hybrid substrate is no longer compatible with the requirements for reducing the thickness of the final components, notably to address the cell phone market. Another solution, proposed by K.Hashimoto et al. (Article previously mentioned) involves roughening the lower surface of the layer of $LiTaO_3$ (at the bonding interface with the substrate) so as to limit the reflections of the acoustic wave on said surface.

AIM OF THE INVENTION

~~An aim~~Aspects of the present ~~invention~~ disclosure seek~~is~~ to provide an alternative solution to the state-of-the-art solutions. Aspects ~~An aim~~ of the present disclosure can ~~invention particularly~~ involve~~s~~ provid~~e~~~~ing~~ a hybrid structure allowing reduction and/or elimination of said spurious acoustic waves.

BRIEF DESCRIPTION OF THE INVENTION

An aspect of ~~T~~the present invention relates to a hybrid structure for a surface acoustic wave device comprising a useful layer of piezoelectric material joined to a carrier substrate having a thermal expansion coefficient lower than that of the useful layer, wherein the hybrid structure is remarkable in that it comprises an intermediate layer located between the useful layer and the carrier substrate, the intermediate layer being a structured layer formed of at least two different materials having a plurality of periodic motifs in the plane of said intermediate layer.

CLAIMS

~~1. Hybrid structure (10) for a surface acoustic wave device comprising a useful layer (1) of piezoelectric material joined to a carrier substrate (5) having a thermal expansion coefficient lower than that of the useful layer (1), characterised in that it comprises an intermediate layer (4) located between the useful layer (1) and the carrier substrate (5), the intermediate layer (4) being a structured layer formed of at least two different materials having a plurality of periodic motifs (6,7) in the plane of said intermediate layer (4).~~

~~2. Hybrid structure (10) for a surface acoustic wave device according to the preceding claim, wherein the periodicity of the motifs (6,7) is selected according to the frequency of the surface acoustic waves of the device.~~

~~3. Hybrid structure (10) for a surface acoustic wave device according to any of the preceding claims, wherein the carrier substrate (5) comprises a material selected from among silicon, glass, silica, sapphire, alumina and aluminium nitride.~~

~~4. Hybrid structure (10) for a surface acoustic wave device according to any of the preceding claims, wherein the useful layer (1) comprises a piezoelectric material selected from among lithium tantalate ($LiTaO_3$), lithium niobate ($LiNbO_3$), quartz and zinc oxide (ZnO).~~

~~5. Hybrid structure (10) for a surface acoustic wave device according to any of the preceding claims, wherein the mean acoustic impedance of the intermediate layer (4) is equal to the square root of the product of the acoustic impedances of the useful layer (1) and of the carrier substrate (5).~~

~~6. Hybrid structure (10) for a surface acoustic wave device according to any of the preceding claims, wherein the thickness of the intermediate layer (4) is greater than the wavelength of the surface acoustic waves of the device.~~

~~7. Hybrid structure (10) for a surface acoustic wave device according to any of the preceding claim, wherein at least one lateral dimension of the motifs (6,7) is smaller than the wavelength of the surface acoustic waves of the device.~~

~~8. Hybrid structure (10) for a surface acoustic wave device according to any of the preceding claims, wherein the periodic motifs (6,7) comprise an alternation of a first motif (6) composed of the material of the useful layer (1) and of a second motif (7) composed of a material of the same type as that of the carrier substrate (5).~~

~~9. Hybrid structure (10) for a surface acoustic wave device according to the preceding claim, wherein the second motif (7) is composed of polycrystalline silicon and wherein the carrier substrate (5) is made of silicon.~~

~~10. Hybrid structure (10) for a surface acoustic wave device according to any of claims 1 to 4, wherein the thickness of the intermediate layer (4) is equal to or smaller than the wavelength of the surface acoustic waves of the device.~~

~~11. Hybrid structure (10) for a surface acoustic wave device according to the preceding claim, wherein at least one lateral dimension of the motifs (6,7) is smaller than or equal to the wavelength of the surface acoustic waves of the device.~~

~~12. Hybrid structure (10) for a surface acoustic wave device according to any of both preceding claims, wherein the periodic motifs (6,7) comprise an alternation of a first motif (6) composed of the material of the useful layer (1) and of a second motif (7) composed of another material.~~

~~13. Hybrid structure (10) for a surface acoustic wave device according to the preceding claim, wherein the second motif (7) is composed of silicon dioxide or silicon nitride.~~

