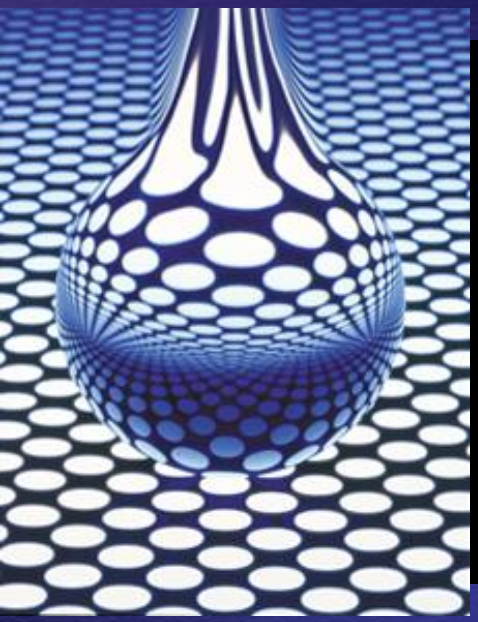

PCB Surface Finishes for Low Temperature Solder Processing

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February 2013

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ENTEK OM Overview

- Definition of ENTEK OM
- Technology of ENTEK OM

ENTEK OM Low Temperature Solder Performance

- Cross Print
- Component Shear Force
- Voiding
- Large Pad Wetting

- Conclusion

Technology

ENTEK OM is *not* an OSP but is an OSP ***replacement technology***.

- Properties behave between OSP and a metallic finish.
- Designed to provide OSP users the benefits of a metallic surface finish.

Technology

ENTEK OM - Organic Metal and Dispersed Nano Silver Particles

- Primary organic metal particle size is 10nm and the Ag particles are only 4nm
- Organic metal is a conductive polymer and the Ag exists as dispersed particles
- Organic metal bonds to the copper
- The organic metal creates a continuous surface potential change
- Ag is not continuous but is bonded to the organic metal nano particles
- Organic Metal is not visible and is almost as noble as Ag
- Organic metal complexion of Cu yields;
  - Complete Cu passivation
  - Oxidation reduction

ENTEK OM and Low Temp Solder

Multiple tests were performed

Highlighting four tests;

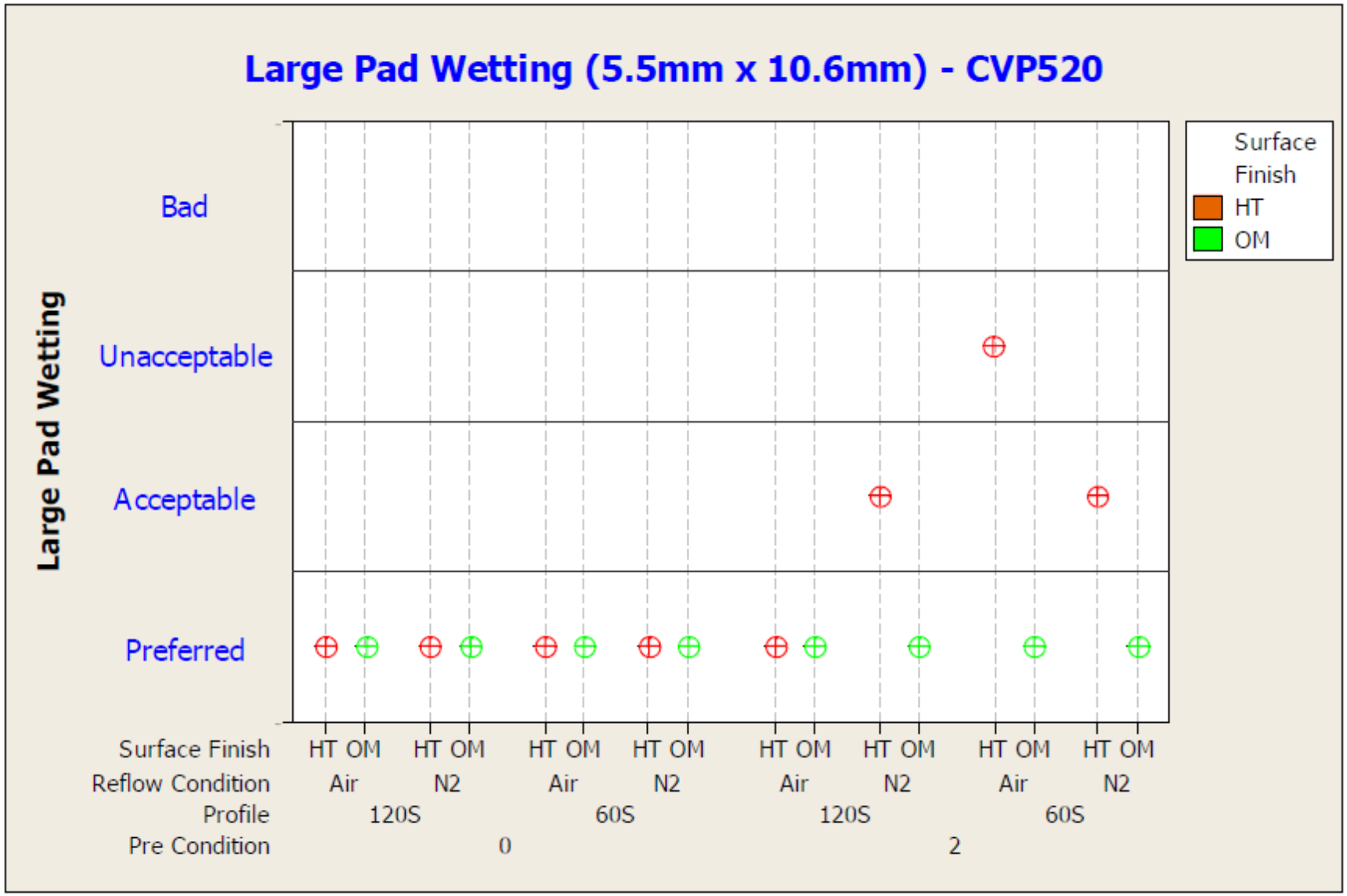
1. Large Reflow Feature Test
2. Solder Spread Test
3. Component Shear Test
4. Large Area Voiding

