CLAIMS

1. A method of transferring a layer (1), composed in particular of a semi-conductor, insulating or metallic material, the method comprising the steps of:

a) providing a layer (1) joined to an initial substrate (4) with a binding energy E0 between the layer (1) and the initial substrate (4);

b) bonding a front face (8) of the layer (1) on an intermediate substrate (5) according to an intermediate bonding energy Ei;

c) detaching the initial substrate (4) from the layer (1) to expose a rear face (9) of the layer (1);

e) bonding a rear face (9) onto a final substrate (11) according to a final bonding energy Ef, and

f) debonding the intermediate substrate (5) from the layer (1) to transfer the layer (1) onto the final substrate (11);

step b) comprising a step of forming siloxane bonds Si-O-Si, step c) being carried out in a first anhydrous atmosphere and step f) being carried out in a second wet atmosphere such that the intermediate bonding energy Ei takes a first value Ei1 in step c) and a second value Ei2 in step f), with $Ei1 > E0$ and $Ei2 < Ef$.

2. The method of transferring a layer (1) according to claim 1, characterized in that step b) comprises a step of carrying out a direct hydrophilic bonding.

3. The method of transferring a layer (1) according to claim 1, characterized in that step b) comprises a step of carrying out an anodic bonding.

4. The method of transferring a layer (1) according to any one of claims 1 to 3, characterized in that the method comprises a step of forming a silicon layer or an oxide layer selected from among native SiO_2, thermal SiO_2, deposited SiO_2, SiOx and SixOyNz, respectively on the front face (8) of the layer (1) and on the intermediate substrate (5) and in that step b) comprises a step of contacting the

formed layers with each other such as to obtain the formation of siloxane bonds Si-O-Si.

5. The method of transferring a layer (1) according to any one of claims 1 to 4, characterized in that the first anhydrous atmosphere has a water vapor content lower than 1 ppm.

6. The method of transferring a layer (1) according to any one of claims 1 to 5, characterized in that the second wet atmosphere has a humidity content ranging between 20% and 80%.

7. The method of transferring a layer (1) according to any one of claims 1 to 6, characterized in that the detachment of step c) and/or the debonding of step f) comprises the simultaneous application of a mechanical stress, such as the use of jaws, the application of a blade or a wedge respectively, between the layer (1) and the initial substrate (4), and between the intermediate substrate (5) and layer (1).

8. The method of transferring a layer (1) according to any one of claims 1 to 7, characterized in that it comprises a technological step d) which is carried out between steps c) and e), and which is applied to the rear face (9) of the layer (1), the thermal budget of the technological step having a value lower than a threshold value beyond which Ei2 > Ef.

9. The method of transferring a layer (1) according to any one of claims 1 to 8, characterized in that step e) comprises a bonding step carried out via an adhesive film (3) such as a DiVinylSiloxane-bis-BenzoCycloButene (DVS-bis-BCB), polyimide or a photosensitive polymer film.

10. The method of transferring a layer (1) according to any one of claims 1 to 8, characterized in that step e) comprises a molecular adhesion bonding step such that the final bonding energy has a value Ef independent from the humidity rate of the second atmosphere.

11. The method of transferring a layer (1) according to any one of claims 1 to 10, characterized in that the binding energy E0 between the layer (1) and the initial substrate (4) is obtained by forming a porous layer (15) on which the layer (1) is deposited.

12. The method of transferring a layer (1) according to any one of claims 1 to 11, characterized in that the layer (1) comprises a monocrystalline silicon material and the intermediate substrate (5) comprises a silicon material.

13. The method of transferring a layer (1) according to any one of claims 1 to 11, characterized in that the layer (1) comprises a material selected from among a material composed of silicon and germanium, a material of elements of the group II-VI and a binary, ternary or quaternary material of elements from the group III-V.

14. The method of transferring a layer (1) according to any one of claims 1 to 13, characterized in that the material of the initial substrate (4) and the material of the final substrate (11) comprise a material selected from among sapphire, silicon, germanium, silica, glass, quartz, a material of elements from the group II-VI, a binary, ternary or quaternary material of elements from the group III-V such as AsGa, InP or GaN, a metal, a metal alloy and a polymer, for example a polyimide such as Kapton®.

15. An intermediate structure (13) formed of a stack comprising

- a final substrate (11) in a polymer material ,

- a DiVinylSiloxane-bis-BenzoCycloButene (DVS-bis-BCB)-based adhesive film (3),

- a monocrystalline silicon layer (1), and

- an intermediate substrate (5) in silicon bonded to a front face (8) of the layer (1) by siloxane bonds Si-O-Si.

16. The intermediate structure (13) according to claim 15, characterized in that the final bonding energy Ef between a rear face (9) of the layer (1) and the final substrate (11) is higher than the intermediate bonding energy Ei2 between the front face (8) of the layer (1) and the intermediate substrate (5) in an atmosphere having a humidity content ranging between 20 and 80%.

