

may be a problem that the reference wafer needs to be prepared regularly. Further, as consumption of the probe needles progresses, the lifetime of the probe card is shortened, which results in a cost increase. Furthermore, though the contact between the probe needles and the electrode pads or the solder bumps can be inspected by checking the needle marks with operator's naked eyes, it is difficult to improve alignment accuracy of the wafer based on such observation result through the naked eyes.

[0009] In view of the foregoing, exemplary embodiments provide a position accuracy inspecting method, a position accuracy inspecting apparatus and a position inspecting unit which enable a simple high-accuracy inspection of a contact position when performing a contact type inspection of an inspection target chip formed on an inspection target substrate.

MEANS FOR SOLVING THE PROBLEMS

[0010] In an exemplary embodiment, there is provided a position accuracy inspecting method performed prior to performing a contact type inspection, wherein the contact type inspection is to be performed by using a probe needle on a preset region of at least one inspection target chip formed on an inspection target substrate. Here, the position accuracy inspecting method includes a placement process of placing the inspection target substrate on a substrate placing table; an imaging process of placing, at a height distanced apart from the inspection target substrate, a glass substrate on which a shape corresponding to the probe needle is formed, and imaging the at least one inspection target chip, including the preset region, formed on the inspection target substrate through the glass substrate from above the inspection target substrate while the glass substrate is not in contact with the inspection target substrate; an analysis process of analyzing a positional relationship between the shape and the preset region from at least one image obtained by the imaging process; and a determination process of determining whether the probe needle is allowed to be brought into contact with the preset region based on the positional relationship between the shape and the preset region obtained by the analysis process, wherein the preset region analyzed by the analysis process includes the preset region where the probe needle is allowed to be brought into contact after the analysis process.

[0011]

[0012] It is desirable to determine that, in the determination process, the probe needle is allowed to be brought into contact with the preset region when a distance between a center of the shape and a center of the preset region is within a preset threshold value.

[0013] It is desirable that the position accuracy inspecting method includes a correction process of correcting, when it is determined in the determination process that a center of the shape and a center of the preset region is not coincident within preset accuracy, coordinates of the substrate placing table such that the center of the shape and the center of the preset region are coincident.

[0014] It is desirable that the at least one inspection target chip is plural in number, and at least two or more inspection target chips formed on the inspection target substrate are imaged through the glass substrate without moving the substrate placing table in the imaging process. Further, it is desirable that the at least one image is plural in number, and the analysis process and the determination process are performed on each of the obtained images, and the correction process is performed when it is determined that the center of the shape and the center of the preset region are not coincident within the preset accuracy for at least one image.

[0015] It is desirable that the inspection target substrate is a semiconductor wafer, and the at least one inspection target chip is a semiconductor device. Further, it is desirable that the preset region is an electrode pad or a solder bump of the semiconductor device.

[0016] In another exemplary embodiment, there is provided a position accuracy inspecting apparatus configured to inspect a contact position prior to performing a contact type inspection, wherein the contact type inspection is to be performed by using a probe needle on a preset region of an inspection target chip formed on an inspection target substrate. Here, the position accuracy inspecting apparatus includes a substrate placing table configured to place the inspection target substrate thereon; at least one imaging unit disposed

above the substrate placing table; and an analysis device configured to analyze an image obtained by the at least one imaging unit. Further, the at least one imaging unit includes a glass substrate, placed at a height distanced apart from the inspection target substrate, on which a shape corresponding to the probe needle is formed; and an imaging device configured to image the inspection target substrate placed on the substrate placing table through the glass substrate from above the inspection target substrate while the glass substrate is not in contact with the inspection target substrate. Furthermore, the analysis device analyzes a positional relationship between the shape and the preset region from an image obtained by imaging the inspection target chip, including the preset region, formed on the inspection target substrate through the glass substrate, and the analysis device determines whether the probe needle is allowed to be brought into contact with the preset region based on the positional relationship between the shape and the preset region. The preset region analyzed by the analysis device includes the preset region where the probe needle is allowed to be brought into contact after analyzing the positional relationship between the shape and the preset region.

[0017] It is desirable that the at least one imaging unit is plural in number.

