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Welcome to the EPTAC Webinar Series:
Delamination, Causes and Cures?

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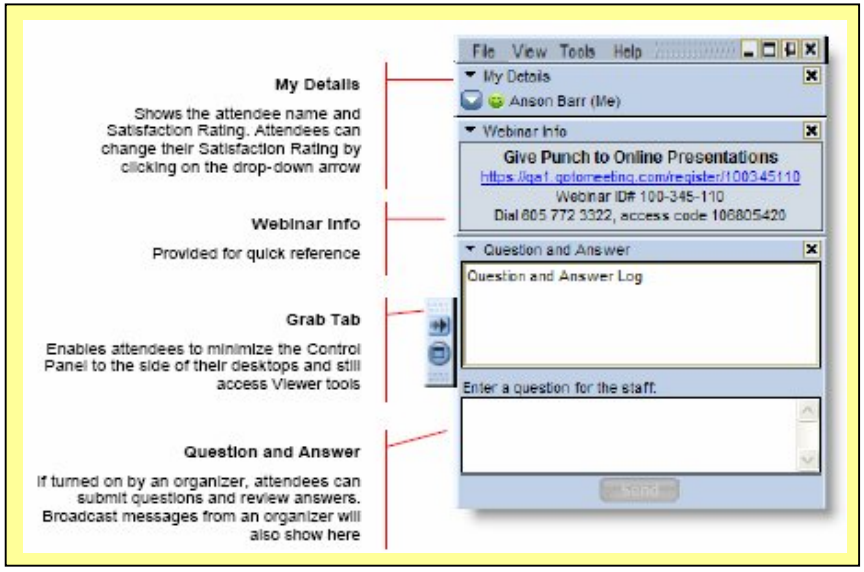

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Delamination, Causes and Cures

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Delamination

- What is it?
- Why is measles not delamination?
- Why is Haloing not delamination?
- Is Crazing a form of delamination?

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What is it?

- It is a separation of either the fiberglass from the resin or
- The resin from the laminate or foil, like the prepreg or B stage.

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What Causes Delamination

- Thermal shock
  - Wave solder process
  - Manual soldering
  - Rework and Repair process
- Moisture in the board
- Poor lamination process
- Wrong Tg for FR-4 material

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What Can Help Prevent Delamination

- Oxide layer on inner layers
- Baking of board prior to thermal processing
- Keeping them dry in storage
- Qualification of supplier to provide boards that are acceptable to the process

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Some Typical Stress Testing Parameters

- Solder Float test 6X @ 288°C
- Interconnect Stress Test 6X @ 230°C
- n passes in reflow simulation at 260°C
- Time at 260°C must be greater than 10 minutes.

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Types of Tests to Measure Delamination

- Time to delamination is a common measurement used to assess base material performance.
- The time to delamination is a measure of the time it takes for the resin and copper, or resin and reinforcement, to separate or delaminate.
- This test utilizes TMA equipment to bring a sample to a specified temperature and then measures the time it takes for failure to occur.

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Types of Tests to Measure Delamination

- Temperatures of 260°C (T260) and 288°C (T288) are commonly used for this testing.
- Many high-Tg FR-4 materials will exhibit *lower* times to delamination than low-Tg FR-4 materials.
- With Pb-free assembly temperatures reaching 260°C, the T260 test has become a much more relevant measure of performance.

