

# Redefining Substrate Pre-Bake Method for Strip Warpage Improvement

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## I. OVERVIEW

- Substrate material or the substrate strip in Fig. 1 played a very important role in packaging industry, not only because it represents a great portion of the cost but also has a great influence on package performance

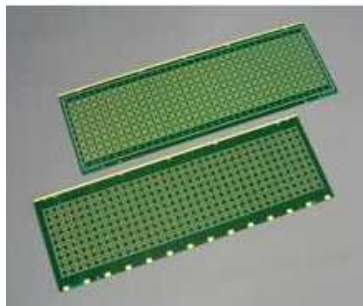


Fig. 1. Substrate strip.

- Substrate pre-bake in Fig. 2 is a sub-process step wherein substrate were subjected to prebaking to remove moisture on material as part of material preparation

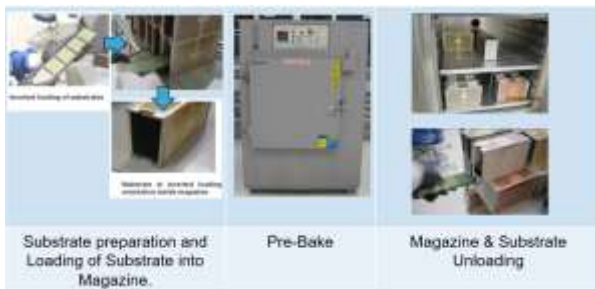


Fig. 2. Substrate pre-bake process.

- With respect to substrates, typically the reason to do this is to remove absorbed moisture from the substrate so that there are no issues with moisture or water outgassing during subsequent processes
- In these cases, moisture on the substrate can cause voiding and delamination during process

## III. ASSEMBLY PROCESS IMPROVEMENT

- Two substrate methods Fig. 4 were evaluated to check the effectivity addressing the substrate warpage and other quality response

## II. PROBLEM IDENTIFICATION

- Substrate warpage were encountered after oven pre-bake using in-strip loading method at perforated magazine, as shown in Fig. 3

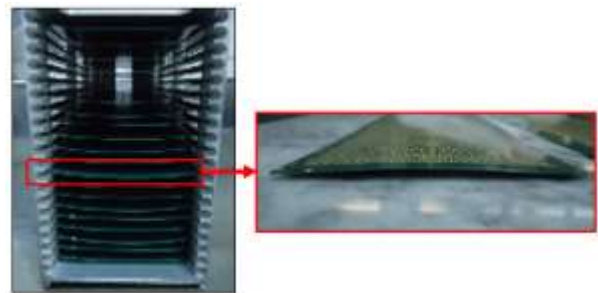


Fig. 3. Warpage of substrate strip.

- The ‘IPC-1601 printed board handling and storage guidelines’ states that “If substrate have absorbed excessive moisture, baking is the most practical remedy”
- It goes on to state, “However, baking not only increases cost and cycle time, it can also degrade solderability and can cause strip warpage of the substrate which requires extra handling and increases the likelihood of handling damage or contamination”
- The other thing to keep in mind is that heating the substrate will increase the rate of oxidation
- Since oxidation on the substrate pads will impact the soldering and bondability performance you don't want to keep re-baking boards over and over again if you are going to try to solder them in a subsequent process
- In general, both the printed board fabricator and the user should strive to study baking by practicing effective handling, packaging, storage, and process controls

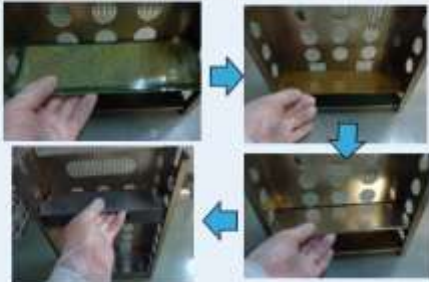
Pre-bake Method	Illustration / Picture	Remarks
1. Substrate Pre-bake using Magazine In-strip loading to Magazine		One by one Loading/Transfer of the Substrates into Magazine
2. Substrate Pre-bake using Stack loading + weight.		Batch / Stack Loading/Transfer of the Substrates into Stack Magazine. Plus plate and weight.

