The Impact of Converting Flex Circuits From HASL to a RoHS Compliant Surface Finishes

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Executive Summary

This paper will explore the most common alternatives to hot air-leveled solder (HASL) as a finish for flex circuits and some of the issues one may want to be aware of when converting. Whether the reason for seeking alternative finishes is RoHS compliance or assembly process enhancement, there are factors one must consider in switching.

We will address benefits and impacts of ENIG (electro-less nickel/immersion gold), Immersion Sn (tin) and Immersion Ag (silver), electrolytic Ni/Au (nickel/gold), as well as what is commonly known as "lead-free" solder. The benefits range from ease of processing – bare flex and assembly – to a more robust interconnect concept for specific applications. Impacts are the "gothchas" - potential pitfalls – and can include electrical test failures and significantly increased part cost.

The attendee will leave with an appreciation for the careful nature of making such a significant change in part configuration.

The Impact Of Converting Flex Circuits From Hasl To A Rohs Compliant Surface Finish

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INTRODUCTION

- Flex Circuits as interconnects
  - predominantly connector assembly
  - Rigid-Flex bring PCB issues
- Availability of non-RoHS components
  - nearly all components now RoHS
  - re-tinning is costly and time consuming
- HDI components require planar surface
  - tight pitch parts require accurate placement
  - pad configurations changing with density

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MOST POPULAR ALTERNATES

- ENIG (electro-less nickel/immersion gold)
- Immersion Ag (silver)
- Immersion Sn (tin)
- “Lead-Free” HASL
- Electrolytic Ni/Au

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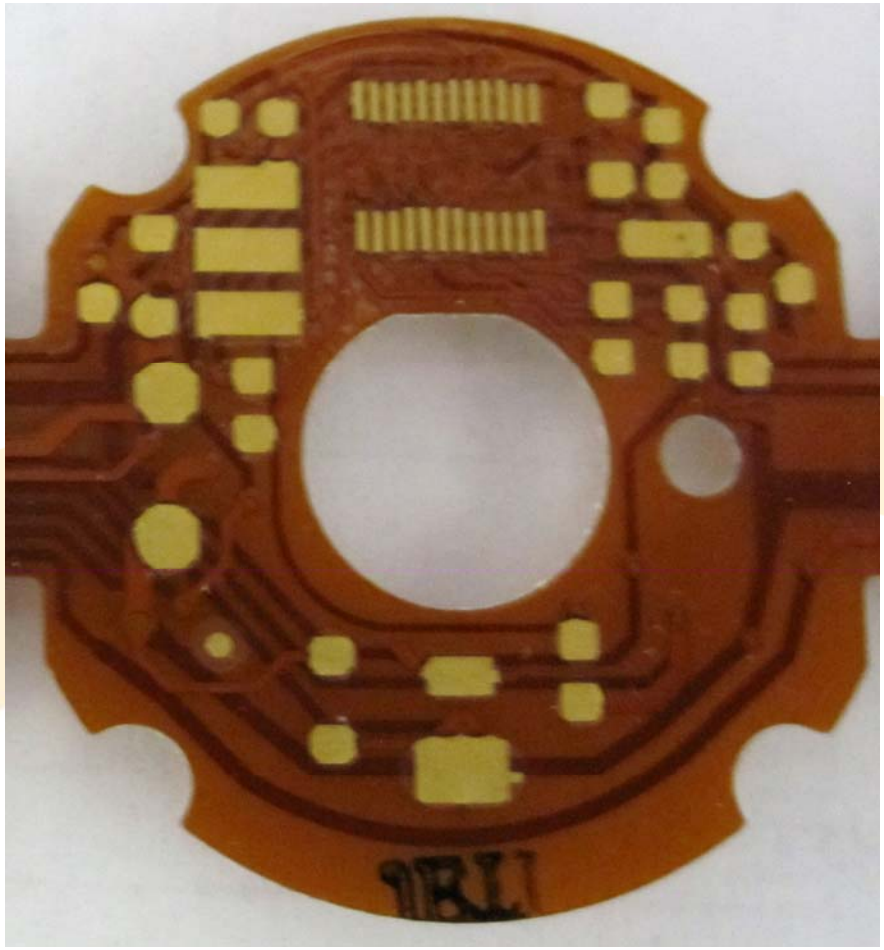
BENEFITS AND CHALLENGES