~~14. Method of manufacturing a hybrid structure (10) for a surface acoustic wave device, characterised in that it comprises the following stages:~~

~~i) Providing a useful layer (1) of piezoelectric material and a carrier substrate (5) having a thermal expansion coefficient lower than that of the useful layer (1);~~

~~ii) Local etching according to periodic motifs of a front face of the useful layer (1) or carrier substrate (5), forming a set of etched motifs and unetched motifs of a first material;~~

~~iii) Applying to the etched motifs an additional layer of a second material different from the first material, wherein the unetched periodic motifs and the additional layer form an intermediate layer (4);~~

~~iv) Assembling the useful layer (1) and the carrier substrate (5) such that the intermediate layer (4) is arranged between the useful layer (1) and the carrier substrate (5).~~

~~15. Method of manufacturing a hybrid structure (10) for a surface acoustic wave device according to the preceding claim, wherein the useful layer (1) provided at stage i) is a piezoelectric material donor substrate.~~

~~16. Method of manufacturing a hybrid structure (10) for a surface acoustic wave device according to the preceding claim, comprising a stage v) of thinning the donor substrate to the desired thickness of the useful layer (1) for manufacture of the acoustic wave device.~~

1. A hybrid structure for a surface acoustic wave device comprising a useful layer of piezoelectric material joined to a carrier substrate having a thermal expansion coefficient lower than that of the useful layer, the hybrid structure comprising an intermediate

layer located between the useful layer and the carrier substrate, the intermediate layer being a structured layer formed of at least two different materials having a plurality of periodic motifs in the plane of the intermediate layer, wherein at least one lateral dimension of the motifs is smaller than or equal to the wavelength of the surface acoustic waves of the device.

2. The hybrid structure of claim 1, wherein a periodicity of the motifs is selected according to the frequency of the surface acoustic waves of the device.

3. The hybrid structure of claim 1, wherein the carrier substrate comprises a material selected from among silicon, glass, silica, sapphire, alumina and aluminum nitride.

4. The hybrid structure of claim 1, wherein the useful layer comprises a piezoelectric material selected from among lithium tantalate ($LiTaO_3$), lithium niobate ($LiNbO_3$), quartz and zinc oxide (ZnO).

5. The hybrid structure of claim 1, wherein a mean acoustic impedance of the intermediate layer is equal to the square root of the product of the acoustic impedances of the useful layer and of the carrier substrate.

6. The hybrid structure of claim 1, wherein the thickness of the intermediate layer is greater than the wavelength of the surface acoustic waves of the device.

7. The hybrid structure of claim 1, wherein the periodic motifs comprise an alternation of a first motif composed of the material of the useful layer and of a second motif composed of a material of the same type as that of the carrier substrate.

8. The hybrid structure of claim 7, wherein the second motif is composed of polycrystalline silicon and wherein the carrier substrate is made of silicon.

9. A hybrid structure for a surface acoustic wave device comprising a useful layer of piezoelectric material joined to a carrier substrate having a thermal expansion coefficient lower than that of the useful layer, the hybrid structure comprising an intermediate layer located between the useful layer and the carrier substrate, the intermediate layer being a structured layer formed of at least two different materials having a plurality of periodic motifs in the plane of the intermediate layer, wherein the thickness of the intermediate layer is equal to or smaller than the wavelength of the surface acoustic waves of the device.

10. The hybrid structure of claim 9, wherein at least one lateral dimension of the motifs is smaller than or equal to the wavelength of the surface acoustic waves of the device.

11. The hybrid structure of claim 10, wherein the periodic motifs comprise an alternation of a first motif composed of the material of the useful layer and of a second motif composed of another material.

12. The hybrid structure of claim 11, wherein the second motif is composed of silicon dioxide or silicon nitride.

13. The hybrid structure of claim 9, wherein the periodic motifs comprise an alternation of a first motif composed of the material of the useful layer and of a second motif composed of another material.

14. The hybrid structure of claim 13, wherein the second motif is composed of silicon dioxide or silicon nitride.

15. The hybrid structure of claim 2, wherein the carrier substrate comprises a material selected from among silicon, glass, silica, sapphire, alumina and aluminum nitride.

16. The hybrid structure of claim 15, wherein the useful layer comprises a piezoelectric material selected from among lithium tantalate ($LiTaO_3$), lithium niobate ($LiNbO_3$), quartz and zinc oxide (ZnO).