Claims

1. A method of recovering a bonding apparatus during a bonding failure to resume a normal operating state for semiconductor chip fabrication, the bonding apparatus having a bonding tool for bonding a wire between a semiconductor chip and a substrate, and a position sensor, the method comprising the steps of:

the position sensor determining a position of the bonding tool when the bonding tool contacts a surface to bond the wire to the substrate;

the bonding apparatus detecting a bonding failure caused by detachment of the semiconductor chip from the substrate based on the position of the bonding tool; and

the bonding apparatus detaching the semiconductor chip from the wire.

2. The method of claim 1, wherein the step of the position sensor determining the position of the bonding tool comprises an encoder measuring a height of the bonding tool with respect to a reference level.

3. The method of claim 2, wherein the step of the bonding apparatus detecting the bonding failure comprises the bonding apparatus comparing the measured height of the bonding tool against a corresponding height of the bonding tool with respect to the reference level in relation to an immediately preceding electrical connection in which bonding of the wire with the substrate has been successful.

4. The method of claim 3, wherein the step of the bonding apparatus detecting the bonding failure comprises the bonding apparatus detecting a difference between the measured height of the bonding tool and the corresponding height of the bonding tool relating to the immediately preceding electrical connection that equals or exceeds 2 mils.

5. The method of claim 1, wherein the bonding apparatus further comprises an electrode for generating an electric discharge, the step of the bonding apparatus detaching the semiconductor chip from the wire comprises the electrode directing the electric discharge towards the semiconductor chip to melt and break a portion of the bonding wire connected to the chip.

6. The method of claim 1, wherein a portion of the bonding wire broken by the electric discharge is a bond between the bonding tool and the semiconductor chip.

7. The method of claim 1, further comprising the step of the bonding apparatus repositioning the bonding tool with respect to an original position of the detached semiconductor chip on the substrate, before detaching the semiconductor chip from the wire.

8. The method of claim 1, further comprising the step of the bonding apparatus bonding the wire to the substrate after the semiconductor chip has been detached from the wire.

9. The method of claim 1, wherein the bonding apparatus further comprises a plurality of clamps, the method further comprising the step of the bonding apparatus using the plurality of clamps to automatically thread the wire through the bonding tool.

10. The method of claim 1, further comprising the step of the bonding apparatus detecting a wire bond between the wire and the substrate before detecting the bonding failure due to detachment of the semiconductor chip from the substrate.

11. The method of claim 10, wherein the bonding apparatus detects an absence of the wire bond if an electrical connection between the bonding tool and the substrate is open, and the bonding apparatus detects a presence of the wire bond if the electrical connection between the bonding tool and the substrate is closed.

12. A computer readable medium containing program instructions for performing the method of claim 1.

13. A method of recovering a bonding apparatus during a bonding failure to resume a normal operation state for semiconductor chip fabrication, the bonding apparatus being for bonding a wire between a semiconductor chip and a substrate, and the bonding apparatus

comprising an electrode for generating an electric discharge, the method comprising the steps of:

the bonding apparatus detecting a bonding failure caused by detachment of the semiconductor chip from the substrate; and

the bonding apparatus detaching the semiconductor chip from the wire by directing the electric discharge generated by the electrode towards the semiconductor chip to break the bonding wire.

14. The method of claim 13, wherein a portion of the bonding wire broken by the electric discharge is a bond between the bonding tool and the semiconductor chip.

15. The method of claim 13, further comprising the step of the bonding apparatus repositioning the bonding tool with respect to an original position of the detached semiconductor chip on the substrate, before detaching the semiconductor chip from the wire.

Claims

1. A method of recovering a bonding apparatus during a bonding failure to resume a normal operating state for semiconductor chip fabrication, the bonding apparatus having a bonding tool for bonding a wire between a semiconductor chip and a substrate, and a position sensor, the method comprising the steps of:

the position sensor determining a position of the bonding tool when the bonding tool contacts a surface to bond the wire to the substrate;

the bonding apparatus detecting a bonding failure caused by detachment of the semiconductor chip from the substrate based on the position of the bonding tool; and

the bonding apparatus detaching the semiconductor chip from the wire.

2. The method of claim 1, wherein the step of the position sensor determining the position of the bonding tool comprises an encoder measuring a height of the bonding tool with respect to a reference level.

3. The method of claim 2, wherein the step of the bonding apparatus detecting the bonding failure comprises the bonding apparatus comparing the measured height of the bonding tool against a corresponding height of the bonding tool with respect to the reference level in relation to an immediately preceding electrical connection in which bonding of the wire with the substrate has been successful.

4. The method of claim 3, wherein the step of the bonding apparatus detecting the bonding failure comprises the bonding apparatus detecting a difference between the measured height of the bonding tool and the corresponding height of the bonding tool relating to the immediately preceding electrical connection that equals or exceeds 2 mils.

5. The method of any one of the preceding claims, wherein the bonding apparatus further comprises an electrode for generating an electric discharge, the step of the bonding apparatus detaching the semiconductor chip from the wire comprises the electrode directing the electric discharge towards the semiconductor chip to melt and break a portion of the bonding wire connected to the chip.

6. The method of any one of the preceding claims, wherein a portion of the bonding wire broken by the electric discharge is a bond between the bonding tool and the semiconductor chip.

7. The method of any one of the preceding claims, further comprising the step of the bonding apparatus repositioning the bonding tool with respect to an original position of the detached semiconductor chip on the substrate, before detaching the semiconductor chip from the wire.

8. The method of any one of the preceding claims, further comprising the step of the bonding apparatus bonding the wire to the substrate after the semiconductor chip has been detached from the wire.

9. The method of any one of the preceding claims, wherein the bonding apparatus further comprises a plurality of clamps, the method further comprising the step of the bonding apparatus using the plurality of clamps to automatically thread the wire through the bonding tool.

10. The method of any one of the preceding claims, further comprising the step of the bonding apparatus detecting a wire bond between the wire and the substrate before detecting the bonding failure due to detachment of the semiconductor chip from the substrate.

11. The method of claim 10, wherein the bonding apparatus detects an absence of the wire bond if an electrical connection between the bonding tool and the substrate is open, and the bonding apparatus detects a presence of the wire bond if the electrical connection between the bonding tool and the substrate is closed.

12. A non-transient computer readable medium containing program instructions for performing the method of any one of the preceding claims.

13. A method of recovering a bonding apparatus during a bonding failure to resume a normal operation state for semiconductor chip fabrication, the bonding apparatus being for bonding a wire between a semiconductor chip and a substrate, and the bonding

apparatus comprising an electrode for generating an electric discharge, the method comprising the steps of:

the bonding apparatus detecting a bonding failure caused by detachment of the semiconductor chip from the substrate;

and the bonding apparatus detaching the semiconductor chip from the wire by directing the electric discharge generated by the electrode towards the semiconductor chip to break the bonding wire.

14. The method of claim 13, wherein a portion of the bonding wire broken by the electric discharge is a bond between the bonding tool and the semiconductor chip.

15. The method of claim 13 or claim 14, further comprising the step of the bonding apparatus repositioning the bonding tool with respect to an original position of the detached semiconductor chip on the substrate, before detaching the semiconductor chip from the wire.