- ENIG (electro-less nickel/immersion gold)
  - very thin 3 – 7 µin (.07 - .17 µm) and flat
  - virtually eliminates solder “tomb stoning”
  - can make certain FOD conductive
  - acceptance measurements time consuming
  - may require x-ray fluorescence technology
  - “black pad”: palladium barriers/process control
  - highest per panel cost alternative
  - use IPC-4556 for requirements

BENEFITS AND CHALLENGES



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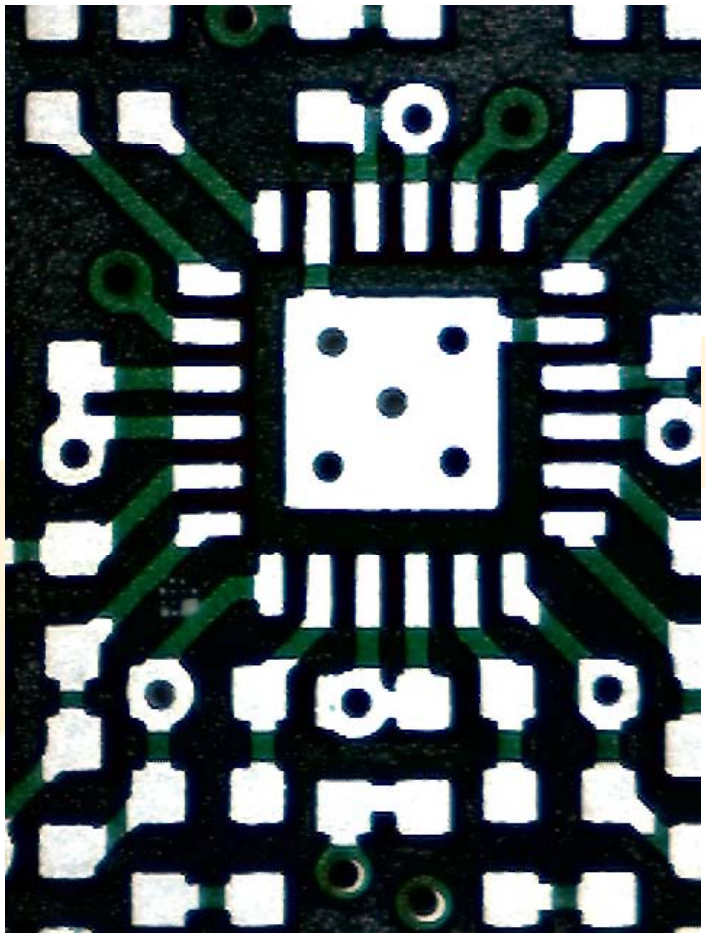
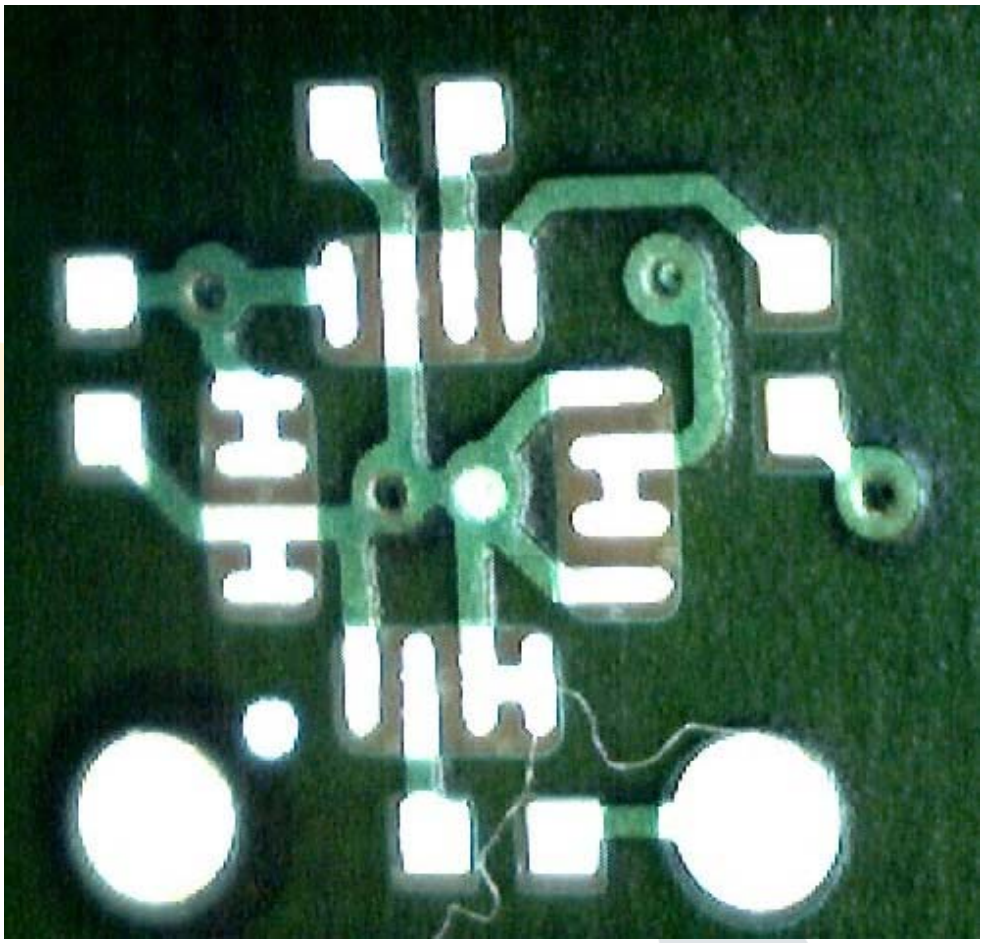
ENIG Finish

