[CLAIMS]

[Claim 1]

A substrate processing apparatus comprising:

a substrate retainer comprising: ~~provided with~~

a substrate support region in which a substrate is supported; and

a heat insulator provided below the substrate support region; and

a reaction vessel of a cylindrical shape in which the substrate retainer ~~and the heat insulator are~~is capable of being accommodated,

wherein the reaction vessel comprises:

an auxiliary chamber protruding outward in a radial direction of the reaction vessel and extending along an extending direction from at least a position below an upper end of the heat insulator to a position facing the substrate support region; and

a first cover provided in the auxiliary chamber along a plane perpendicular to the extending direction of the auxiliary chamber so as to divide an inner space of the auxiliary chamber,

wherein the auxiliary chamber is provided with a groove on an inner wall of the auxiliary chamber, the groove being recessed in a direction perpendicular to the extending direction of the auxiliary chamber and engaged with the first cover.

[Claim 2]

The substrate processing apparatus of claim 1, wherein the first cover is located at a same height as the upper end of the heat insulator.

[Claim 3]

The substrate processing apparatus of claim 1, wherein the first cover is located above the upper end of the heat insulator.

[Claim 4]

The substrate processing apparatus of claim 1, further comprising

a heater provided at a location facing the substrate support region and configured to heat the substrate supported in the substrate support region, and

wherein the first cover is located above a lower end of the heater.

~~[Claim 5]~~

~~The substrate processing apparatus of claim 1, wherein the auxiliary chamber is provided with a groove on an inner wall of the auxiliary chamber, the groove being recessed in a direction perpendicular to the extending direction of the auxiliary chamber and engaged with the first cover.~~

[Claim ~~6~~5]

The substrate processing apparatus of claim 1, wherein a first gap is provided along an outer edge of the heat insulator between the outer edge of the heat insulator and an edge of the first cover.

[Claim ~~7~~6]

The substrate processing apparatus of claim 2, wherein a first gap is provided along an outer edge of the upper end of the heat insulator between the outer edge of the upper end of the heat insulator and an edge of the first cover.

[Claim ~~8~~7]

The substrate processing apparatus of claim ~~6~~5, wherein a width of the first gap is substantially equal to a width of a second gap provided between an inner wall of the reaction vessel and the outer edge of the heat insulator.

[Claim ~~9~~8]

The substrate processing apparatus of claim 1, wherein the first cover comprises:

a first outer plate whose edge is elongated along and in contact with the inner wall of the auxiliary chamber; and

a first inner plate wherein at least a part of the first inner plate vertically overlaps the first outer plate and whose edge is elongated along an outer edge of the heat insulator.

[Claim ~~10~~9]

The substrate processing apparatus of claim 1, further comprising

a gas supply nozzle provided in the auxiliary chamber.

[Claim ~~11~~10]

The substrate processing apparatus of claim 1, further comprising

a second cover provided along the extending direction of the auxiliary chamber and extending downward from an edge of the first cover facing the heat insulator so as to cover an opening of the auxiliary chamber.

[Claim ~~12~~11]

The substrate processing apparatus of claim ~~11~~10, further comprising

a third cover provided in the auxiliary chamber at a position corresponding to a lower end of the second cover along the plane perpendicular to the extending direction of the auxiliary chamber.

[Claim ~~13~~12]

The substrate processing apparatus of claim ~~12~~11, wherein the third cover comprises:

a third outer plate whose edge thereof is elongated along and in contact with the inner wall of the auxiliary chamber; and

a third inner plate wherein at least a part of the third inner plate vertically overlaps the third outer plate and whose edge is elongated along an outer edge of the heat insulator.

[Claim ~~14~~13]

The substrate processing apparatus of one of claims 1 through ~~13~~12, further comprising

an inert gas supplier configured to supply an inert gas to a space below the heat insulator.

[Claim ~~15~~14]

The substrate processing apparatus of claim ~~11~~10, further comprising

an inert gas supplier configured to supply an inert gas to a space below the heat insulator,

wherein the auxiliary chamber communicates with the space below the heat insulator to which the inert gas is supplied, and

the first cover is provided with a first cover opening through which the inert gas supplied into the auxiliary chamber is ejected into a space above the upper end of the heat insulator.