Large Size Reflow Feature

- Two finishes were compared OSP and ENTEK OM
- 5.5 x 10.6 mm feature pads were printed
- Reflow was performed in air and nitrogen
- Two profiles – 60 second and 120 second soak
- Boards were fresh and preconditioned

- All the boards are visually inspected to observe the ability of a PCB base metal to be evenly wetted with an coat of solder after reflow.

- Pads were graded on the following scale;
  - **Preferred = 1**
  - **Acceptable = 2**
  - **Unacceptable = 3**
  - **Bad = 4**

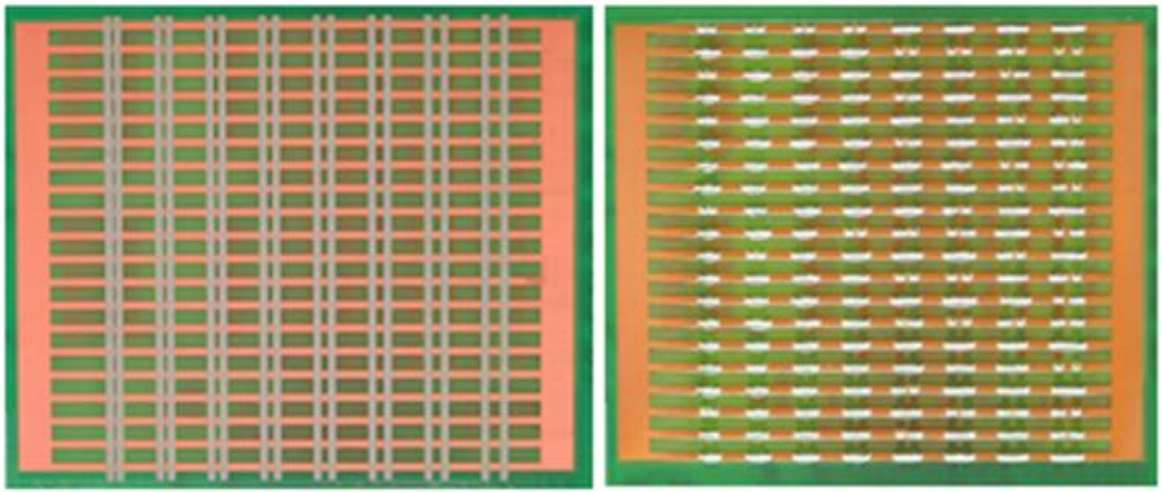

Large Pad Wetting (5.5mm x 10.6mm) - CVP520
Large Pad Wetting
Bad
Unacceptable
Acceptable
Preferred
Surface Finish
HT
OM
Surface Finish HT OM HT OM HT OM HT OM HT OM HT OM HT OM HT OM
Reflow Condition Air N2 Air N2 Air N2 Air N2
Profile 120S 60S 120S 60S
Pre Condition 0 2