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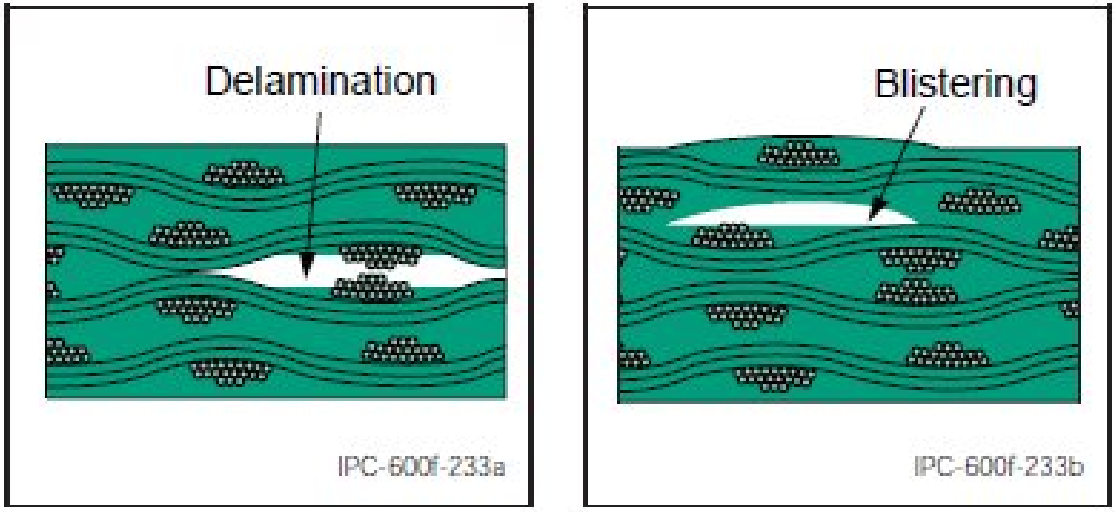
Delamination Illustration



Adapted from IPC-A-600

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Microsection Delamination Example

Adapted from IPC-A-600

- Microsection of laminate separation from the internal foil.

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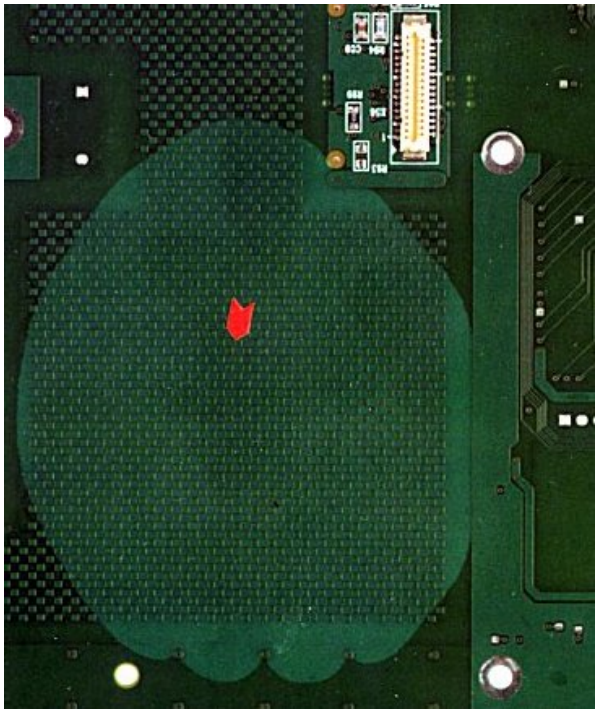
External Example



- This happened after the wave soldering process.

Provided by Assurance Technology Corporation

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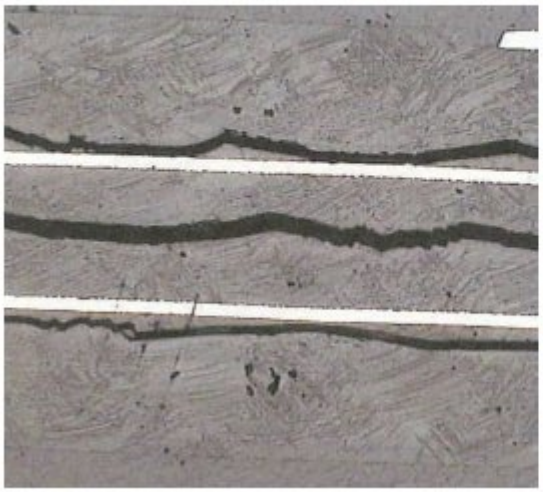
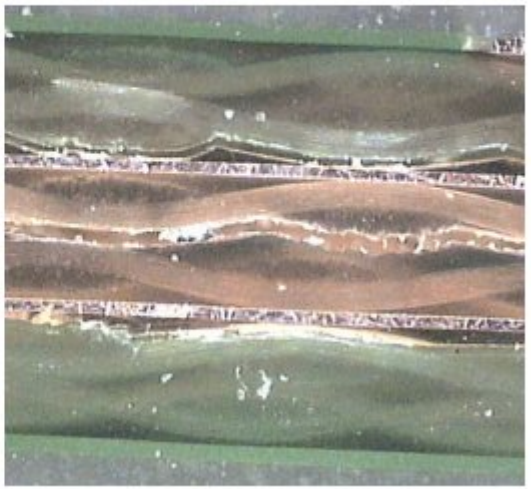
Microsection example

- This manufacturer switched to a 175°C T_g FR-4 to "avoid problems" with Pb-free assembly.