BENEFITS AND CHALLENGES

- Immersion Ag (silver)
  - very thin – 300 µin (7.2 µm) and flat
  - virtually eliminates solder “tomb stoning”
  - can make certain FOD conductive
  - interleafing sheets during processing critical
  - may require beta backscatter technology
  - may require protective coating (OSP)
  - high per panel cost alternative
  - use IPC-4553 for requirements

BENEFITS AND CHALLENGES





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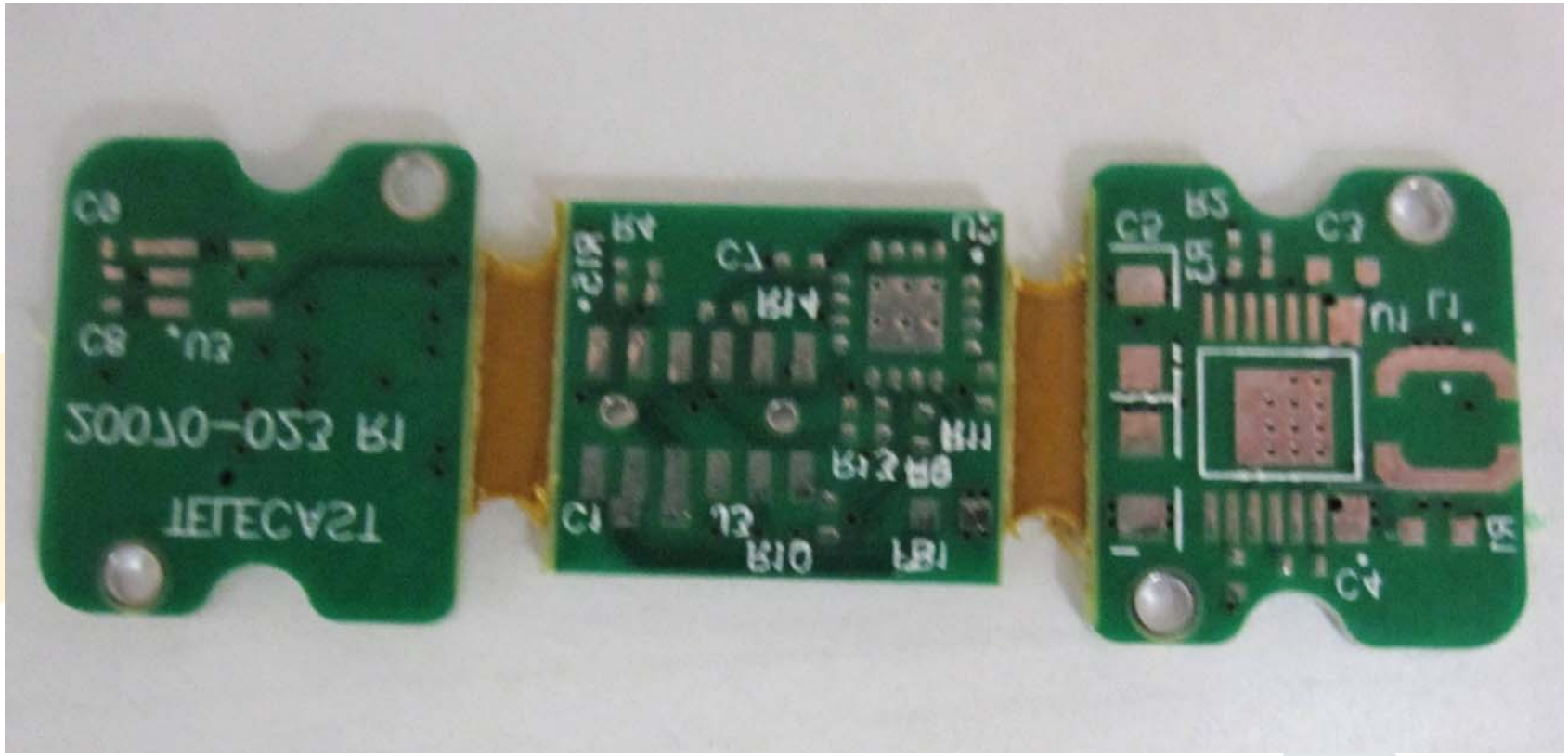
Immersion Ag Finish

BENEFITS AND CHALLENGES

- Immersion Sn (tin)
  - very thin – 300 µin (7.2 µm) and flat
  - virtually eliminates solder “tomb stoning”
  - can make certain FOD conductive
  - acceptance measurements time consuming
  - may require beta backscatter technology
  - requires protective packaging
  - moderate per panel cost alternative
  - use IPC-4554 for requirements