Summary – Large Pad wetting

Board Precondition	Reflow Profile	Reflow Atmosphere	Better Surface Finish for Good Wetting CVP520
0	60S Soak	Air	Comparable
		Nitrogen	Comparable
	120S Soak	Air	Comparable
		Nitrogen	Comparable
2X	60S Soak	Air	OM
		Nitrogen	OM
	120S Soak	Air	Comparable
		Nitrogen	OM

ENTEK OM performed as well as or better in multiple scenarios with large pad wetting testing with low temp solder especially with preconditioning.

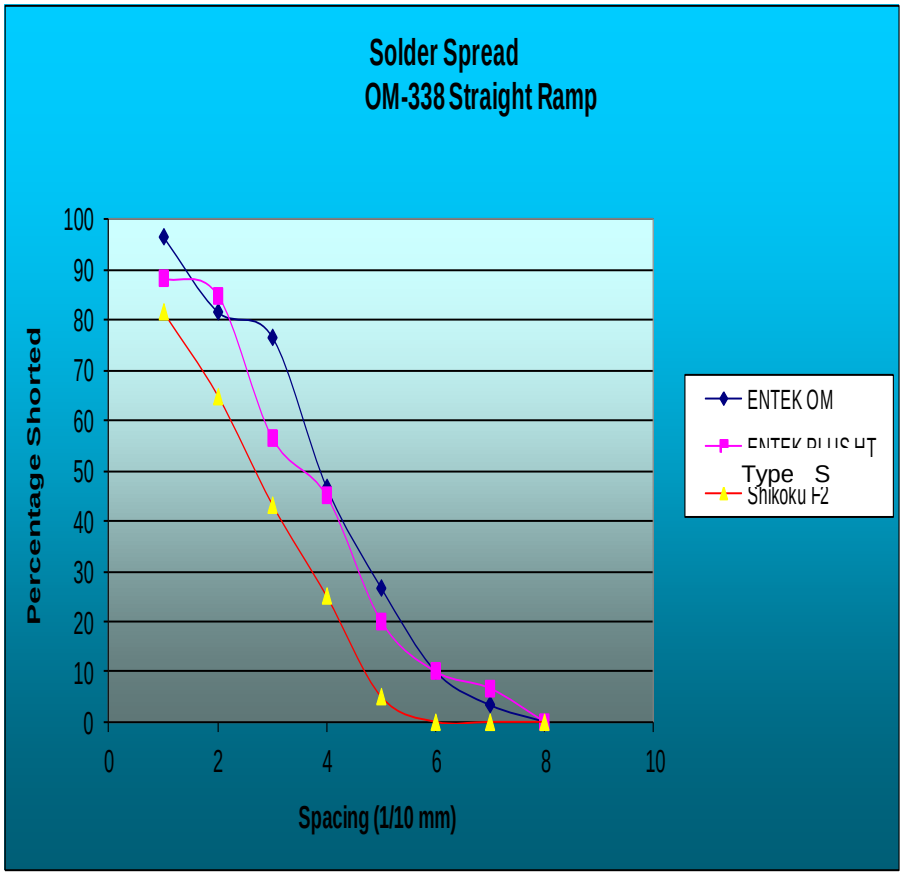
Performance Attributes
Solder Spread Test Method

