trapping layer, reducing the efficiency of the latter and compromising the overall performance of the devices.

SUMMARY OF THE DISCLOSURE

The aim of the present disclosure is to at least partially tackle this problem of contamination of the electric-charge-trapping layer exacerbated by the thinness of the dielectric layer. More particularly, it aims to propose a structure comprising a superficial layer attached to a carrier provided with an electric-charge-trapping layer limiting the contamination of the latter, and a method for fabricating such a structure.

With a view to achieving this aim, a first aspect of the disclosure relates to a device comprising a ferroelectric superficial layer containing lithium; a dielectric layer comprising an oxide and placed in contact with the ferroelectric superficial layer; and a substrate in contact with the dielectric layer, the substrate comprising a charge-trapping layer placed on a carrier, the charge-trapping layer being placed between the carrier and the dielectric layer, in which device the dielectric layer has a thickness of between 150 nm and 500 nm, preferably of between 150 nm and 300 nm; a concentration of nitrogen in the dielectric layer and a surface roughness of the charge-trapping layer are such that the charge-trapping layer has a dose of lithium of less than 5.10^{11} at/cm^2; the nitrogen concentration of the dielectric layer is between 5.10^{20} at/cm^3 and 10^{22} at/cm^3; and the surface roughness of the trapping layer (14), in peak-valley measurement, is less than 800 nm, preferably less than 400 nm, and even more preferentially less than 100 nm.

An advantage of the structure according to the disclosure is that of maintaining the efficiency of the trapping function of the electric-charge-trapping layer even when the dielectric layer separating the charge-trapping layer from the superficial layer is thinned, while preventing said electric-charge-trapping layer from being contaminated by chemical species, in particular

hydrogen and lithium present in the superficial layer, which contamination is liable to passivate the charge-trapping sites.

Accordingly, the structure according to the disclosure makes it possible to provide substrates with a view to fabricating components comprising piezoelectric layers and designed to operate at high frequencies and exhibiting excellent performance.

According to additional non-limiting characteristics of the first example of the disclosure, considered individually or in any technically feasible combination:

- the dielectric layer may have a thickness of between 150 nm and 250 nm;
- the nitrogen concentration of the dielectric layer may be between 10^{21} at/cm^3 and 6.10^{21} at/cm^3;
- the dielectric layer may be a layer of silicon oxide, and a hydrogen concentration of the dielectric layer may be strictly less than the nitrogen concentration of the dielectric layer;
- a hydrogen concentration of the dielectric layer may be at least three times less than the nitrogen concentration of the dielectric layer;
- a hydrogen concentration in the dielectric layer may be less than 10^{22} at/cm^3;
- the lithium dose in the charge-trapping layer may be less than 10^{11} at/cm^2;
- the ferroelectric superficial layer may comprise lithium niobate or lithium tantalate;
- the charge-trapping layer may comprise polycrystalline silicon;
- the ferroelectric superficial layer may be made up of a monocrystalline material.

A second aspect of the disclosure relates to a method for fabricating a device comprising the steps of forming a charge-trapping layer on a carrier in order to form a substrate; smoothing an exposed surface of the trapping layer so as to reduce a roughness of this exposed surface below a threshold roughness; forming a dielectric layer at least on the smoothed charge-trapping layer and optionally on a donor substrate comprising a ferroelectric material containing lithium, the dielectric layer having a thickness of between 150 nm and 500 nm; joining the donor substrate and the substrate by way of the dielectric layer; removing a portion of the donor substrate in order to form a ferroelectric superficial layer containing lithium, the threshold roughness and a nitrogen concentration in an oxide layer comprised in the dielectric layer being chosen such that the lithium dose in the charge-trapping layer is less than 5.10^{11} at/cm^2 at the end of the fabrication method; wherein: the nitrogen concentration of the dielectric layer is between 5.10^{20} at/cm^3 and 10^{22} at/cm^3; and the surface roughness of the trapping layer (14), in peak-valley measurement, is less than 800 nm, preferably less than 400 nm, and even more preferentially less than 100 nm.

According to additional non-limiting characteristics of the second example of the disclosure, considered individually or in any technically feasible combination:

- the smoothing step may comprise the chemical-mechanical polishing of the charge-trapping layer;
- the charge-trapping layer may comprise polycrystalline silicon;

- the fabrication method may comprise the formation of a weakened plane by implanting light species into the donor substrate in order to define the superficial layer there, and the step of removing a portion of the donor substrate may comprise the detachment of the superficial layer at the weakened plane.

