Claims

1. A piezoelectric-on-insulator (POI) substrate comprising:

- a support substrate having a first acoustic impedance,

- a piezoelectric layer, especially a layer of lithium tantalate (LTO), lithium niobate (LNO), aluminium nitride (AlN), lead zirconate titanate (PZT), langasite or langatate,

- a dielectric layer having a second acoustic impedance and sandwiched between the piezoelectric layer and the support substrate,

- an intermediate layer positioned between the support substrate and the dielectric layer,

wherein the intermediate layer is a layer having a variable composition, more particularly along its thickness, such that the acoustic impedance of the intermediate layer varies, especially in a gradual manner, between the values of the first and the second acoustic impedance.

2. The piezoelectric-on-insulator (POI) substrate according to Claim 1, wherein the support substrate is a silicon-based substrate, the dielectric layer is a layer of silicon oxide and the intermediate layer is a layer of silicon oxynitride SiO_xN_y having a variable oxygen composition and/or a variable nitrogen composition.

3. The piezoelectric-on-insulator (POI) substrate according to Claim 1 or 2, wherein the variation in the composition of the intermediate layer is a gradual linear or a stepwise variation.

4. The piezoelectric-on-insulator (POI) substrate (100, 200) according to any of Claims 1 to 3, wherein the variable composition of the intermediate silicon oxynitride SiO_xN_y layer of the quantity qt of the variable composition of the silicon oxynitride SiO_xN_y layer is defined by $qt = y/(y+x)$ and varies along its thickness, more particularly where qt is 0 at the interface with the dielectric layer and qt is at least 0.4 at the interface with the support substrate.

5. The piezoelectric-on-insulator (POI) substrate according to Claim 4, wherein the quantity qt at the interface with the support substrate is equal to about 0.5 for a support substrate of the type where Si has an orientation, qt is equal to about 0.68 for a support substrate of the type where Si has an orientation, and qt is equal to about 0.7 for a support substrate of the type where Si has an orientation.

6. The piezoelectric-on-insulator (POI) substrate according to Claim 4 or 5, wherein the quantity qt of the silicon oxynitride SiO_xN_y layer varies in an increasing manner between the interface with the dielectric layer of the piezoelectric layer and the interface with the support substrate, especially in a stepwise or linear increasing manner.

7. The piezoelectric-on-insulator (POI) substrate according to any of Claims 1 to 6, further comprising a trapping layer on the support substrate, especially a polycrystalline silicon-based layer.

8. A process for producing a piezoelectric-on-insulator (POI) substrate according to any of Claims 1 to 7 comprising the steps of:

- providing a support substrate having a first acoustic impedance, especially a silicon-based substrate,

- providing a piezoelectric substrate, especially a lithium tantalate (LTO), lithium niobate (LNO), aluminium nitride (AlN), lead zirconate titanate (PZT), langasite or langatate substrate,

- forming a dielectric layer having a second acoustic impedance on the piezoelectric substrate, especially a layer of silicon oxide,

- forming an intermediate layer on a free surface of the support substrate, especially a layer based on silicon oxynitride SiO_xN_y, the intermediate layer having a variable composition, more particularly along its thickness *e*, such that the acoustic impedance of the intermediate layer varies, especially in a gradual manner, between the values of the first and the second acoustic impedance, and

joining the piezoelectric substrate with the dielectric layer with the support substrate with the intermediate layer.

9. The process for producing a piezoelectric-on-insulator (POI) substrate according to Claim 8, wherein the joining between the piezoelectric substrate and the support substrate is achieved between the intermediate layer and the dielectric layer.

10. The process for producing a piezoelectric-on-insulator (POI) substrate according to Claim 8, further comprising a step of forming of a dielectric layer on the intermediate layer of the support substrate before the joining step, such that the joining is then achieved between the dielectric layer of the support substrate and the dielectric layer of the piezoelectric substrate.

11. The process for producing a POI substrate according to any of Claims 8 to 10, wherein the step of forming of the intermediate layer on the support substrate comprises the formation of a layer based on silicon oxynitride SiO_xN_y in which the amount of nitrogen in relation to the oxygen in the silicon oxynitride SiO_xN_y layer defined by $qt_1 = y/(y+x)$ varies along its thickness e_1, more particularly where qt_1 is 0 at the interface with the dielectric layer and qt_1 is at least 0.4 at the interface with the support substrate.

12. The process for producing a piezoelectric-on-insulator (POI) substrate according to Claim 8, wherein the step of forming of the intermediate layer on the support substrate comprises the formation of a layer based on silicon oxynitride SiO_xN_y in which the quantity qt_2 of the silicon oxynitride SiO_xN_y layer defined by $qt_2 = y/(y+x)$ varies along its thickness e_2, more particularly where qt_2 is at least 0.4 at the interface with the support substrate, and

the process further comprises a step of forming of a SiO_xN_y layer on the dielectric layer of the piezoelectric substrate before the joining step, said SiO_xN_y layer having a quantity qt_3 for the silicon oxynitride SiO_xN_y layer defined by $qt_3 = y/(y+x)$ that varies along its thickness e_3, more particularly $qt_3 = 0$ at the interface with the dielectric layer of the piezoelectric substrate,

such that the joining is then achieved between the SiO_xN_y layer of the support substrate and the SiO_xN_y layer of the piezoelectric substrate, where qt_2 is equal to qt_3 at the interface between the SiO_xN_y layers of the piezoelectric substrate and the support substrate.

13. The process for producing a piezoelectric-on-insulator (POI) substrate according to any of Claims 8 to 12, further comprising a step of forming of a trapping layer on the support substrate, especially a polycrystalline silicon-based layer.

14. The process for producing a piezoelectric-on-insulator (POI) substrate according to any of Claims 8 to 13, wherein the step of forming of the intermediate layer is carried out by radiofrequency sputtering in a mixed oxygen and nitrogen atmosphere.

15. A surface acoustic wave device (SAW) comprising a piezoelectric-on-insulator substrate according to any of Claims 1 to 7.