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Establishing a Reliable Model for Breaking Load Prediction of a Very Thin Package

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Keywords— *Package breaking load; bend test; thin package; package crack; finite element modeling.*

I. OVERVIEW

- As semiconductor package becomes thinner, determining the force that can be applied to the package without causing package crack becomes very important.
- Package 3-point bend test is usually done to determine the package breaking load as shown in Fig. 1.
- However, the package bend test could only be done after the package is manufactured or assembled.

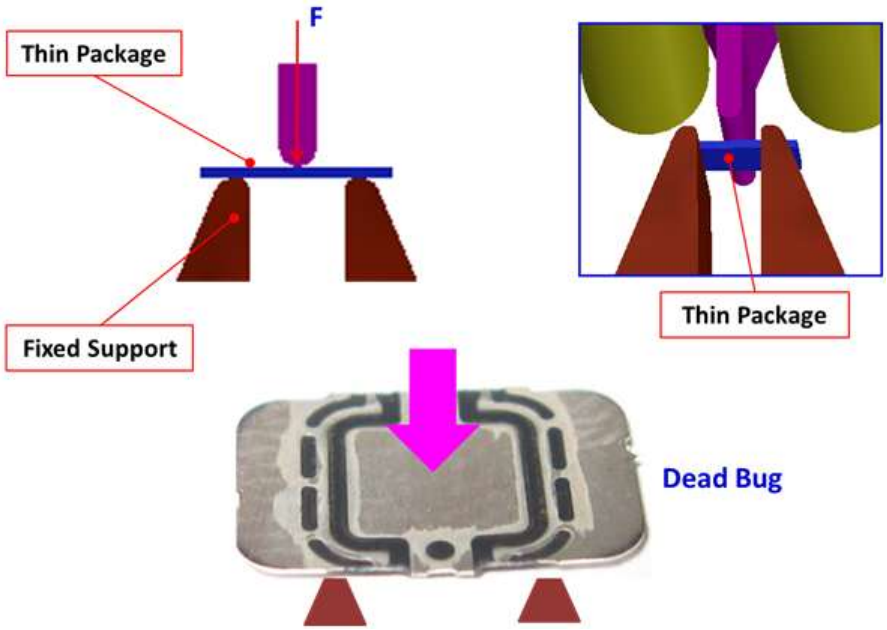

Fig. 1. Package 3-point bend test.

II. PROBLEM IDENTIFICATION

- One common problem for a very thin semiconductor package is package crack as shown in Fig. 2.
- Since actual bend test could only be done after the package is manufactured, there needs to be a way in which the package breaking load could be predicted even during the design stage.

Fig. 2. Package crack due to package bending of a very thin package.

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III. Finite Element Modeling

- Finite element modeling was used to establish a thin package model for predicting breaking load even during the design stage.
- The 3-point bend test was modeled (Fig. 3) using a commercially available finite element software and the result was compared with actual result for model validation.

