

Warpage Reduction in Molded Interconnect Substrate Package through Pre-mold Material Modeling

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Keywords— Molded interconnect substrate; epoxy molding material; pre-mold material; warpage; finite element modeling.

I. OVERVIEW

- Molded interconnect substrate (MIS) is a packaging technology that uses a pre-mold material as illustrated in Fig. 1.
- The pre-mold materials have more compatible properties with silicon and package encapsulation material.
- MIS is an alternative to organic laminate substrate or leadframe and a semiconductor package using it is shown in Fig. 2.
- Package assembly using MIS is usually done in strip format, in which the die is attached to the MIS followed by wire bonding and then the whole strip is encapsulated using epoxy molding compound (EMC).

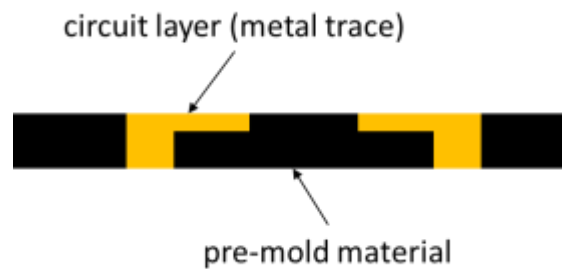


Fig. 1. Schematic of a 1-layer molded interconnect substrate (MIS).

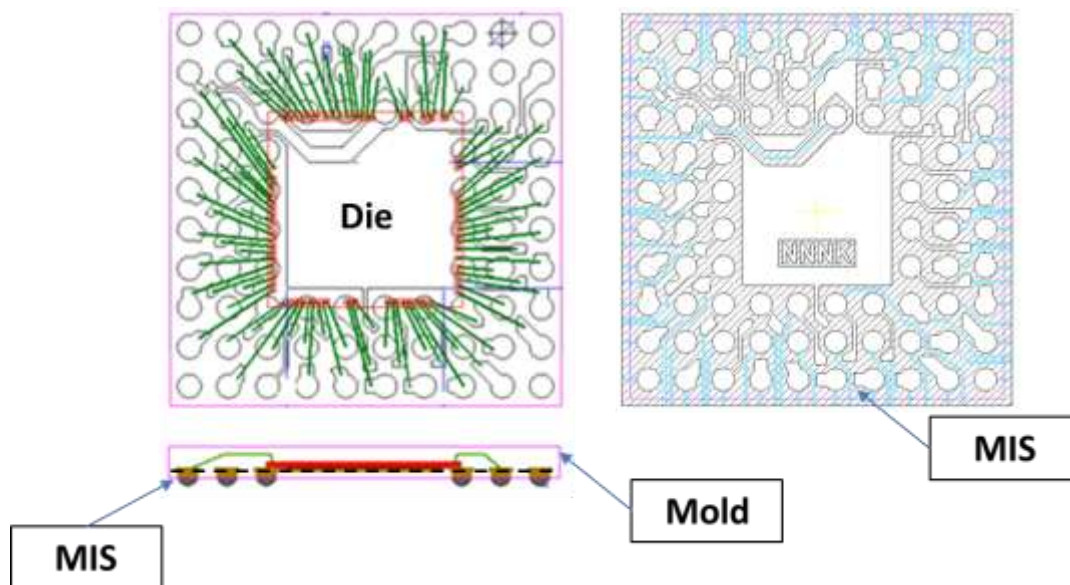


Fig. 2. Semiconductor package using MIS.

II. PROBLEM IDENTIFICATION

- With thinner packages, strip warpage due to CTE (coefficient of thermal expansion) mismatch is a common problem.
- For MIS, the choice of the right pre-mold material that would result in an acceptable strip warpage needs to be done during the design stage to ensure that no warpage-related issues would happen during actual manufacturing.

III. WARPAGE MODELING

- Warpage modeling was done to select the appropriate pre-mold material that would give the lowest acceptable warpage.
- The modeling would simulate warpage after cool down from molding or post mold cure (PMC) temperature to room temperature.
- The MIS package modeled using finite element modeling technique is shown in Fig. 3.

