CLAIMS

[Claim 1]

A substrate processing apparatus comprising:

a holding unit configured to hold a substrate;

a rotating unit configured to rotate the holding unit;

a processing tool configured to process a surface of the substrate held by the holding unit;

a replacement tool configured to be detachably attached to the holding unit;

a holding and transport unit configured to hold and transport the processing tool; and

a control unit,

wherein the processing tool includes another fastening part configured to be fastenable to a fastening part provided on the holding and transport unit,

wherein the replacement tool includes:

a main body configured to be engageable with an engagement part of the processing tool; and

a flange portion projecting from a peripheral surface of the main body for attachment to and detachment from the holding unit, and

wherein the control unit is configured to execute a first process of attaching and detaching the processing tool to and from the holding and transport unit by controlling the rotating unit to rotate the holding unit in a state where the replacement tool is attached to the holding unit via the flange portion and the engagement part of the processing tool is engaged

with the main body of the replacement tool.

[Claim 2]

The apparatus according to claim 1, wherein the replacement tool is detachably attached to a portion substantially coinciding with a center of rotation of the holding unit.

[Claim 3]

The apparatus according to claim 1 or 2, further comprising a suction unit configured to cause the substrate to be suctioned to the holding unit,

wherein the holding unit includes a suction hole that is open upward and is connected to the suction unit, and

wherein the control unit is further configured to execute a second process of operating the suction unit to cause the flange portion to be suctioned to the holding unit before the first process.

[Claim 4]

The apparatus according to claim 3, wherein the second process includes causing the flange portion to be suctioned to the holding unit by operating the suction unit in a state where a lower part of the main body is inserted into the suction hole to generate a negative pressure between the flange portion and an upper surface of the holding unit before the first process.

[Claim 5]

The apparatus according to claim 4, wherein the main body includes a cutout in which an outer peripheral surface of the lower part of the main body is partially cut out such that the cutout extends in an extending direction of the replacement tool.

[Claim 6]

The apparatus according to any one of claims 3 to 6,

wherein the holding unit includes a first ridge which has an annular shape and is provided on an upper surface of the holding unit to support the substrate,

wherein the first ridge has an annular shape;

wherein the flange portion includes a second annular ridge projecting toward a lower side of the main body, and

wherein the second ridge is located inside the first ridge in a state where the replacement tool is attached to the holding unit.

[Claim 7]

The apparatus according to any one of claims 1 to 6,

wherein an outer peripheral surface of the engagement part of the processing tool has a non-circular deformed shape,

wherein the main body of the replacement tool has a tubular shape capable of housing the engagement part of the processing tool, and

wherein an inner peripheral surface of an opening of the main body of the replacement tool has a shape corresponding to the outer peripheral surface of the engagement part of the processing tool.

[Claim 8]

The apparatus according to any one of claims 1 to 7,

wherein the main body of the replacement tool includes:

a base portion having a tubular shape;

an outer tubular portion having a tubular shape and disposed outside the base portion;

a transmission portion configured to transmit a rotational force from the holding unit between the base portion and the outer tubular portion; and

a biasing unit,

wherein the outer tubular portion is configured to be slidable relative to the base portion in an extending direction of the replacement tool, and

wherein the biasing unit is configured to apply a biasing force to the outer tubular portion in a direction to separate the base portion and the outer tubular portion from each other in the extending direction of the replacement tool.

[Claim 9]

The apparatus according to claim 8,

wherein the main body of the replacement tool further includes a slide portion configured to be slidable in the extending direction of the replacement tool inside the outer tubular portion between the base portion and the outer tubular portion,

wherein the biasing unit is configured to apply the biasing force to the outer tubular portion via the slide portion, and

wherein the control unit is further configured to execute a third process of controlling the holding and transport unit to apply pressure to the slide portion via the processing tool by the holding and transport unit until the biasing unit is compressed by a predetermined amount, in a state where the engagement part of the processing tool is inserted into the outer tubular portion of the replacement tool attached to the holding unit via the flange portion, and in a state where the processing tool is supported by the slide portion, before the first process.

[Claim 10]

The apparatus according to claim 8 or 9,

wherein an outer peripheral surface of the base portion has a non-circular deformed shape,

wherein an inner peripheral surface of the outer tubular portion has a shape corresponding to the outer peripheral surface of the base portion, and

wherein the transmission portion is constituted by the outer peripheral surface of the base portion and the inner peripheral surface of the outer tubular portion.

[Claim 11]

The apparatus according to any one of claims 8 to 10,

wherein the main body includes a projection projecting from the outer tubular portion toward the base portion, and

wherein the base portion includes a receiving part that receives the projection.

