an arm 17, a base 18, and a pickup tool 19. The stepping motor 15 is an inversion drive mechanism that rotates the rotating shaft 16 to invert the base 18 and the pickup tool 19. The arm 17 has one end attached to the rotating shaft 16, extends obliquely downward in the Z-axis direction from the rotating shaft 16, and has another end attached to an upper surface 18a of the base 18 in the Z-axis direction. The base 18 is a plate-shaped member fixed to a tip of the arm 17 by a bolt or the like. The pickup tool 19 is attached to a lower surface 18b of the base 18 in the Z-axis direction. The pickup tool 19 is movable in the Z-axis direction by a Z-axis drive mechanism (not shown).

[0024] The handling unit 14 shown in FIG. 1 shows a case where the pickup tool 19 faces downward, that is, a state in which the upper surface 18a of the base 18 faces upward in the Z-axis direction. In this state, by moving the handling unit 14 to above the wafer holding part 12, pushing up the chip 72 through the film from below the wafer holding part 12, and sucking the chip 72 on the film from above by the pickup tool 19, the chip 72 is picked up by the pickup tool 19 of the handling unit 14. On the other hand, when the rotating shaft 16 is rotated by the stepping motor 15 and the base 18 and the pickup tool 19 are inverted, the lower surface 18b of the base 18 faces upward in the Z direction, and the pickup tool 19 also faces upward. Accordingly, the handling unit 14 can invert the picked up chip 72.

[0025] The bonding head part 20 is configured to suck the inverted chip 72 picked up from the wafer holding part 12 and transport the chip 72 to a bonding position of the substrate 80 to bond the chip 72 to the substrate 80.

[0026] The bonding head part 20 holds the bonding tool 22 and the top camera 24. Specifically, the bonding tool 22 is attached to the bonding head part 20 via a Z-axis drive mechanism 21, and the top camera 24 is attached to the bonding head part 20 at a position separated from the bonding tool 22. The bonding head part 20 is movable in the X-axis direction and the Y-axis direction by the XY table 26, and accordingly the bonding tool 22 and the top

where it can be determined that the chip 72 has a defect such as a crack, the bonding control part 60 stops bonding of this chip 72.

[0068] Next, the calculation part 61 detects the position of the reference mark 32 at the reference member 30 based on the first image g1 acquired in step S104, and detects the position of the chip 72 held by the bonding tool 22 based on the second image g2 acquired in step S104 (S105).

[0069] Next, the calculation part 61 measures a deviation amount Δmk of the reference mark 32 with respect to the top camera 24 based on the position of the reference mark 32 detected in step S105, and measures a deviation amount Δbh of the chip 72 with respect to the bottom camera 28 based on the position of the chip 72 detected in step S105 (S106). The deviation amount Δmk of the reference mark 32 and the deviation amount Δbh of the chip 72 measured in step S106 are stored to a memory or the like.

[0070] Next, the calculation part 61 calculates a change amount Δod in the offset distance using Formula (1) described above based on the predetermined distance PD, the deviation amount Δmk of the reference mark, and the deviation amount Δbh of the chip 72 (S107).

[0071] Next, the movement control part 62 causes the bonding head part 20 to move and arranges the bonding tool 22 at a position directly above the mounting part of the substrate 80 (S108). At this time, considering the change amount Δod in the offset distance calculated in step S107, the movement control part 62 determines the movement amount of the bonding head part 20 such that the bonding tool 22 is directly above the mounting part of the substrate 80.

[0072] Then, the bonding control part 60 lowers the bonding tool 22 to the vicinity of the substrate 80 and bonds the chip 72 to the mounting part of the substrate 80 (S109). Upon completion of bonding of one chip 72, the process returns to step S101 to perform bonding of a next chip 72.

[0073] When the process from step S101 to step S109 for bonding one chip 72 is taken as one cycle, in a conventional bonding apparatus, with 383 chips taken as a sample, the time per cycle

CLAIMS:

[Claim 1] A bonding apparatus comprising:

a bonding head part which is movable and holds a first camera installed with an optical system oriented toward one side and a bonding tool arranged apart from the first camera by an offset distance;

a second camera installed with an optical system oriented toward another side to be capable of photographing the bonding head part;

a reference member which has a reference mark on a surface on the another side and is fixed at a position spaced apart from the second camera by a predetermined distance; and

a calculation part which calculates a change amount in the offset distance based on the predetermined distance, a position of the reference mark detected by the first camera, and a position of a chip detected by the second camera, when the bonding head part moves such that the reference mark is positioned within a field of view of the first camera and the chip held by the bonding tool is positioned within a field of view of the second camera, wherein

the calculation part detects the position of the reference mark based on a first image captured by the first camera, and detects the position of the chip based on a second image captured by the second camera.

[Claim 2] The bonding apparatus according to claim 1, wherein

the calculation part measures a deviation amount of the reference mark with respect to the first camera based on the first image, and measures a deviation amount of the chip with respect to the second camera based on the second image.

[Claim 3] The bonding apparatus according to claim 1 or 2, further comprising:

a movement control part which controls movement of the bonding head part and determines a movement amount of the bonding head part based on the calculated change amount in the offset distance.

[Claim 4] The bonding apparatus according to any one of claims 1 to 3, wherein the second camera and the reference member are integrated.

[Claim 5] The bonding apparatus according to any one of claims 1 to 4, wherein the predetermined distance is set based on the offset distance.

[Claim 6] A bonding method, which is a bonding method of a bonding apparatus comprising:

a bonding head part which is movable and holds a first camera installed with an optical system oriented toward one side and a bonding tool arranged apart from the first camera by an offset distance;

a second camera installed with an optical system oriented toward another side to be capable of photographing the bonding head part; and

a reference member which has a reference mark on a surface on the another side and is fixed at a position spaced apart from the second camera by a predetermined distance,

the bonding method comprising:

detecting, by the first camera, a position of the reference mark, and detecting, by the second camera, a position of a chip held by the bonding tool; and

calculating a change amount in the offset distance based on the predetermined distance, the detected position of the reference mark, and the detected position of the chip, wherein

the calculating comprises detecting the position of the reference mark based on a first image captured by the first camera, and detecting the position of the chip based on a second image captured by the second camera.