BRIEF DESCRIPTION OF THE FIGURES

Other features and advantages of the invention will become apparent from the following detailed description of the invention, which is given with reference to the appended figures, in which:

[Fig. 1] Figure 1 shows a structure that is the subject of the present description;

[Fig. 2] Figure 2 illustrates a method for fabricating the structure shown in Figure 1;

[Fig. 3] Figure 3 shows a schematic diagram of a mechanism for diffusing chemical species and the concept of peak-valley measurement in the structure according to the invention;

[Fig. 4] Figure 4 shows a graph indicating a required thickness of oxide in the structure of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a structure 1 comprising a substrate 10 integrating a carrier 12 and an electric-charge-trapping layer 14 on the carrier, a superficial layer 20 placed on the substrate 10, and a dielectric layer 16 interposed between the superficial layer 20 and the substrate 10, preferably in direct contact with the superficial layer 20 and the charge-trapping layer 14.

CLAIMS

1. A device comprising:

- a ferroelectric superficial layer (20) containing lithium;
- a dielectric layer (16) comprising an oxide and placed in contact with the ferroelectric superficial layer; and
- a substrate (10) in contact with the dielectric layer, the substrate comprising a charge-trapping layer (14) placed on a carrier (12), the charge-trapping layer (14) being placed between the carrier (12) and the dielectric layer (16),

wherein:

the dielectric layer (16) has a thickness of between 150 nm and 500 nm, preferably of between 150 nm and 300 nm;

a concentration of nitrogen in the dielectric layer (16) and a surface roughness of the charge-trapping layer (14) are such that the charge-trapping layer (14) has a dose of lithium of less than 5.10^{11} at/cm^2;

the nitrogen concentration of the dielectric layer is between 5.10^{20} at/cm^3 and 10^{22} at/cm^3; and

the surface roughness of the trapping layer (14), in peak-valley measurement, is less than 800 nm, preferably less than 400 nm, and even more preferentially less than 100 nm.

2. The device according to Claim 1, wherein the dielectric layer (16) has a thickness of between 150 nm and 250 nm.

3. The device according to Claim 1 or 2, wherein the nitrogen concentration of the dielectric layer (16) is between 10^{21} at/cm^3 and 6.10^{21} at/cm^3.

4. The device according to any one of Claims 1 to 3, wherein the dielectric layer is a layer of silicon oxide, and a hydrogen

concentration of the dielectric layer (16) is strictly less than the nitrogen concentration of the dielectric layer (16).

5. The device according to Claim 4, wherein a hydrogen concentration of the dielectric layer (16) is at least three times less than the nitrogen concentration of the dielectric layer (16).

6. The device according to any one of Claims 1 to 5, wherein a hydrogen concentration in the dielectric layer (16) is less than 10^{22} at/cm^3.

7. The device according to any one of Claims 1 to 6, wherein the lithium dose in the charge-trapping layer (14) is less than 10^{11} at/cm^2.

8. The device according to any one of Claims 1 to 7, wherein the ferroelectric superficial layer (20) comprises lithium niobate or lithium tantalate.

9. The device according to any one of preceding Claims 1 to 8, wherein the charge-trapping layer (14) comprises polycrystalline silicon.

10. The device according to any one of the preceding claims, wherein the ferroelectric superficial layer (20) is made up of a monocrystalline material.

11. A method for fabricating a device comprising the following steps:

- forming a charge-trapping layer (14) on a carrier (12) in order to form a substrate (10);

- smoothing an exposed surface of the trapping layer (14) so as to reduce a roughness of this exposed surface below a threshold roughness;
- forming a dielectric layer (16) at least on the smoothed charge-trapping layer (14) and optionally on a donor substrate (200) comprising a ferroelectric material containing lithium, the dielectric layer (16) having a thickness of between 150 nm and 500 nm;
- joining the donor substrate (200) and the substrate (10) by way of the dielectric layer (16);
- removing a portion of the donor substrate in order to form a ferroelectric superficial layer (20) containing lithium,

the threshold roughness and a nitrogen concentration in an oxide layer comprised in the dielectric layer (16) being chosen such that the lithium dose in the charge-trapping layer is less than 5.10^{11} at/cm^2 at the end of the fabrication method; wherein:

- the nitrogen concentration of the dielectric layer is between 5.10^{20} at/cm^3 and 10^{22} at/cm^3; and
- the surface roughness of the trapping layer (14), in peak-valley measurement, is less than 800 nm, preferably less than 400 nm, and even more preferentially less than 100 nm.

12. The method according to Claim 11, wherein the smoothing step comprises the chemical-mechanical polishing of the charge-trapping layer (14).

13. The method according to Claim 11 or 12, wherein the charge-trapping layer (14) comprises polycrystalline silicon.

14. The method according to any one of preceding Claims 11 to 13, comprising the formation of a weakened plane (220) by implanting light species into the donor substrate (200) in order to define the superficial layer (20) there, and the step of

removing a portion of the donor substrate comprising the detachment of the superficial layer (20) at the weakened plane (220).