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A Modeling Study on the Relationship between Silicon Die Crack and Tacky Die Attach Film

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Keywords— *Silicon die crack; broken die; die attach film; pick and place; finite element modeling.*

I. OVERVIEW

- In the die attach process of a semiconductor package assembly manufacturing, a pick and place (PnP) vacuum rubber tip picks the die having die attach film (DAF) from the wafer mounting tape as illustrated in Fig. 1 before attaching the die to the substrate or leadframe.
- During pickup, there is adhesion between DAF and the mounting tape that must be overcome so the die and DAF will be completely separated from the mounting tape to have successful picking up of the die.

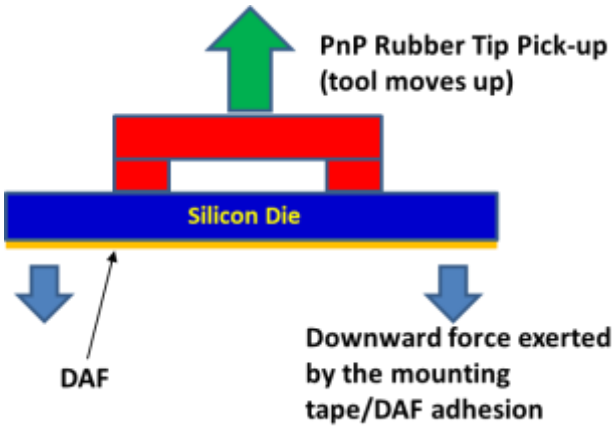

Fig. 1. Schematic of the die pick up process with tacky DAF trying to resist the pickup force.

II. PROBLEM IDENTIFICATION

- Die crack resulting in a broken die was observed after die pickup as shown in Fig. 2.
- It can be seen that the outer portion of the broken die is left on the mounting tape.

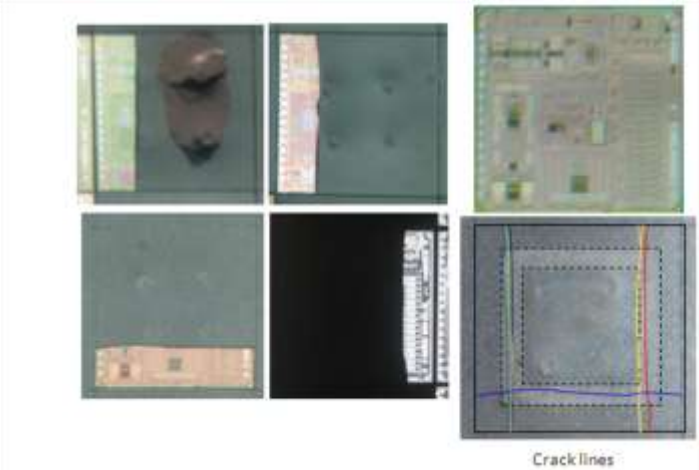

Fig. 2. Actual die crack encountered after die pickup resulting in a broken die.

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III. FINITE ELEMENT MODELING

- Finite element modeling was conducted to understand the relationship between die crack and tacky die attach film (DAF).
- Based on the modeling result, as the rubber tip pick-up tool moves up with the die and DAF, any strong adhesion or sticking of the DAF/die to the mounting tape would produce high stress areas that would then break the die when the adhesion is excessive as shown in Fig. 3.
- Comparison of actual die crack pattern with stress result tends to suggest that it is more of a crack due to strong adhesion or sticking of DAF/die to the mounting tape.

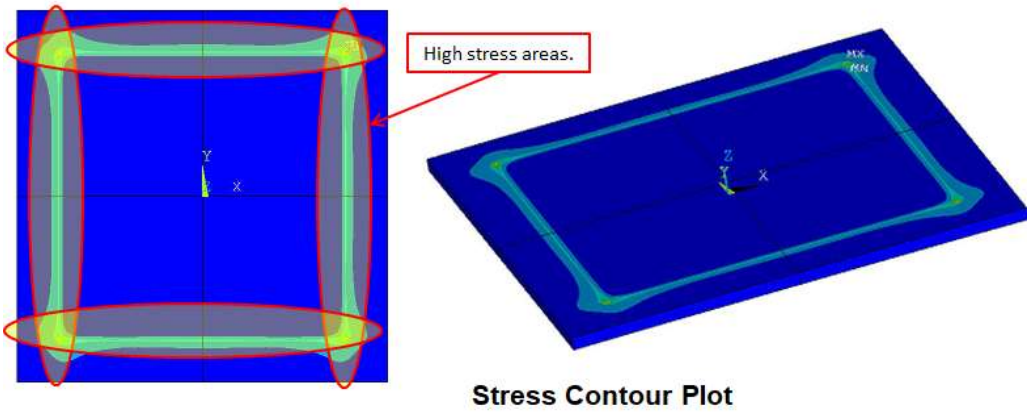

Fig. 3. Die stress result due to tacky DAF.

IV. DESIGN AND PROCESS SOLUTION

- From the modeling results, it could be seen that one option to eliminate die crack due to tacky DAF is to modify the PnP rubber tip design so it would have a wider pickup area as illustrated in Fig. 4.
- And to further provide improvement during the die pickup process, reducing the tackiness of the DAF would help reduce die bending stress and eliminate die crack.

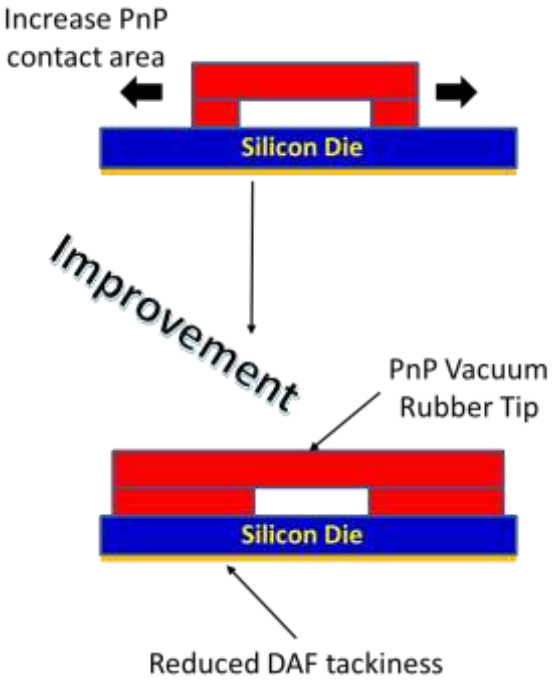

Fig. 4. Improvement to eliminate die crack due to tacky DAF.

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