Fig. 1 is a system diagram showing a configuration of a wire non-attachment inspection system of an embodiment.

Fig. 2 is a plan view showing an image captured by a camera.

Fig. 3 is a flowchart showing an operation of a control unit of the wire non-attachment inspection system shown in Fig. 1.

Fig. 4(a) is an enlarged plan view of a part A of Fig. 2 when a substrate is ultrasonically vibrated and Fig. 4(b) is an enlarged plan view of a part B shown in Fig. 4(a).

Fig. 5 is a plan view showing an excess region when the substrate is ultrasonically vibrated.

Fig. 6 is a system diagram showing a configuration of a wire non-attachment inspection system of another embodiment.

Fig. 7 is a system diagram showing a configuration of a wire non-attachment detection device of an embodiment.

Fig. 8 is a flowchart showing an operation of the wire non-attachment detection device shown in Fig. 7.

DESCRIPTION OF THE EMBODIMENTS

[0036]

Hereinafter, a wire non-attachment inspection system 100 of an embodiment will be described with reference to the drawings. As shown in Fig. 1, the wire non-attachment inspection system 100 is used to inspect non-attachment between a wire 30 of a semiconductor device 10 and an electrode 12 of a substrate 11 or electrodes 25 to 28 of the semiconductor device 10. The wire non-attachment inspection system 100 includes an ultrasonic oscillator 40, an ultrasonic transducer 42 which is an ultrasonic

and 25 to 28. When the wire 30a is ultrasonically vibrated, the first-stage to fourth-stage wires 31a to 34a are vibrated laterally at the natural frequency f0 between the electrodes 12 and 25 to 27 which are respectively connected to the lower ends of the first-stage to fourth-stage wires 31a to 34a and the electrodes 25 to 28 which are respectively connected to the upper ends thereof. The natural frequency f0 is different depending on the diameter of the wire 30 and the gap a between the electrodes 25 and 26 and between the electrodes 26 and 27, but is often on the order of several tens of Hz in a general semiconductor device 10.

[0044]

On the other hand, a non-attached wire 30b is not attached to the electrode 26 of the second-stage semiconductor chip 22. Similarly to the non-attached wire 30a, the non-attached wire 30b are provided with the first-stage to fourth-stage wires 31b to 34b. When the non-attached wire 30b is ultrasonically vibrated, the second-stage wire 32b and the third-stage wire 33b are laterally vibrated at the natural frequency f1 between the electrode 25 of the first-stage semiconductor chip 21 and the electrode 27 of the third-stage semiconductor chip 23. In this example, as shown in Fig. 4(b), since a gap between the electrode 25 and the electrode 27 becomes 2a which is twice the gap a between the electrodes 25 and 26 and between the electrodes 26 and 27, the natural frequency f1 of the third-stage wire 33b and the second-stage wire 32b of the non-attached wire 30b is about a half of f0 and is often on the order of 20 to 30 Hz in a general semiconductor device 10.

[0045]

Additionally, since the substrate 11 and the semiconductor chips 21 to 24 do not have a portion that is naturally vibrated even when these are ultrasonically vibrated, low-frequency natural vibrations such as those of the wire 30a and the non-attached wire 30b do not occur.

[0046]