

BRIEF DESCRIPTION OF THE INVENTION

An aspect of the present invention provides a method for transferring a thin film made of a first material onto a support substrate made of a second material, the first and the second material having different coefficients of thermal expansion, the method being characterized in that it comprises:

a. supplying a donor substrate obtained by bonding a thick layer, formed of the first material, and a handling substrate, the difference in coefficient of thermal expansion of the material forming the handling substrate and that of the support substrate being less, in absolute value, than the difference in thermal expansion of the thick layer and that of the support substrate, and the donor substrate having a main face on the thick layer;

b. introducing light species into the thick layer to generate therein a plane of embrittlement and to define the thin layer between the plane of embrittlement and the main face of the donor substrate;

c. joining the main face of the donor substrate with a face of the support substrate;

d. detaching the thin layer at the embrittlement plane, the detachment including application of a heat treatment.

The assembly formed from the donor substrate and the support may be exposed to a much higher temperature than that applied in the context of a "direct" approach in accordance with the prior art, according to which the donor substrate does not include any handling substrate, without risk of uncontrolled fracture of one of the substrates or peeling of the donor substrate or of the thin layer. The balanced structure, in terms of coefficient of thermal expansion of this assembly, notably makes it possible to facilitate the step of detachment of the thin layer by exposing the assembly to a relatively high temperature.

According to embodiments of the invention, taken alone or in any technically feasible combination:

- 5 - the coefficient of thermal expansion of the first material constituting the thick layer and that of the second material constituting the support substrate differ by at least 10% at room temperature;
- the light species implanted are hydrogen ions and/or helium ions;
- 10 - the first material is a ferroelectric material such as LiTaO₃, LiNbO₃, LiAlO₃, BaTiO₃, PbZrTiO₃, KNbO₃, BaZrO₃, CaTiO₃, PbTiO₃ or KTaO₃;
- the material of the support substrate is silicon;
- the handling substrate is of the same nature as the support substrate;
- 15 - the handling substrate has a thickness equivalent to that of the support substrate;
- the thick layer has a thickness of between 10 and 400 micrometres to enable sampling of one or more thin layers;
- 20 - the bonding is obtained by molecular adhesion;
- a step of thinning the source substrate is included to provide the thick layer;
- the thinning step is performed by milling and/or
- 25 mechanochemical polishing and/or etching.

CLAIMS

1. Method for transferring a thin film made of a first
5 material onto a support substrate made of a second
material, the first and the second material having
different coefficients of thermal expansion, the method
being characterized in that it comprises:
 - 10 a. supplying a donor substrate obtained by bonding a
thick layer, formed of the first material, and a
handling substrate, the difference in coefficient
of thermal expansion of the material forming the
handling substrate and that of the support
15 substrate being less, in absolute value, than the
difference in thermal expansion of the thick layer
and that of the support substrate, and the donor
substrate having a main face on the thick layer;
 - 20 b. introducing light species into the thick layer to
generate therein a plane of embrittlement and to
define the thin layer between the plane of
embrittlement and the main face of the donor
substrate;
 - 25 c. joining the main face of the donor substrate with a
face of the support substrate;
 - d. detaching the thin layer at the embrittlement
plane, the detachment including application of a
heat treatment.
2. Method according to the preceding claim, wherein the
30 coefficient of thermal expansion of the first material
forming the thick layer and that of the second material
forming the support substrate are different by at least
10% at room temperature.
- 35 3. Method according to either of the preceding claims,
wherein the implanted light species are hydrogen ions
and/or helium ions.

4. Method according to any of the preceding claims, wherein the first material is a ferroelectric material such as LiTaO_3 , LiNbO_3 , LiAlO_3 , BaTiO_3 , PbZrTiO_3 , KNbO_3 , BaZrO_3 , CaTiO_3 , PbTiO_3 or KTaO_3 .
5. Method according to any of the preceding claims, wherein the material of the support substrate is silicon.
6. Method according to any of the preceding claims, wherein the handling substrate is of the same kind as the support substrate.
7. Method according to any of the preceding claims, wherein the handling substrate has a thickness equivalent to that of the support substrate.
8. Method according to any of the preceding claims, wherein the thick layer has a thickness of between 10 and 400 micrometers to allow the removal of one or more thin layers.
9. Method according to any of the preceding claims, wherein the bonding is obtained by molecular adhesion.
10. Method according to any of the preceding claims, including a step of thinning a source substrate to provide the thick layer.
11. Method according to the preceding claim, wherein the thinning step is carried out by grinding and/or mechanical-chemical polishing and/or etching.