Assignment to be Solved by the Invention

【0008】 Embodiments of the present invention provide a substrate for surface acoustic wave element, substrate which is likely to dissipate or radiate heat, namely, whose thermal conductivity is high.

Means for Solving the Assignment

【0009】 Hence, the present inventors studied earnestly or wholeheartedly in order to solve the assignment. As a consequence of their repetitive trials and errors, they discovered that it is possible to fabricate a substrate for surface acoustic wave element, substrate whose thermal conductivity is high, by using a magnesium/lithium niobate single crystal, which contains Mg in a predetermined proportion, or a magnesium/lithium tantalate single crystal, which contains Mg in a predetermined proportion. They thus arrived at completing the present invention.

【0010】 According to a first aspect of the present invention, there is provided a substrate for surface acoustic wave element including:

a magnesium/lithium niobate single crystal in which an atomic ratio between Li and Nb satisfies $0.9048 \leqq (Li/Nb) \leqq 0.9685$, and whose Mg content proportion is from 1% by mole or more to 9% by mole or less; or

a magnesium/lithium tantalate single crystal in which an atomic ratio between Li and Ta satisfies $0.9048 \leqq (Li/Ta) \leqq 0.9685$, and whose Mg content proportion is from 1% by mole or more to 9% by mole or less.

【0011】 According to a second aspect of the present invention, there is provided a production process for a substrate for surface acoustic wave element, the production process including:

a raw-material mixture preparation step of preparing a raw-material mixture by mixing lithium carbonate (Li_2CO_3) making a lithium source, niobium pentoxide (Nb_2O_5) making

a niobium source, and magnesium oxide (MgO) making a magnesium source with each other so as to satisfy following requirements (1) and (2);

(1) an atomic ratio between Li and Nb: $0.9048 \leqq (Li/Nb) \leqq 0.9685$; and

(2) an MgO molar ratio with respect to a sum of $LiNbO_3$ and MgO assuming that $LiNbO_3$ is generated from Li_2CO_3 and Nb_2O_5: $0.01 \leqq \{MgO/(MgO + LiNbO_3)\} \leqq 0.09$;

a raw-material mixture melting step of making a raw-material mixture melt by melting the raw-material mixture;

a single-crystal growth step of growing a magnesium/lithium niobate single crystal by immersing a seed crystal into the raw-material mixture melt and then pulling it up therefrom; and

a substrate fabrication step of fabricating a substrate from the magnesium/lithium niobate single crystal obtained at the single-crystal growth step.

【0011a】 According to a third aspect of the present invention, there is provided a production process for a substrate for surface acoustic wave element, the production process including:

a raw-material mixture preparation step of preparing a raw-material mixture by mixing lithium carbonate (Li_2CO_3) making a lithium source, tantalum pentoxide (Ta_2O_5) making a tantalum source, and magnesium oxide (MgO) making a magnesium source with each other so as to satisfy following requirements (3) and (4);

(3) an atomic ratio between Li and Ta: $0.9048 \leqq (Li/Ta) \leqq 0.9685$; and

(4) an MgO molar ratio with respect to a sum of $LiTaO_3$ and MgO assuming that $LiTaO_3$ is generated from Li_2CO_3 and Ta_2O_5: $0.01 \leqq \{MgO/(MgO + LiTaO_3)\} \leqq 0.09$;

a raw-material mixture melting step of making a raw-material mixture melt by melting the raw-material

mixture;

a single-crystal growth step of growing a magnesium/lithium niobate single crystal or magnesium/lithium tantalate single crystal by immersing a seed crystal into the raw-material mixture melt and then pulling it up therefrom; and

a substrate fabrication step of fabricating a substrate from the magnesium/lithium niobate single crystal or magnesium/lithium tantalate single crystal obtained at the single-crystal growth step.

Advantageous Effects of Invention

【0012】 The substrate for surface acoustic wave element according to embodiments of the present invention exhibits a high thermal conductivity. Surface acoustic wave elements whose heat dissipating or radiating property is high are manufactured by using embodiments of the present substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

【0013】 Fig. 1 is a graph for comparing thermal conductivities which a substrate according to Example No. 1 and another substrate according to Comparative Example No. 1 exhibited at various temperatures.

MODE FOR CARRYING OUT THE INVENTION

(Substrate for Surface Acoustic Wave Element)

【0014】 A substrate for surface acoustic wave element according to the present invention comprises:

a magnesium/lithium niobate single crystal in which an atomic ratio between Li and Nb satisfies $0.9048 \leqq (Li/Nb) \leqq 0.9685$, and whose Mg content proportion is from 1% by mole or more to 9% by mole or less; or

a magnesium/lithium tantalate single crystal in which