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# Die Attach Epoxy Break Tail Parameter Optimization

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## I. INTRODUCTION

Die attach, also known as die bonding, is the process of attaching (or bonding) a die (or chip) to a substrate, leadframe or another die. This process can take on many forms and can be applied in many different ways. The common die attach material is Epoxy.

Epoxy Dispensed through dispensing needle or nozzle by controlled volume on the substrate. The location of the dispensing is controlled with vision control system in the die attach equipment as illustrated in Figure 1.

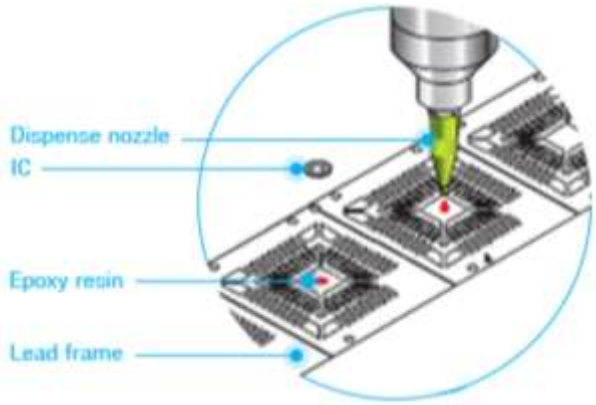


Fig. 1. Epoxy Dispense

The excessive flow of epoxy between dispensed patterns can lead to Epoxy tailing as shown in Figure 2, due to un-optimized dispense parameters. This can cause different epoxy dispense related problem; such as Epoxy on Lead, Epoxy splatter and Epoxy Bridging. This study is performed to eliminate the cause of epoxy related defects.

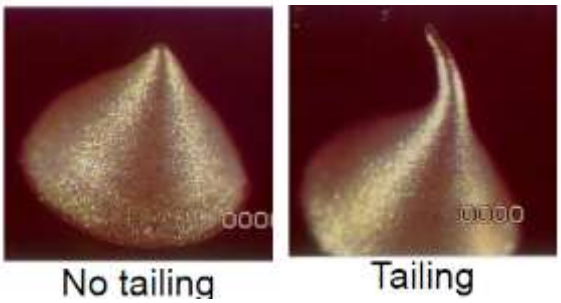


Fig. 2. Excessive Epoxy Flow

## II. PROBLEM IDENTIFICATION

Epoxy Tailing is the excess amount included during dispense process as shown in Figure 3. And this excess epoxy can splatter to leads, die and pad. Epoxy on leads was induced during glue dispense pattern on leadframe extending from the center to leads. This project

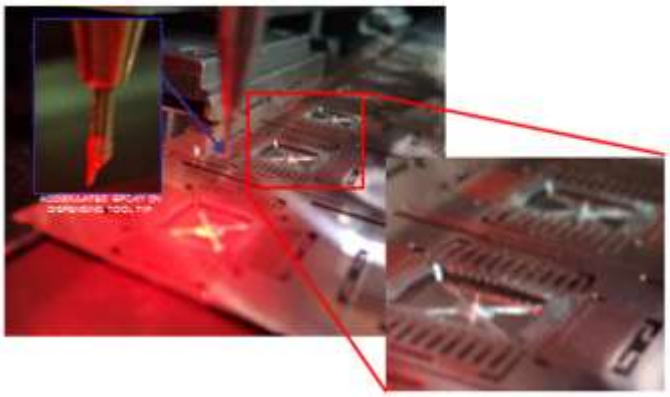

Fig. 3. Epoxy Tailing

## III. EVALUATION ASSEMBLY PROCESS IMPROVEMENT

One of the solution is to optimize the Break Tail Parameter for the Epoxy Dispense. Below is the Evaluation methodology using Design of Experiment (DOE) shown in Figure 4.

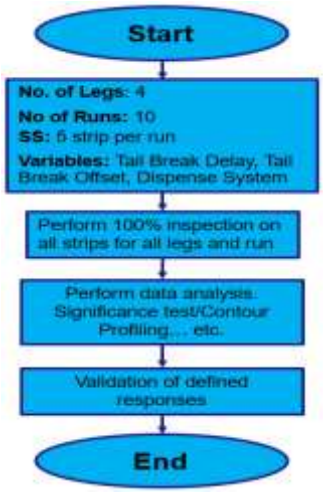


Fig. 4. Evaluation methodology

The Input Variables are tail break parameters is one of the factors that can induce epoxy splatter and tailings if not controlled on an optimized setting.