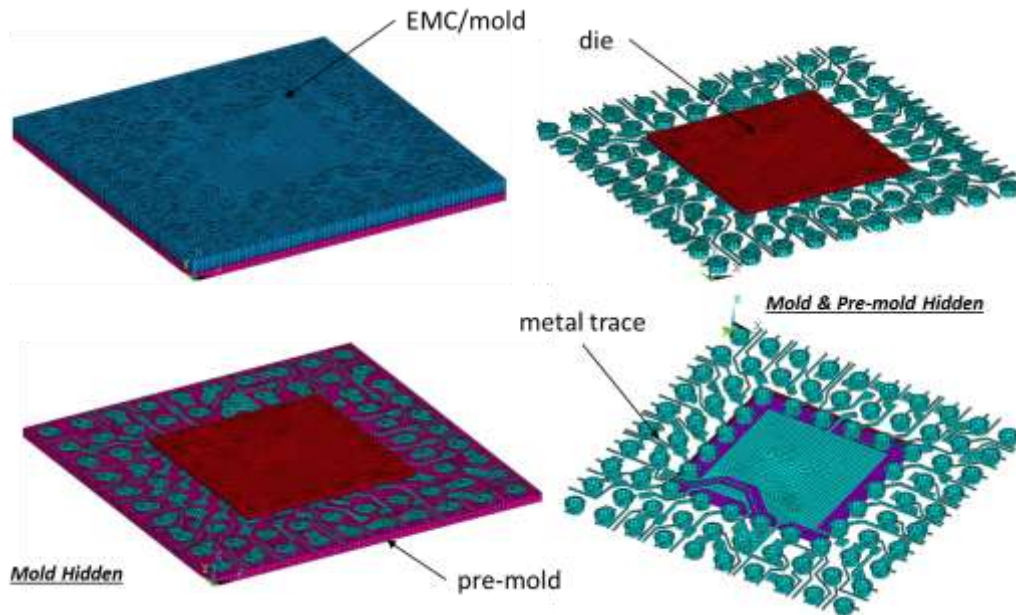


Fig. 3. Finite element model of the package using MIS.

IV. RESULT AND IMPROVEMENT SOLUTION

- Based on the results shown in Fig. 4, warpage is lower when using MIS pre-mold material A, which has lower CTE compared to pre-mold material B.
- Correct choice of pre-mold material for the molded interconnect substrate is very important with very thin packages.
- From the modeling result, warpage of MIS package could be controlled to an acceptable level using the right pre-mold material determined in advance using finite element modeling.

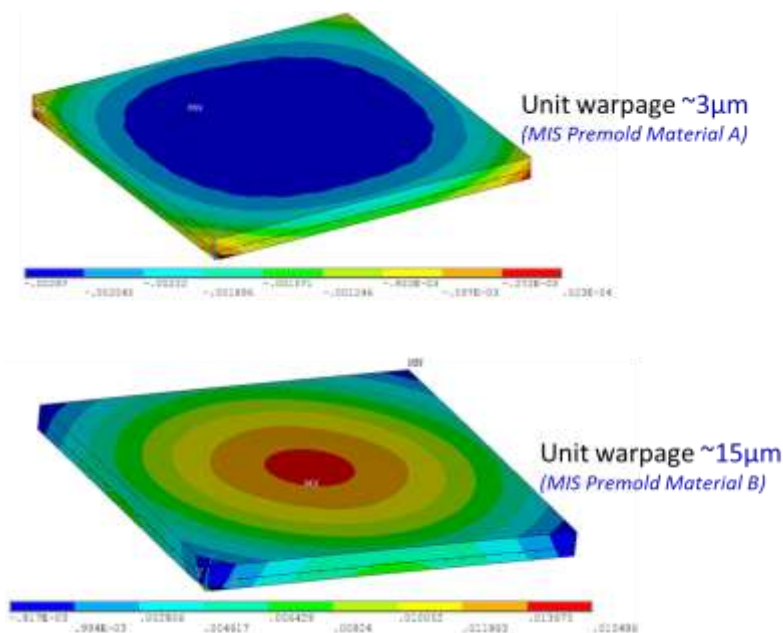


Fig. 4. Warpage modeling result for the MIS package under consideration.