

Using Predictive Modeling Approach in Eliminating Die Crack Induced by Ejector Pin

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Keywords— Predictive modeling approach; die crack; ejector pin; die attach; finite element modeling.

I. OVERVIEW

- During the die attach process in the assembly of a semiconductor package, the die is ejected from an adhesive carrier and picked by a pick and place (PnP) tool's rubber tip as shown in Fig. 1.
- After being picked up, the die is then attached to a lead frame or laminate substrate.

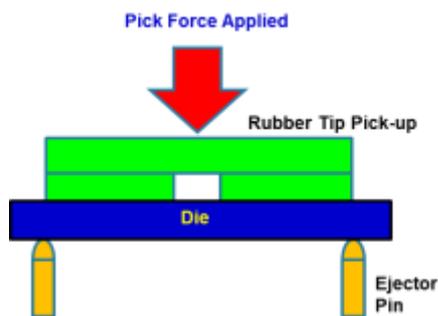


Fig. 1. Schematic of ejector pin and silicon die.

II. PROBLEM IDENTIFICATION

- The die used is relatively thin (70 μm) and die crack was encountered after die pickup as indicated in Fig. 2.
- The crack looks close to a straight line that divides the die in half.

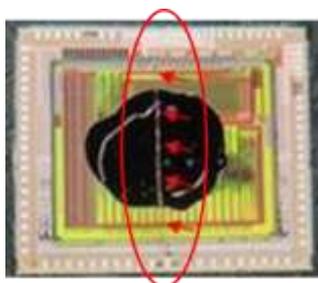


Fig. 2. Die crack after die pickup.

III. FINITE ELEMENT MODELING

- The first step in finding the solution is understanding the failure mechanism using finite element modeling, a predictive method for analyzing failure.

- The interactions between the die and the ejector pin as well as the PnP rubber tip were modeled.
- Finite element modeling result (Fig. 3) has indicated that the die crack encountered was indeed caused by the ejector pin during die pickup process causing excessive die bending stress since the die crack signatures matches with the high stress location.

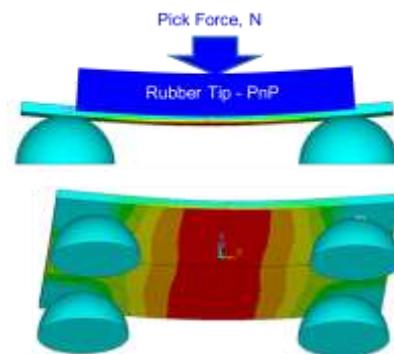


Fig. 3. Modeling result.

IV. DESIGN AND PROCESS SOLUTION

- With the failure mechanism understood and the cause of die crack ascertained, design and process solution could then be accurately identified
- From a process standpoint, the pick force needs to be controlled to reduce die stress.
- On the design aspect, the ejector pin could be improved by reducing the pin-to-pin distance (moving the pins closer) and increasing the rubber tip coverage area such that the pin contact is within it as illustrated in Fig. 4.

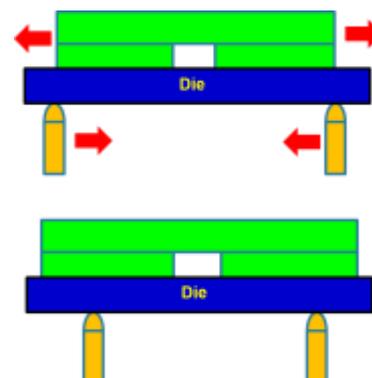


Fig. 4. Design improvement.