Discoloration Issue Analysis on Smart7 products

Final Project Proposal

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The undersigned author declare that the contents of part or all of my Final Project entitled: “Discoloration Issue Analysis on Smart7 products” are author work, completed without the use of materials that are not permitted, and are not the work of other parties that author acknowledge it as your own work. All references cited or referred to have been written in full in the bibliography. If my statement is not true, author is willing to accept sanctions in accordance with applicable regulations.

Batam, 31 July 2024

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Attestattion Sheet

The Final Project Proposal is prepared to be used as a work plan for the implementation of the Final Project

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Discoloration Issue Analysis on Smart7 products

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Abstrak

Discoloration is a color change test that occurs on the bond pad caused by a Non-Stick On Pad (NSOP) defect, namely a wire that does not stick to the surface of the bond pad on the IC. Discoloration is also caused by the Lifted Ball Bond (LBB)defect, which is the ball bond process that is not perfectly attached. Discolorationoccurs during the wire bonding process which is the process of connecting the chipto the lead using wire. Wire bonding process is a stage in the IC manufacturing process in this project. There are 3 types of wire used, namely Au (Gold), Cu (Copper), and Alu (Aluminum) with each diameter of 25µm, 30µm, 50µm, and 65µm. Testing on the IC aims to determine the results of discoloration on the IC after the wire bonding process is carried out on the bond pad which results in Lifted Ball Bond (LBB) and non-stick on pad (NSOP) defects, so that the wire cannotstick properly to the bond pad in Smart7 products. The method used in this projectis to conduct Discoloration testing for 5 minutes with a temperature of 250 ° C onSmart7 products.

Kata kunci: Discoloration, Defect, Integrated Circuit (IC),NSOP

1. Introduction

ic is produced through several stages following a brief overview of the stages of making ic ,The first process is the pre-Assembly process, this process connects the frontend and backend. Frontend is the process of making IC raw materials into wafers. While the backend is the process of wafers obtained from the frontend which will be cut into a die using a knife, then sent to the next process, namely thedie attach process of laying the die to the lead frame, the third process is the wirebond process, which is the connection process contained in the die to the lead finger on the lead frame. The fourth process is the A2 platting process, which is a process where the lead frame will be coated with chemicals to grow dendry, namely epoxy for moulding. The last process is the Autovision process, which is a process of checking

from the beginning to the end of the process**,** checkingwhether there are rejects or not in the Ic manufacturing process. In the IC manufacturing process requires a wire bond process. Because the process of connecting thewire to the bond pad greatly affectsthe IC performanceprocess, where the wire does not stick well to the surface of the pad usually due to contamination on the surface of the pad [2]

In this project, the author raises the topic of Discoloration Issue Analysis on Smart7 products. Discoloration is a colour change test that occurs on the bond paddue to a Non-Stick On Pad (NSOP) defect, which is a wire that does not stick to thesurface of the bond pad on the IC. Because discoloration occurs during the wirebonding process which is the process of connecting the chip to the lead usinga wire. The author focuses ontesting IC on SMART7 products to see if discoloration occurs onthe bond pad in SMART7 products after the completion ofthe wirebonding process which causes NSOP (non-stick on pad) rejects. By testingthe IC, it aims to find out what causes discoloration to occur so that discoloration can be minimized [3]

The limitation of the problem in testing is that the testing process only uses a Hot Die Shear Machine and for image data capture uses a Keyence VHX-500 and only tests discoloration rejects. The purpose of the author conducting research on IC testing on S7 products is to test the discoloration of the bond pad on

S7 products after the completion of the wirebonding process and find a good S7 Reject IC from the results of the discoloration test so that it can be used and produced again.

2. Literature Review

The wire bonding process is the process of connecting the wire from the pad to the lead frame which is connected using a capillary [1]. when connecting the wire from the lead to the chip, the orientation and intensity of the focus light mustbe set up in advance to make it easier for themachine to readthe chiporientationand lead frame orientation. The wire bond process is still very much under development and therefore needs to be developed all the time. Because ICs are getting smaller and smaller, and new types of ICs are being developed, the processon wire bond also needs to be developed [2]. The process of connecting the wire to the bond pad is very important because it can affect the IC performance process, where the wire does not stick well to the pad surface usually due to contamination on the pad surface [3].

