CLAIMS

[Claim 1]

A plasma processing apparatus comprising:

a plasma processing chamber;

a substrate support disposed in the plasma processing chamber and including a lower electrode;

an upper electrode structure disposed above the substrate support,

wherein the upper electrode structure includes:

a cooling plate having a coolant channel;

an electrode plate disposed below the cooling plate; and

an electrostatic attracting film formed on a bottom surface of the cooling plate and configured to electrostatically attract the electrode plate, the electrostatic attracting film having a dielectric portion and at least one conductor portion disposed in the dielectric portion; and

a power supply electrically connected to the at least one conductor portion, wherein the electrostatic attracting film has a plurality of dot-shaped protrusions to be in contact with an upper surface of the electrode plate.

[Claim 2]

The plasma processing apparatus of claim 1, wherein the electrostatic attracting film is a thermal sprayed film in direct contact with the cooling plate.

[Claim 3]

The plasma processing apparatus of claim 1, wherein the electrostatic attracting film has an annular protrusion to be in contact with the upper surface of

the electrode plate and surrounding the plurality of dot-shaped protrusions.

[Claim 4]

The plasma processing apparatus of claim 3, wherein the at least one conductor portion includes a plurality of conductor portions.

[Claim 5]

The plasma processing apparatus of claim 4, wherein the plurality of conductor portions have an annular shape and are arranged concentrically.

[Claim 6]

The plasma processing apparatus of claim 5, wherein the plurality of dot-shaped protrusions include:

a plurality of first dot-shaped protrusions arranged in a first region overlapping a first conductor portion among the plurality of conductor portions in plan view; and

a plurality of second dot-shaped protrusions arranged in a second region overlapping a second conductor portion among the plurality of conductor portions in plan view,

wherein a density of the plurality of second dot-shaped protrusions in the second region is different from a density of the plurality of first dot-shaped protrusions in the first region.

[Claim 7]

The plasma processing apparatus of any one of claims 1 to 6, wherein the cooling plate includes a gas diffusion space, a first gas channel extending from an

upper surface of the cooling plate to the gas diffusion space, and a plurality of second gas channels extending from the gas diffusion space to the bottom surface of the cooling plate,

the electrode plate has a plurality of gas injection holes communicating with the plurality of second gas channels, and

the plurality of second gas channels are formed at positions that do not overlap the plurality of gas injection holes in plan view.

[Claim 8]

The plasma processing apparatus of claim 1, wherein the dielectric portion is made of at least one of alumina and aluminum nitride.

[Claim 9]

The plasma processing apparatus of claim 7, wherein the gas diffusion space is formed at a position lower than the coolant channel.

[Claim 10]

The plasma processing apparatus of claim 7, wherein the gas diffusion space is formed at a position higher than the coolant channel.

[Claim 11]

The plasma processing apparatus of claim 1, further comprising:

a heater disposed at a peripheral portion of the cooling plate.

[Claim 12]

The plasma processing apparatus of claim 1, further comprising:

a support member configured to support the electrode plate.

[Claim 13]

An upper electrode structure used in a plasma processing device, comprising:

a cooling plate having a coolant channel;

an electrode plate disposed below the cooling plate; and

an electrostatic attracting film formed on a bottom surface of the cooling plate and configured to electrostatically attract the electrode plate, the electrostatic attracting film having a dielectric portion and at least one conductor portion disposed in the dielectric portion,

wherein the electrostatic attracting film has a plurality of dot-shaped protrusions to be in contact with an upper surface of the electrode plate.