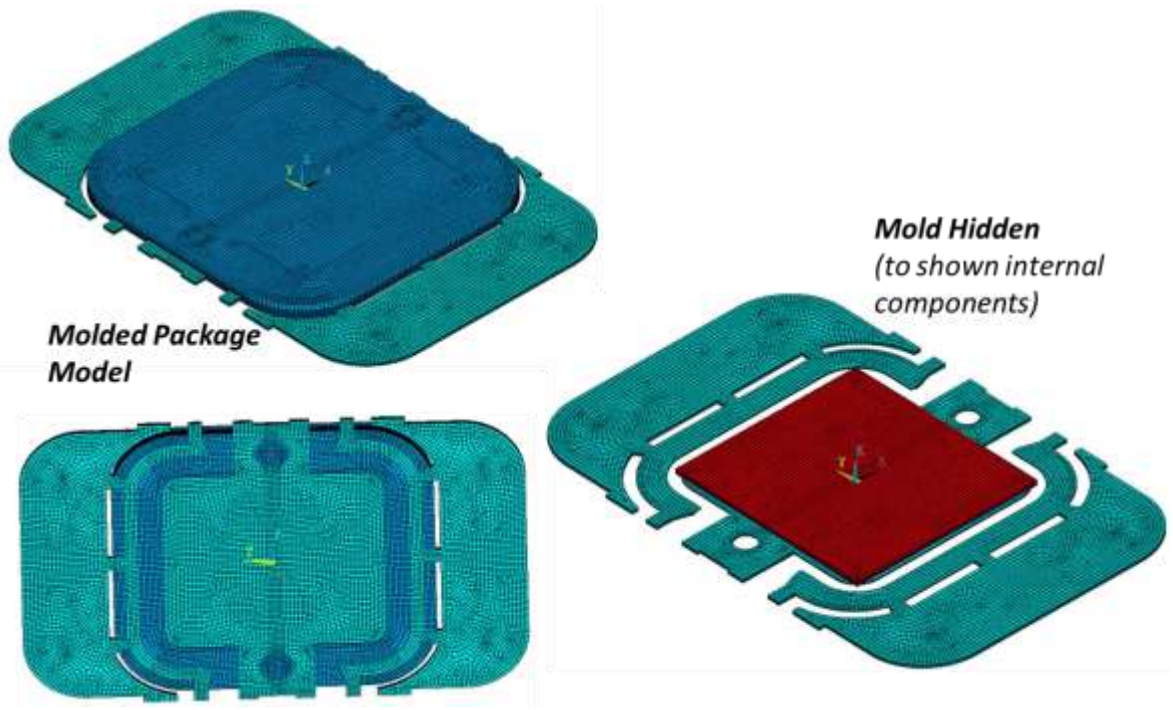

Fig. 3. Finite element model of the very thin package used for breaking load prediction.

IV. Modeling Results and Prediction Validation

- The predicted breaking load was obtained by varying the load applied in the 3-point bend test model.
- The load that results in the mold or package stress that is equal to the flexural strength of the mold compound used is the breaking load as shown in Fig. 4.

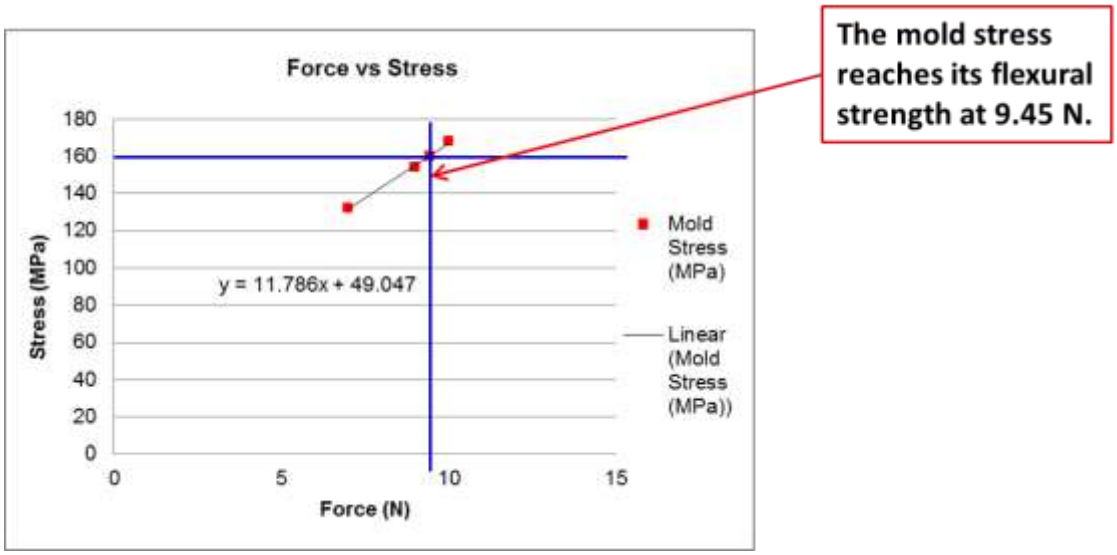

Fig. 4. Modeling result with linear regression to establish relationship between applied force and the induced package stress.

- Modeling results (Fig. 5) indicate that the mold flexural strength (160 MPa) would be reached at ~9.45 N applied force.
- This means that the mold material or package is predicted to break at ~9.45 N bending load.