Figure 1.wire bonding process

The wire bond process is the process of connecting the wire to the bond pad on the leadframe using gold thread (gold wire), meaning that the gold thread connection produced by the wire bond process can be said to be perfect because it does not contain defects in accordance with its specifications. Conversely, the results of the production process produced by the wire bond machine do not always produce units that are free from defects (zero defect),

The wirebond process is still very much in the process of development and therefore needs to be developed at all times. Because ICs are getting smaller and smaller the process on wirebond also needs to be developed. The process of connecting the wire to the bond pad is very important because it can affect the IC performance process, where the wire does not stick well to the surface of the pad usually due to contamination on the surface of the pad.

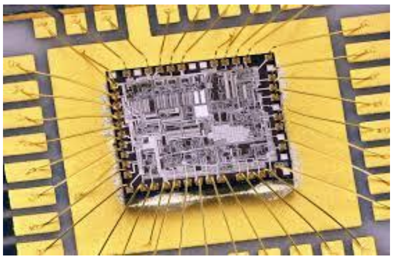


Figure 2: Wirebonding on IC

3. Method

1. Plan Flowchart Research

In analysis discoloration issues in smart7 products, the author needs to makearesearch flowchart to make it easier to do structural design.

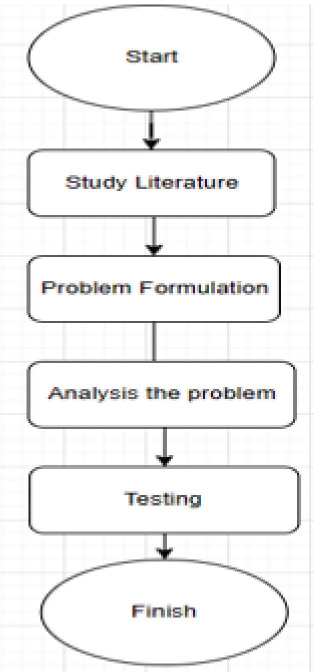


Figure 3.Flowchart Research

2. Fish Bond

Original contributions are solicited on topics covered When analysis, a fishbone diagram is needed to find out the causes of the problems that occur in the discoloration issue on smart7 products. The following is the discoloration problem in smart7 products in a fishbone diagram.

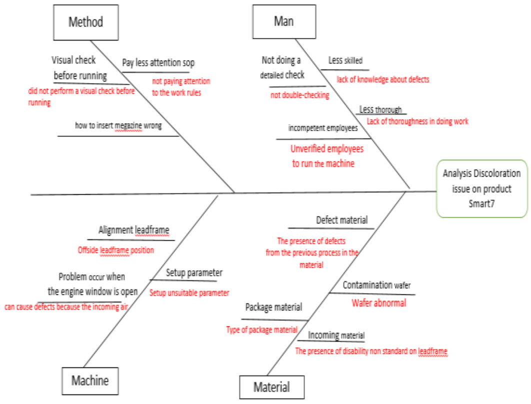


Figure 4.Fishbone

3 flowchart testing hot plate test

When testing, a testing flowchart is needed to know the beginning to end flowin a study

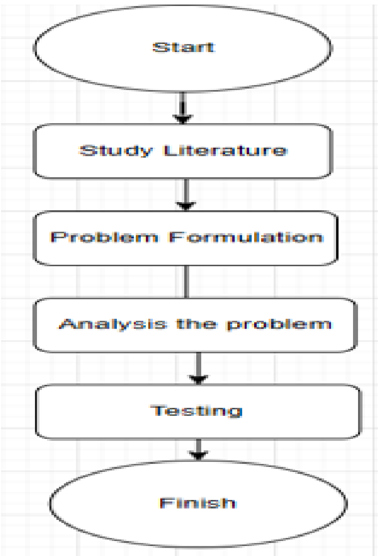


Figure 5.Flowchart Testing hot plate test

4. Analysis and discussion

1 Material Preparation

A. The Shinkawa UTC-5000 Wirebonder

A machine used to perform the wirebonding process on a die with a leadframe as a container.

