Claims

1. An elastic surface wave device (100) comprising a piezoelectric layer (120), electrodes (150A, 150B) embedded in the piezoelectric layer, and a substrate (130) supporting the piezoelectric layer and the electrodes, wherein the substrate satisfies the following two conditions:

an attenuation of an elastic mode having an electrode in the piezoelectric layer is less than 0.1 dB/λ; and a speed ratio between a volumetric elastic mode for cutting the substrate and a fundamental elastic mode for cutting the piezoelectric layer is smaller than a predetermined speed ratio value equal to 1, the substrate being chosen from among gallium arsenide and a glass having a Young's modulus of between 60 GPa and 180 GPa, a Poisson's ratio of between 0.15 and 0.35, and a density of between 2000 kg/m^3 and 6000 kg/m^3.

2. The device according to claim 1, wherein a ratio of an attenuation of the fundamental mode for cutting the piezoelectric layer to the attenuation of the electrode elastic mode is greater than 10.

3. The device according to claim 1 or 2, wherein the electrodes pass completely through the piezoelectric layer.

4. The device according to any one of the claims 1 to 3, wherein the substrate is formed from a glass having a Young's modulus of between 60 GPa and 80 GPa, a Poisson's ratio of between 0.15 and 0.25, and a density of between 2100 kg/m^3 and 2400 kg/m^3.

5. The device according to any one of claims 1 to 3, wherein the substrate is formed from gallium arsenide.

6. The device according to any one of claims 1 to 5, wherein the predetermined speed ratio value is equal to 0.9.

7. The device according to any one of claims 1 to 6, wherein the attenuation of the electrode elastic mode is defined by the formula $Attn = -40\pi \frac{\pi}{\pi-\Delta} \frac{f_h - f_b}{f_h + f_b} log(e)$ where, for an electrode excitation generating a propagating mode of an elastic cutting wave, Δ is the acoustic reflection coefficient per electrode, the function log represents the decimal logarithm such that log(e)~0.434 and f_h and f_b are frequencies associated with a resonance of the elastic cutting wave at which an electrical susceptance of the elastic wave device reaches its highest and lowest point, respectively.

8. A method (900) for determining the matching of a substrate to an elastic surface wave device comprising a piezoelectric layer, electrodes embedded in the piezoelectric layer and said substrate, the method being implemented by means of a computer system and comprises a step of emitting (940) a signal representative of a matching of the substrate to the elastic surface wave device, when:

an attenuation of an electrode elastic mode in the piezoelectric layer is less than 0.1 dB/λ; and a ratio between a speed of a volumetric elastic mode for cutting the substrate and a fundamental elastic mode for cutting the piezoelectric layer is smaller than a predetermined speed ratio having a value equal to 1.

9. The method (900) for determining the suitability of a substrate for an elastic surface wave device according to claim 8, wherein the computer system (1000) comprises a computer calculation unit (1010) and a computer memory (1020) functionally in communication with the computer calculation unit and storing a database storing parameters relating to the geometry and nature of the electrodes, the piezoelectric layer, and the substrate, the computer calculation unit implementing the following steps:

retrieving (910) data from the computer memory database, including parameters relating to the geometry and nature of the electrode, the piezoelectric layer and the substrate;

calculating (920) the attenuation of an elastic electrode mode in the piezoelectric layer, based on the retrieved data;

comparing (925) the attenuation of the elastic electrode mode in the piezoelectric layer with a predefined attenuation value of 0.1 dB/λ;

calculating (930) a speed ratio between a volumetric elastic mode for cutting the substrate and a fundamental elastic mode for cutting the piezoelectric layer, from the retrieved data;

comparing (935) the speed ratio with a predetermined speed ratio value equal to 1;

emitting (940) the signal representative of a matching of the substrate to the elastic surface wave device, when:

the attenuation of the electrode elastic mode in the substrate is smaller than the predefined attenuation value; and

the speed ratio is smaller than the predetermined speed ratio value.

10. The method according to claim 8 or 9, wherein the predetermined speed ratio value is equal to 0.9.

11. The method according to any one of claims 8 to 10, wherein the attenuation is defined by the formula $Attn = -40\pi \frac{\pi}{\pi - \Delta} \frac{f_h - f_b}{f_h + f_b} log(e)$ where, for an electrode excitation generating a propagating mode of an elastic cutting wave, Δ is the acoustic reflection coefficient per electrode, the function log represents the decimal logarithm such that log(e)~0.434 and f_h and f_b are frequencies associated with a resonance of the elastic cutting wave at which an electrical susceptance of the elastic wave device reaches its highest and lowest point, respectively.

12. A method (1100) for manufacturing an elastic surface wave device comprising a piezoelectric layer, electrodes embedded in the piezoelectric layer and a substrate, wherein the method (1100) comprises the method (900) of determining the matching of a substrate material according to any one of claims 8 to 11.