

CLAIMS

1. A plasma processing device comprising:

a chamber configured to perform a plasma process of a subject to be processed inside of the chamber, the inside of the chamber configured to be compressed;

a flat-plate-shaped first electrode disposed in the chamber and on which the subject to be processed is mounted;

a first high frequency power supply configured to apply a bias voltage of a first frequency to the first electrode;

a helical second electrode disposed outside the chamber and disposed to face the first electrode with a quartz plate forming an upper lid of the chamber therebetween; and

a gas introducing unit configured to introduce a fluorine-containing process gas from a gas introducing port into the chamber, the gas introducing port being disposed in the upper lid or the vicinity thereof, wherein

a second high frequency power supply and a third high frequency power supply are configured to be electrically connected to the second electrode, the second high frequency power supply being configured to apply an AC voltage of a second frequency to the second electrode, the third high frequency power supply being configured to apply an AC voltage of a third frequency to the second electrode, the third frequency being higher than the second frequency;

two types of AC voltages are configured to be simultaneously applied; and

the second electrode comprises a first part, a second part, and a third part, the first part being disposed at a helical central end and being configured to apply a high

frequency from the second power supply, the second part being disposed at a helical outer peripheral end and being grounded, and the third part being disposed in an intermediate region positioned between the helical central end and the outer peripheral end and being configured to apply a high frequency from the third power supply.

2. The plasma processing device according to claim 1, wherein the third part is disposed in an outermost peripheral region that forms a helical shape within the intermediate region of the second electrode.

3. The plasma processing device according to claim 1 or claim 2, wherein the helical second electrode comprises a first circulating portion, a second circulating portion, and a connection portion, the first circulating portion having a specific radius, the second circulating portion having a radius that is greater than the specific radius, and the connection portion connecting the first circulating portion and the second circulating portion, and the helical second electrode forms a helical shape in which the first circulating portion, the second circulating portion, and the connection portion are repeatedly disposed.

4. The plasma processing device according to any one of the preceding claims, wherein the second frequency of the second power supply which is connected to the second electrode is 2 MHz, and the third frequency of the third power supply which is connected to the second electrode is 13.56 MHz.