Adapted from "Final Finishes and Laminate Lead Free Overview"
by Joe Renda Enthone OEM Manager

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Material Differences for Delamination

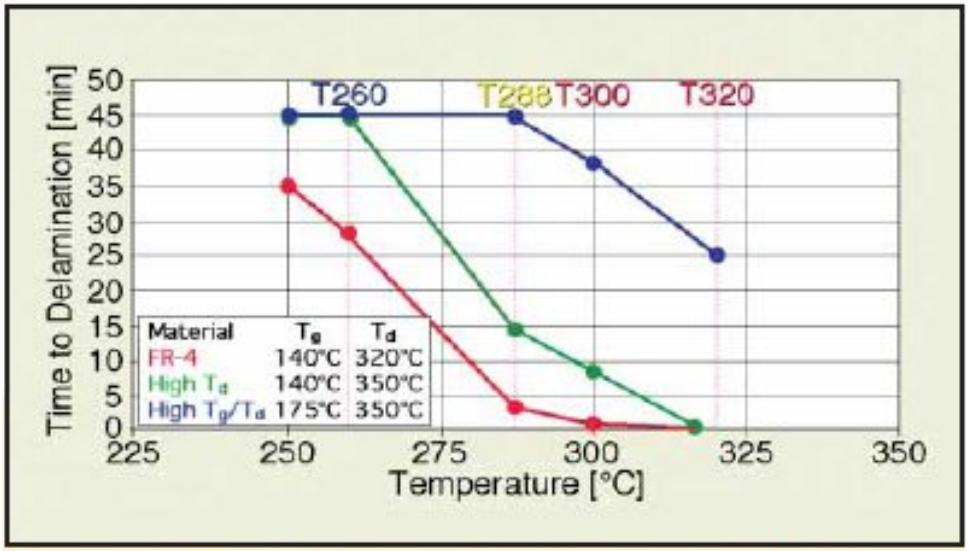

Figure 5. Times to delamination for FR-4 resins with different glass transition and decomposition temperatures. Source: Cookson Electronics, USA.

Adapted from Werner Engelmaier
PRINTED CIRCUIT BOARD RELIABILITY: NEEDED PCB DESIGN CHANGES FOR LEAD-FREE SOLDERING

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Measles: Definition and Causes

Are a form of separation

- They occurs at the knuckles of the fiber bundles and look like a cross when viewed externally
- Causes can be many, but basically poor preparation of the fiber, lack of wetting of the epoxy and excessive pressure applied during soldering
- Measles will not propagate with exposure to thermal cycle

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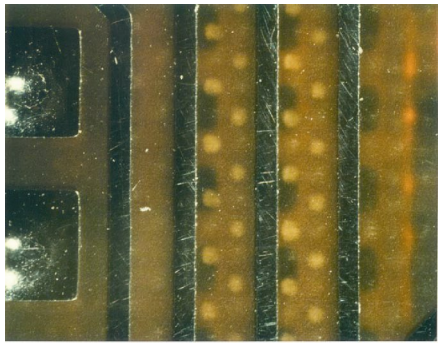
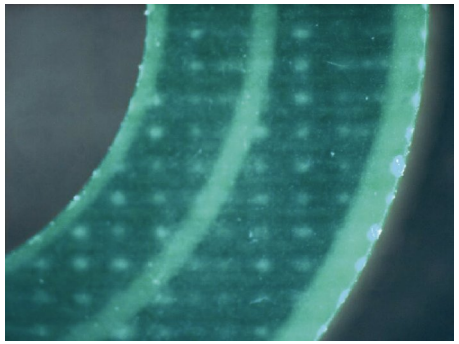
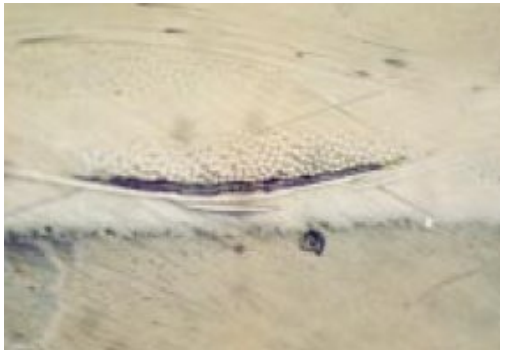
Example of Measles







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Crazing: Definition and Cause

- It is a separation along the fiber bundles
- Most times it is caused by mechanical means, such as bending the boards.