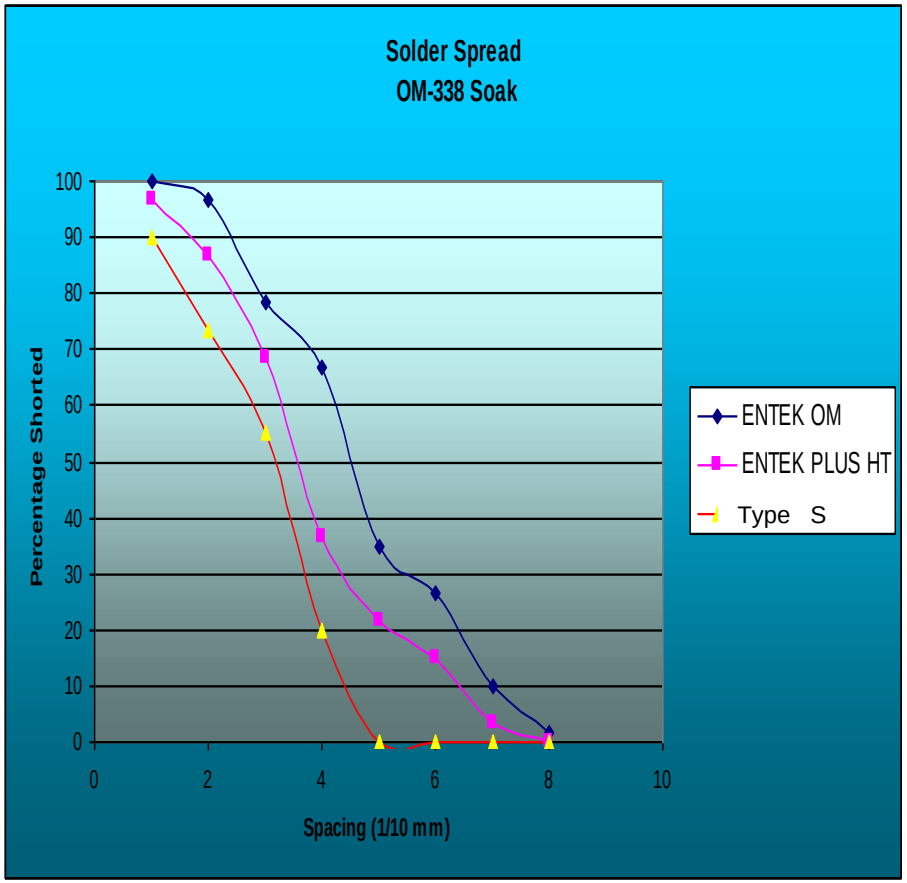


Pre Reflow Post Reflow

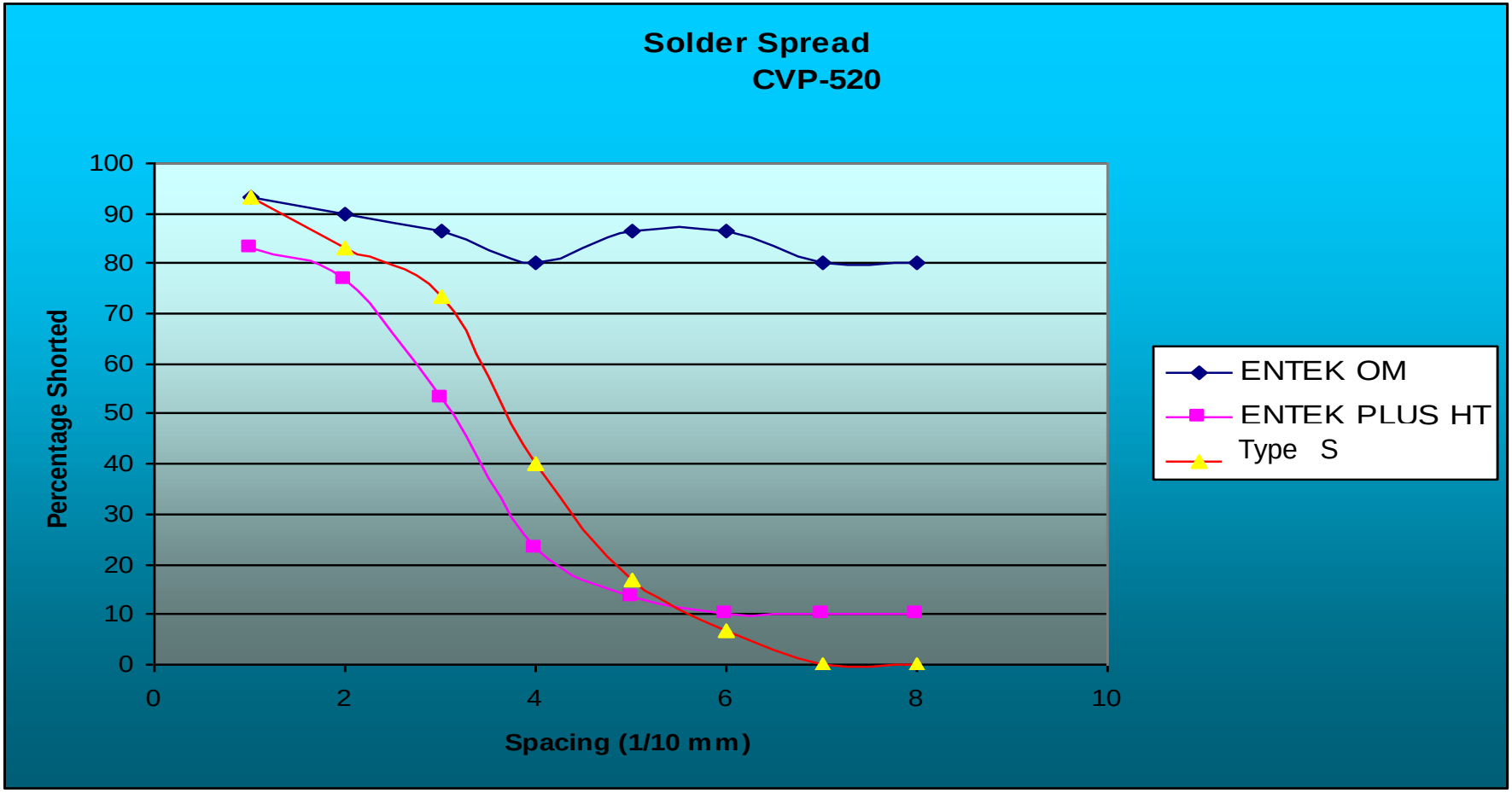
A test vehicle with evenly spaced copper pads are coated with a final finish and then graduated lines spaces are printed in a perpendicular fashion. The test vehicle is then reflowed and continuous solder unions are counted. The higher count - the better the spread.
Compared two OSPs and ENTEK OM with

Solder Spread test performed with OM-338 Solder Paste





CVP-520 Pin In Paste Solder



Summary

- ENTEK OM performed better that OSP in the spread tests
- Low temp solder in combination with ENTEK OM far exceeded OSP in the spread test.

