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Study on the law of multiparameter in dipping process

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ABSTRACT

In order to remove defect and enhance quality of flip-chip bonding, the influence of multiparameter in dipping process is researched. A dipping experimental bed is established, and images of dipping process is recorded by high-speed camera, the relationships between dipping glue quantity and dipping parameters including dipping speed, dipping depth, dipping time and viscosity of flux are discussed. In dipping process, a phenomenon that flux gathers into a mass was observed, and it is the main reason why there is a corrosion phenomenon. And dipping results show a decreasing trend of glue quantity as dipping speed increases, an increasing trend of glue quantity as dipping depth increases and an increasing trend of glue quantity as dipping time increases. The influence of viscosity is divided into two stages, it shows an increasing trend as viscosity increases when viscosity is smaller than 8 Pa S, and it is a decreasing trend as viscosity increases when viscosity is larger than 8 Pa S.

1. Introduction

The increase in the packaging density is current main trend. Traditional packaging technology is limited by the large volume, increased wire-bonding resistance and high cost [1–6]. So many works focus on the development of highly integrated and highly performance packaging [7–13]. With the development of packaging technology, more and more technologies have been applied in different fields [14–19]. Flip-chip has its own advantages.

Flip chip and associated assembly technologies allow the connections between the chip's pads and the tracks of the substrate via adhesive paste, stud bumps, copper pillars, or solder bumps instead of bonding wires [20–23]. Flip chip bonding technology offers greater interconnect density, better electrical performance and lower inductance and resistance [24,25]. Those advantages mean that flip-chip bonding technology has grown explosively in recent years and has become the mainstream of the ultra-large-scale integration (ULSI) interconnection technology [26,27]. In today's market, flip-chip occupies most of the market share.

The usage of flux is very important, but there is not much research in this area from literature. Flux coating can increase the wettability of the solder bump and improve assembly reliability [28,29]. And there are also some problems during flux coating process. Because flux is caustic and may affect the performance of the circuit, the glue quantity of flux on bumps should be controlled accurately. An appropriate value of glue quantity should be used to avoid un-bonding or damage of product.

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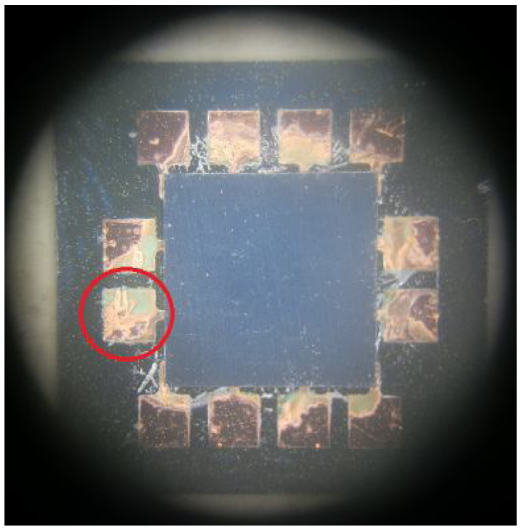

Fig. 1. corrosion phenomenon.

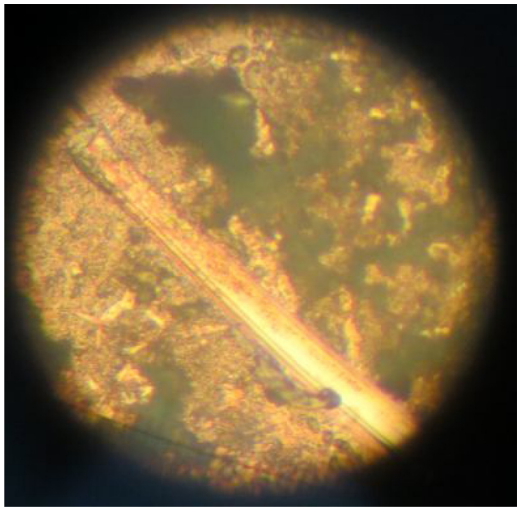

Fig. 2. enlarged picture of Cu pad.

In this paper, the effect of multiparameter on dipping process was studied. Dipping depth, dipping speed, dipping time and viscosity of flux were mainly concerned. The changing trend of glue quantity under different parameters was found out. It offers a reliable reference basis.

2. Experiment

In flip-chip bonding process, flux is very important. But if there is excessive flux during bonding process, it may remain on chip and it will have damage on quality of flip-chip. In the past flip chip bonding sample, a corrosion phenomenon was observed when flux remained on chip for few days as shown in Fig. 1. Fig. 2 is an enlarged picture of Cu pad in Fig. 1.

As we can see, some flux remained on Cu pad, and this phenomenon has an obvious impact on electrical performance in testing process. For the purpose of ensuring the quality of product, it is necessary to control the glue quantity of flux in dipping process. To reach this goal, the influence of multiparameter on dipping has to be studied.

In order to research the dipping process, an experimental platform is established as shown in Fig. 3. It consists of motion controller, motion guide, dipping head, computer, ultrasonic cleaning machine, light source and high-speed camera. Upper right corner of Fig. 3 is the detail looks of dipping head and dipping die.

The dipping die in experiment is only 1.2×0.8 mm, there are 6 bumps on each die, the diameter of bumps is 225 μm, and the height of bumps is 180 μm. Die is pasted to the dipping head, and the flux container locates under the dipping head. The