additional layer having the same chemical composition as the covering layer.

According to one embodiment, the useful layer comprises monocrystalline silicon, the additional layer comprises thermal silicon dioxide, the dielectric layer

20 comprises silicon nitride, and the covering layer comprises silicon dioxide.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages will emerge from

25 the following description of embodiments of a manufacturing method according to the invention, given by way of non-limitative examples with reference to the accompanying drawings, in which:

- Figure 1 is a schematic representation of a manufacturing method according to the techniques known from the prior art;

5 - Figure 2 is a view of the front face of a composite structure obtained by a manufacturing method according to the known techniques of the prior art;

- Figure 3 is a view in cross section of a substrate used in the manufacturing method according to the known techniques of the prior art;

10 - Figures 4a and 4b are a schematic representation of a first embodiment of the invention;

- Figure 5 is a view in transverse section of a composite structure that has been obtained by a manufacturing method according to the invention and has
15 undergone an encapsulation treatment;

- Figures 6a and 6b are a schematic representation of a second embodiment of the invention.

20 DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

For the various embodiments, the same references will be used for identical elements or ones fulfilling the same function, for reasons of simplification of the description.

25 The method illustrated in Figures 4a and 4b is a method for manufacturing a composite structure comprising, from its rear face to its front face, a supporting substrate 10, a covering layer 20, at least one dielectric layer 30 and a useful layer 40, said
30 method comprising the following steps:

a) providing a donor substrate 50 and the supporting substrate 10;

b) forming at least the dielectric layer 30 comprising:

5 - a first surface in contact with the donor substrate,

 - a second surface opposite to the first surface,

 - a peripheral surface connecting the first and second surfaces together;

10 the dielectric layer 30 has a contour Cz;

c) forming the covering layer 20 arranged to cover the second surface of the dielectric layer 30;

d) forming a weakened zone 60 in the donor substrate 50 delimiting the useful layer 40 in contact
15 with the first surface of the dielectric layer 30;

e) assembling the supporting substrate 10 and the donor substrate 50, so that the supporting substrate 10 and the covering layer 20 are in contact along a contact surface 70 having a contour Cs;

20 f) breaking the donor substrate 50 along the weakened zone 60.

Steps b) and e) are executed so that the contour Cz of the dielectric layer 30 fits within the contour Cs of the contact surface 70, and step c) is executed
25 so that the covering layer 20 covers the peripheral surface of the dielectric layer 30.

Prior to the implementation of the manufacturing method according to the invention, a step for determining the contour Cs of the contact surface can
30 be executed.

This determination step is particularly advantageous when it is a question of implementing the method for manufacturing a plurality of composite structures.

5 This is because, in the context of the manufacture of a plurality of composite structures, a plurality of donor substrates 50 and a plurality of supporting substrates 10 are chosen so that the contour Cs of the contact surface is substantially equivalent
10 (or even identical) from one composite structure to another.

 The donor substrates 50 in the plurality of donor substrates 50 are then chosen so as to have substantially equivalent or even equal geometric
15 characteristics.

 The supporting substrates 10 of the plurality of supporting substrates 10 are then chosen so as to have substantially equivalent or even equal geometric characteristics.

20 Geometric characteristics of a substrate means, non-limitatively, its thickness at any point on its surface, its variation in thickness and its shape.

 Thus it suffices to determine the contour Cs for manufacturing a structure and to apply the result to
25 the manufacture of a plurality of composite structures.

 The determination of the contour Cs may comprise the following steps:

 - assembling a supporting substrate 10 and a donor substrate 50;

- use of a scanning acoustic microscope in order to obtain an image of the contour Cs of the contact surface 70.

5 Another solution would be, in implementing the method for manufacturing a composite structure, to omit the formation of the dielectric layer 30 and to measure, at all points on the edge of the supporting substrate, the width of the peripheral ring.

10 The appearance of the peripheral ring on the composite structure is delimited by the edge of the supporting substrate and the contour Cs of the contact surface 70. Determination of the contact Cs is then direct.

15 For example, the applicant has found that the manufacture of a composite structure comprising a covering layer 20 leads to the formation of a peripheral ring with a width of 0.8 mm.