Figure 6. Shinkawa UTC-5000 Wirebonder

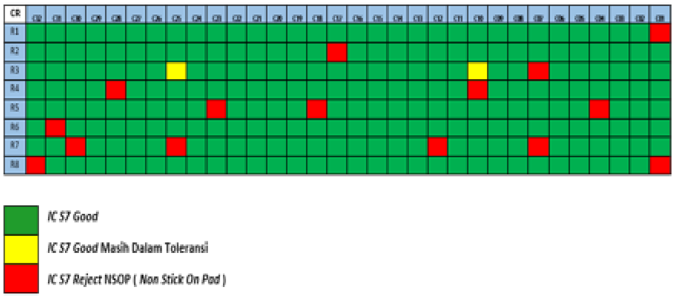
B. Autovision Inspection Machine

It is a machine used to check whether there are problems or IC defects in the form of Non Stick On Pad (NSOP) and Lifted Ball Bond (LBB). In this machine, reject leadframe die material is taken as testing material.

Figure 7 Autovision Inspection Machine

IC data on the leadframe obtained after the checking process using the Autovision Inspection Machine

TABEL 1. Inspection results on autovision inspection machine



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R2	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
R3	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟩	🟩
R4	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
R5	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩
R6	🟩	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
R7	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩	🟩	🟩	🟩
R8	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟥

🟩 *IC S7 Good*
🟨 *IC S7 Good Masih Dalam Toleransi*
🟥 *IC S7 Reject NSOP (Non Stick On Pad)*

Table 2 smart7reject ic result

Nomor	Column & Row IC Reject
1	C1R1
2	C1R8
3	C4R5
4	C7R3
5	C7R7
6	C10R4
7	C12R7
8	C17R2
9	C18R5
10	C23R5
11	C25R7
12	C28R4
13	C30R7
14	C31R6
15	C32R8

Leadframe

It is a metal structure lead frame in which there is an IC array of 256 pcs in 1 leadframe. Leadframes based on lead frames are often made from Copper or copper (Cu) alloy base material.

Figure 8: Leadframe

Keyence VHX-500

It is a microscope used in taking micro-scale image visualisation used for taking before & after images in testing.

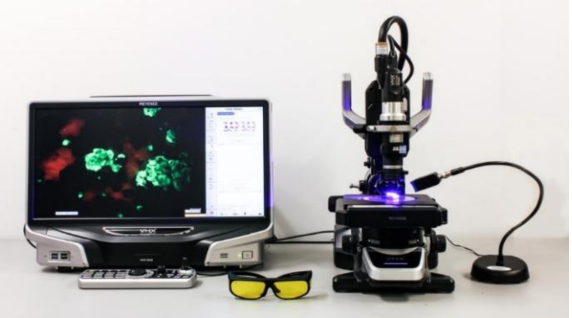


Figure 9: Keyence VHX-500

Hot Die Shear Machine

Testing is carried out using a Hot Die Shear machine used in testing which functions in heating the IC so that discoloration can occur on the IC. The temperature required in the test is 250 ° C and a holding time of 5 minutes so that discoloration can occur on the IC.

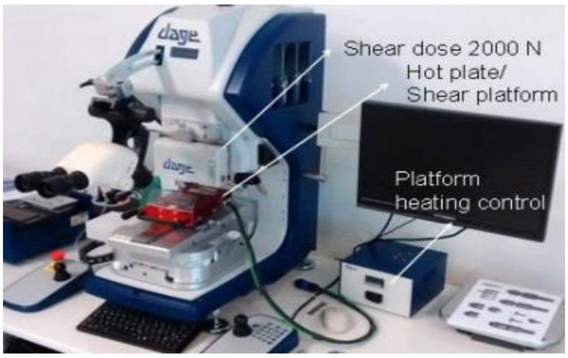
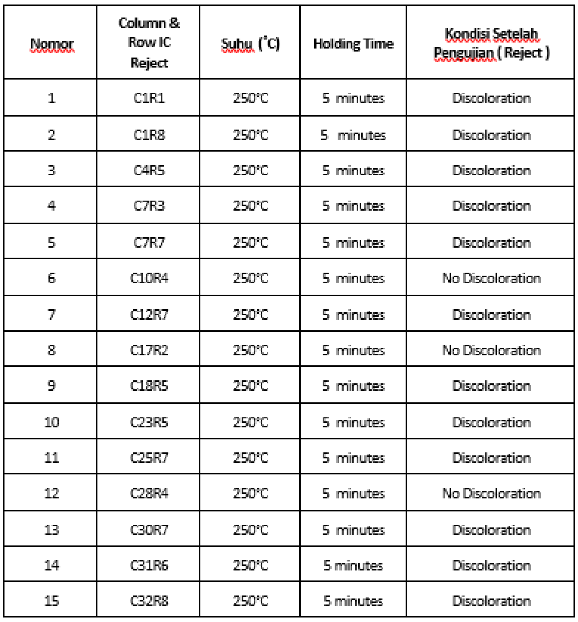


Figure 10 hot die shaer machine

1. Data Analysis and Discussion

Tests carried out with the Hot Die Shear Machine and the image capture process using the Keyence VHX-500 and for test data using 15 IC Reject samples as test material and obtained the results of the test as can be seen in Tables 3 and 4.

