

ferroelectric layer of lithium tantalate transferred by a method implementing an implantation of hydrogen leads to the formation of a multidomain layer. Such a feature makes the layer unfit for use, since it affects the performance of the devices that are to be formed on/in the thin layer, for example, surface acoustic wave devices (SAW).

Document FR3068508 discloses the finishing of a thin ferroelectric layer transferred onto a support by means of an intermediate layer, and by application of the Smart Cut method. In one example, this finishing comprises heat treatment of the thin layer, followed by polishing. According to this document, this sequence would allow the initial monodomain properties of the thin ferroelectric layer to be restored. Additional analyses carried out by the Applicant have, however, shown that this finishing sequence alone could not guarantee the monodomain nature of the layer over its entire thickness, that is to say, from its interface with the intermediate layer to its free surface. More particularly, these analyses using PFM (**"Piezoresponse Force Microscopy"**) measurement, which generally extend over a depth of approximately 50 nm from the measurement surface, have confirmed that the surface portion of the thin layer was indeed monodomain, but that a buried portion juxtaposed with the intermediate layer could prove to be multidomain. To carry out this "buried" PFM measurement, the layer was gradually thinned by chemical-mechanical polishing in order to approach the measurement surface of this intermediate layer.

Document FR2914492 also discloses a method for manufacturing a thin layer of ferroelectric material using Smart Cut technology. In this document, as in the aforementioned document US20100088868, the layer that is removed and transferred onto a support substrate is prepared by subjecting it to an electric field so as to improve or restore its monodomain ferroelectric properties. Such a treatment requires the presence of a pair of electrodes placed on either side of the ferroelectric layer to be treated, for example, in electrical contact with this layer. It is not always possible to have such a pair of electrodes, in particular when the ferroelectric layer is transferred onto an electrically insulating substrate or onto an electrically insulating layer.

AIM OF THE INVENTION

Embodiments of the disclosure seek to provide a method for preparing a thin layer of

ferroelectric material partially addressing at least the aforementioned drawbacks. More particularly, embodiments of the disclosure seek to provide a method for transferring a layer of ferroelectric material implementing a step of implanting light species, the method preserving or being able to restore the monodomain quality of the transferred layer over its entire thickness. It can therefore be unnecessary, in the layer preparation method, to subject the latter to an electric field to restore its monodomain quality, and it can be transferred onto an electrically insulating substrate or provided with a dielectric layer.

BRIEF DESCRIPTION OF THE INVENTION

An aspect of the disclosure provides a method for preparing a thin monodomain layer of ferroelectric material comprising the following steps:

- implanting light species in a first face of a ferroelectric donor substrate to form an embrittlement plane and define a first layer between the embrittlement plane and the first face of the donor substrate;
- assembling the first face of the donor substrate to a support substrate by means of a dielectric assembly layer;
- fracturing the donor substrate at the embrittlement plane in order to transfer the first layer onto the support substrate and expose a free face of the first layer;
- finishing the first layer, this finishing comprising heat treatment of the free face of the first layer, followed by thinning of the first layer to form the thin monodomain layer;
- the dielectric assembly layer comprising an oxide preventing the diffusion of hydrogen towards the first layer, or the dielectric assembly layer comprising a barrier preventing the diffusion of hydrogen towards the first layer.

In an embodiment, the dielectric assembly layer comprises an oxide having a hydrogen concentration lower than that of the first layer.

Surprisingly, this precise series of preparation steps combined with the specific nature of the assembly layer results in the formation of a final thin layer having monodomain polarization over its entire thickness and a satisfactory crystal and surface quality.

According to other advantageous and non-limiting characteristics of the invention,