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Reduction of Epoxy on Leads Defects thru Optimization of Epoxy Dispense Parameter

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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.

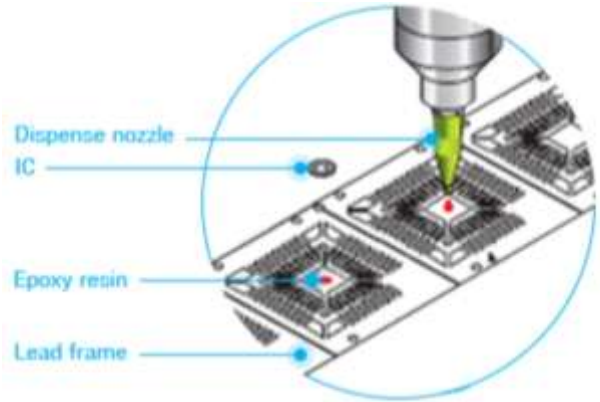

Fig. 1. Epoxy Dispense Process

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.

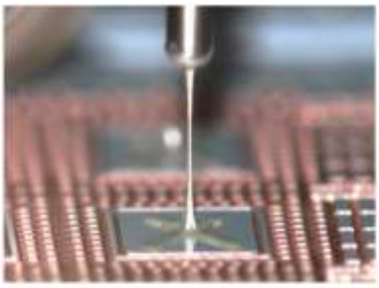

Fig. 2. Excessive Epoxy tailing and Epoxy on Leads failure mechanism

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 as shown in Figure 4. Epoxy on leads was induced during glue dispense pattern on leadframe extending from the center to leads.

Fig. 3. Epoxy on Leads at Die Bond

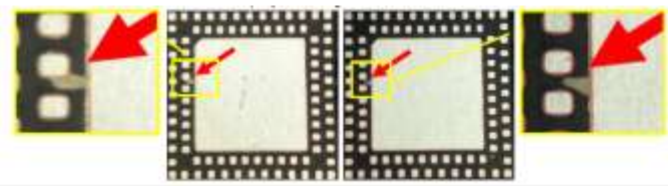

Fig. 4. Epoxy on Leads at Visual Inspection

III. Evaluation Assembly Process Improvement

One of the solution is to optimize the Parameter for the Epoxy Dispense. Below is the Diagram of experimental study using Design of Experiment (DOE) shown in Figure 5.

Fig. 5. Diagram of experimental study

The Input Variables are the Burst Time, Standby Height to Leadframe, Process Speed and Snuffback Time, there are the

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factors that can induce epoxy on leads if not controlled on an optimized setting. Below is the table for Summary of Design of Experiment (DOE) shown in Table I.

TABLE I. Design of the Experiment

Input Variable	Parameter Range
Burst Time	20 to 90
Standby Ht to LF	9 to 10
Process Speed	35 to 50
Snuffback Time	-10 to -30

Based on the Pareto and Normal probability plots in Figure 6, the main significant predictor is Snuffback time

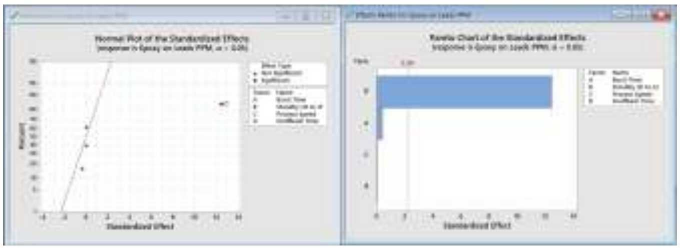
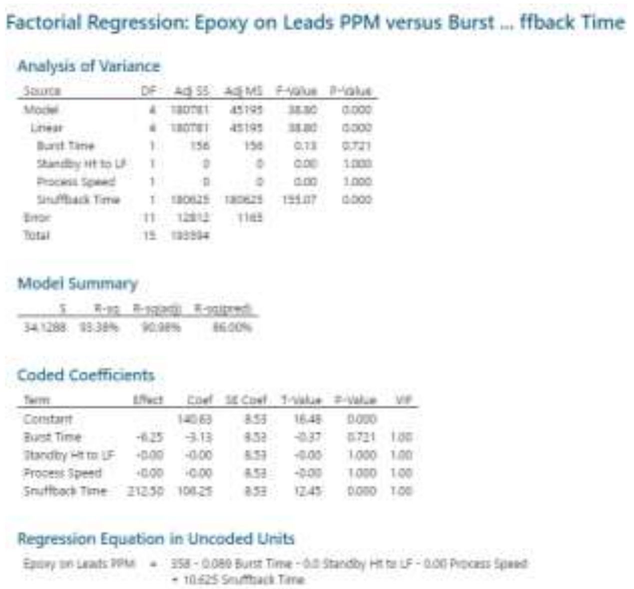