[Claim ~~16~~15]

The substrate processing apparatus of claim ~~15~~14, further comprising

a third cover provided in the auxiliary chamber at a position corresponding to a lower end of the second cover along the plane perpendicular to the extending direction of the auxiliary chamber,

wherein the third cover is provided with a third cover opening through which the inert gas flows into the auxiliary chamber above the third cover.

[Claim ~~17~~16]

The substrate processing apparatus of claim ~~16~~15, wherein an area of the first cover opening is smaller than an area of the third cover opening.

[Claim ~~18~~17]

A method of manufacturing a semiconductor device, comprising:

(a) accommodating a substrate retainer in which a substrate is supported in a reaction vessel of a substrate processing apparatus, wherein the substrate processing apparatus comprises:

the substrate retainer comprising: ~~provided with~~

a substrate support region in which the substrate is supported; and

a heat insulator provided below the substrate support region; and

a reaction vessel of a cylindrical shape in which the substrate retainer ~~and the heat insulator are~~is capable of being accommodated,

wherein the reaction vessel comprises:

an auxiliary chamber protruding outward in a radial direction of the reaction vessel and extending along an extending direction from at least a position below an upper end of the heat insulator to a position facing the substrate support region; and

a first cover provided in the auxiliary chamber along a plane perpendicular to the extending direction of the auxiliary chamber so as to divide an inner space of the auxiliary chamber,

wherein the auxiliary chamber is provided with a groove on an inner wall of the auxiliary chamber, the groove being recessed in a direction perpendicular to the extending direction of the auxiliary chamber and engaged with the first cover; and

(b) supplying a process gas to the substrate in the reaction vessel.

[Claim ~~19~~18]

A substrate processing method comprising:

(a) accommodating a substrate retainer in which a substrate is supported in a reaction vessel of a substrate processing apparatus, wherein the substrate processing apparatus comprises:

the substrate retainer comprising: ~~provided with~~

a substrate support region in which the substrate is supported; and

a heat insulator provided below the substrate support region; and

a reaction vessel of a cylindrical shape in which the substrate retainer ~~and the heat insulator are~~is capable of being accommodated,

wherein the reaction vessel comprises:

an auxiliary chamber protruding outward in a radial direction of the reaction vessel and extending along an extending direction from at least a position

below an upper end of the heat insulator to a position facing the substrate support region; and

a first cover provided in the auxiliary chamber along a plane perpendicular to the extending direction of the auxiliary chamber so as to divide an inner space of the auxiliary chamber,

wherein the auxiliary chamber is provided with a groove on an inner wall of the auxiliary chamber, the groove being recessed in a direction perpendicular to the extending direction of the auxiliary chamber and engaged with the first cover; and

(b) supplying a process gas to the substrate in the reaction vessel.

[Claim ~~20~~19]

A program that causes, by a computer, a substrate processing apparatus to perform:

(a) accommodating a substrate retainer in which a substrate is supported in a reaction vessel of a substrate processing apparatus, wherein the substrate processing apparatus comprises:

the substrate retainer ~~provided with~~comprising:

a substrate support region in which the substrate is supported; and

a heat insulator provided below the substrate support region; and

a reaction vessel of a cylindrical shape in which the substrate retainer ~~and the heat insulator are~~is capable of being accommodated,

wherein the reaction vessel comprises:

an auxiliary chamber protruding outward in a radial direction of the reaction vessel and extending along an extending direction from at least a position below an upper end of the heat insulator to a position facing the substrate support region; and

a first cover provided in the auxiliary chamber along a plane perpendicular to the extending direction of the auxiliary chamber so as to divide an inner space of the auxiliary chamber,

wherein the auxiliary chamber is provided with a groove on an inner wall of the auxiliary chamber, the groove being recessed in a direction perpendicular to the extending direction of the auxiliary chamber and engaged with the first cover; and

(b) supplying a process gas to the substrate in the reaction vessel.