

Embodiments of the present invention provide a device and a method for the alignment and contacting of substrates, with which a more precise and more efficient alignment and contacting of the substrates is enabled.

According to a first aspect of the present invention, there is provided a method for aligning and contacting a first contact face of a first substrate with a second contact face of a second substrate with the following steps, the following sequence: fixing of a first support face of the first substrate on a first substrate holder and a second support face of the second substrate on a second substrate holder, which can be arranged opposite the first substrate holder, detection of a first X-Y position, related to a focal plane of a first detection unit, and/or first alignment orientation of a first alignment marking arranged in a peripheral region of the first substrate, detection of a second X-Y position, related to a focal plane of a second detection unit, and/or second alignment orientation of a second alignment marking arranged in a peripheral region of the second substrate, alignment of the first substrate with respect to the second substrate, and contacting of the first substrate with the second substrate, said first substrate being aligned with respect to the second substrate, wherein, before the alignment, additionally a detection of a third X-Y position and/or third alignment orientation of a third alignment marking arranged on the first substrate holder and/or the first substrate takes place by a third detection unit, by means of which the alignment is controlled.

According to a second aspect of the present invention, there is provided a device for aligning and contacting a first contact face of a first substrate with a second contact face of a second substrate with: a first substrate holder for fixing a first support face of the first substrate, a second substrate holder for fixing a second support face of the second substrate, said second substrate holder being able to be arranged lying opposite the first substrate holder, a first detection unit for detecting a first X-Y position and/or first alignment orientation of a first alignment marking arranged on the first substrate, a second detection unit for detecting a second X-Y position and/or second alignment orientation of a second alignment marking arranged on the second substrate, alignment means for aligning the first substrate with respect to the second substrate, and contacting means for contacting the first substrate with the second substrate, said first substrate being aligned with respect to the second substrate, wherein the device comprises a third detection unit for detecting a third X-Y position and/or third alignment orientation of a third alignment marking arranged on the first substrate holder and/or the first substrate, by means of which the alignment can be controlled.

All combinations of at least two features given in the description, the claims and/or the figures also fall within the scope of the invention. In stated value ranges, values lying inside the stated limits are also deemed to be disclosed as limiting values and can be claimed in any combination.

Claims

1. A method for aligning and contacting a first contact face (16i) of a first substrate (16) with a second contact face (17i) of a second substrate (17), the method comprising the steps of:

- fixing of a first support face (16o) of the first substrate (16) on a first substrate holder (10) and a second support face (17o) of the second substrate (17) on a second substrate holder (13), which can be arranged opposite the first substrate holder (10),
- detection of a first X-Y position, related to a focal plane (12) of a first detection unit (3), and/or first alignment orientation of a first alignment marking (20) arranged in a peripheral region of the first substrate (16),
- detection of a second X-Y position, related to a focal plane (12) of a second detection unit (4), and/or second alignment orientation of a second alignment marking (21) arranged in a peripheral region of the second substrate (17),
- alignment of the first substrate (16) with respect to the second substrate (17), and
- contacting of the first substrate (16) with the second substrate (17), said first substrate being aligned with respect to the second substrate (17),

wherein, before the alignment, a detection of a third X-Y position and/or third alignment orientation of a third alignment marking arranged on the first substrate holder (10) and/or the first substrate (16) also takes place by a third detection unit (7), by means of which the alignment is controlled, wherein for the alignment of the substrates (16, 17) a correlation of the third X-Y position and/or the third alignment orientation with at least one of a) the first X-Y position and/or the first alignment orientation and b) the second X-Y position and/or the second alignment orientation takes place and a real-time measurement and control is carried out during the alignment.

2. The method according to claim 1, wherein the detection of the first alignment marking (20) and of the third alignment marking (22) takes place in a combined process step, simultaneously, preferably by synchronising the first detection unit (3) and the third detection unit (7).

3. The method according to any one of the preceding claims, wherein the second substrate holder (13) is fixed at least in the X-Y direction during the alignment.

4. The method according to any one of the preceding claims, wherein the first detection unit (3) and the second detection unit (4) are provided on a common X-Y positioning device and/or optical axes of the first detection unit (3) and of the second detection unit (4) are aligned with or assigned to one another, preferably having a common optical axis.

5. The method according to any one of the preceding claims, wherein the third detection unit (7) is arranged fixedly in the X- and Y-direction, preferably has no degrees of freedom, at least with respect to the first detection unit (3), with respect to an optical system (2) comprising the first detection unit (3) and the second detection unit (4), during the detection at least up to the alignment.

6. The method according to any one of the preceding claims, wherein the control of the alignment takes place exclusively by means of the detection of the third X-Y position and/or third alignment orientation.

7. The method according to any one of the preceding claims, wherein the first substrate and the second substrate are arranged between the first substrate holder and the second substrate holder with a constant spacing A between the first contact face and the second contact face in a Z-direction during the detections and up to the alignment.

8. The method according to claim 7, wherein spacing A amounts to less than 500 microns, particularly preferably less than 100 microns, in the optimum case less than 50 microns, in the ideal case less than 10 microns.

9. A device for aligning and contacting a first contact face (16i) of a first substrate (16) with a second contact face (17i) of a second substrate (17) with:

- a first substrate holder (10) for fixing a first support face (16o) of the first substrate (16),
- a second substrate holder (13) for fixing a second support face (17o) of the second substrate (17), said second substrate holder being able to be arranged lying opposite the first substrate holder (10),
- a first detection unit (3) for detecting a first X-Y position and/or first alignment orientation of a first alignment marking (20) arranged on the first substrate,
- a second detection unit (4) for detecting a second X-Y position and/or second alignment orientation of a second alignment marking (21) arranged on the second substrate,
- alignment means for aligning the first substrate (16) with respect to the second substrate (17), and
- contacting means (15) for contacting the first substrate (16) with the second substrate (17), said first substrate being aligned with respect to the second substrate (17),

wherein the device comprises a third detection unit (7) for detecting a third X-Y position and/or third alignment orientation of a third alignment marking arranged on the first substrate holder (10) and/or the first substrate (16), by means of which the alignment can be controlled, wherein for the alignment of the substrates (16, 17) a correlation of the third X-Y position and/or the third alignment orientation with at least one of a) the first X-Y position and/or the first alignment orientation and b) the second X-Y position and/or the second alignment orientation takes place and a real-time measurement and control is carried out during the alignment.

10. The device according to claim 9, wherein the first detection unit (3) and the third detection unit (7) can be synchronised or are synchronised.

11. The device according to claim 9, wherein the second substrate holder (13) is constituted capable of being fixed at least in the X-Y direction during the alignment.

12. The device according to claim 9, wherein the first detection unit (3) and the second detection unit (4) are provided on a common X-Y positioning device and/or optical axes of the first detection unit (3) and of the second detection unit (4) are aligned with or assigned to one another, preferably having a common optical axis.

13. The device according to claim 9, wherein the third detection unit (7) is arranged fixedly in the X- and Y-direction, preferably has no degrees of freedom, at least with respect to the first detection unit (3), with respect to an optical system (2) comprising the first detection unit (3) and the second detection unit (4), during the detection at least up to the alignment.