

Two Dimensional Modeling and Characterization of Epoxy Dispense Pattern

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I. INTRODUCTION

Die attach provides the mechanical support between the silicon die and the substrate, i.e., leadframe, plastic or ceramic substrate. The die attach is also critical to the thermal and, for some applications, the electrical performance of the device. Significant results have been achieved in previous studies, focusing on mechanical analysis for the DA process.

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

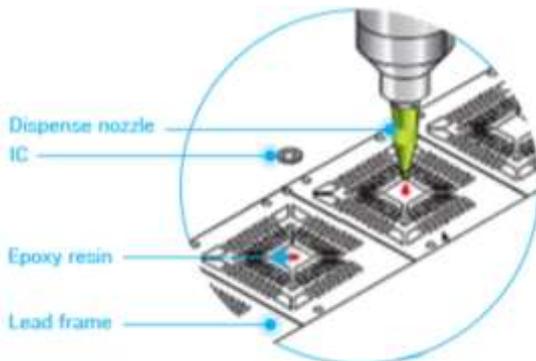


Fig. 1. Epoxy Dispense

In most cases, an adhesive dispense pattern is designed so that when the die (adhered) is placed over the adhesive, and pressure applied, the adhesive will squeeze out without trapping air. A standard pattern is automatically selected based on chip size X & Y.

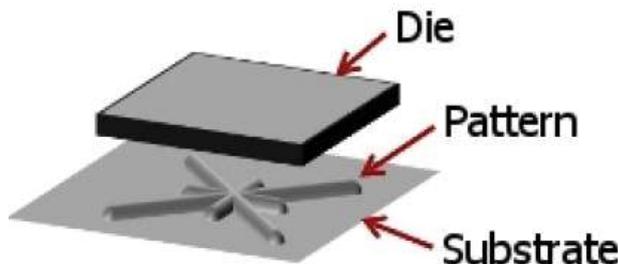


Fig. 2. Epoxy Dispense Pattern

Dispensing Patterns can vary from simple dot dispensing for small die (<5 mm on a side) to complicated patterns of lines for large die as shown in Figure 2 (>20 mm on a side). The challenge for larger die is to have the adhesive spread to assume the shape of the die during the die placement process. There are many approaches to this problem and it can consume considerable process engineering time for critical applications.

II. PROBLEM IDENTIFICATION

The mass of epoxy on the die peripheral of the die is known as the Epoxy Coverage area after die bonded, this provide mechanical strength along die edge. Common criteria or requirement for epoxy coverage is 100%. The problems in achieving and controlling the Epoxy Coverage and Inadequate corner coverage can lead to delamination at the corners.

Insufficient Epoxy Coverage after Die bond can lead into separation or gap at the chip edge during curing due to mismatch between die and leadframe. Leadframe is going to be expanded while Die attach curing, but the adhesive is being shrunken because of its polymerization. And during Molding process the mold compound or EMC can be penetrated through gap that cause reliability failure of Delamination as illustrated in Figure 3, the Failure mechanism for Insufficient Epoxy Coverage.

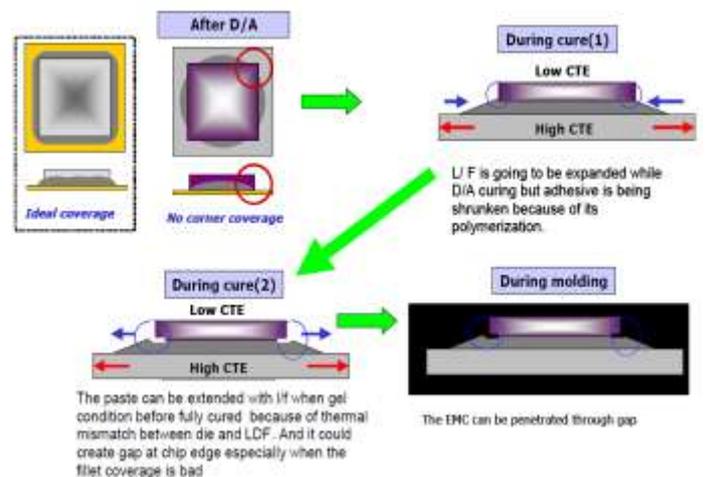


Fig. 3. Failure mechanism for Insufficient Epoxy Coverage

III. EVALUATION ASSEMBLY PROCESS IMPROVEMENT

Below are the 2D rheological simulations that can investigate the flow of the liquid DA under an applied force

during the DA process per die size. In order to enhance the evenness of epoxy distribution along the peripheral of the die, built a 2D model to investigate various dispensing patterns and to study their evolvement patterns.

For the Die Size 1mm x 1mm the Dispensing Pattern recommended is Cross with Longer line to have More corner Coverage.

