What is claimed is:

1. A bulk acoustic resonator, comprising a substrate having a cavity, and a bottom electrode, a piezoelectric layer and a top electrode that are sequentially arranged on the substrate, wherein an overlapping area of orthographic projections of the bottom electrode, the piezoelectric layer and the top electrode on the substrate forms a resonance area; and

in the resonance area, an outline shape of the orthographic projection of each of the bottom electrode and the top electrode on the substrate is a closed figure formed by connecting M arcs end to end, and the closed figure is an axisymmetric figure, wherein M is an integer greater than or equal to 2, and the arcs comprise a concave arc that is concave toward a center of the resonance area and a convex arc that is convex away from the center of the resonance area;

wherein the bottom electrode is etched into the closed figure having the outline shape formed by connecting M arcs end to end through photolithography and an ion etching technology, and the closed figure is the axisymmetric figure.

2. The bulk acoustic resonator according to claim 1, wherein the concave arc and the convex arc are alternatively arranged.

3. The bulk acoustic resonator according to claim 2, wherein the arcs comprise a first arc and a second arc that are sequentially connected end to end, the first arc is the convex arc, and the second arc is the concave arc.

4. The bulk acoustic resonator according to claim 2, wherein the arcs comprise a first arc, a second arc, a third arc and a fourth arc that are sequentially connected end to end, the first arc and the third arc are convex arcs and are symmetrically arranged with respect to a first direction, the second arc and the fourth arc are concave arcs and are symmetrically arranged with respect to a second direction, and the first direction is perpendicular to the second direction.

5. The bulk acoustic resonator according to claim 2, wherein the arcs comprise a first arc, a second arc, a third arc, a fourth arc, a fifth arc, a sixth arc, a seventh arc and an eighth arc that are sequentially connected end to end, the first arc, the third arc, the fifth arc and the seventh arc are convex arcs, and the second arc, the fourth arc, the sixth arc and the eighth arc are concave arcs.

6. The bulk acoustic resonator according to claim 1, wherein the piezoelectric layer is made of any one of aluminum nitride, lithium niobate, lithium tantalate, lead zirconate titanate and scandium-doped aluminum nitride.

7. The bulk acoustic resonator according to claim 1, wherein the bottom electrode is made of any one of molybdenum, aluminum, platinum, silver, tungsten and gold.

8. The bulk acoustic resonator according to claim 1, wherein the top electrode is made of any one of molybdenum, aluminum, platinum, silver, tungsten and gold.

9. The bulk acoustic resonator according to claim 1, wherein in the resonance area, an outline shape of the orthographic projection of the piezoelectric layer on the substrate is a closed figure formed by connecting M arcs end to end, and the closed figure is an axisymmetric figure, wherein M is an integer greater than or equal to 2, and the arcs comprise a concave arc that is concave toward the center of the resonance area and a convex arc that is convex away from the center of the resonance area.

10. A method for manufacturing a bulk acoustic resonator, comprising: providing a substrate having a cavity, sequentially forming a bottom electrode, a piezoelectric layer and a top electrode on the substrate, and forming a resonance area by an overlapping area of orthographic projections of the bottom electrode, the piezoelectric layer and the top electrode on the substrate,

wherein in the resonance area, an outline shape of the orthographic projection of each of the bottom electrode and the top electrode on the substrate is a closed figure formed by connecting M arcs end to end, and the closed figure is an axisymmetric figure, wherein M is an integer greater than or equal to 2, and the arcs comprise a concave arc that is concave toward a center of the resonance area and a convex arc that is convex away from the center of the resonance area;

wherein the bottom electrode is etched into the closed figure having the outline shape formed by connecting M arcs end to end through photolithography and an ion etching technology, and the closed figure is the axisymmetric figure.

11. The method for manufacturing a resonator according to claim 10, wherein the piezoelectric layer is made of any one of aluminum nitride, lithium niobate, lithium tantalate, lead zirconate titanate and scandium-doped aluminum nitride.

12. The method for manufacturing a resonator according to claim 11, wherein shapes of the orthographic projections of the top electrode and the bottom electrode on the substrate coincide, or an area of the orthographic projection of the top electrode on the substrate is greater than that of the orthographic projection of the bottom electrode on the substrate, or an area of the orthographic projection of the top electrode on the substrate is smaller than that of the orthographic projection of the bottom electrode on the substrate.

13. The method for manufacturing a resonator according to claim 12, wherein the substrate is etched to form the cavity, and an outline shape of an orthographic projection of the cavity on the substrate is the same as that of the orthographic projection of the top electrode on the substrate.

14. The method for manufacturing a resonator according to claim 10, wherein the substrate is etched to form the cavity, a sacrificial layer is deposited in the cavity, a release hole is etched through the photolithography and an ion etching technology, and etching gas or liquid is introduced to remove the sacrificial layer.

15. The method for manufacturing a resonator according to claim 14, wherein a seed layer

grows on the sacrificial layer, further the piezoelectric layer grows on the seed layer, and the seed layer provides a lattice matching interface required for growth of the piezoelectric layer.

16. The method for manufacturing a resonator according to claim 15, wherein shapes of the orthographic projections of the top electrode and the bottom electrode on the substrate coincide, or an area of the orthographic projection of the top electrode on the substrate is greater than that of the orthographic projection of the bottom electrode on the substrate, or an area of the orthographic projection of the top electrode on the substrate is smaller than that of the orthographic projection of the bottom electrode on the substrate.

17. The method for manufacturing a resonator according to claim 16, wherein an outline shape of an orthographic projection of the cavity on the substrate is the same as that of the orthographic projection of the top electrode on the substrate.

18. A filter, comprising a bulk acoustic resonator, wherein the bulk acoustic resonator comprises a substrate having a cavity, and a bottom electrode, a piezoelectric layer and a top electrode that are sequentially arranged on the substrate, wherein an overlapping area of orthographic projections of the bottom electrode, the piezoelectric layer and the top electrode on the substrate forms a resonance area; and

in the resonance area, an outline shape of the orthographic projection of each of the bottom electrode and the top electrode on the substrate is a closed figure formed by connecting M arcs end to end, and the closed figure is an axisymmetric figure, wherein M is an integer greater than or equal to 2, and the arcs comprise a concave arc that is concave toward a center of the resonance area and a convex arc that is convex away from the center of the resonance area;

wherein the bottom electrode is etched into the closed figure having the outline shape formed by connecting M arcs end to end through photolithography and an ion etching technology, and the closed figure is the axisymmetric figure.

19. The filter according to claim 18, wherein the concave arc and the convex arc are alternatively arranged.