WHAT IS CLAIMED IS:

1. A substrate processing apparatus, comprising:

a plasma generation space in which a processing gas is plasma-excited;

a substrate mounting table configured to mount a substrate thereon;

an electrode installed around an outer periphery of the plasma generation space;

a substrate mounting table elevating part configured to raise or lower the substrate mounting table;

a gas supply part configured to supply the processing gas to the plasma generation space; and

a controller configured to be capable of controlling the substrate mounting table elevating part, based on a power value of a high-frequency power supplied to the electrode, so that the substrate mounted on the substrate mounting table is positioned at a target height, wherein the target height is set according to the power value of the high-frequency power from a plurality of pre-determined heights, where a predetermined range of distribution of a plasma density is satisfied, which are determined in advance for each of a plurality of power values of the high-frequency power.

2. The apparatus of Claim 1, wherein the electrode comprises a coil installed so as to be wound around the outer periphery of the plasma generation space.

3. The apparatus of Claim 1, wherein in the act of controlling the substrate mounting table elevating part, the substrate mounting table elevating part is controlled to position at the target height where a density of plasma generated while processing the substrate is uniform in a plane direction of the substrate.

4. The apparatus of Claim 2, wherein the coil has a diameter larger than a diameter of the substrate to be mounted on the substrate mounting table.

5. The apparatus of Claim 2, wherein the plasma generation space is arranged above a lower end of the coil.

6. The apparatus of Claim 2, wherein the plasma generation space is arranged between a lower end of the coil and an upper end of the coil.

7. The apparatus of Claim 2, wherein the target height is spaced apart by a distance of 38 mm or more downward from a lower end of the coil.

8. The apparatus of Claim 7, wherein the target height is spaced apart by a distance of 138 mm or less downward from the lower end of the coil.

9. The apparatus of Claim 2, wherein an electrical length of the coil is an integral multiple of a wavelength of the high-frequency power supplied to the coil.

10. The apparatus of Claim 9, wherein the coil has an electrical length which is one time the wavelength of the high-frequency power.

11. The apparatus of Claim 2, wherein a diameter of the substrate to be mounted on the substrate mounting table is about 300 mm, and a diameter of the coil is 500 mm or more.

12. The apparatus of Claim 1, wherein the plasma generation space is included in a chamber where the substrate mounting table is installed.

13. A method of manufacturing a semiconductor device, comprising:

mounting a substrate on a substrate mounting table;

adjusting a height of the substrate mounting table, based on a power value of a high-

frequency power supplied to an electrode installed around an outer periphery of a plasma generation space in which a processing gas is plasma-excited, so that the substrate mounted on the substrate mounting table is positioned at a target height, wherein the target height is set according to the power value of the high-frequency power from a plurality of predetermined heights, where a predetermined range of distribution of a plasma density is satisfied, which are determined in advance for each of a plurality of power values of the high-frequency power;

supplying the processing gas to the plasma generation space;

plasma-exciting the processing gas supplied to the plasma generation space by supplying the high-frequency power to the electrode; and

processing the substrate mounted on the substrate mounting table by the plasma-excitation.

14. A method of processing a substrate, comprising:

mounting the substrate on a substrate mounting table;

adjusting a height of the substrate mounting table, based on a power value of a high-frequency power supplied to an electrode installed around an outer periphery of a plasma generation space in which a processing gas is plasma-excited, so that the substrate mounted on the substrate mounting table is positioned at a target height, wherein the target height is set according to the power value of the high-frequency power from a plurality of predetermined heights, where a predetermined range of distribution of a plasma density is satisfied, which are determined in advance for each of a plurality of power values of the high-frequency power;

supplying the processing gas to the plasma generation space;

plasma-exciting the processing gas supplied to the plasma generation space by supplying the high-frequency power to the electrode; and

processing the substrate mounted on the substrate mounting table by the plasma-excitation.

15. A program for causing a computer to control a substrate processing apparatus so as to

perform:

mounting a substrate on a substrate mounting table;

adjusting a height of the substrate mounting table, based on a power value of a high-frequency power supplied to an electrode installed around an outer periphery of a plasma generation space in which a processing gas is plasma-excited, so that the substrate mounted on the substrate mounting table is positioned at a target height, wherein the target height is set according to the power value of the high-frequency power from a plurality of predetermined heights, where a predetermined range of distribution of a plasma density is satisfied, which are determined in advance for each of a plurality of power values of the high-frequency power;

supplying the processing gas to the plasma generation space;

plasma-exciting the processing gas supplied to the plasma generation space by supplying the high-frequency power to the electrode; and

processing the substrate mounted on the substrate mounting table by the plasma-excitation.

16. The apparatus of Claim 1, wherein the distribution of the plasma density is an in-plane deviation of the plasma density.

17. The apparatus of Claim 1, wherein the plurality of predetermined heights are determined based on distributions of the plasma density at a plurality of heights acquired in advance for each of the plurality of power values of the high-frequency power.

18. The apparatus of Claim 1, wherein the controller is further configured to be capable of acquiring, for each of the plurality of power values of the high-frequency power, distributions of the plasma density at a plurality of heights.