Particularly advantageously, the supporting substrate (10) comprises:

- 20 - a top surface onto which the covering layer (20), the dielectric layer (30) and the useful layer (40) are transferred;
- a bottom surface opposite to the top surface;
 - a peripheral zone connecting the bottom surface
- 25 and the top surface;

the contour (Cs) of the contact surface (70) and the peripheral zone of the supporting substrate (10) delimiting an essentially annular surface of width L, and steps b) and e) are executed so that the contour

30 (Cz) of the dielectric layer (30) and the peripheral

zone of the supporting substrate (10) delimit an essentially annular surface with a width of between 105% and 150%, preferably between 110% and 140%, even more preferentially between 115% and 130%, of the width L.

Thus, in the context of a method for manufacturing a plurality of composite structures, the plurality of donor substrates 50 and the plurality of supporting substrates 10 may have a certain dispersion of their geometrical characteristics.

The donor substrate 10 provided at step a) may comprise one of the materials chosen from: silicon, silicon germanium, germanium.

The supporting substrate 30 provided at step a) may consist of all the materials normally used in the microelectronic, optical, optoelectronic and photovoltaic industries.

In particular, the supporting substrate 10 comprises at least one of the materials selected from the following group: silicon, silicon carbide, silicon germanium, glass, a ceramic or a metal alloy.

At least one dielectric layer 30 is formed on the donor substrate.

A covering layer 20 is formed so as to cover the dielectric layer 30.

The formation of the covering layer 20 and of the dielectric layer 30 will be detailed below during the description of various embodiments.

Next, a step d) of forming a weakened zone 60 in the donor substrate 50 is executed.

The weakened zone 60 delimits, in the donor substrate 50, a useful layer 40, the useful layer being in contact with the dielectric layer 30.

5 The useful layer 40 is intended to be transferred onto the supporting substrate 10.

The weakened zone 60 may be created by the implantation of atomic species in the donor substrate 50.

10 Atomic species means atomic, molecular or ionic species.

The species introduced may comprise at least one of the following species: hydrogen, helium.

15 The hydrogen may be introduced with an energy of between 10 and 210 keV and a dose of between 7×10^{15} and 1×10^{17} at/cm².

The assembly step e) may be a molecular bonding step.

20 The breaking step f) may advantageously be a thermal annealing executed at a temperature of between 300° and 600°C.

At the end of step f), the composite structure is obtained.

25 The composite structure comprises, from its front face to its rear face, the useful layer 40, the dielectric layer 30, the covering layer 20 and the supporting substrate 10.

First embodiment

30 The first embodiment is illustrated in Figures 4a and 4b.

Formation of the dielectric layer 30

The dielectric layer 30 may be formed in two steps:

5 b1) formation of a layer of dielectric material of the donor substrate 10;

 b2) partial removal of the layer of dielectric material so that the residual layer of dielectric material forms the dielectric layer 20.

10 Step b1) may be a technique of vapour deposition, low-pressure vapour deposition or plasma-assisted vapour deposition on the donor substrate 50. It may also be a heat treatment technique in a chosen atmosphere (nitriding, oxidation, etc.).

15 The thickness of the layer of dielectric material may be between 10 nm and 80 nm, for example 50 nm.

 Step b1) is then followed by a step b2), which comprises a partial removal of the layer of dielectric material. The partial removal is executed so that the
20 remaining or residual portion of the layer of dielectric material constitutes the dielectric layer 30.

 In other words, the partial removal of the layer of dielectric material is executed on a peripheral
25 surface of the donor substrate 50 delimited by the edge of the donor substrate 50 and the contour Cz.

 Thus the residual portion of the layer of dielectric material forms the dielectric layer 30.

 The peripheral surface of the donor substrate 50
30 may have the form of an annular surface.

Step b2) may advantageously be executed by a chemical etching solution.

Particularly advantageously, a plurality of dielectric layers 30 may be formed successively.

5 For example, one dielectric layer 30 comprising silicon nitride and another dielectric layer 30 comprising silicon dioxide.

10 In the case of a dielectric layer 30 comprising silicon nitride (Si_3N_4), the chemical etching solution may be a solution of phosphoric acid (H_3PO_4) heated to a temperature greater than 50°C .

15 The chemical etching solution may be distributed by a nozzle on the edge of the donor substrate 50 in rotation, so as to etch the dielectric layer 30 only on the peripheral surface of the donor substrate 50 delimited by the edge of the donor substrate 10 and the contour Cz.

Formation of the covering layer 20

20 The covering layer 20 may be formed by a vapour deposition, low-pressure vapour deposition or plasma-assisted vapour deposition technique.

