

Delamination behavior of printed circuit board by DMA with sample observation

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Introduction

Printed circuit boards (PCBs), common components in electronics, are formed as a stack of layers sandwiching copper sheets between non-conductive materials including fiberglass and plastic films. During operation, each electronic component generates heat. Furthermore, each layer of the PCB also expands thermally. The differences in coefficients of thermal expansion of each layer can lead to delamination. Therefore, it is important to evaluate coefficient of thermal expansion by TMA. In one approach to evaluating heat resistance, the time to delamination of a layered board can be measured by using TMA to observe thickness changes in various directions. This method can show the time to delamination. The onset is marked by the moment when the TMA curve increases during isothermal heating [1]. In a sample, various phenomena are designated as delamination behavior. However, when studying TMA results, assigning the events to delamination behaviors can be difficult. Herein, we report the use of sample observation results for specific determination of delamination behaviors.

Reference

1. IPC-TM-650 TEST METHODS MANUAL 2.4.24.1, The Institute for Interconnecting and Packaging Electronic Circuits, (1994)

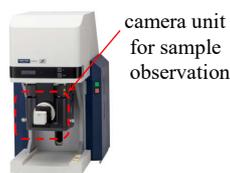
Samples and Instrument

Sample

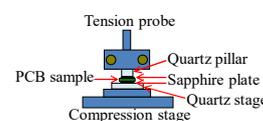


3 kinds of Printed Circuit Board
approximately 6.4mm × 6.4mm, square, 1.6mm thickness

Instrument



Dynamic Mechanical Analyzer DMA7100 with sample observation unit RV-1DMA, by Hitachi High-Tech Science Corporation



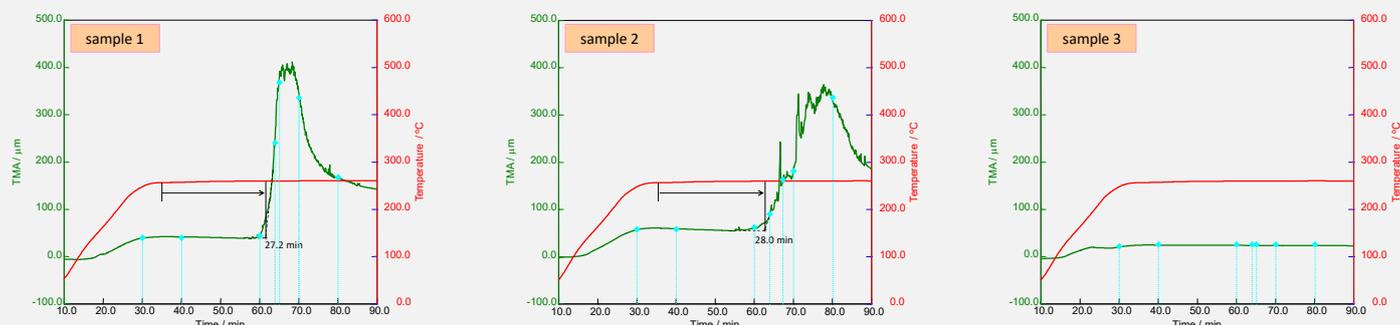
Delamination measurements of PCBs were performed using static mode DMA with sample observation.

Temperature range : ambient to 260 °C (isothermal hold)
Heating rate : 10 °C/min
Compression load : approximately 50mN
Purge gas : Air 200 mL/min

Results

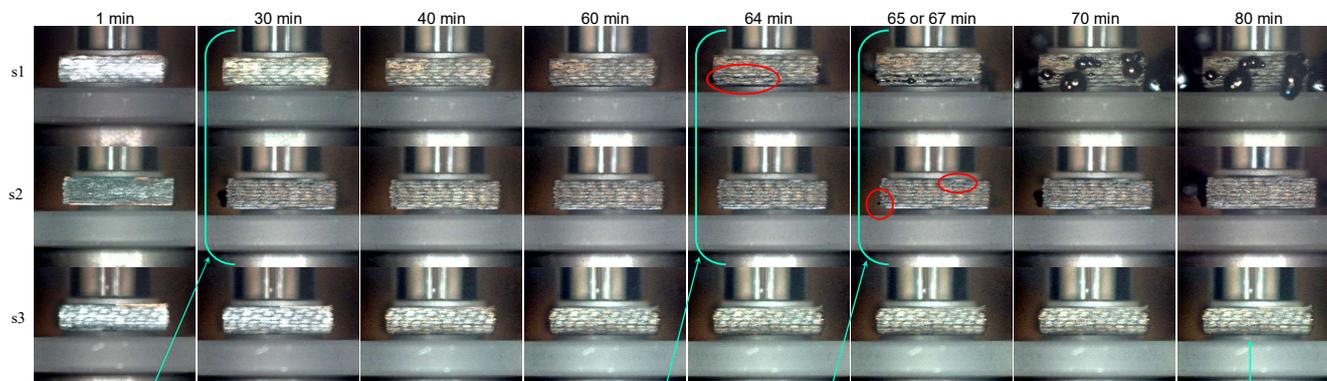
The time to delamination results are similar for both samples 1 and 2.
Sample 1 expanded more than sample 2 during delamination.
Sample 2 seems to show some noise behaviors.

Sample 3 does not show any expanding behavior.
It shows that delamination does not occur during an isothermal hold at 260 °C.



TMA results by static mode of DMA

↑ Image point



Sample 2 begins to change color earlier than sample 1.

Bubble of residual gas material in sample or gas produced by decomposition expanded. The bubbles in Sample 2 expanded less than in Sample 1.

On sample 3, there is no color change and no bubble.

Summary and Conclusion

- Using static mode DMA, the time to delamination of PCBs can be studied.
- Optical images of DMA collected using the sample observation unit, show that the color change by degradation is different for each sample.
- Optical Images show that the reason for noise in the TMA curve is due to the formation of bubbles.
- The measurements by static mode DMA with sample observation can be useful to assign characteristic behaviors to events in the TMA curve.