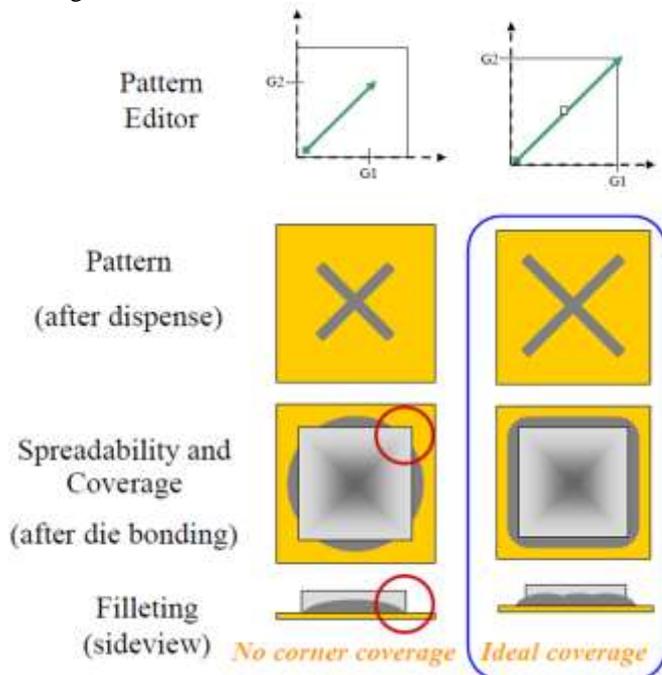


Fig. 4. Square Pattern: Cross

For the Die Size 3mm x 3mm the Dispensing Pattern recommended is Asterisk pattern with Longer line to have liner fillet height as shown in figure 5.

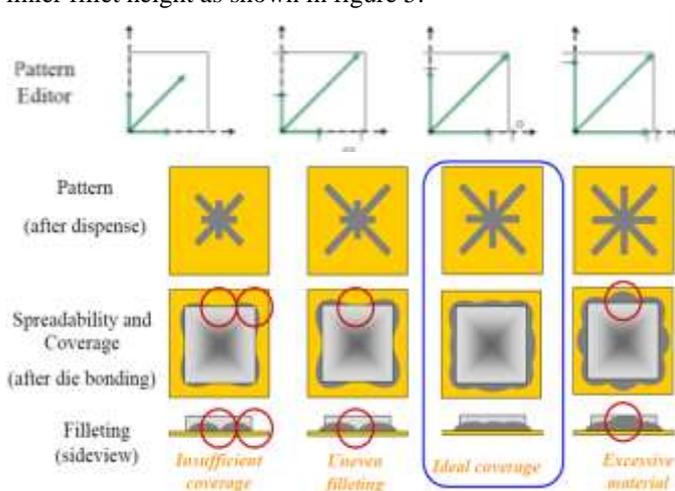


Fig. 5. Square Pattern: Asterisk

For the Die Size 5mm x 5mm the Dispensing Pattern recommended is Snowstar pattern with Longer line to have liner fillet height as shown in figure 6.

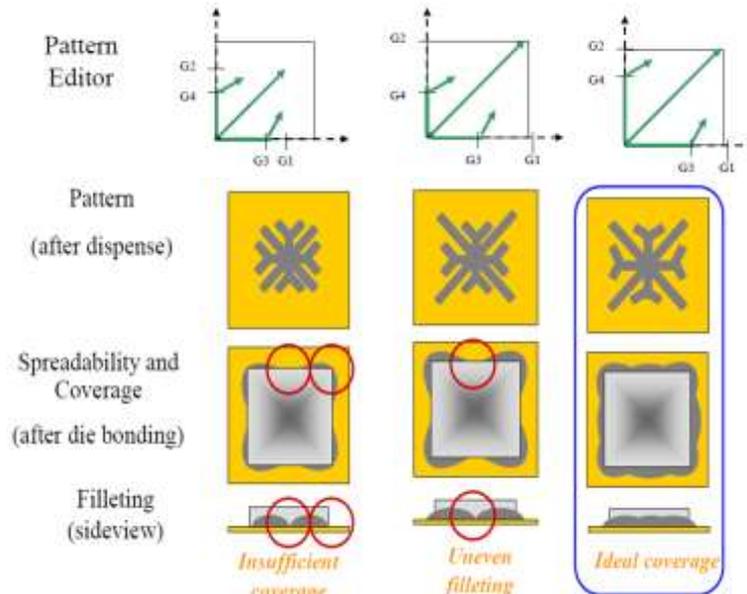


Fig. 6. Square Pattern: Snowstar

IV. CONCLUSION & RECOMMENDATIONS

The studies show that a suitable epoxy pattern is the key to ensure that the epoxy dispensed on the substrate can evolve to the final shape of the chip after the initial squeezing during the DA process. Complex dispensing patterns, i.e. snow star pattern is more likely to trap voids than basic dispensing pattern, i.e. x dispensing pattern. Typically, the pattern size is smaller than the chip size X & Y because the adhesive will spread during die bonding. Standard patterns can be modified in the Pattern Editor, especially for increasing the pattern size. Corner coverage or filleting may need to be improved by typically increasing the diagonal lines. start dispensing with the default pattern size, die bond, then increase the pattern size until adequate coverage is achieved.

REFERENCES

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