SUBJECT MATTER OF THE INVENTION

One aim of the invention is to at least partly remedy this problem. More precisely, one aim of the invention is to provide a piezoelectric-on-insulator structure the thin piezoelectric layer of which is devoid of pits and triangular defects or, at the very least, has a lower density of these defects than a thin piezoelectric layer obtained using a prior-art process.

SUMMARY

With a view to achieving this aim, the subject matter of the disclosure provides a process for preparing a thin mono-domain layer made of lithium-containing ferroelectric material, the process comprising:

- a step of implanting light species into a first side of a lithium-containing ferroelectric donor substrate, to form a weakened plane and to define a first layer between the weakened plane and the first side of the donor substrate;
- a step of joining the first side of the donor substrate to the carrier, preferably by way of a dielectric interlayer, to form an intermediate assembly;
- a step of splitting the intermediate assembly, comprising a first heat treatment, this step leading to splitting of the donor substrate along the weakened plane and the formation of a free side of the first layer;
- a finishing sequence applied to the first layer, comprising an annealing step including a second heat treatment and, after the annealing step, a step of thinning the first layer to form the thin mono-domain layer;

- a surface treatment exposing the free side of the first layer to a treatment atmosphere comprising at least 0.02% carbon dioxide to form a lithium-rich passivation layer; and
- a removal treatment to remove the lithium-rich passivation layer.

According to other advantageous and non-limiting features of the disclosure, taken alone or according to any technically feasible combination:

- the treatment atmosphere has a temperature comprised between 100°C and the Curie temperature of the ferroelectric material from which the first layer is made;
- the removal treatment is carried out by cleaning the free side of the first layer using wet processing;
- the cleaning comprises brushing the free side of the first layer;
- the brushing is performed while dispensing deionized water onto the free side of the first layer;
- the surface treatment and the removal treatment are carried out during an intermediate step that comes between the splitting step and the finishing sequence;
- the surface treatment is carried out during the splitting step, the exposure of the free side of the first layer to the treatment atmosphere being performed during the first heat treatment or straight after the latter;

CLAIMS

1. A process for preparing a thin mono-domain layer (4) made of lithium-containing ferroelectric material, the process comprising:
   - a step of implanting light species into a first side (6) of a lithium-containing ferroelectric donor substrate (5), to form a weakened plane (7) and to define a first layer (8) between the weakened plane (7) and the first side (6) of the donor substrate (5);
   - a step of joining the first side (6) of the donor substrate (5) to the carrier (2), preferably by way of a dielectric interlayer (3), to form an intermediate assembly;
   - a step of splitting the intermediate assembly, comprising a first heat treatment, this step leading to splitting of the donor substrate (5) along the weakened plane (7) and the formation of a free side (9) of the first layer (8);
   - a finishing sequence applied to the first layer (8), comprising an annealing step including a second heat treatment and, after the annealing step, a step of thinning the first layer (8) to form the thin mono-domain layer (4);
   - a surface treatment exposing the free side (9) of the first layer (8) to a treatment atmosphere comprising at least 0.02% carbon dioxide to form a lithium-rich passivation layer; and
   - a removal treatment to remove the lithium-rich passivation layer.

2. The process according to the preceding claim wherein the treatment atmosphere has a temperature comprised between

100°C and the Curie temperature of the ferroelectric material from which the first layer (8) is made.

3. The process according to one of the preceding claims, wherein the removal treatment is carried out by cleaning the free side (9) of the first layer (8) using wet processing.

4. The process according to claim 3, wherein the cleaning comprises brushing the free side (9) of the first layer (8).

5. The process according to claim 4, wherein the brushing is performed while dispensing deionized water onto the free side (9) of the first layer (8).

6. The process according to one of the preceding claims, wherein the surface treatment and the removal treatment are carried out during an intermediate step that comes between the splitting step and the finishing sequence.

7. The process according to one of claims 1 to 5, wherein the surface treatment is carried out during the splitting step, the exposure of the free side (9) of the first layer (8) to the treatment atmosphere being performed during the first heat treatment or straight after the latter.

8. The process according to claim 7, wherein the treatment atmosphere comprises at least 0.02% carbon dioxide in a neutral gas, such as argon or nitrogen, the first heat treatment being performed at a temperature comprised between 100°C and 700°C.

9. The process according to one of claims 1 to 5, wherein the surface treatment is carried out during the annealing step of the finishing sequence, the exposure of the free side (9) of the first layer (8) to the treatment atmosphere being performed during the second heat treatment.

10. The process according to claim 9, wherein the treatment atmosphere comprises at least 0.02% carbon dioxide in oxygen or in a neutral gas, such as argon or nitrogen, the second heat treatment being performed at a temperature comprised between 300°C and the Curie temperature of the ferroelectric material from which the first layer (8) is made.

11. The process according to one of the preceding claims, wherein the treatment atmosphere comprises more than 0.05% carbon dioxide.

12. The process according to one of the preceding claims, wherein the carrier (2) is formed of an electrically conductive or semi-conductive bulk substrate.

13. The process according to one of the preceding claims, wherein the carrier (2) comprises a base substrate (2a) and a trapping layer (2b), the trapping layer (2b) being placed between the dielectric interlayer (3) and the base substrate (2a).

14. The process according to one of the preceding claims, wherein the first layer (8) and the thin layer (4) are made of a single-crystal piezoelectric material, such as lithium tantalate or lithium niobate.

15. The process according to one of the preceding claims, wherein the dielectric interlayer (3) comprises at least one layer of silicon oxide, silicon oxynitride or silicon nitride.