25 The covering layer covers the second surface and the peripheral surface of the dielectric layer 30 in their entirety.

 The covering layer 20 may comprise a material, different from the materials of the dielectric layer 30, selected from the following materials: silicon oxide, silicon nitride or oxynitride, aluminium

nitride, aluminium oxide, polycrystalline silicon and amorphous silicon.

Particularly advantageously, the covering layer 20 comprises silicon oxide and its thickness is greater than 80 nm, for example 100 nm.

At the end of step f), the composite structure is obtained.

The composite structure comprises, from its rear face to its front face, a supporting substrate 10, a covering layer 20, at least one dielectric layer 30 and a useful layer 40, the dielectric layer 30 having:

- a first surface in contact with the useful layer 40;
- a second surface in contact with the covering layer 20;
- a peripheral surface connecting the first surface and the second surface,

the covering layer 20 covers in its entirety the peripheral surface of the dielectric layer 30, so that the useful layer 40 and the covering layer 30 encapsulate the dielectric layer 30.

Thus, after the transfer step, the dielectric layer 30 of contour Cz is situated vertically in line with a central surface 80, of contour Cp, of the supporting substrate 10.

Thus the surface delimited by the contour Cs of the contact surface 70 and the contour Cp of the central surface 80 is opposite a stack of layers comprising only the useful layer 40 and the covering layer 20.

Moreover, the central surface 80 of the supporting substrate 10 is facing a stack of layers comprising the useful layer 40, the dielectric layer 30 and the covering layer 20.

5 Thus a single step is observed at the edge of the substrate.

Consequently the observation of a single step makes it possible to encapsulate the covering layer 20 and the dielectric layer 30 with the useful layer 40.
10 The encapsulation is executed by a heat treatment, without observing any dewetting of the useful layer 40 as illustrated in Figure 5.

In this regard, a person skilled in the art will find a technical description of encapsulation of an
15 insulation layer by the useful layer 40 in the published application FR 2852143 A1 (E. NEYRET) 11 September 2005 (11.10.2005) page 10 lines 3-28.

In a particular configuration of this first embodiment, the covering layer 20 is made from
20 polycrystalline silicon or amorphous silicon, and its thickness is between a few nm and a few thousands of nm, such as for example 2000 nm. The dielectric layer 30 is made from silicon oxide, and the useful layer 40 is made from silicon. Thus a composite silicon on
25 insulator structure having a buried layer of polycrystalline silicon or amorphous silicon under the insulating layer is formed. This type of composite structure is particularly suitable for manufacturing semiconductor devices finding applications in the
30 radio-frequency field.

Second embodiment

The second embodiment, illustrated in Figures 6a and 6b, differs from the first embodiment in that the donor substrate 50 comprises an additional layer 90, the additional layer 90 being in contact with the dielectric layer 30, the additional layer 90 having the same chemical composition as the covering layer 20.

For example, the additional layer 90 and the covering layer 20 comprise silicon oxide.

The additional layer 90 is formed directly on the donor substrate 50, before the dielectric layer 30.

The additional layer 90 may comprise a material, different from the materials of the dielectric layer 30, selected from the following materials: silicon oxide, silicon nitride or oxynitride, aluminium nitride, aluminium oxide, polycrystalline silicon and amorphous silicon.

Advantageously, the additional layer 90 is made from silicon oxide and its thickness is between 2 and 20 nm, for example 7 nm.

When the donor substrate 50 is made from silicon, the additional layer 90 of silicon oxide may be obtained by thermal oxidation of this donor substrate, and therefore form an additional layer 90 of thermal silicon dioxide.

At the end of step f), the composite structure is obtained.

The composite structure comprises, from its front face to its rear face, a useful layer 40, an additional

layer 90, a dielectric layer 30, a covering layer 20 and a supporting substrate 10.

Thus, after the transfer step, the dielectric layer 30 of contour Cz is situated vertically in line
5 with a central surface 80 of contour Cp of the supporting substrate 10.

Thus the surface delimited by the contour Cs of the contact surface 70 and the contour Cp of the central surface 80 is opposite a stack of layers
10 comprising only the useful layer 40, the additional layer 90 and the covering layer 20.

Moreover, the central surface 80 of the supporting substrate 10 is opposite a stack of layers comprising the useful layer 40, the dielectric layer 30
15 and the covering layer 20.

The covering layer 20 and the additional layer 90 having the same chemical composition, their stack is then associated with a single layer of dielectric material.

