

and 2b. This is because the substrate cleaning rolls 2a and 2b cannot clean the outermost edge of the substrate S.

[0012]

Embodiments of the present invention seek to provide a substrate cleaning roll capable of cleaning the outermost edge of a substrate, and a substrate cleaning apparatus and a substrate cleaning method that use the substrate cleaning roll.

Solution to Problem

[0013]

A substrate cleaning roll according to one embodiment has a cylindrical shape and scrubs a surface of a substrate by rotating about a rotational axis in a longitudinal direction in contact with the substrate, the longitudinal direction being parallel to the surface of the substrate, the substrate cleaning roll comprising a bevel cleaner at least at one end of the substrate cleaning roll in the longitudinal direction, the bevel cleaner comprising a first sloping surface and a second sloping surface, wherein the first sloping surface is to be in contact with an outermost edge of a bevel portion at a rim of the substrate when the substrate cleaning roll comes into contact with the substrate and cleans the surface of the substrate, and the second sloping surface slopes in a direction where the farther a distance between the second sloping surface and a base face is, the closer a distance between the second sloping surface and the first sloping

surface on an opposite side of the first sloping face, the base face being a surface of the substrate cleaning roll.

In this structure, the outermost edge of the bevel portion at the rim of the substrate is cleaned by the bevel cleaner of the substrate cleaning roll.

[0014]

The bevel cleaner may have a trapezoidal shape including a contact surface in a cross-section taken along a virtual plane including the rotational axis.

In this structure, the bevel cleaner can be easily deformed so as to enclose the bevel portion at the rim of the substrate.

[0015]

A plurality of nodules may be formed on the substrate cleaning roll, the plurality of nodules being configured to be in contact with the surface of the substrate at a time of cleaning of the surface of the substrate; and a height of the bevel cleaner may be greater than a height of the nodules.

In this structure, the bevel cleaner can also be easily deformed so as to enclose the bevel portion at the rim of the substrate.

[0016]

A substrate cleaning roll according to one embodiment has a cylindrical shape and scrubs a surface of a substrate by rotating about a rotational axis in a longitudinal direction in contact with the substrate, the longitudinal direction being parallel to the surface of the substrate, the substrate cleaning roll comprising a bevel cleaner at least at one end of the substrate cleaning roll in the longitudinal direction, the bevel cleaner comprising a first sloping surface and a second sloping surface, wherein the first sloping surface is to be in contact with an outermost edge of a bevel portion at

a rim of the substrate when the substrate cleaning roll comes into contact with the substrate and cleans the surface of the substrate, wherein a skin layer is not formed on the first sloping surface.

In this structure, the bevel cleaner can also be easily deformed so as to enclose the bevel portion at the rim of the substrate.

[0017]

A substrate cleaning apparatus according to one embodiment comprises a substrate holding member configured to hold a substrate; a substrate cleaning roll configured to scrub a surface of the substrate by rotating about a rotational axis in a longitudinal direction in contact with the substrate, the

longitudinal direction being parallel to the surface of the substrate, the substrate cleaning roll having a cylindrical shape; a vertical drive mechanism configured to push the substrate cleaning roll against the surface of the substrate held by the substrate holding member, the longitudinal direction being parallel to the surface of the substrate; and a rotative drive mechanism configured to rotate the substrate cleaning roll about the rotational axis in the longitudinal direction, the substrate cleaning roll being pushed against the surface of the substrate by the vertical drive mechanism, wherein the substrate cleaning roll comprises a bevel cleaner at least at one end of the substrate cleaning roll in the longitudinal direction, the bevel cleaner comprising a first sloping surface and a second sloping surface, wherein the first sloping surface is to be in contact with an outermost edge of a bevel portion at a rim of the substrate when the substrate cleaning roll is brought into contact with the substrate by the vertical drive mechanism, and the second sloping surface slopes in a direction where an upper portion of the second sloping surface approaches the first sloping surface on an opposite side of the first surface.

In this structure, the outermost edge of the bevel portion at the rim of the substrate is also cleaned by the bevel cleaner of the substrate cleaning roll.

[0018]

The bevel portion at the rim of the substrate may comprise two sloping portions and a side portion between the two sloping portions; and, when the vertical drive mechanism may push the substrate cleaning roll against the substrate held by the substrate holding member, the sloping surface may be deformed

A method for cleaning a substrate according to one embodiment comprises: holding the substrate on a substrate holding unit; and press a first edge nodule of a first porous member and a second edge nodule of a second porous member to a first surface side and a second surface side on a bevel portion of the substrate, respectively, to have the an edge portion of the bevel portion bite into the first edge nodule and the second edge nodule, thereby contacting the deformed first edge nodule and the deformed second edge nodule with whole of the bevel portion of the substrate; wherein a skin layer is not formed on a first surface of the first edge nodule and a second surface of the second edge nodule, the first surface and the second surface contacting the substrate.

In this structure, the outermost edge of the bevel portion at the rim of the substrate is also cleaned by the bevel cleaner of the substrate cleaning roll.

Brief Description of Drawings

[0022]

Fig. 1 is a perspective view of the outline of a cleaning apparatus according to an embodiment of the present technology.