TABLE.3 IC TESTING ON S7 PRODUCTS



Nomor	Column & Row IC Reject	Suhu (˚C)	Holding Time	Kondisi Setelah Pengujian (Reject)
1	C1R1	250°C	5 minutes	Discoloration
2	C1R8	250°C	5 minutes	Discoloration
3	C4R5	250°C	5 minutes	Discoloration
4	C7R3	250°C	5 minutes	Discoloration
5	C7R7	250°C	5 minutes	Discoloration
6	C10R4	250°C	5 minutes	No Discoloration
7	C12R7	250°C	5 minutes	Discoloration
8	C17R2	250°C	5 minutes	No Discoloration
9	C18R5	250°C	5 minutes	Discoloration
10	C23R5	250°C	5 minutes	Discoloration
11	C25R7	250°C	5 minutes	Discoloration
12	C28R4	250°C	5 minutes	No Discoloration
13	C30R7	250°C	5 minutes	Discoloration
14	C31R6	250°C	5 minutes	Discoloration
15	C32R8	250°C	5 minutes	Discoloration

From the results of tests that have been carried out on 15 IC Smart Reject products which are carried out for 5 minutes. It can be said that in the 15 pcs Reject IC Smart products with 12 pcs experiencing discoloration so that it cannot be used for the next production process and only 3 pcs of the whole can be reused

TABLE.4 TEST RESULTS

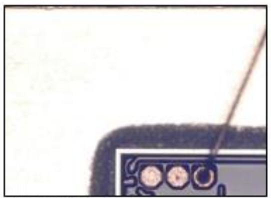


FIGURE 11 IC Reject Good before testing

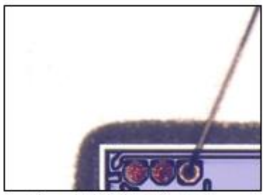


figure 12 Ic Reject after testing

FIGURE13 Reject Good before testing

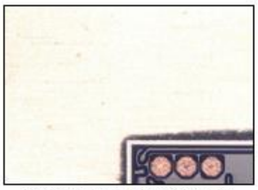


Figure 14 Ic Reject after testing

5. Conclusion and Recommendation

1. Conclusion

Based on the results of the research conducted in this project, it can be concluded that all aspects of the research objectives of this project can be achieved well after conducting several experiments. The following are the objectives that were successfully achieved:

When conducting experiments using a die shear machine based on the results of the tests that have been carried out, it can be concluded that the discoloration test for 5 minutes with a temperature of 250 ° C on smart IC products totalling 15 pcs Reject with 12 pcs IC smart rejects experiencing discoloration with a reject percentage of 4.60% of the total IC produced in 1 leadframe which amounts to 256 pcs so that it cannot be used for the next production process and only 3 pcs IC smart reject good with a percentage of 1.1%

2. Recommendation

Further research that needs to be done to improve this research is to use the seven existing tools in total quality control management, namely, check sheets, histograms, control charts, pareto diagrams, cause-and-effect diagrams, scatter diagrams, and process diagrams.

In addition, it is also necessary to periodically check the abnormality of raw materials and production equipment, especially the elements that cause defects in the product as well as training on maintenance and use of machinery and work equipment to improve operator skills so that the level of accuracy and expertise is getting higher..

Acknowledgment

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FORMULIR LOOGBOOK BIMBINGAN DAN PENGAJUAN SEMINAR PROPOSAL/SIDANG TUGAS AKHIR*

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No	Hari/Tgl	Rincian Kegiatan	TTD Pembimbing I
1	9/05	Mengirim laporan via gmail	
2	5/07	Mengirim laporan dan ppt via gmail	
3	19/07	Pertemuan membahas jurnal	
4	30/07	Diskusi mengenai revisi	
5	31/07	Memberitahu sudah di approve oleh penguji	
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