Fig. 6. Pareto and Normal probability plots

Based from Minitab Factorial Regression in Figure 7, the R-sq (adj) of model = 90.98% which means a strong linear trend among factors and the response variable. And the P value = 0.000 the model is significant in predicting the variability of the response variable.



Factorial Regression: Epoxy on Leads PPM versus Burst ... ffback Time

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Model	4	180781	45195	38.80	0.000
Linear	4	180781	45195	38.80	0.000
Burst Time	1	156	156	0.13	0.721
Standby Ht to LF	1	0	0	0.00	1.000
Process Speed	1	0	0	0.00	1.000
Snuffback Time	1	180625	180625	155.07	0.000
Error	11	12812	1165		
Total	15	193594			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
34.1288	93.38%	90.98%	86.00%

Coded Coefficients

Term	Effect	Coef	SE Coef	T-Value	P-Value	VIF
Constant		140.63	8.53	16.48	0.000	
Burst Time	-6.25	-3.13	8.52	-0.37	0.721	1.00
Standby Ht to LF	-0.00	-0.00	8.53	-0.00	1.000	1.00
Process Speed	-0.00	-0.00	8.53	-0.00	1.000	1.00
Snuffback Time	212.50	106.25	8.53	12.45	0.000	1.00

Regression Equation in Uncoded Units

Epoxy on Leads PPM = 358 - 0.089 Burst Time - 0.0 Standby Ht to LF - 0.00 Process Speed + 10.625 Snuffback Time

Fig. 7. Factorial Regression

In Figure 8, based on the main effect plot, Epoxy on Leads PPM reduce as Snuffback time increases or faster.

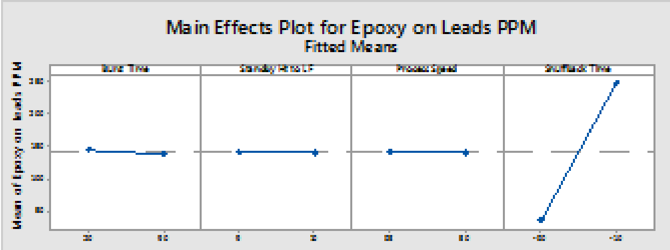


Fig. 8. Main Effect plot for Epoxy on leads

Regression Test was performed to validate if Snuffback time can induced Epoxy on Leads compare to Fast Snuffback time in Figure 9. There is a strong positive relationship between Snuffback time and EOL PPM as indicated by the correlation value 82% changed in EOL PPM can be explained by the Snuffback time Linear Fit on Snuffback time is -32.29ms near to -30ms setting.

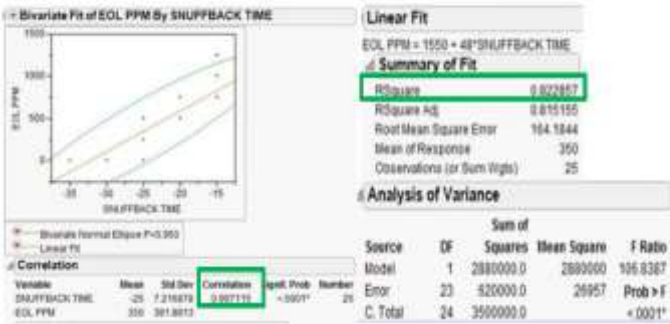


Fig. 9. Regression Test

IV. CONCLUTION & RECOMMENDATIONS

Decrease in value of Snuffback time (-) will result to earlier end of pressure pulse and earlier deceleration on writing pattern. Glue tailing reduce while dispenser is moving upward Increase in value of Snuffback time (+) will results to late end of pressure pulse and late deceleration on writing pattern. Glue tailing exist while dispenser is moving upward.

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