Claims

1. A resonator, comprising: a substrate, and a lower electrode layer, a piezoelectric layer and an upper electrode layer, which are sequentially formed on the substrate, wherein an acoustic reflection structure is formed on a surface of the substrate that is close to the lower electrode layer, and an overlapping region of the acoustic reflection structure, the lower electrode layer, the piezoelectric layer and the upper electrode layer along a stacking direction forms a resonant region; and

in the resonant region, a surface, which is away from the substrate, of at least one of the lower electrode layer, the piezoelectric layer and the upper electrode layer is etched to form an etched region, a depth of the etched region is less than a thickness of an etched layer, and an area of the etched region is less than an area of the resonant region.

wherein in the resonant region, the piezoelectric layer is partially etched to form the etched region, and the etched region is filled with a material having a positive temperature coefficient; wherein there are two or more etched layers, and areas of the etched regions of the etched layers are equal.

2. The resonator according to claim 1, wherein the etched region is located at a periphery of the resonant region; and in the resonant region, a contour of an orthographic projection of an unetched region on the substrate is any one of a circle, a closed graph composed of a plurality of arcs, or a polygon.

3. The resonator according to claim 1, wherein in the resonant region, a contour of an orthographic projection of an unetched region on the substrate is a plurality of closed graphs, which are arranged at intervals.

4. The resonator according to claim 1, wherein the etched region is located in a middle region of the resonant region, and a contour of an orthographic projection of the etched region on the substrate is any one of a circle, a closed graph composed of a plurality of arcs, or a polygon.

5. The resonator according to claim 1, wherein the etched region comprises a plurality of sub-regions arranged at intervals, and a contour of an orthographic projection of the sub-region on the substrate is any one or a combination of at least two of a circle, a closed graph composed of a plurality of arcs, or a polygon.

6. The resonator according to claim 1, wherein in the resonant region, surfaces of the upper electrode layer and the piezoelectric layer, which are respectively away from the substrate, are partially etched.

7. The resonator according to claim 1, wherein in the resonant region, surfaces of the upper electrode layer, the piezoelectric layer and the lower electrode layer, which are respectively away from the substrate, are partially etched.

8. The resonator according to claim 1, wherein the upper electrode layer is provided with an inclination angle, and the inclination angle ranges from 80° to 90°.

9. The resonator according to claim 1, wherein the lower electrode layer is provided with an inclination angle, and the inclination angle ranges from 15° to 30°.

10. The resonator according to claim 1, wherein the etched region comprises a plurality of sub-regions that are spaced apart from each other and are arranged in parallel, and a spacing between the sub-regions is greater than or equal to half of a length of the sub-region.

11. The resonator according to claim 1, wherein projections of the etched regions on the substrate overlap with each other.

12. A filter, comprising at least two resonators according to claim 1, wherein the at least two resonators are respectively in respective resonant regions, and an area ratio of an etched region and an unetched region of each of the at least two resonators is different from each other.

13. The filter according to claim 12, wherein the etched region of each of the at least two resonators comprises a plurality of sub-regions that are spaced apart from each other and are arranged in parallel, and a spacing between the sub-regions is greater than or equal to half of a length of the sub-region.

14. The filter according to claim 13, wherein there are two or more etched layers, and areas of the etched regions of the etched layers of each of the at least two resonators are equal.

15. The filter according to claim 13, wherein projections of the etched regions of each of the at least two resonators on the substrate overlap with each other.

16. The filter according to claim 13, wherein the lower electrode layer of each of the at least two resonators is provided with an inclination angle, and the inclination angle ranges from 15° to 30°.

17. The filter according to claim 13, wherein the upper electrode layer of each of the at least two resonators is provided with an inclination angle, and the inclination angle ranges from 80° to 90°.

18. A duplexer, comprising a transmitting filter and a receiving filter, wherein the transmitting filter and/or the receiving filter is the filter according to claim 12.