Fig. 2 is a side view of an upper substrate cleaning roll and a lower substrate cleaning roll of the substrate cleaning apparatus, and a substrate in the embodiment of the present

CLAIMS

1. A substrate cleaning roll that has a cylindrical shape and scrubs a surface of a substrate by rotating about a rotational axis in a longitudinal direction in contact with the substrate, the longitudinal direction being parallel to the surface of the substrate,

the substrate cleaning roll comprising a bevel cleaner at least at one end of the substrate cleaning roll in the longitudinal direction, the bevel cleaner comprising a first sloping surface and a second sloping surface, wherein the first sloping surface is to be in contact with an outermost edge of a bevel portion at a rim of the substrate when the substrate cleaning roll comes into contact with the substrate and cleans the surface of the substrate, and the second sloping surface slopes in a direction where the farther a distance between the second sloping surface and a base face is, the closer a distance between the second sloping surface and the first sloping surface on an opposite side of the first sloping face, the base face being a surface of the substrate cleaning roll.

2. The substrate cleaning roll according to claim 1, wherein the bevel cleaner has a trapezoidal shape including the first sloping surface in a cross-section taken along a virtual plane including the rotational axis.

3. The substrate cleaning roll according to claim 1 or 2,
wherein:

a plurality of nodules are formed on the substrate cleaning
roll, the plurality of nodules being configured to be in contact
with the surface of the substrate at a time of cleaning of the
surface of the substrate; and

a height of the bevel cleaner is greater than a height of the nodules.

4. A substrate cleaning roll that has a cylindrical shape and scrubs a surface of a substrate by rotating about a rotational axis in a longitudinal direction in contact with the substrate, the longitudinal direction being parallel to the surface of the substrate,

the substrate cleaning roll comprising a bevel cleaner at least at one end of the substrate cleaning roll in the longitudinal direction, the bevel cleaner comprising a first sloping surface and a second sloping surface, wherein the first sloping surface is to be in contact with an outermost edge of a bevel portion at a rim of the substrate when the substrate cleaning roll comes into contact with the substrate and cleans the surface of the substrate,

wherein a skin layer is not formed on the first sloping surface.

5. A substrate cleaning apparatus comprising:
a substrate holding member configured to hold a substrate;
a substrate cleaning roll configured to scrub a surface of the substrate by rotating about a rotational axis in a longitudinal direction in contact with the substrate, the

longitudinal direction being parallel to the surface of the substrate, the substrate cleaning roll having a cylindrical shape;

a vertical drive mechanism configured to push the substrate cleaning roll against the surface of the substrate held by the substrate holding member, the longitudinal direction being parallel to the surface of the substrate; and

a rotative drive mechanism configured to rotate the substrate cleaning roll about the rotational axis in the longitudinal direction, the substrate cleaning roll being pushed against the surface of the substrate by the vertical drive mechanism,

wherein the substrate cleaning roll comprises a bevel cleaner at least at one end of the substrate cleaning roll in

the longitudinal direction, the bevel cleaner comprising a first sloping surface and a second sloping surface, wherein the first sloping surface is to be in contact with an outermost edge of a bevel portion at a rim of the substrate when the substrate cleaning roll is brought into contact with the substrate by the vertical drive mechanism, and the second sloping surface slopes in a direction where an upper portion of the second sloping surface approaches the first sloping surface on an opposite side of the first surface.

6. The substrate cleaning apparatus according to claim 5, wherein:

the bevel portion at the rim of the substrate comprises two sloping portions and a side portion between the two sloping portions; and,

when the vertical drive mechanism pushes the substrate cleaning roll against the substrate held by the substrate holding member, the sloping surface is deformed and comes into contact with one of the sloping portions and the side portion of the substrate.

7. The substrate cleaning apparatus according to claim 5, wherein:

the bevel portion at the rim of the substrate comprises a curved cross-section protruding outward; and,

when the vertical drive mechanism pushes the substrate cleaning roll against the substrate held by the substrate holding member, the first sloping surface is deformed and comes into contact with a portion between the surface of the substrate and the

outermost edge of the bevel portion.

8. The substrate cleaning apparatus according to any of claims 5 to 7, comprising

two of the substrate cleaning rolls as two substrate cleaning rolls configured to clean two surfaces of the substrate.

9. The substrate cleaning apparatus according to any of claims 5 to 8, wherein when an edge portion of the bevel portion contacts the first sloping surface, the first sloping surface is configured so that the edge portion of the bevel portion bites into the first sloping surface.

10. A method for cleaning a substrate, comprising:

holding the substrate on a substrate holding unit; and
press a first edge nodule of a first porous member and a second edge nodule of a second porous member to a first surface side and a second surface side on a bevel portion of the substrate, respectively, to have the an edge portion of the bevel portion bite into the first edge nodule and the second edge nodule, thereby contacting the deformed first edge nodule and the deformed second edge nodule with whole of the bevel portion of the substrate;

wherein a skin layer is not formed on a first surface of the first edge nodule and a second surface of the second edge nodule, the first surface and the second surface contacting the substrate.