[Claim 12]

The apparatus according to claim 11, wherein the receiving part extends along the extending direction of the replacement tool.

[Claim 13]

The apparatus according to any one of claims 1 to 12, wherein the processing tool includes a nozzle for supplying a processing liquid to the surface of the substrate.

[Claim 14]

The apparatus according to any one of claims 1 to 12,

wherein the processing tool includes a plurality of nozzles for supplying a processing liquid to the surface of the substrate, and

wherein the control unit executes the first process for a designated one of the plurality of nozzles.

[Claim 15]

The apparatus according to any one of claims 1 to 12, wherein the processing tool includes a brush for scrub cleaning the surface of the substrate.

[Claim 16]

The apparatus according to any one of claims 1 to 12,

wherein the processing tool includes another flange portion projecting from a peripheral surface of the processing tool, and

wherein the another fastening part is configured to be fastenable to the fastening part of the holding and transport unit via the another flange portion.

[Claim 17]

The apparatus according to claim 1 or 2,

wherein the holding unit is configured to be capable of physically gripping a peripheral edge of the substrate, and

wherein the replacement tool is attached to the holding unit by the peripheral edge of the flange portion being gripped by the holding unit.

[Claim 18]

The apparatus according to any one of claims 1 to 17, further comprising an imaging unit configured to capture an image of the holding unit,

wherein the control unit is configured to execute a fourth process of determining a state of the replacement tool and/or the processing tool based on a captured image from the imaging unit.

[Claim 19]

The apparatus according to any one of claims 1 to 18,

wherein the engagement part of the processing tool is provided with a plurality of processing tool protrusions projecting outward in a radial direction of the engagement part,

wherein the main body of the replacement tool has a tubular shape capable of housing the engagement part of the processing tool,

wherein an opening of the main body of the replacement tool is provided with a first replacement tool protrusion and a second replacement tool protrusion that project inward in a radial direction of the opening and are configured to be engageable with any of the plurality of processing tool protrusions in a state where the engagement part of the processing tool is housed in the opening, and

wherein the first replacement tool protrusion and the second replacement tool protrusion are positioned to face each other with a center of the opening therebetween.

[Claim 20]

The apparatus according to any one of claims 1 to 19, wherein the flange portion of the replacement tool has an area larger than an area of a surface of the holding unit, and is configured to cover the entire surface of the holding unit in a state where the replacement tool is attached to the holding unit via the flange portion.

[Claim 21]

A method of replacing a processing tool, comprising:

a first step of attaching a replacement tool to a holding unit configured to hold a substrate, the replacement tool including a main body and a flange portion projecting from a peripheral surface of the main body for attachment to and detachment from the holding unit;

a second step of causing an engagement part of a processing tool to engage with the main body, the processing tool being configured to process a surface of the substrate held by the holding unit, and the

processing tool being configured to be transportable while being held by a holding and transport unit; and

a third step of attaching and detaching the processing tool to and from the holding and transport unit by rotating the holding unit.

[Claim 22]

A replacement tool for replacing a processing tool configured to process a surface of a substrate held by a holding unit, the replacement tool comprising:

a main body configured to be engageable with an engagement part of the processing tool; and

a flange portion projecting from a peripheral surface of the main body for attachment to and detachment from the holding unit.

[Claim 23]

The replacement tool according to claim 22,

wherein the main body has a tubular shape capable of housing the engagement part of the processing tool,

wherein an opening of the main body is provided with a first replacement tool protrusion and a second replacement tool protrusion projecting inward in a radial direction of the opening, and

wherein the first replacement tool protrusion and the second replacement tool protrusion are

positioned to face each other with a center of the opening therebetween, and

configured to be engageable with any of a plurality of

processing tool protrusions in a state where the engagement part of the processing tool is housed in the opening, the plurality of processing tool protrusions being provided on the engagement part of the processing tool and projecting outward in a radial direction of the engagement part.

[Claim 24]

The replacement tool according to claim 23, wherein the opening has a substantially circular shape.

[Claim 25]

The replacement tool according to claim 23 or 24, wherein an outer peripheral surface of the first and second replacement tool protrusions has a shape corresponding to an outer peripheral surface of a processing tool recess formed between two of the plurality of processing tool protrusions that are adjacent each other in a circumferential direction of the engagement part.

[Claim 26]

The replacement tool according to any one of claims 23 to 25, wherein the first and second replacement tool protrusions are ridges extending in an extending direction of the main body.

[Claim 27]

The replacement tool according to any one of claims 22 to 26, wherein the flange portion has an area larger than an area of a surface of the holding unit, and is configured to cover the entire surface of the

holding unit in a state where the replacement tool is attached to the holding unit via the flange portion.