[0018]

[0019] It is desirable that the position accuracy inspecting apparatus includes a driving mechanism configured to move the substrate placing table in an in-plane direction parallel to a placing surface of the substrate placing table and configured to rotate the substrate placing table with respect to an axis orthogonal to the placing surface. Further, it is desirable that the analysis device controls, when it is determined that a center of the shape and a center of the preset region is not coincident within preset accuracy, the driving mechanism to correct coordinates of the substrate placing table such that the center of the shape and the center of the preset region are coincident.

[0020] It is desirable that the inspection target substrate is a semiconductor wafer, and the inspection target chip is a semiconductor device. Further, it is desirable that the preset region is an electrode pad or a solder bump of the semiconductor device.

[0021] In still another exemplary embodiment, there is provided a position inspecting unit provided above a semiconductor wafer in order to inspect a contact position prior to performing a contact type inspection, wherein the contact type inspection is to be performed

with respect to an electrode pad or a solder bump of a semiconductor device formed on the semiconductor wafer to inspect electrical characteristics of the semiconductor device by bringing a probe needle into contact with the electrode pad or the solder bump at the contact position. Here, the position inspecting unit includes an imaging unit; and a holding substrate configured to hold the imaging unit. Further, the imaging unit includes a glass substrate, placed at a height distanced apart from the semiconductor wafer, on which a shape corresponding to the probe needle is formed; and an imaging device configured to image the semiconductor device formed on the semiconductor wafer through the glass substrate from above the semiconductor wafer while the glass substrate is not in contact with the electrode pad or the solder bump; and an analysis device analyzes a positional relationship between the shape and the electrode pad or the solder bump, and determines whether the probe needle is allowed to be brought into contact with the electrode pad or the solder bump, wherein the electrode pad or the solder bump analyzed by the analysis device includes the electrode pad or the solder bump where the probe needle is allowed to be brought into contact after analyzing the positional relationship between the shape and the electrode pad or the solder bump.

EFFECT OF THE INVENTION

[0022] According to the exemplary embodiments, when performing a contact type inspection by a probe needle on a preset region of an inspection target chip formed on an inspection target substrate, a contact position between the preset region and the probe needle is inspected in advance. For the purpose, a glass substrate on which a shape indicating a position of the probe needle to be brought into contact with the inspection target substrate is formed is placed, instead of the probe needle at a position where the probe needle is arranged, and the inspection target chip formed on the inspection target substrate is imaged through the glass substrate. Further, a positional relationship between the shape formed on the glass substrate and the preset region of the inspection target chip is analyzed based on the obtained image.

[0023] Accordingly, when performing the contact type inspection on the inspection target chip, the inspection of the contact accuracy and the determination of the acceptability thereof can be performed in advance on more accurate sub-micron level with non-contact manner. Further, the position deviation between the shape (pattern) formed on the glass substrate and the preset region formed on the inspection target substrate can be quantitatively analyzed. Furthermore, since no needle mark caused by the probe needle is left on the preset region, unlike in the conventional cases,

WE CLAIM

1. A position accuracy inspecting method performed prior to performing a contact type inspection, wherein the contact type inspection is to be performed by using a probe needle on a preset region of at least one inspection target chip formed on an inspection target substrate, the position accuracy inspecting method comprising:

a placement process of placing the inspection target substrate on a substrate placing table;

an imaging process of placing, at a height distanced apart from the inspection target substrate, a glass substrate on which a shape corresponding to the probe needle is formed, and imaging the at least one inspection target chip, including the preset region, formed on the inspection target substrate through the glass substrate from above the inspection target substrate while the glass substrate is not in contact with the inspection target substrate;

an analysis process of analyzing a positional relationship between the shape and the preset region from at least one image obtained by the imaging process; and

a determination process of determining whether the probe needle is allowed to be brought into contact with the preset region based on the positional relationship between the shape and the preset region obtained by the analysis process,

wherein the preset region analyzed by the analysis process includes the preset region where the probe needle is allowed to be brought into contact after the analysis process.

2. The position accuracy inspecting method of Claim 1,
wherein it is determined in the determination process that the probe needle is allowed to be brought into contact with the preset region when a distance between a center of the shape and a center of the preset region is within a preset threshold value.
3. The position accuracy inspecting method of Claim 1, further comprising:

a correction process of correcting, when it is determined in the determination process that a center of the shape and a center of the preset region is not coincident within preset accuracy, coordinates of the substrate placing table such that the center of the shape and the center of the preset region are coincident.