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Tail Break Delay is the duration of time before the dispenser move to the next pad from the Z-ready Position. Break Tail Offset is the initial height/step before the dispenser move to Z-ready Position. And Z-ready Position is the height of dispenser in idle position

Simulations were performed to compare the responses of Die Attach machine built-in dispense system versus Mushashi Dispense system.

Below is the table for Summary of Responses and Measurement Methodology base on the Design of Experiment (DOE) shown in Table I.

TABLE I. Design of the Experiment

| Dispense System | Tail Break Delay | Tail Break Offset | Strip | Results |
|---|---|---|---|---|
| Built-in | 50 | 100 | 5 | 44 |
| | 50 | 250 | 5 | 24 |
| | 50 | 400 | 5 | 36 |
| | 200 | 100 | 5 | 21 |
| | 200 | 250 | 5 | 1 |
| | 200 | 400 | 5 | 35 |
| | 350 | 100 | 5 | 15 |
| | 350 | 250 | 5 | 0 |
| | 350 | 400 | 5 | 55 |
| | 150 | 300 | 5 | 7 |
| Mushashi | 50 | 100 | 5 | 26 |
| | 50 | 250 | 5 | 29 |
| | 50 | 400 | 5 | 36 |
| | 200 | 100 | 5 | 10 |
| | 200 | 250 | 5 | 0 |
| | 200 | 400 | 5 | 12 |
| | 350 | 100 | 5 | 4 |
| | 350 | 250 | 5 | 0 |
| | 350 | 400 | 5 | 42 |
| | 150 | 300 | 5 | 13 |

Data Analysis below show there is No Significance different for the occurrence of splattering, between Built-in and Mushashi dispense system using 2 Sample T-test.

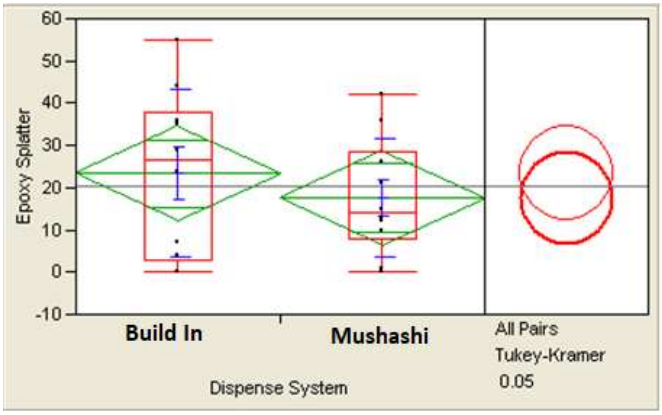


Fig. 5. 2 Sample T-test

Using Variability Chart in Figure 6, for Built-In Dispense versus Mushashi System on Tailing Parameters. Observed quadratic response mostly on Built-in dispense system. Below data suggests settings for Tail Break Delay: 200-350 ms and Tail Break Offset is 250 counts.

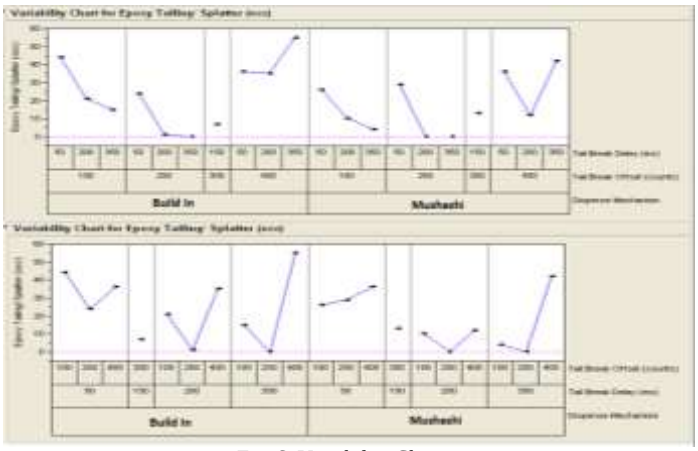


Fig. 6. Variability Chart

Below is the DOE Prediction Profile for Built-in Dispense System Tailing Parameters in Figure 7. Show the recommended Parameter Window for Tail Break Delay is 100- 350 ms. And Tail Break Offset is 150-300 counts.

