

CLAIMS

[Claim 1]

A wire bonding apparatus comprising:

- a first imaging unit which detects a position of a bonding target on a reference surface;
- a bonding tool provided to be spaced from the first imaging unit;
- a moving mechanism which integrally moves the bonding tool and the first imaging unit in a direction parallel to the reference surface;
- a reference member;
- a second imaging unit arranged on the opposite side to the bonding tool and the first imaging unit with respect to the reference surface; and
- a control unit which measures an offset between the bonding tool and the first imaging unit, wherein
 - in the bonding tool, a wire is inserted therethrough and a ball-shaped tip section of the wire is extended out,
 - the first imaging unit detects a position of an optical axis of the first imaging unit with respect to a position of the reference member,
 - the second imaging unit detects the position of the reference member and detects a position of the ball-shaped tip section of the wire when moving the bonding tool above the reference member according to a previously stored offset value,
 - the control unit measures a change in the offset between the bonding tool and the first imaging unit based on each detection result of the first imaging unit and the second imaging unit, and
 - the reference member has a first mark to be detected by the first imaging unit, and a second mark to be detected by the second imaging unit.

[Claim 2]

The wire bonding apparatus according to claim 1, wherein the first mark is a tapered surface of the reference member.

[Claim 3]

The wire bonding apparatus according to claim 1, wherein the first mark is a step of the reference member.

[Claim 4]

The wire bonding apparatus according to claim 3, wherein the reference member has an opening bottom portion surrounded by the step, and the second mark is formed on the opening bottom portion.

[Claim 5]

The wire bonding apparatus according to claim 2, wherein the reference member has an opening bottom portion surrounded by the tapered surface, and the second mark is formed on the opening bottom portion.

[Claim 6]

The wire bonding apparatus according to any one of claims 1 to 5, further comprising, at the ball-shaped tip section of the wire, an irradiation unit which irradiates each slit light in an XY axis direction parallel to the reference surface from the opposite side to the bonding tool, wherein

the control unit measures the change in the offset between the bonding tool and the first imaging unit based on each slit light in the XY axis direction.

[Claim 7]

The wire bonding apparatus according to claim 6, wherein the control unit measures at least one of the diameter and the shape of the ball-shaped tip section of the wire extended out from the bonding tool.

[Claim 8]

The wire bonding apparatus according to any one of claims 1 to 7, wherein the reference member has a light path length correcting unit, and

the second imaging unit detects the position of the ball-shaped tip section of the wire via the light path length correcting unit of the reference member.

[Claim 9]

The wire bonding apparatus according to any one of claims 1, 6 or 7, wherein the control unit provides feedback of the measured change in offset, and reflects it to next wire bonding.

[Claim 10]

The wire bonding apparatus according to claim 9, wherein the previously stored offset value is the offset value measured at the last time by the control unit.

[Claim 11]

The wire bonding apparatus according to claim 1, wherein the control unit measures the oxidation level of the ball-shaped tip section of the wire based on the detection result of the second imaging unit.

[Claim 12]

The wire bonding apparatus according to claim 11, wherein if the measured oxidation level is high, the control unit provides feedback to a bonding parameter and reflects it to next wire bonding.

[Claim 13]

The wire bonding apparatus according to claim 11, wherein the second imaging unit detects the change associated with the movement of the ball-shaped tip section of the wire when moving the bonding tool in a vertical direction with respect to the reference surface.

[Claim 14]

A method of wire bonding a position of a bonding target on a reference surface, the method comprising:

a preparing step of a wire bonding apparatus comprising:

- a bonding tool provided to be spaced from a first imaging unit;
- a moving mechanism which integrally moves the bonding tool and the first imaging unit in a direction parallel to the reference surface;
- a reference member;
- a second imaging unit arranged on the opposite side to the bonding tool and the first imaging unit with respect to the reference surface; and
- a control unit which measures an offset between the bonding tool and the first imaging unit, wherein the reference imaging unit has a first mark to be detected by the first imaging unit, and a second mark to be detected by the second imaging unit,

a step of forming a ball-shaped tip section on a wire extended out from the bonding tool;

- a first detecting step of detecting a position of an optical axis of the first imaging unit with respect to a position of the reference member by the first imaging unit after moving the first imaging unit above the reference member,
- a second detecting step of detecting the position of the reference member and detecting a position of the ball-shaped tip section of the wire by the second imaging unit after moving the bonding tool above the reference member according to a previously stored offset value, and
- a measuring step of a change in the offset between the bonding tool and the first imaging unit based on each detection result of the first and second imaging units.