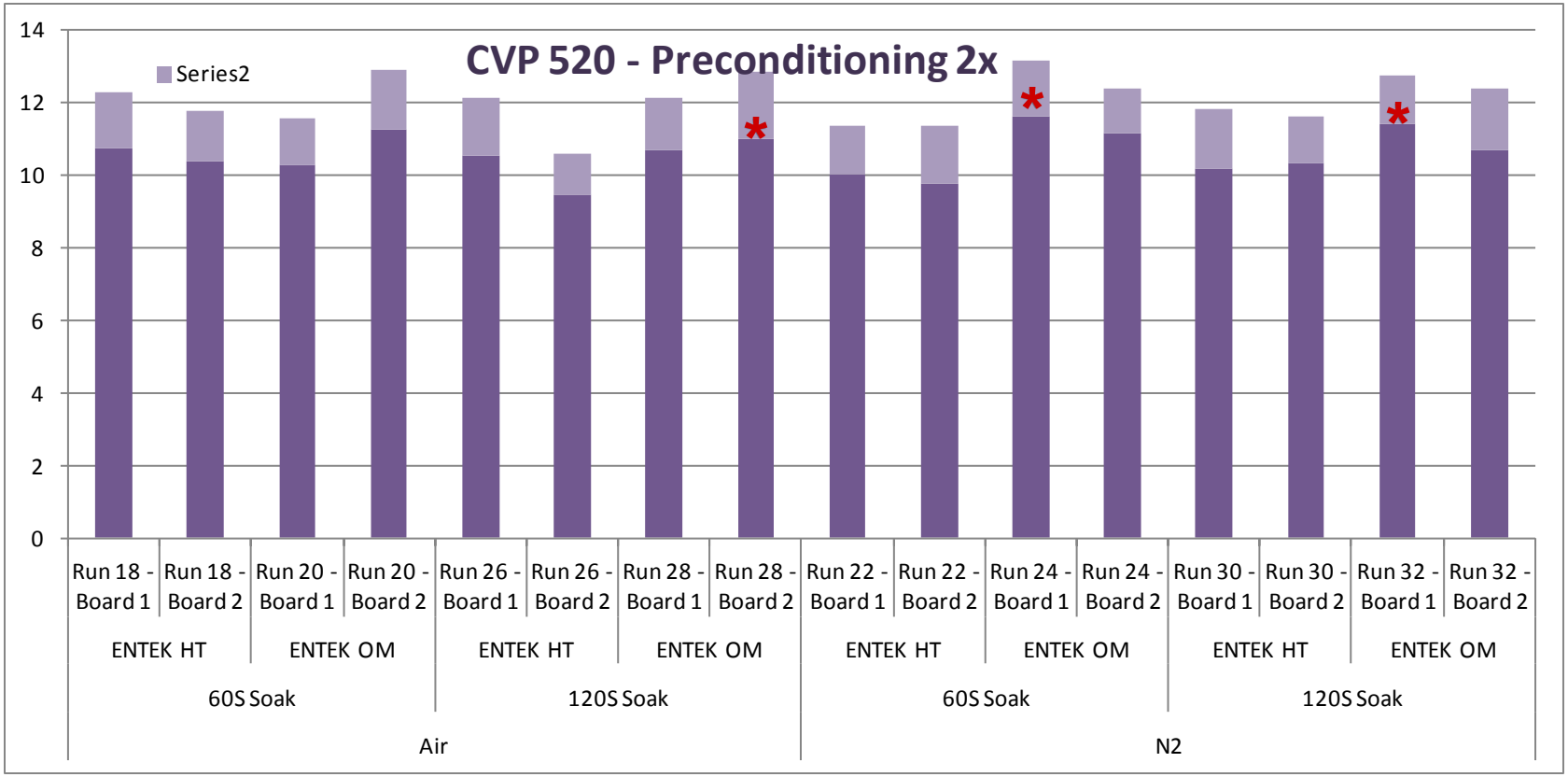
1206 Component Shear Test

Shear Test Details

- Equipment: Dage 4000 bond tester
- Testing Standard: Die/Chip shear testing IRC-SOP-MET-0007
- Additional test details:
  - Cartridge: DS100 (kg)
  - Shear speed: 700 μm
  - Shear height: 5 μm

Procedure

- Number of replicates for every *combination*
  (Solder Paste/Surface finish/Reflow Atmosphere/Reflow Types/Preconditioning reflows) = 2
- Number of 1206 chip components tested per board = 20
- Data provided: Average Shear Force and standard deviation
- Each board was preconditioned with two reflows