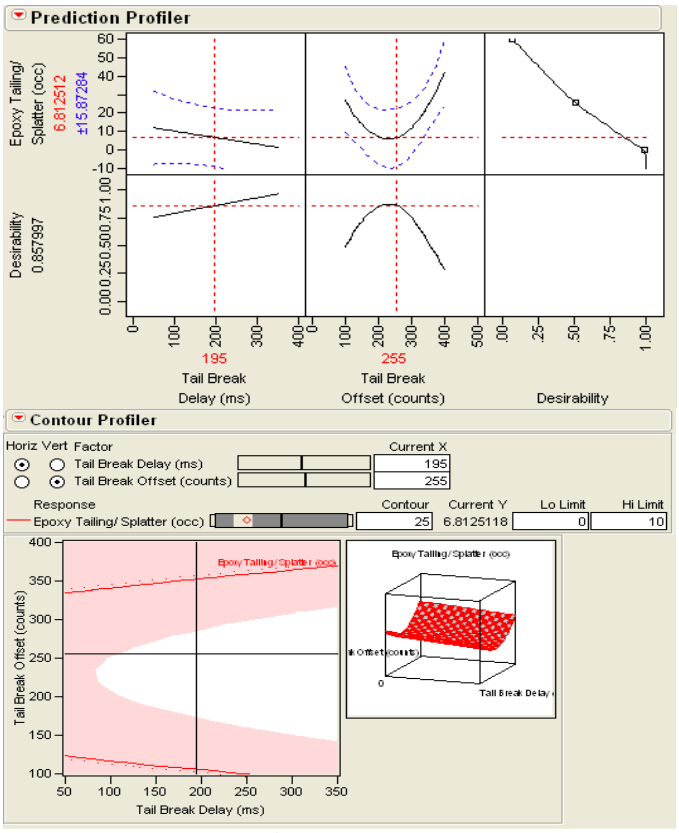


Fig. 7. DOE for Built-in Dispense System

And for DOE Prediction Profile result for Mushashi dispenser show the Tailing Parameters is recommended parameter Window is Tail Break Delay:150- 350 ms and Tail Break Offset is 175-350 counts.



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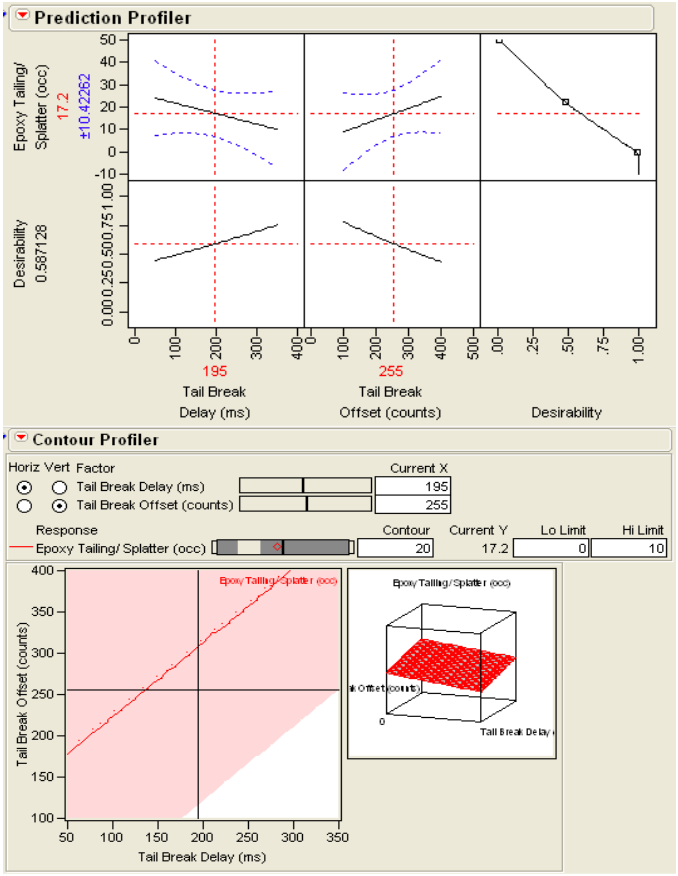


Fig. 8. DOE for Mushashi Dispense System

## IV. CONCLUTION & RECOMMENDATIONS

Growth is inevitable which brings changes and challenges in assembly manufacturing like that of Die attach process complexities with respect to devices. These challenges however can be overcome through Design of Experiment (DOE) method which consists of rich parametric tools to optimize a process.

Simulation runs showed that occurrences of splattering and epoxy tailing is influenced by tail break parameters. And studies that will allow standardization for all Die attach process Break tail parameter.

## REFERENCES

[1] JMP Design of Experiments, Release 7 Copyright © 2007, SAS Institute Inc., Cary, NC, USA ISBN 978-1-59994-413-5.
[2] The Lean Six Sigma, Michael A. George, McGrawHill, 2002.
[3] Diebond Machine Process Capability Study, July 2010.



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