BENEFITS AND CHALLENGES



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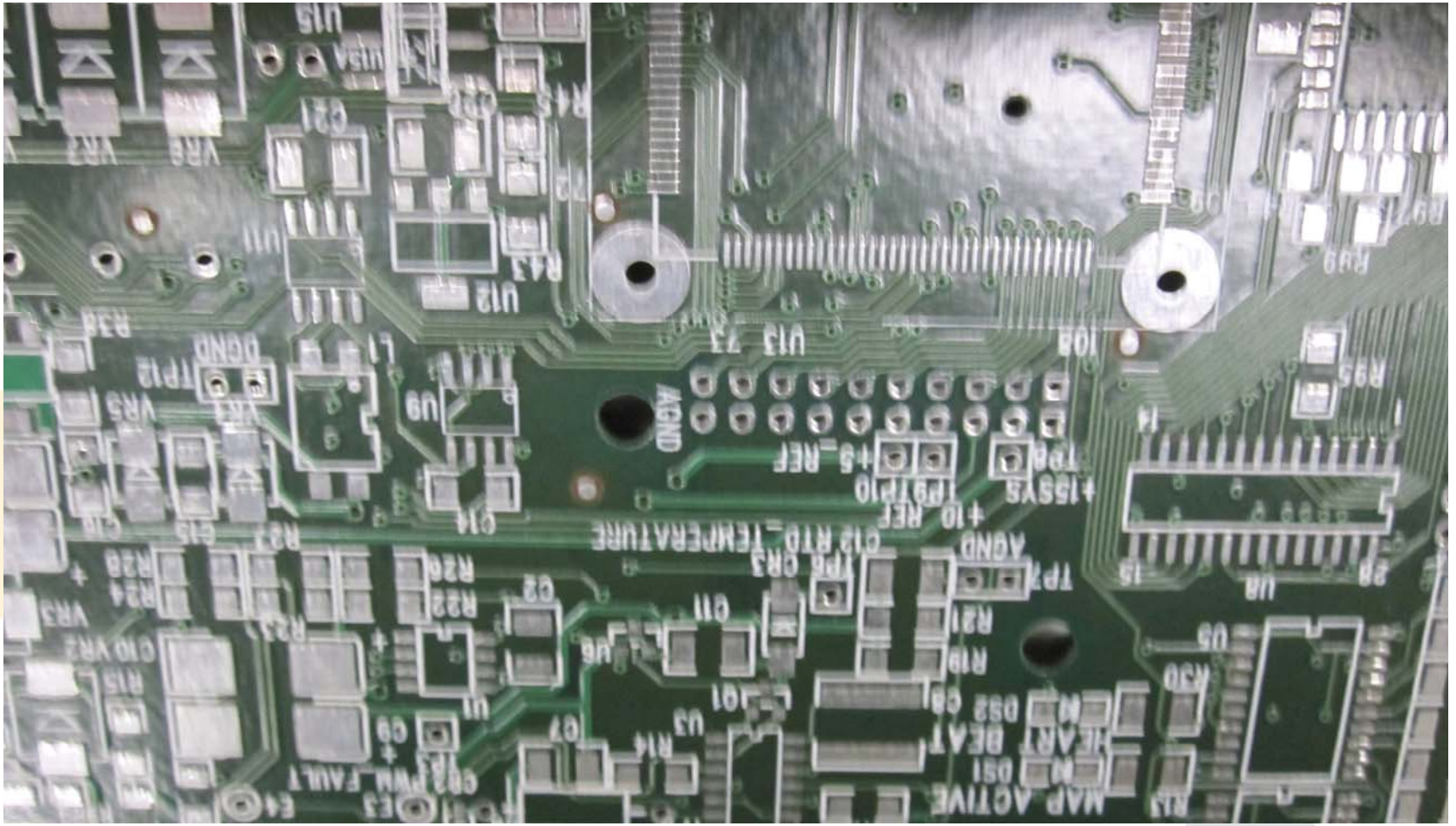
Immersion Sn Finish

BENEFITS AND CHALLENGES

- "Lead-Free" HASL (hot air – solder level)
  - processes just like HASL
  - thickest alternative (1 mil) – least planar
  - may see "tomb stoning" on pads
  - requires higher temp soldering at assembly
  - acceptance measurements like HASL
  - solder migration (Sn/Cu alloy)
  - long shelf life – annual Mil re-certification
  - lowest per panel cost alternative

BENEFITS AND CHALLENGES



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“Lead-Free” HASL Finish

BENEFITS AND CHALLENGES

- Electrolytic Ni/Au (nickel/gold)
  - standard plating process
  - thickness of Ni and Au is process variable
  - requires “shunting” – exposed edge copper
  - very hard surface for wire bonding/switches
  - acceptance measurements time consuming
  - may require beta backscatter technology
  - panel cost susceptible to Au market cost
  - use IPC-4556 for requirements

BENEFITS AND CHALLENGES

Electrolytic Ni/Au Finish

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SUMMARY

- control process/vendor very tightly
- run test lots – impact on full fabrication process
- work with your customer
  - what is end application?
  - what is termination technique?
  - how will thicknesses be measured?
  - how long will product wait to be assembled?
  - have customer run test lots
  - determine best thicknesses

SUMMARY

Thank You

for your time and interest

For further discussion on this, or any flex circuit related topic, please feel free to contact the authors:

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