US20130168835 discloses a method of forming a silicon on insulator substrate comprising providing a support substrate; forming a layer of high-resistivity material on the support substrate, the layer of high-resistivity material having a thickness of between 10 and 50 microns and comprising one of amorphous or polycrystalline silicon carbide, polycrystalline or amorphous diamond ; forming an insulating layer on the layer of high resistivity material; and assembling a donor wafer to an upper surface of the insulating layer to form the SOI substrate.

This solution of providing a trapping layer based on polycrystalline or amorphous semiconductor material, although quite effective, is relatively expensive, especially when the trapping layer is thick or composed of a stack of elementary layers. In addition, the formation of a thick layer, for example several microns, may lead to deform the wafer on which this layer is formed or to make this layer particularly rough, which makes the manufacturing process particularly difficult. This cost of the solution is difficult to justify for integrated devices requiring low RF performance.

The present invention aims at providing a substrate for applications in the fields of radiofrequency electronics and microelectronics which is simple and not expensive to produce while having a higher level of performances than a substrate of the silicon-on-insulator type which includes no trapping layer.

## BRIEF DESCRIPTION OF THE INVENTION

An aspect of the present invention provides a substrate for applications in the fields of radiofrequency electronics and microelectronics comprising:

- a base substrate;

- a single carbon layer positioned on and directly in contact with the base substrate, with the carbon layer having a thickness strictly ranging from 1nm to 5nm;
- an insulator layer positioned on the carbon layer;
- a layer of devices positioned on the insulator layer.

The carbon layer which has a very low thickness forms a trapping layer which can be very easily, and quite surprisingly, very efficiently produced.

According to other advantageous and non-restrictive embodiments of the invention, taken either separately or in any technically feasible combination:

- the base substrate is a single-crystal silicon substrate having a resistivity of less than 100 ohm.cm;

- with the base substrate being a single-crystal silicon substrate having a resistivity above 100 or 1,000 ohm.cm;

- the carbon layer has a thickness ranging from 1 to 3nm;

- the substrate further comprises a bonding layer positioned between, and in contact with, the carbon layer and the insulator layer;

- the bonding layer has a thickness of less than 10nm;

- the bonding layer is made of an amorphous, polycrystalline silicon or made of silicon dioxide;

- the insulator layer is made of silicon dioxide;

- the layer of devices comprises silicon;

- with the layer of devices comprising at least one radiofrequency device.

Another aspect of the present invention provides a method for manufacturing a substrate for applications in the fields of radiofrequency electronics and microelectronics, comprising:

- a step of exposing a base substrate to a precursor gas containing carbon to saturate the exposed substrate with carbon species freed from the precursor gas and to form a single carbon layer having a thickness ranging strictly from 1nm to 5nm on the base substrate;
- a step of forming a thickness of insulator on the carbon layer and/or on a source substrate;
- a step of assembling the base substrate and the source substrate so as to form an insulator layer between the base substrate and the source substrate;
- a step of thinning the source substrate to form a layer of devices.

According to other advantageous and non-restrictive embodiments of the invention, taken either separately or in any technically feasible combination:

- the method comprises a step of forming a bonding layer having a thickness of less than 10nm on, and in contact with, the carbon layer after the exposition step;

- the step of forming the bonding layer comprises the deposition of a bonding material and the polishing of the deposited bonding material;

- the source substrate is made of silicon and the step of forming the insulator layer comprises the oxidation of the source substrate;

- the source substrate comprises radiofrequency devices and the step of forming the insulator layer comprises the deposition of a silicon dioxide layer on the source substrate;

- the step of thinning the source substrate comprises a step of progressively reducing a part of the thickness of the source substrate by physical and/or chemical thinning;

**CLAIMS**

1. A substrate for applications in the fields of radiofrequency electronics and microelectronics comprising:
   - a base substrate;
   - a single carbon layer positioned on and directly in contact with the base substrate, with the carbon layer having a thickness strictly ranging from 1nm to 5nm;
   - an insulator layer positioned on the carbon layer;
   - a layer of devices positioned on the insulator layer.

2. A substrate according to the preceding claim, wherein the base substrate is a single-crystal silicon substrate having a resistivity of less than 100 ohm.cm.

3. A substrate according to claim 1, wherein the base substrate is a single-crystal silicon substrate having a resistivity above 100 or 1,000 ohm.cm.

4. A substrate according to one of the preceding claims, wherein the carbon layer has a thickness ranging from 1 to 3nm.

5. A substrate according to one of the preceding claims, further comprising a bonding layer positioned between, and in contact with, the carbon layer and the insulator layer.

6. A substrate according to the preceding claim, wherein the bonding layer has a thickness of less than 10nm.

7. A substrate according to one of the preceding two claims, wherein the bonding layer is made of an amorphous, polycrystalline silicon or made of silicon dioxide.

8. A substrate according to one of the preceding claims, wherein the insulator layer is made of silicon dioxide.

9. A substrate according to one of the preceding claims, wherein the layer of devices comprises silicon.

10. A substrate according to one of the preceding claims, wherein the layer of devices comprises at least one radiofrequency device.

11. A method for manufacturing a substrate for applications in the fields of radiofrequency electronics and microelectronics, comprising:
- a step of exposing a base substrate to a precursor gas containing carbon to saturate the exposed substrate with carbon species freed from the precursor gas and to form a single carbon layer having a thickness ranging strictly from 1nm to 5nm on the base substrate;
- a step of forming a thickness of insulator on the carbon layer and/or on a source substrate;
- a step of assembling the base substrate and the source substrate so as to form an insulator layer between the base substrate and the source substrate;
- a step of thinning the source substrate to form a layer of devices.

12. A method according to the preceding claim, comprising a step of forming a bonding layer having a thickness of less than 10nm on, and in contact with, the carbon layer after the exposition step.

13. A method according to the preceding claim, wherein the step of forming the bonding layer comprises the deposition of a bonding material and the polishing of the deposited bonding material.

14. A method according to one of claims 11 to 13, wherein the source substrate is made of silicon and the step of forming the insulator layer comprises the oxidation of the source substrate.

15. A method according to one of claims 11 to 13, wherein the source substrate comprises radiofrequency devices and the step of forming the insulator layer comprises the deposition of a silicon dioxide layer on the source substrate.

16. A method according to one of claims 11 to 15, wherein the step of thinning the source substrate comprises a step of progressively reducing a part of the thickness of the source substrate by physical and/or chemical thinning.

17. A method according to one of claims 11 to 15, wherein the step of thinning the source substrate comprises a first step of forming a brittle plane in the source substrate prior to the step of assembling, and a second step of breaking the source substrate at such brittle plane thereof, after the step of assembling.

18. A method according to one of claims 11 to 17, wherein the carbon layer has a thickness ranging strictly from 1 to 3nm.