Fig. 4. Substrate pre-bake methods for evaluation.

- Method#2, which is the batch/stack loading of substrate pre-bake, resulted to less warpage in Fig. 5 compared to Method#1 which is the in-strip loading using magazine after pre-bake

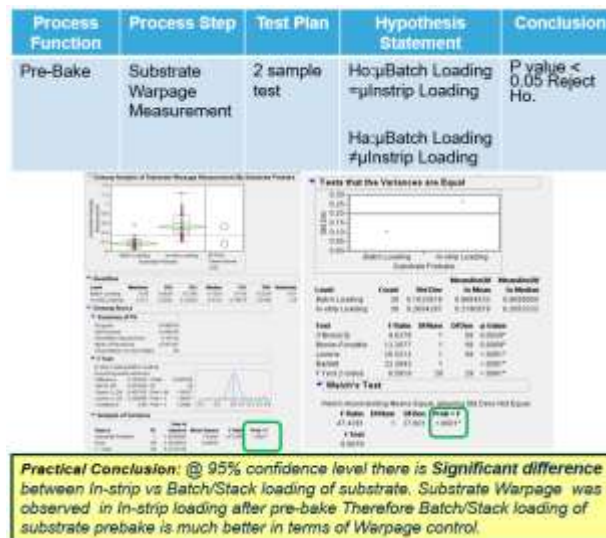


Fig. 5. Substrate warpage measurement.

- This time on bondability performance results such as die shear strength test in Fig. 6, wire pull test in Fig. 7, scanning acoustic tomography (SCAT) delamination test in Fig. 8, and solderability test in Fig. 9, it showed statistically no significant difference

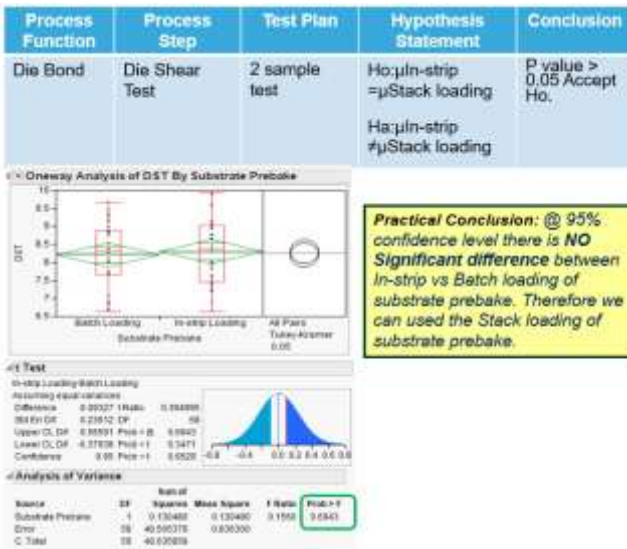


Fig. 6. Die shear strength test.

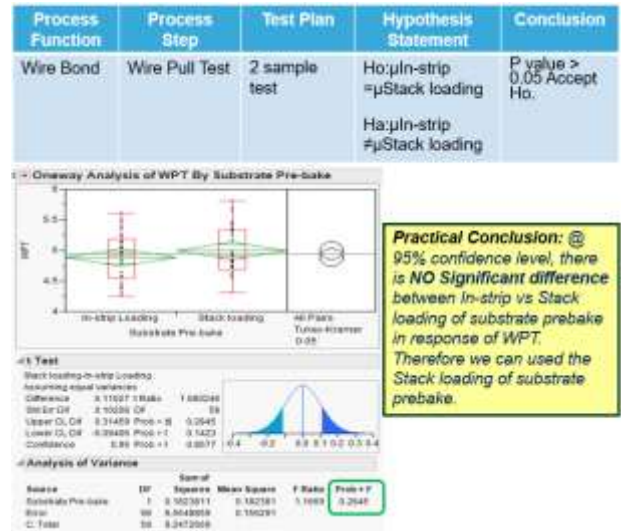


Fig. 7. Wire pull test.