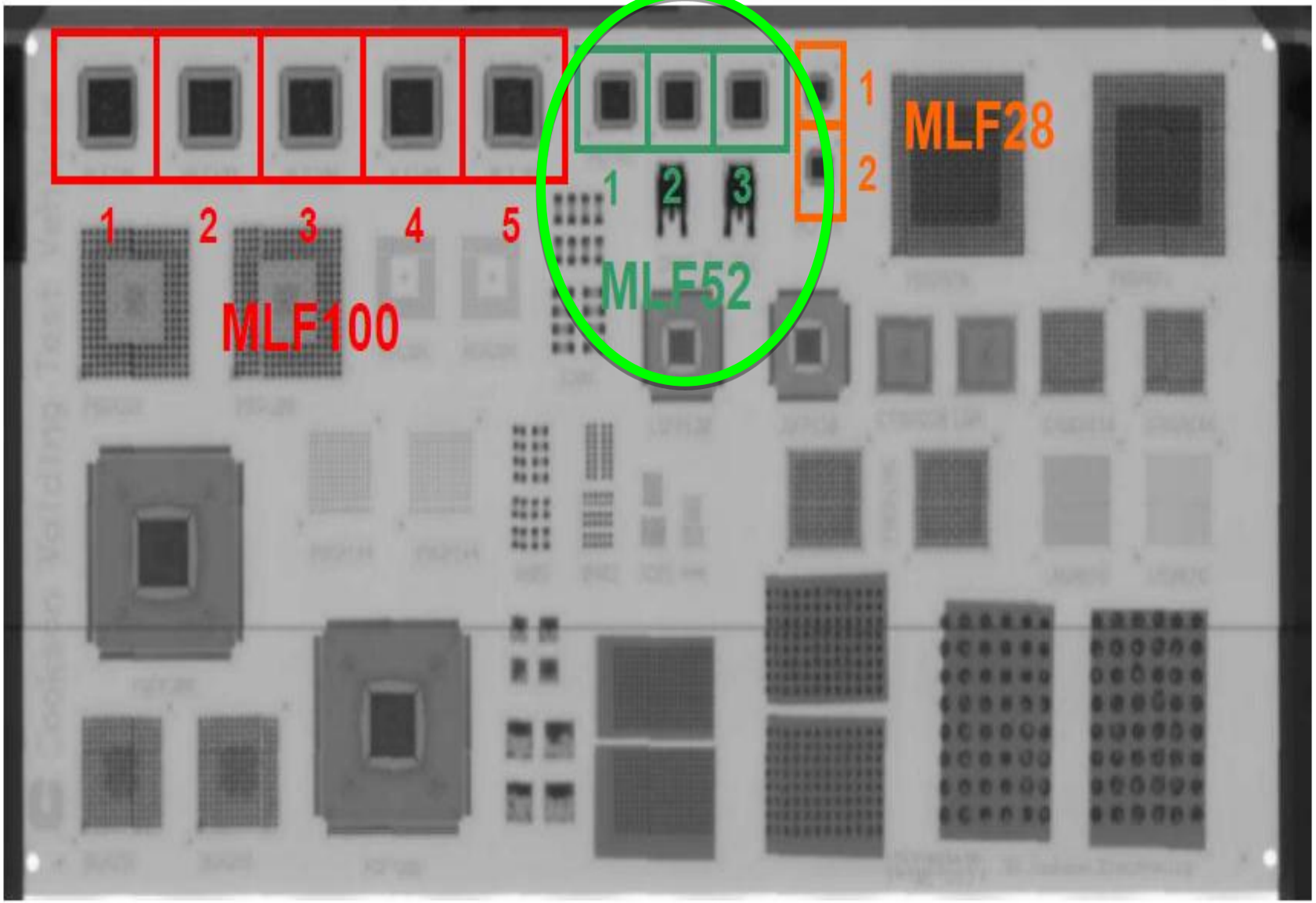
- Taking into account the standard deviation, there is no difference in shear force among any of the combinations.
- However, when reflowed in N2, the components on ENTEK OM tend to have higher shear force - indicated by the asterisks