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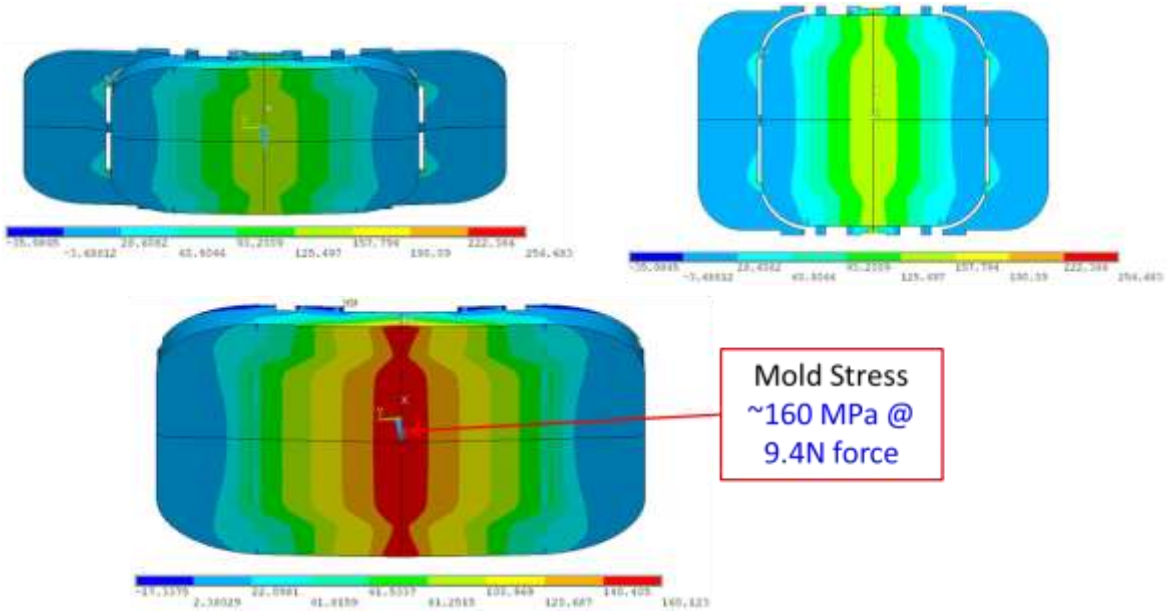

Fig. 5. Modeling result of the thin package subjected to 3-point bend test.

- To ensure the accuracy of the established model, actual breaking load results from 3-point test conducted were compared to the modeling results.
- Comparison (Fig. 6) shows good correlation between the predicted breaking load by finite element modeling and actual results especially for the more mature production samples (2nd set of samples).
- This means that the established package model is reliable and could be used to predict package breaking load even before an actual package is manufactured.

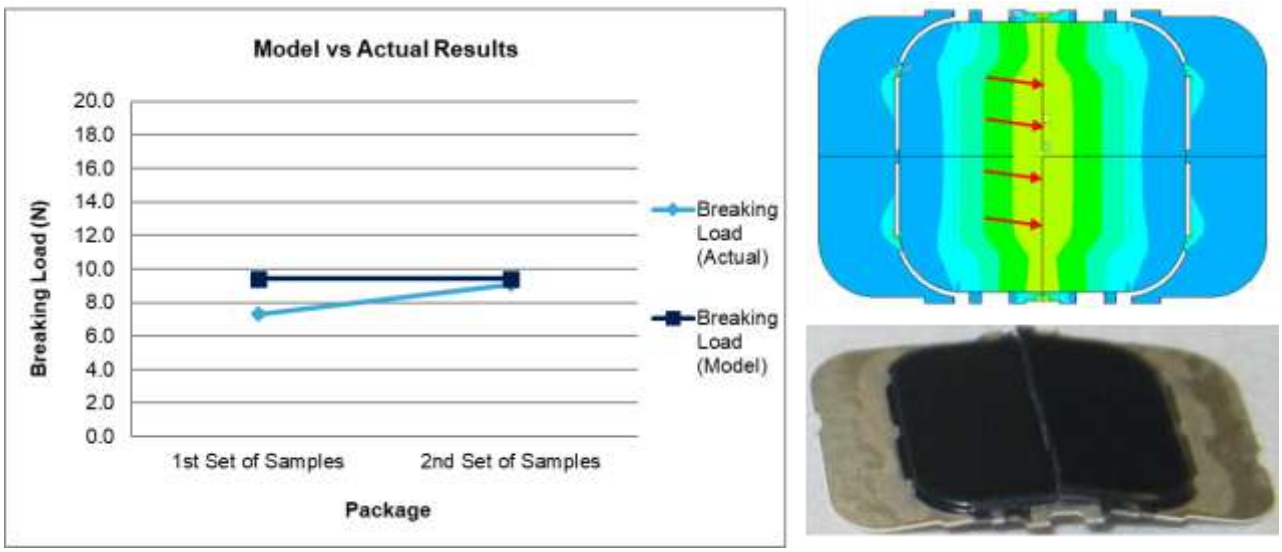

Fig. 6. Comparison between modeling results and actual results.

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