17. A final structure (14) comprising a

- final substrate (11) in a polymer material,

- a DiVinylSiloxane-bis-BenzoCycloButene (DVS-bis-BCB)-based adhesive film (3), and

- a monocrystalline silicon layer (1),

the rear face (9) of the layer (1) exhibiting features for applications in the field of flexible technologies, flexible electronics such as smart cards, smart textiles, electronics, MEMS, NEMS, high power electronics, RF and microwave, microelectronics, optics, optoelectronics and photovoltaics.

CLAIMS

1. A method of transferring a layer (1), composed of a semi-conductor, insulating or metallic material, the method comprising the steps of:

a) providing a layer (1) joined to an initial substrate (4) with a binding energy E0 between the layer (1) and the initial substrate (4);

b) bonding a front face (8) of the layer (1) on an intermediate substrate (5) according to an intermediate bonding energy Ei;

c) detaching the initial substrate (4) from the layer (1) to expose a rear face (9) of the layer (1);

e) bonding a rear face (9) onto a final substrate (11) according to a final bonding energy Ef, and

f) debonding the intermediate substrate (5) from the layer (1) to transfer the layer (1) onto the final substrate (11);

step b) comprising a step of forming siloxane bonds Si-O-Si, step c) being carried out in a first anhydrous atmosphere and step f) being carried out in a second wet atmosphere such that the intermediate bonding energy Ei takes a first value Ei1 in step c) and a second value Ei2 in step f), with $Ei1 > E0$ and $Ei2 < Ef$.

2. The method of transferring a layer (1) according to claim 1, characterized in that step b) comprises a step of carrying out a direct hydrophilic bonding.

3. The method of transferring a layer (1) according to claim 1, characterized in that step b) comprises a step of carrying out an anodic bonding.

4. The method of transferring a layer (1) according to any one of claims 1 to 3, characterized in that the method comprises a step of forming a silicon layer or an oxide layer selected from among native SiO_2, thermal SiO_2, deposited SiO_2, SiO_x and $Si_xO_yN_z$, respectively on the front face (8) of the layer (1) and on the intermediate substrate (5) and in that step b) comprises a step of contacting the formed layers with each other such as to obtain the formation of siloxane bonds Si-O-Si.

5. The method of transferring a layer (1) of claim 1, characterized in that the first anhydrous atmosphere has a water vapor content lower than 1 ppm.

6. The method of transferring a layer (1) of claim 1, characterized in that the second wet atmosphere has a humidity content ranging between 20% and 80%.

7. The method of transferring a layer (1) according to any one of claims 1 to 6, characterized in that the detachment of step c) and/or the debonding of step f) comprises the simultaneous application of a mechanical stress, such as means of the use of jaws, or means of a blade or a wedge respectively, between the layer (1) and the initial substrate (4), and between the intermediate substrate (5) and layer (1).

8. The method of transferring a layer (1) according to any one of claims 1 to 7, characterized in that it comprises a technological step d) which is carried out between steps c) and e), and which is applied to the rear face (9) of the layer (1), the thermal budget of the technological step having a value lower than a threshold value beyond which $Ei2 > Ei1$.

9. The method of transferring a layer (1) according to any one of claims 1 to 8, characterized in that step e) comprises a bonding step carried out via an adhesive film

(3) such as a DiVinylSiloxane-bis-BenzoCycloButene (DVS-bis-BCB), polyimide or a photosensitive polymer film.

10. The method of transferring a layer (1) according to claim 1, characterized in that step e) comprises a molecular adhesion bonding step such that the final bonding energy has a value Ef independent from the humidity rate of the second wet atmosphere.

11. The method of transferring a layer (1) according to any one of claims 1 to 10, characterized in that the binding energy E0 between the layer (1) and the initial substrate (4) is obtained by forming a porous layer (15) on which the layer (1) is deposited.

12. The method of transferring a layer (1) according to any one of claims 1 to 11, characterized in that the layer (1) comprises a monocrystalline silicon material and the intermediate substrate (5) comprises a silicon material.

13. The method of transferring a layer (1) according to any one of claims 1 to 11, characterized in that the layer (1) comprises a material selected from among a material composed of silicon and germanium, a material of elements of the group II-VI and a binary, ternary or quaternary material of elements from the group III-V.

14. The method of transferring a layer (1) according to any one of claims 1 to 13, characterized in that the material of the initial substrate (4) and the material of the final substrate (11) comprise a material selected from among sapphire, silicon, germanium, silica, glass, quartz, a material of elements from the group II-VI, a binary, ternary or quaternary material of elements from the group III-V such as AsGa, InP or

GaN, a metal, a metal alloy and a polymer including, for example, a polyimide such as Kapton®.

15. An intermediate structure (13) formed of a stack comprising

- a final substrate (11) in a polymer material ,

- a DiVinylSiloxane-bis-BenzoCycloButene (DVS-bis-BCB)-based adhesive film (3),

- a monocrystalline silicon layer (1), and

- an intermediate substrate (5) in silicon bonded to a front face (8) of the monocrystalline silicon layer (1) by siloxane bonds Si-O-Si.

16. The intermediate structure (13) according to claim 15, characterized in that the final bonding energy Ef between a rear face (9) of the layer (1) and the final substrate (11) is higher than the intermediate bonding energy Ei2 between the front face (8) of the layer (1) and the intermediate substrate (5) in an atmosphere having a humidity content ranging between 20 and 80%.