20 Thus a single step is observed at the edge of the substrate.

Consequently the observation of a single step makes it possible to encapsulate the covering layer 20, the dielectric layer 30 and the additional layer 90
25 with the useful layer 40. The encapsulation is executed by heat treatment, without observing any dewetting of the useful layer 40.

The additional layer 90 advantageously comprises silicon dioxide. Thus a composite structure commonly

referred to as SOI ONO (silicon on silicon dioxide, on silicon nitride and on silicon dioxide) is formed.

Thus the invention is advantageously implemented for producing composite SOI ONO substrates or for
5 producing SOI substrates for radio-frequency applications.

1. A method for manufacturing a composite structure comprising, from its rear face toward its front face, a supporting substrate, a covering layer, at least one dielectric layer and a useful layer, the method comprising the following steps:

- a) providing a donor substrate and the supporting substrate;
- b) forming the dielectric layer such that the dielectric layer has a contour contained within a peripheral surface of the donor substrate, the dielectric layer comprising:
 - a first surface in contact with the donor substrate,
 - a second surface opposite to the first surface,
 - a peripheral surface connecting the first and second surfaces together;
- c) forming the covering layer after forming the dielectric layer, the covering layer arranged so as to cover the second surface and the peripheral surface of the dielectric layer;
- d) forming a weakened zone in the donor substrate delimiting the useful layer in contact with the first surface of the dielectric layer;
- e) assembling the supporting substrate and the donor substrate such that the supporting substrate and the covering layer are in contact along a contact surface having a contour, and such that the contour of the dielectric layer fits within the contour of the contact surface; and
- f) breaking the donor substrate along the weakened zone.

2. The manufacturing method of claim 1, wherein the supporting substrate comprises:

- a top surface onto which the covering layer, the dielectric layer and the useful layer are transferred;
- a bottom surface opposite to the top surface;
- a peripheral zone connecting the bottom surface and the top surface; and

wherein the contour of the contact surface and the peripheral zone of the supporting substrate delimit an essentially annular surface of width L_1 , and steps b) and e) are executed such that the contour of the dielectric layer and the peripheral zone of the supporting substrate delimit an

essentially annular surface with a width L_2 of between 105% and 150% of the width L_1 .

3. The manufacturing method of claim 1, wherein forming the dielectric layer comprises the following steps:

- b1) forming a layer of dielectric material on the donor substrate; and
- b2) partially removing the layer of dielectric material such that the residual layer of dielectric material forms the dielectric layer and the contour of the dielectric layer is contained within the peripheral surface of the donor substrate.

4. The manufacturing method of claim 1, wherein the dielectric layer comprises silicon nitride and has a thickness of between 10 nm and 80 nm, and wherein the covering layer comprises silicon dioxide and has a thickness greater than 80 nm.

5. The manufacturing method of claim 1, wherein the dielectric layer comprises silicon oxide, and wherein the covering layer comprises polycrystalline silicon or amorphous silicon.

6. The manufacturing method of claim 1, wherein the donor substrate comprises at least one of the following materials: silicon, germanium, and silicon germanium alloy.

7. The manufacturing method of claim 1, wherein step f) is followed by a heat treatment step for encapsulating the covering layer and the dielectric layer with the useful layer.

8. The manufacturing method of claim 1, wherein the donor substrate comprises an additional layer, the additional layer being in contact with the dielectric layer, the additional layer having the same chemical composition as the covering layer.

9. The manufacturing method of claim 8, wherein the donor substrate comprises silicon, the additional layer comprises silicon dioxide, the dielectric layer comprises silicon nitride, and the covering layer comprises silicon dioxide.

10. The manufacturing method of claim 2, wherein the contour of the dielectric layer and the peripheral zone of the supporting substrate delimit an essentially annular surface with a width L_2 of between 110% and 140% of the width L_1 .

11. The manufacturing method of claim 10, wherein the contour of the dielectric layer and the peripheral zone of the supporting substrate delimit an essentially annular surface with a width L_2 of between 115% and 130% of the width L_1 .

12. The manufacturing method of claim 2, wherein forming at least the dielectric layer comprises the following steps:

- b1) forming a layer of dielectric material on the donor substrate; and
- b2) partially removing the layer of dielectric material such that the residual layer of dielectric material forms the dielectric layer and the contour of the dielectric layer is contained within the peripheral surface of the donor substrate.