## CLAIMS

What is claimed is:

1. A piezoelectric thin film resonator comprising:

a substrate;

a piezoelectric film that is located on the substrate and includes a first film made of an aluminum nitride film containing an additive element and second films located on an upper surface and a lower surface of the first film and made of an aluminum nitride film containing the additive element at a concentration lower than that of the first film; and

a lower electrode and an upper electrode that are located to sandwich the piezoelectric film.

2. The piezoelectric thin film resonator according to claim 1, wherein

the additive element is a divalent element and a tetravalent element, or a divalent element and a pentavalent element.

3. The piezoelectric thin film resonator according to claim 2, wherein

the additive element is a divalent element and a tetravalent element, the divalent element includes at least one of calcium, magnesium, strontium, and zinc, and the tetravalent element includes at least one of titanium, zirconium, and hafnium.

4. The piezoelectric thin film resonator according to claim 2,

the additive element is a divalent element and a tetravalent element, a concentration of the additive element in the first film is greater than or equal to 3 atomic% and less than or equal to 30 atomic% when a total of a number of aluminum atoms of the additive element in the first film and a number of aluminum atoms of the aluminum nitride film defines 100 atomic%.

5. The piezoelectric thin film resonator according to claim 2, wherein

the additive element is a divalent element and a pentavalent element, the divalent element includes at least one of magnesium and zinc, and the pentavalent element includes at least one of tantalum, niobium, and vanadium.

6. The piezoelectric thin film resonator according to claim 1, wherein

the second film is made of an aluminum nitride film not containing an additive element.

What is claimed is:

1. A piezoelectric thin film resonator comprising:

a substrate;

a piezoelectric film that is located on the substrate and includes a first film made of an aluminum nitride film containing an additive element and second films located on an upper surface and a lower surface of the first film and made of an aluminum nitride film containing the additive element at a concentration lower than that of the first film; and

a lower electrode and an upper electrode that are located to sandwich the piezoelectric film.

2. The piezoelectric thin film resonator according to claim 1, wherein

the additive element is a divalent element and a tetravalent element, or a divalent element and a pentavalent element.

3. The piezoelectric thin film resonator according to claim 2, wherein

the additive element is a divalent element and a tetravalent element, the divalent element includes at least one of calcium, magnesium, strontium, and zinc, and the tetravalent element includes at least one of titanium, zirconium, and hafnium.

4. The piezoelectric thin film resonator according to claim 2 or 3,

the additive element is a divalent element and a tetravalent element, a concentration of the additive element in the first film is greater than or equal to 3 atomic% and less than or equal to 30 atomic% when a total of a number of aluminum atoms of the additive element in the first film and a number of aluminum atoms of the aluminum nitride film defines 100 atomic%.

5. The piezoelectric thin film resonator according to claim 2, wherein

the additive element is a divalent element and a pentavalent element, the divalent element includes at least one of magnesium and zinc, and the pentavalent element includes at least one of tantalum, niobium, and vanadium.

6. The piezoelectric thin film resonator according to any one of claims 1 to 5, wherein

the second film is made of an aluminum nitride film not containing an additive element.