

[DESCRIPTION]

[TITLE OF INVENTION]

WIRE BONDING APPARATUS, METHOD FOR MANUFACTURE OF SEMICONDUCTOR
DEVICE, AND SEMICONDUCTOR DEVICE

5 [Technical Field]

[0001]

The present specification discloses a wire bonding apparatus for connecting a first bonding point and a second bonding point provided on a mounted body to each other with a wire, a method for manufacture of a semiconductor device, and a semiconductor device.

10 [Background Art]

[0002]

In recent years, in accordance with increase in the level of functionality of portable information terminals, digital AV instruments, IC cards, and the like, mounted semiconductor chips have been required to be smaller and thinner and have a higher level of integration.

15 Particularly, in laminated memory devices or the like, memory capacities thereof are determined depending on the number of chips which can be laminated. For this reason, it is important to be able to laminate a larger number of semiconductor chips within a prescribed package height. In order to satisfy such a demand, it is necessary to restrict the heights of wire loops formed through wire bonding. Hence, in the related art, many low looping technologies for restricting
20 the loop height have been proposed.

[0003]

Here, a pressure bonded ball having a flat disk shape and a column part overlapping the pressure bonded ball are present at one end of a wire connecting a first bonding point and a second bonding point to each other. In many low looping technologies in the related art, since
25 looping is performed in a state in which a column part remains on a pressure bonded ball as it

technology in Fig. 10 is often approximately the total of a thickness Bt of the pressure bonded ball 60 and the wire diameter ϕ . For example, when the wire diameter is 18 μm and the thickness Bt of the pressure bonded ball 60 is 7 μm , the loop height HL according to the technology in Fig. 10 is approximately 25 μm .

5 [0043]

In the wire bonding apparatus 10 disclosed in the present specification, the loop height HL is further reduced. Specifically, in this device, after the pressure bonded ball 60 and the column part 62 are formed, the column part 62 is scraped using the capillary 12 by horizontally moving the capillary 12 as it stands without moving it upward. Accordingly, low looping is
10 achieved. This will be described with reference to Figs. 4 to 6. Fig. 4 is a view illustrating a movement trajectory of the capillary 12 at the time of forming the first bonded part 54. In addition, Figs. 5 and 6 are views illustrating movement of the capillary 12 and the wire 50 when the first bonded part 54 is formed. The alphabets a to l applied in each diagram of Figs. 5 and 6 correspond to trajectories a to m indicated in Fig. 4.

15 [0044]

When the first bonded part 54 is formed, the control unit 24 first releases the clasper 21. In this state, driving control of the XY table 18 and the ascending/descending mechanism is performed, and the capillary 12 is moved to a place immediately above the first bonding point P1. Subsequently, the control unit 24 causes a high voltage to be applied between the discharge
20 electrode 22 and the tip of the wire 50 to generate a discharge, and the FAB 52 is formed at the tip of the wire 50.

[0045]

If the FAB 52 is formed, the control unit 24 causes the capillary 12 to descend toward the first bonding point P1. At this time, a distance from the upper surface of the pad 112 to the
25 lower end of the capillary 12 (which will hereinafter be referred to as “a pressure bonding height

[0054]

The control unit 24 repeats this pressing operation a plurality of times while a horizontal position is changed until the wire 50 arrives at a forward side end part of the pressure bonded ball 60. In the present example, the control unit 24 performs the pressing operation three times. The trajectory e in Fig. 4 and the diagram at the center in the lower stage in Fig. 5 illustrate a first pressing operation. In addition, the trajectory h in Fig. 4 and the diagram at the center in the upper stage in Fig. 6 illustrate a second pressing operation, and the trajectory k in Fig. 4 and the diagram at the center in the lower stage in Fig. 6 illustrate a third pressing operation. As is obvious in Figs. 5 and 6, the wire 50 can be drawn out from the forward side end part of the pressure bonded ball 60 while the thickness of the first bonded part 54 is maintained thin by repeating the pressing operation until the wire 50 arrives at the forward side end part of the pressure bonded ball 60.

[0055]

Here, it is desirable that the number of times of performing this pressing operation and horizontal intervals (distances of the trajectories d, g, and j) be set such that the entire wire 50 placed on the pressure bonded ball 60 is thoroughly pressed down by the facing surface 44 on the reverse side of the hole 40.

[0056]

In addition, the movement height H2 is set within a range in which the wire 50 can be folded back. That is, if the movement height H2 is excessively smaller than the wire diameter ϕ , the wire 50 is unlikely to lie, and thus the wire 50 cannot be folded back. On the other hand, if the movement height H2 is larger than necessary, it takes extra time for the increased portion. Hence, it is desirable that an appropriate value for the movement height H2 corresponding to the diameter or the material of the used wire 50 be obtained in advance through an experiment or the like and be stored in the control unit 24.