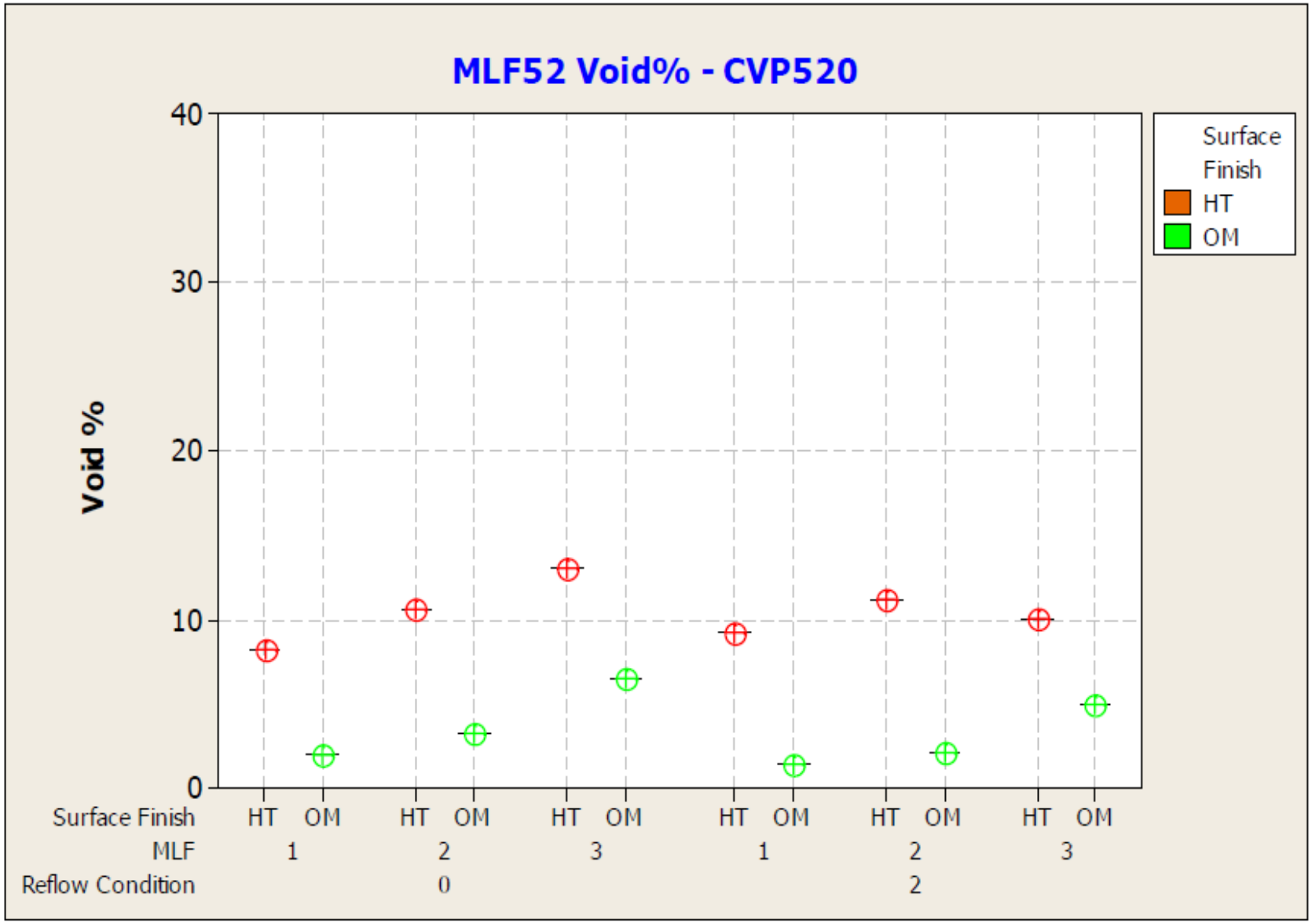
Large Area Voiding

- **Print Parameters**
  - Print Speed (inch/sec) = **2**
  - Print Pressure (lbs/inch) = **1.25**
  - Snap Off Speed (inch/sec) = **0.2**
- **Paste**
  - Low Temp CVP-520
- **Two Air Reflow Preconditions**
  - Reflow 0 – Boards were reflowed with components (No Precondition and these boards are subjected to only one reflow)
  - Reflow 2 – Bare boards were preconditioned twice in each profile & reflowed with components (in total these boards were reflowed 3 times)
- **Two PCB Surface Finishes**
  - ENTEK OM
  - ENTEK PLUS HT

Molded Lead Frame 52 Voiding

- Voids are caused by the amount of out gassing flux that gets entrapped in the solder joint during reflow.
- For large thermal pads it is more difficult for out gassing of solder paste flux to escape and results in voiding.
- The solder joints are inspected under Phoenix Micromex X-ray for the presence of voids. The data obtained are plotted under different conditions.


1
2
3
4
5
MLF100
1
2
3
MLF52
1
2
MLF28


MLF52 Void% - CVP520
Void %
40
30
20
10
0
Surface Finish
HT
OM
Surface Finish HT OM HT OM HT OM HT OM HT OM HT OM
MLF 1 2 3 1 2 3
Reflow Condition 0 2

Molded Lead Frame 52 Voiding Summary

Board Precondition	Better Surface Finish for Less Voids	
	CVP390	CVP520
0	OM	OM
	OM	OM
	Comparable	OM
2X	OSP	OM
	Comparable	OM
	OM	OM
	OM	OM

ENTEK OM and low temp solder exhibited the best performance

	Better Surface Finish for Less Voids	
	CVP390	CVP520
Surface Finish	Comparable	OM
Board Conditioning	2X Preconditon is better than 0	Conditioning is comparible

Entek OM and low temp solder exhibited the best performance

Conclusion

Low temp solders are a viable solution and their performance can be enhance thought final finish selection

Initial data suggest that an organic metal final finish in combination with a low temperature solderpaste can out perform standard paste and OSP in the tests performed.