

A Collaborative Approach in Understanding the Die Crack Occurrence during Die Attach Assembly

Rennier S. Rodriguez, Frederick Ray I. Gomez

Central Engineering and Development NPI, Back-End Manufacturing & Technology, STMicroelectronics, Inc.
Calamba City, Laguna, Philippines 4027

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I. OVERVIEW

- Die bonding process or die attach process refers to the “pick and bonding” process of silicon die from wafer tapes to a carrier, as shown in Fig. 1

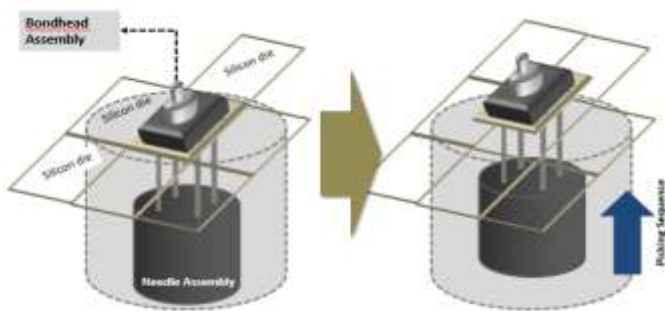


Fig. 1. Pick-up process for standard silicon die.

- The pick-up process can be divided into two machine sequences: (1) a needle protruding through the wafer tapes which separates the silicon die to the wafer tape and (2) a vacuum supplied to the bondhead assembly to hold the units upon ejection

II. PROBLEM IDENTIFICATION

- Challenges are brought-up as the silicon die becomes thinner, as given in Fig. 2



Fig. 2. Crack/breaking in the silicon material during pick-up process.

- As the thickness of the silicon material decreases, the lesser it can withstand the stress induced by the die attach process

- Through proper identification of potential factors that might affect the picking consistency, a study may be conducted to formulate the correct configuration for a robust pick-up process and to understand the contribution of needle configuration during the process

III. DESIGN OF EXPERIMENTS

- Design-of-experiments (DOE) for needle or ejector pin configuration is formulated to determine the significance of the parameter in terms of stress level reduction
- Two different needle configurations in Fig. 4 with 4 and 5 needle pins, respectively are measured using finite element analysis

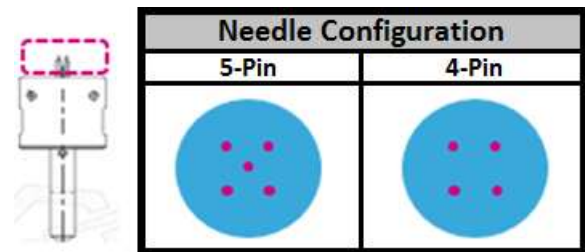


Fig. 3. Needle configurations used for DOE.

IV. PROCESS DESIGN SOLUTION AND IMPROVEMENT

- The die stress level is observed to improve (lower value) with increasing needle count per ejector needle assembly, with 5-pin configuration having better (lower value) stress level than the 4-pin configuration as indicated in Fig. 4

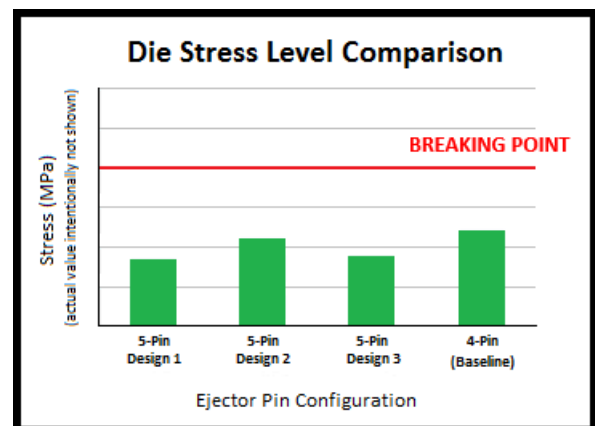


Fig. 4. Stress level result for different needle configurations.