Reworkable Underfills and BGA Reliability

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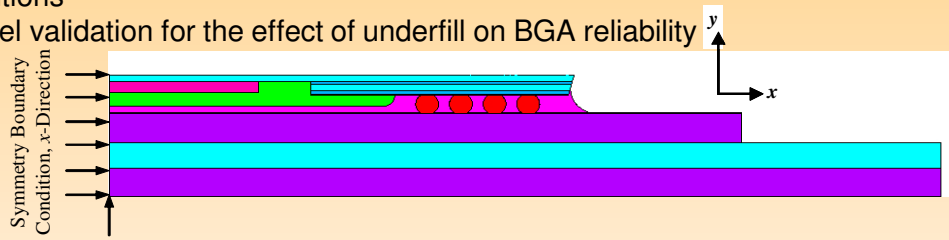
OBJECTIVES:

- To develop physics-based models and methodologies
- To evaluate the thermo-mechanical reliability of BGA's with reworkable underfill, conventional underfill, and no underfill
- To study failure modes such as solder joint fatigue, underfill delamination, underfill cracking, and die cracking
- To recommend design guidelines for BGA packages with reworkable underfills for use in harsh environment.
- To extend the methodology to other area-array devices and to SOP to be able to make suitable choice with respect to reworkable and conventional underfills
- To use the methodology to upfront select material, geometry, and process parameters for SOP module testbed, and to validate the modeling results with experimental data from the testbed

APPROACH

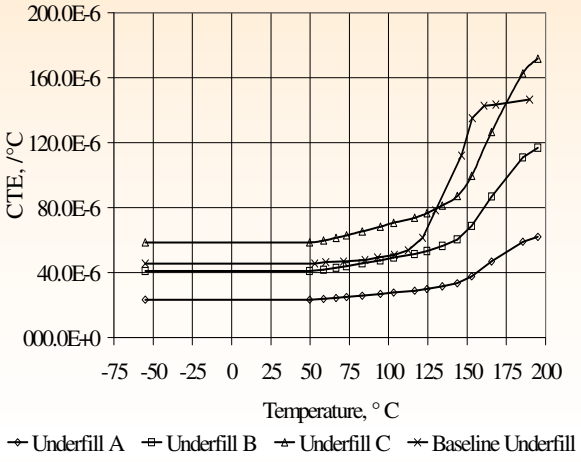
- Develop feature-based parametric models
- Use time and temperature dependent material models
- Use phenomenological and Mechanics - based life prediction models
- Develop damage metric-based mapping methodology for harsh field-use conditions
- Model validation for the effect of underfill on BGA reliability



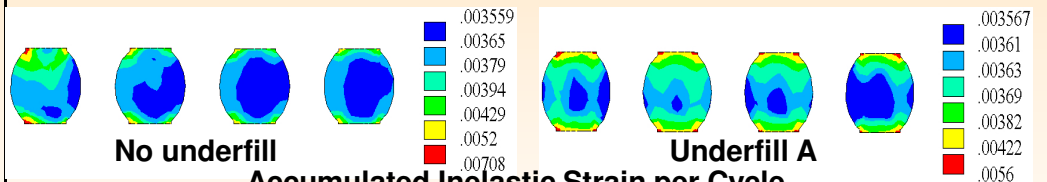
SBGA Plane-strain model

ACCOMPLISHMENTS:

- Feature based parametric models developed
- Performed parametric studies to determine the effect of different underfill materials and geometry
- Damage metric-based mapping of field-use conditions are demonstrated for harsh filed-use conditions
- Identified failure modes such as solder joint fatigue, underfill delamination, die cracking
- Model validation for the effect of underfills on BGA reliability is done with similar literature results

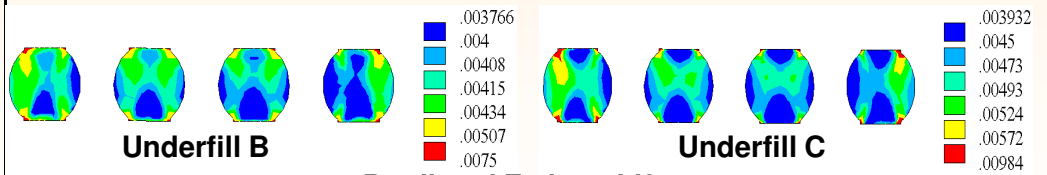


Underfill Properties



No underfill **Underfill A**

Accumulated Inelastic Strain per Cycle



Underfill B **Underfill C**

Predicted Fatigue Life

Underfill	Creep-Fatigue Life, Cycles to 50% failure
none	3566
A	3627
B	3228
C	2926
Baseline	2818

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