The invention also relates to a surface acoustic wave device comprising a substrate as described above and two electrodes formed of two interdigitated metallic combs on the surface of the piezoelectric layer.

The invention also relates to a bulk acoustic wave device comprising a substrate as described above and two electrodes arranged on either side of the piezoelectric layer.

Another object relates to a method of manufacture of a substrate as described above, characterised in that it comprises:

- providing a first donor substrate comprising a semiconductor layer,
- providing a stiffening substrate which has a coefficient of thermal expansion closer to the coefficient of thermal expansion of the material of the piezoelectric layer than that of silicon,
- transferring the semiconductor layer onto the stiffening substrate from a first donor substrate,
- providing a second donor substrate comprising the piezoelectric layer,
- transferring the piezoelectric layer onto the semiconductor layer from a second donor substrate
- forming a dielectric layer on one and/or the other of the piezoelectric layer and the semiconductor layer; and
- forming a charge trapping layer at the interface between said dielectric layer and the semiconductor layer and/or the interface between the dielectric layer and the piezoelectric layer.

According to one embodiment at least one of the transfer steps comprises the following sub-steps:

- formation of an embrittlement zone in the first, second donor substrates respectively by the implantation of atomic species;
- bonding of the first, second donor substrates respectively onto the stiffening substrate and semiconductor layer respectively;
- detachment of said first, second substrates respectively along the embrittlement zone.

BRIEF DESCRIPTION OF DRAWINGS

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

- figure 1 is a schematic section view of a temperature compensated surface acoustic wave filter,
- figure 2 is a schematic section view of a temperature compensated bulk acoustic wave resonator,

- figure 3 is schematic section of a substrate according to one embodiment form of the invention,

- figure 4 is a schematic section of a temperature compensated surface acoustic wave filter according to one embodiment of the invention,

- figure 5 is a schematic section of a temperature compensated surface acoustic wave filter according to an alternative embodiment of the invention,

- figures 6A to 6E show successive steps in the manufacture of a substrate according to one embodiment of the invention.

For readability purposes the elements shown are not necessarily shown to scale. In addition the same components are designated by the same reference symbols on the various figures.

CLAIMS

1. Substrate (1) for a surface acoustic wave device or bulk acoustic wave device which comprises a support substrate (11) and an piezoelectric layer (10) on said support substrate, characterised in that the support substrate (11) comprises a semiconductor layer (111) on a stiffening substrate (110) which has a coefficient of thermal expansion closer to the coefficient of thermal expansion of the material of the piezoelectric layer (10) than that of silicon, where the semiconductor layer (111) is arranged between the piezoelectric layer (10) and the stiffening substrate (110), the substrate (1) being characterised in that it comprises a dielectric layer (114) between the piezoelectric layer (10) and the semiconductor layer (111) and a charge trapping layer (115) at the interface between said dielectric layer and the semiconductor layer and/or the interface between the dielectric layer and the piezoelectric layer.

2. Substrate according to claim 1, characterised in that the stiffening substrate (110) comprises sapphire, glass and/or spinel ($MgAl_2O_4$).

3. Substrate according to one of claims 1 or 2 characterised in that the semiconductor layer (111) is formed from one of the following materials: silicon, germanium, SiGe, SiC, III-V material.

4. Substrate according to one of claims 1 to 3 characterised in that the semiconductor layer (111) comprises at least one electronic component (112).

5. Substrate according to claim 4, characterised in that said electronic component (112) is chosen from: a CMOS transistor, a switch and a power amplifier.

6. Substrate according to one of claims 1 to 5, characterised in that the ratio of the thickness of the piezoelectric layer (10) to the thickness of the stiffening substrate (110) is less than or equal to 0.125.

7. Substrate according to one of claims 1 to 6 characterised in that the thickness of the piezoelectric layer (10) is less than 50 µm, preferably less than 20 µm, yet more preferably less than 1 µm, and the thickness of the stiffener substrate (110) is between 400 and 800 µm.

8. Substrate according to one of claims 1 to 7, characterised in that said charge trapping layer (115) comprises a layer of polycrystalline silicon.

9. Surface acoustic wave device comprising a substrate (1) according to one of claims 1 to 8 and two electrodes (12, 13) formed of two interdigitated metallic combs on the surface of the piezoelectric layer (10).

10. Bulk acoustic wave device comprising a substrate (1) according to one of claims 1 to 8 and two electrodes (12, 13) arranged on either side of the piezoelectric layer (10).

11. Method of manufacturing a substrate (1) for a surface acoustic wave device or bulk acoustic wave device which comprises a support substrate (11) and a piezoelectric layer (10) on said support substrate, characterised in that it comprises:

- providing a first donor substrate (116) comprising a semiconductor layer (111),
- providing a stiffening substrate (110) which has a coefficient of thermal expansion closer to the coefficient of thermal expansion of the material of the piezoelectric layer (10) than that of silicon,
- transferring the semiconductor layer (111) onto the stiffening substrate (110) from a first donor substrate (116),
- providing a second donor substrate (118) comprising the piezoelectric layer (10),
- transferring the piezoelectric layer (10) onto the semiconductor layer (111) from the second donor substrate (118);
- forming a dielectric layer (114) on one and/or the other of the piezoelectric layer (10) and the semiconductor layer (111); and
- forming a charge trapping layer (115) at the interface between said dielectric layer and the semiconductor layer and/or the interface between the dielectric layer and the piezoelectric layer.

12. Method according to claim 11, wherein at least one of the transfer steps comprises the following sub-steps:

- formation of an embrittlement zone in the first, second donor substrate respectively by the implantation of atomic species;
- bonding of the first, second donor substrate respectively onto the stiffening substrate and semiconductor layer respectively;
- detachment of said first, second substrates respectively along the embrittlement zone.