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Crazing

- *Crazing is much less controlled separation in the base material forming "interconnections" between measles and possibly adjacent conductive patterns;*
- *Therefore, the acceptance requirements for crazing were set the same as the similar conditions of delamination and blistering.*

From IPC-A-600

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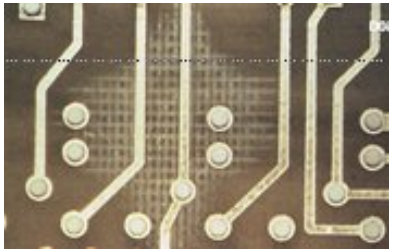
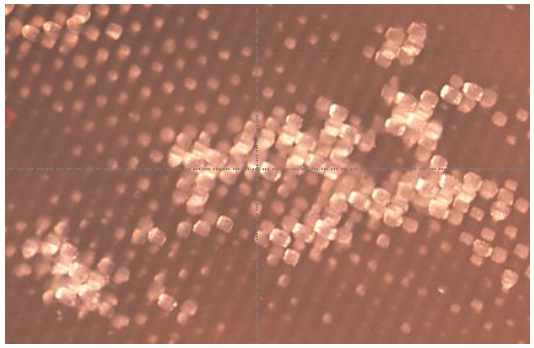
Crazing Pictures





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Haloing: Definition and Causes

Is a separation of the epoxy from the glass,

- It occurs either along the edges of the board or around the circumference of a drilled hole. Therefore there is a special criteria for its acceptance and non-conformance
- Board separation process and bad drilling process

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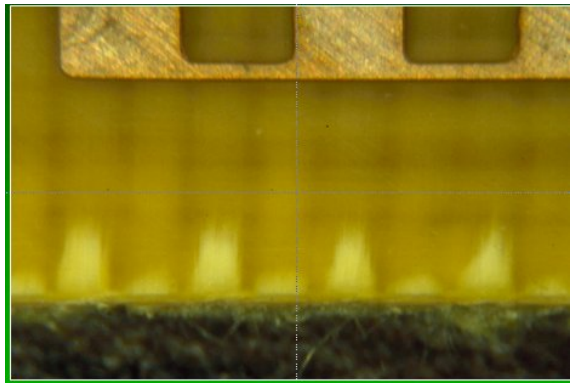
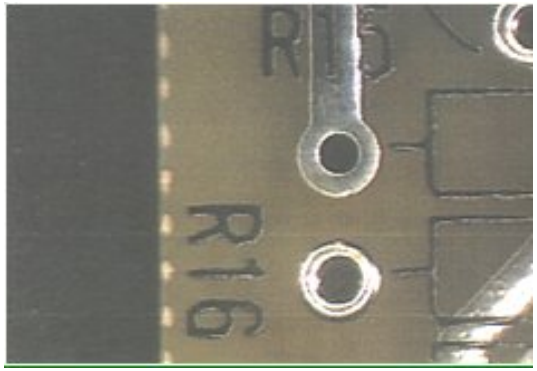
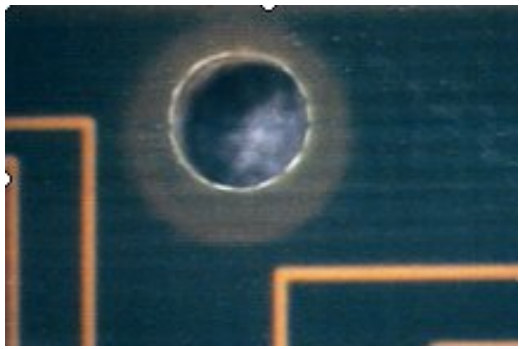
Haloing





On Edges



On internal holes

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