4. The position accuracy inspecting method of Claim 3,

wherein the at least one inspection target chip is plural in number,

at least two or more inspection target chips formed on the inspection target substrate are imaged through the glass substrate without moving the substrate placing table in the imaging process, and

wherein the at least one image is plural in number,

the analysis process and the determination process are performed on each of the obtained images, and the correction process is performed when it is determined that the center of the shape and the center of the preset region are not coincident within the preset accuracy for at least one image.

5. The position accuracy inspecting method of any one of Claims 1 to 4,

wherein the inspection target substrate is a semiconductor wafer,

the at least one inspection target chip is a semiconductor device, and

the preset region is an electrode pad or a solder bump of the semiconductor device.

6. A position accuracy inspecting apparatus configured to inspect a contact position prior to performing a contact type inspection, wherein the contact type inspection is to be performed by using a probe needle on a preset region of an inspection target chip formed on an inspection target substrate, the position accuracy inspecting apparatus comprising:

a substrate placing table configured to place the inspection target substrate thereon;
 at least one imaging unit disposed above the substrate placing table; and
 an analysis device configured to analyze an image obtained by the at least one imaging unit,
 wherein the at least one imaging unit comprises:

a glass substrate, placed at a height distanced apart from the inspection target substrate, on
 which a shape corresponding to the probe needle is formed; and

an imaging device configured to image the inspection target substrate placed on the
 substrate placing table through the glass substrate from above the inspection target substrate while
 the glass substrate is not in contact with the inspection target substrate,

wherein the analysis device analyzes a positional relationship between the shape and the
 preset region from an image obtained by imaging the inspection target chip, including the preset
 region, formed on the inspection target substrate through the glass substrate, and

the analysis device determines whether the probe needle is allowed to be brought into
 contact with the preset region based on the positional relationship between the shape and the
 preset region,

wherein the preset region analyzed by the analysis device includes the preset region where
 the probe needle is allowed to be brought into contact after analyzing the positional relationship
 between the shape and the preset region.

7. The position accuracy inspecting apparatus of Claim 6,
 wherein the at least one imaging unit is plural in number.

8. The position accuracy inspecting apparatus of Claim 6, further comprising:

a driving mechanism configured to move the substrate placing table in an in-plane direction parallel to a placing surface of the substrate placing table and configured to rotate the substrate placing table with respect to an axis orthogonal to the placing surface,

wherein the analysis device controls, when it is determined that a center of the shape and a center of the preset region is not coincident within preset accuracy, the driving mechanism to correct coordinates of the substrate placing table such that the center of the shape and the center of the preset region are coincident.

9. The position accuracy inspecting apparatus of any one of Claims 6 to 8,
wherein the inspection target substrate is a semiconductor wafer,
the inspection target chip is a semiconductor device, and
the preset region is an electrode pad or a solder bump of the semiconductor device.

10. A position inspecting unit provided above a semiconductor wafer in order to inspect a contact position prior to performing a contact type inspection, wherein the contact type inspection is to be performed with respect to an electrode pad or a solder bump of a semiconductor device formed on the semiconductor wafer to inspect electrical characteristics of the semiconductor device by bringing a probe needle into contact with the electrode pad or the solder bump at the contact position,

the position inspecting unit comprising:

an imaging unit; and

a holding substrate configured to hold the imaging unit,

wherein the imaging unit comprises:

a glass substrate, placed at a height distanced apart from the semiconductor wafer, on which a shape corresponding to the probe needle is formed;

an imaging device configured to image the semiconductor device formed on the semiconductor wafer through the glass substrate from above the semiconductor wafer while the glass substrate is not in contact with the electrode pad or the solder bump; and

an analysis device analyzes a positional relationship between the shape and the electrode pad or the solder bump, and determines whether the probe needle is allowed to be brought into contact with the electrode pad or the solder bump,

wherein the electrode pad or the solder bump analyzed by the analysis device includes the electrode pad or the solder bump where the probe needle is allowed to be brought into contact after analyzing the positional relationship between the shape and the electrode pad or the solder bump.

11. The position accuracy inspecting method of claim 5, wherein the shape is analogous to shape of the electrode pad.

12. The position accuracy inspecting apparatus of claim 9, wherein the shape is analogous to shape of the electrode pad.

13. The position inspecting unit of claim 10, wherein the shape is analogous to shape of the electrode pad.