In order to offer more freedom in the dimensioning of bulk acoustic wave filters or surface acoustic wave filters, it would be desirable to be able to use more materials than the materials listed above, without moreover adversely affecting the quality of the materials.

SUMMARY

Embodiments of the invention seek to overcome the aforesaid drawbacks and notably to conceive a method for producing a monocrystalline layer, notably piezoelectric, in particular for a surface acoustic wave device, made of other materials than the materials used for this application, in particular by making it possible to obtain layers that are thin (that is to say of thickness less than 20 µm, or even less than 1 µm) and uniform of the materials used for surface acoustic wave devices. Moreover, this method may also make it possible to use a greater variety of support substrates than in existing bulk acoustic wave devices.

According to a first aspect of the invention, there is provided a method for producing a layer of composition $AA'BO_3$ where A consists of at least one element selected from: Li, Na, K, Ca, Mg, Ba, Sr, Pb, La, Bi, Y, Dy, Gd, Tb, Ce, Pr, Nd, Sm, Eu, Ho, Zr, Sc, Ag, Tl and B consists of at least one element selected from: Nb, Ta, Sb, Ti, Zr, Sn, Ru, Fe, V, Sc, C, Ga, Al, Si, Mn, Zr, Tl, wherein it comprises:

- providing a donor substrate of composition ABO_3,
- forming a layer of composition ABO_3 by thinning said donor substrate,
- before and/or after the thinning step, exposing said layer of composition ABO_3 to a medium containing ions of an element A' belonging to the same list of elements as A, A' being different from A, such that

Said weakened zone is advantageously formed by ion implantation in the donor substrate.

According to a particular embodiment, the element A is lithium and the element A' is sodium and/or potassium. The element B may then be advantageously niobium and/or tantalum.

According to a second aspect of the present invention, there is provided a method for producing a bulk acoustic wave device comprising forming electrodes on two opposite main faces of a piezoelectric layer, wherein it comprises the production of said piezoelectric layer by a method as described above.

According to a third aspect of the present invention, there is provided a method for producing a surface acoustic wave device, comprising the formation of two interdigitated electrodes on the surface of a piezoelectric layer, wherein it comprises the production of said piezoelectric layer by a method as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

Other characteristics and advantages of the invention will become clear from the detailed description that follows, with reference to the appended drawings, in which:

- figures 1A to 1F schematically illustrate the steps of the method for producing a monocrystalline layer of composition $AA'BO_3$ according to one embodiment of the invention,
- figure 2 is a sectional principle view of a surface acoustic wave filter,
- figure 3 is a sectional principle view of a bulk acoustic wave filter.

For reasons of legibility of the figures, the elements illustrated are not necessarily represented to

CLAIMS

1. Method for producing a layer of composition $AA'BO_3$ where A consists of at least one element selected from: Li, Na, K, Ca, Mg, Ba, Sr, Pb, La, Bi, Y, Dy, Gd, Tb, Ce, Pr, Nd, Sm, Eu, Ho, Zr, Sc, Ag, Tl and B consists of at least one element selected from: Nb, Ta, Sb, Ti, Zr, Sn, Ru, Fe, V, Sc, C, Ga, Al, Si, Mn, Zr, Tl, wherein it comprises:

- providing a donor substrate of composition ABO_3,
- forming a layer of composition ABO_3 by thinning said donor substrate,
- before and/or after the thinning step, exposing said layer of composition ABO_3 to a medium containing ions of an element A' belonging to the same list of elements as A, A' being different from A, such that said ions penetrate into said layer to form a layer of composition $AA'BO_3$.

2. Method according to claim 1, in which the ions of the element A' penetrate into the layer by an ion exchange mechanism.

3. Method according to one of claims 1 or 2, in which the medium containing the ions of the element A' is a liquid and the layer is immersed in a bath of said liquid.

4. Method according to one of claims 1 to 3, in which the layer of composition ABO_3 is immersed in a bath comprising an acid solution of a salt comprising the element A'.

5. Method according to one of claims 1 or 2, in which the medium containing the ions of the element

A′ is in gaseous phase and the layer is exposed to said gas.

6. Method according to one of claims 1 or 2, in which the medium containing the ions of the element A′ is in solid phase, a layer of said medium being deposited on the layer.

7. Method according to claim 6, comprising at least one annealing step to favour the diffusion of the element A′ from the medium to the layer.

8. Method according to claim 1, in which the ions of the element A′ penetrate into the layer by implantation.

9. Method according to claim 8, further comprising at least one heat treatment step to make the implanted ions diffuse into the layer.

10. Method according to one of claims 1 to 9, in which the layer is monocrystalline.

11. Method according to one of claims 1 to 10, in which the thinning of the donor substrate comprises the application of a receiver substrate on the donor substrate, the layer being at the interface, and the transfer of the layer onto the receiver substrate.

12. Method according to claim 11, in which the application of the receiver substrate comprises the deposition of said substrate on the donor substrate.

13. Method according to claim 11, in which the application of the receiver substrate comprises the bonding of said substrate on the donor substrate.

14. Method according to one of claims 11 to 13, in which the thickness of the layer is less than 20 µm.

15. Method according to one of claims 11 to 14, in which at least one electrically insulating layer and/or at least one electrically conducting layer is formed at the interface between the receiver substrate and the layer.

16. Method according to one of claims 1 to 10, in which the thickness of the layer is greater than 2 µm, preferably greater than 20 µm, said layer being self-supporting at the end of the thinning of the donor substrate.

17. Method according to claim 11, in which the thinning of the donor substrate comprises the following steps:

- the formation of a weakened zone in the donor substrate so as to delineate the layer of composition ABO_3,
- the detachment from the donor substrate along the weakened zone.

18. Method according to claim 17, in which the weakened zone is formed by ion implantation in the donor substrate.

19. Method according to one of claims 1 to 18, in which A is lithium and the element A' is sodium and/or potassium.

20. Method according to claim 19, in which the element B is niobium and/or tantalum.

21. Method for producing a bulk acoustic wave device, comprising forming electrodes on two opposite main faces of a piezoelectric layer, wherein it comprises the production of said piezoelectric layer by a method according to one of claims 1 to 20.

22. Method for producing a surface acoustic wave device, comprising the formation of two interdigitated electrodes on the surface of a piezoelectric layer, wherein it comprises the production of said piezoelectric layer by a method according to one of claims 1 to 20.