integrity test system) to confirm that proper wire bonds have been formed. International Patent Application Publication WO 2009/002345, which is incorporated by reference herein in its entirety, illustrates exemplary details of such processes and related systems.

[0006] Thus, it would be desirable to provide improved methods of determining a bonding status of a portion of a wire loop (e.g., to determine if the portion of the wire loop is properly bonded to a bonding location).

SUMMARY

[0007] In an aspect, a method of determining a bonding status between a wire and at least one bonding location of a workpiece is provided. The method includes the steps of: (a) bonding a portion of a wire to a bonding location of a workpiece using a bonding tool of a wire bonding machine; (b) determining a motion profile of the bonding tool (thus providing a predetermined motion profile) for determining if the portion of the wire is bonded to the bonding location, the motion profile being configured to result in the wire being broken during the motion profile if the portion of the wire is not bonded to the bonding location; and (c) moving the bonding tool along the motion profile to determine if the portion of the wire is bonded to the bonding location.

[0008] Such methods may be used to check the bonding status of a plurality of portions of the wire bonded to a corresponding plurality of bonding locations of the workpiece. In such an event, steps (b) and (c) described in the prior paragraph may be repeated for each of the plurality of portions of the wire to determine if each of the plurality of portions of the wire are bonded to their corresponding bonding location of the workpiece.

[0009] According to another example, another method of determining a bonding status between a wire and at least one bonding location of a workpiece is provided. The method includes the steps of: (a) bonding a portion of a wire to a bonding location of a workpiece using a bonding tool of a wire bonding machine; (b) detecting, during step (a), at least two of (i) a deformation characteristic related to bonding the portion of wire, (ii) a bond force characteristic related to bonding the portion of wire, and (iii) a transducer characteristic of a transducer of the wire bonding machine; and (c) determining a bonding status of the portion of the wire that was bonded to the bonding location in step (a) using information detected in step (b).

What is Claimed:

1. A method of determining a bonding status between a wire and at least one bonding location of a workpiece, the method comprising the steps of:

(a) bonding a portion of a wire to a bonding location of a workpiece using a bonding tool of a wire bonding machine;

(b) determining a motion profile of the bonding tool for determining if the portion of the wire is bonded to the bonding location, the motion profile being configured to result in the wire being broken during the motion profile if the portion of the wire is not bonded to the bonding location; and

(c) moving the bonding tool along the motion profile to determine if the portion of the wire is bonded to the bonding location.

2. The method of claim 1 wherein the workpiece is a memory based semiconductor device.

3. The method of claim 2 wherein the wire is configured to be at least one of a power lead or a ground lead of the memory based semiconductor device.

4. The method of claim 1 wherein step (c) includes determining if the wire is broken during the motion profile to determine if the portion is bonded to the bonding location.

5. The method of claim 4 wherein the determination of whether the wire is broken is made using a detection system of the wire bonding machine, the detection system detecting whether a conductive path is established between (a) the wire, and (b) a portion of the wire bonding machine.

6. The method of 5 wherein the conductive path includes at least one of (a) a wire clamp for clamping the wire, (b) a wire spool for supplying the wire to the bonding tool, (c) a diverter element for assisting in positioning of the wire between the wire spool and the bonding tool, and (d) an air guide system for assisting in positioning of the wire between the wire spool and the bonding tool.

7. The method of claim 6 wherein the detection system detects whether the conductive path is established by detecting at least one of (a) a predetermined current flow in the conductive path, (b) a predetermined change in

capacitance between the conductive path and a ground connection of the wire bonding machine, and (c) a predetermined phase shift of current flowing in the conductive path.

8. The method of claim 1 wherein a plurality of portions of the wire are bonded to a corresponding plurality of bonding locations of the workpiece, and wherein steps (b) and (c) are repeated for each of the plurality of portions of the wire to determine if each of the plurality of portions of the wire are bonded to their corresponding bonding location of the workpiece.