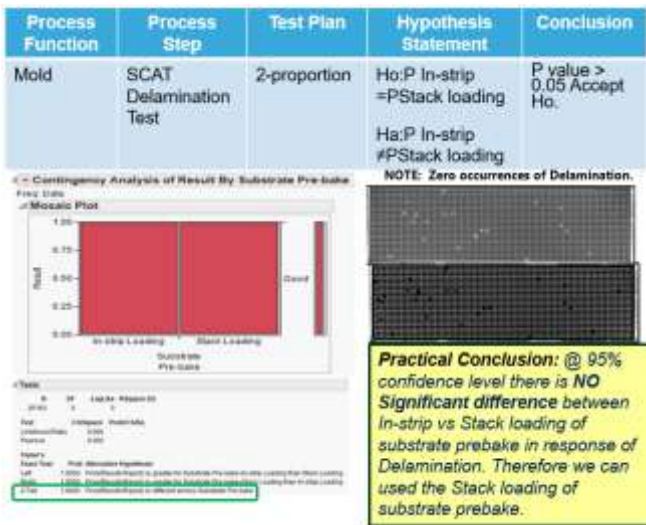


Fig. 8. SCAT delamination test.

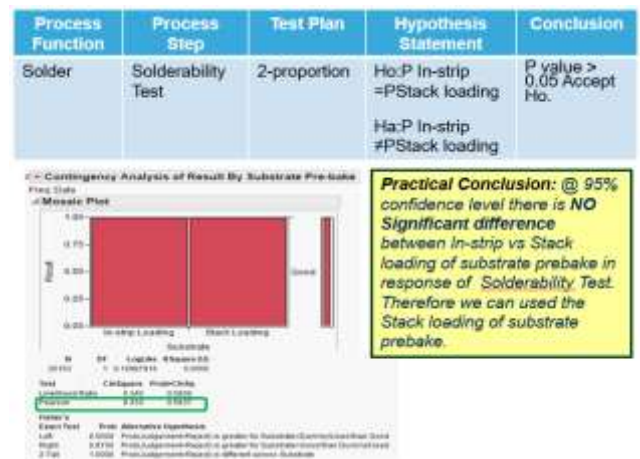


Fig. 9. Solderability test.

- Overall substrate pre-bake using batch/stack loading with weight showed better result with less substrate warpage

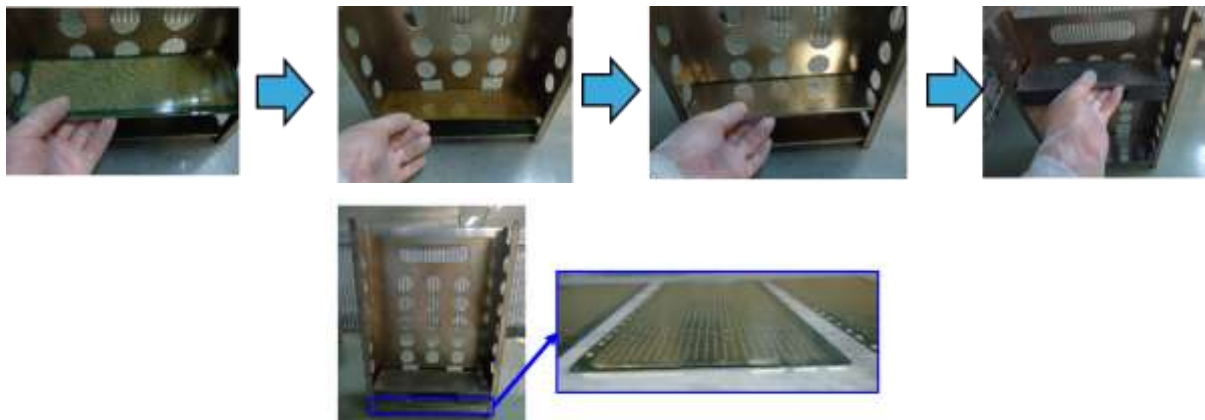


Fig. 10. Substrate warpage improvement through pre-bake method using batch/stack loading.