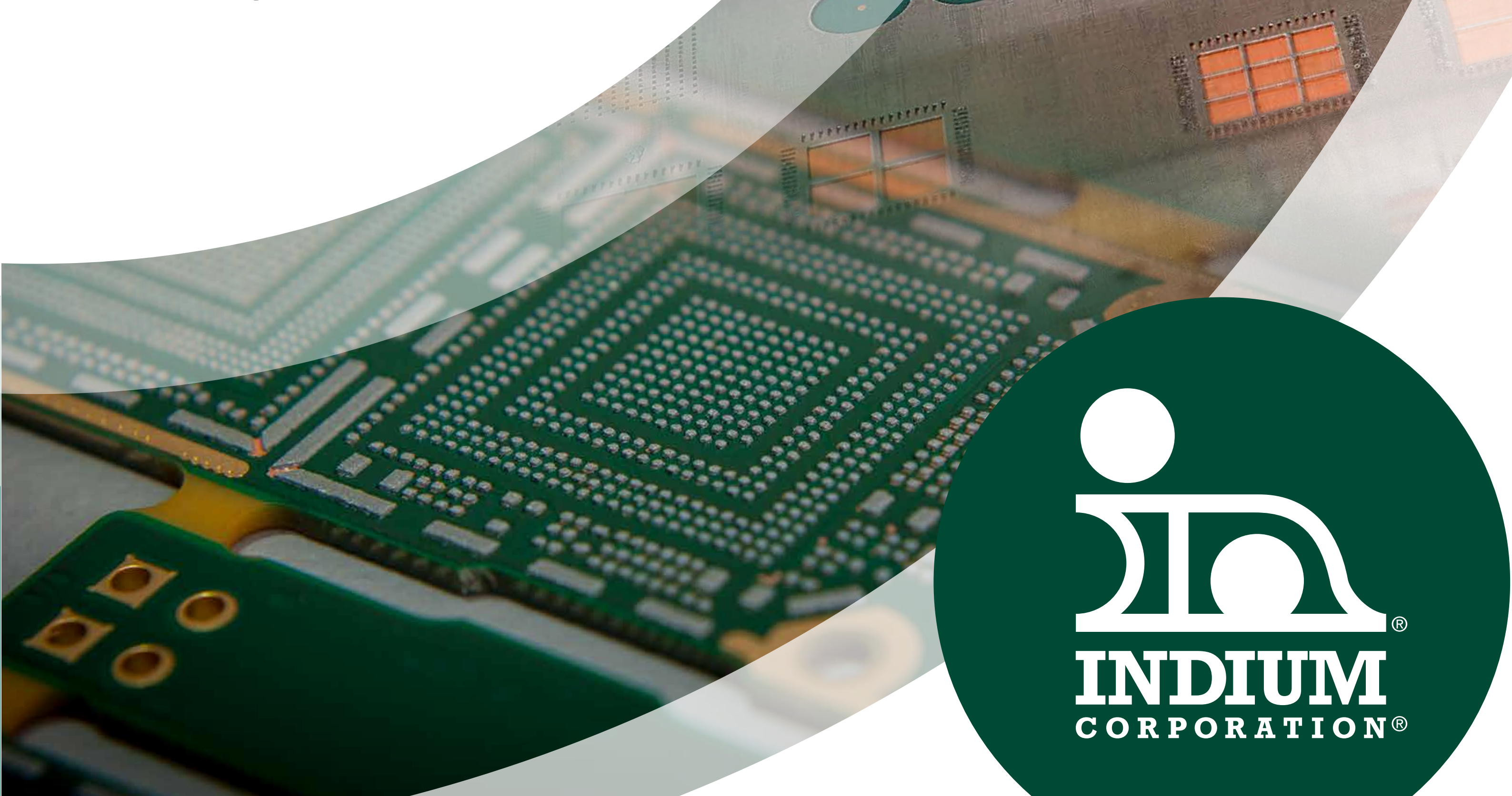
Indium10.1HF Solder Paste

Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste for use with Pb-Free Alloys

- Ultra-low voiding, especially for bottom termination component (BTC) assemblies
- Excellent electrochemical migration (ECM) performance
- Outstanding solder beading and head-in-pillow minimization performance
- Excellent wetting and coalescence in air and nitrogen reflow environments



INDIUM CORPORATION®

INDIUM10.1HF
Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste

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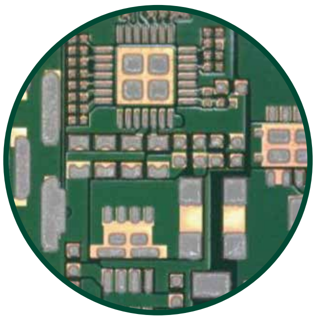

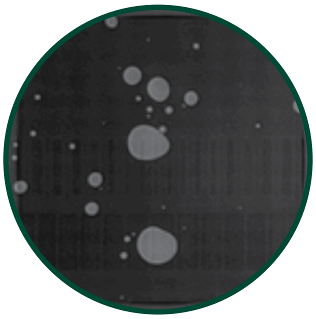

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INDIUM10.1HF Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste

INDIUM10.1HF DELIVERS:

- Ultra-low voiding – bottom termination components (QFN and DPAK), BGA, LGA
- High ECM performance under low standoff components
- Halogen-free per IEC 61249-2-21 test method EN 14582
- Exceptional printing performance
  - High transfer efficiency and low variation
- High slump resistance
  - Outstanding solder beading and solder balling resistance
  - Bridging and short mitigation
- Oxidation barrier technology eliminates head-in-pillow
- Excellent wetting to fresh and aged common metalizations and surface finishes, including, but not limited to:
  - OSP
  - ENIG
  - Immersion Ag
  - Immersion Sn

Pb-Free Alloys for Use with Indium10.1HF

Common Name	Composition	Solidus (°C)	Liquidus (°C)	Comments
SAC387	95.5Sn/3.8Ag/0.7Cu	217	219	Original iNEMI recommended SAC alloy
SAC305	96.6Sn/3.0Ag/0.5Cu	217	220	Solder Products Value Council recommended SAC alloy
Indalloy®276	90.6Sn/3.2Ag/0.7Cu/5.5Sb	224	233	High-reliability

TECHNICAL SUPPORT

From One Engineer To Another®

Indium Corporation's research scientists, application engineers, and technical support engineers work closely with our customers to develop custom solutions to their technical problems and optimize their processes.

Indium Corporation's PhD scientists and engineers are certified by many of the top industry organizations, including the SMTA and the IPC. In addition, our Six Sigma Green Belt- and Black Belt-certified staff are trained in advanced process management methods to help you to:

- Increase yields
- Improve customer satisfaction
- Increase revenues
- Reduce defects
- Increase profits
- Deliver high value and return on investment

Contact our engineers today: **askus@indium.com**

INDIUM CORPORATION®

AVOID THE VOID®

QFN VOIDING PERFORMANCE

Overview

Objective

Voiding in QFN ground planes is one of the most important issues in electronics assembly. Voiding of greater than 40% can cause overheating and potential reliability issues.

Procedure

Voiding experiments were performed with the following parameters:

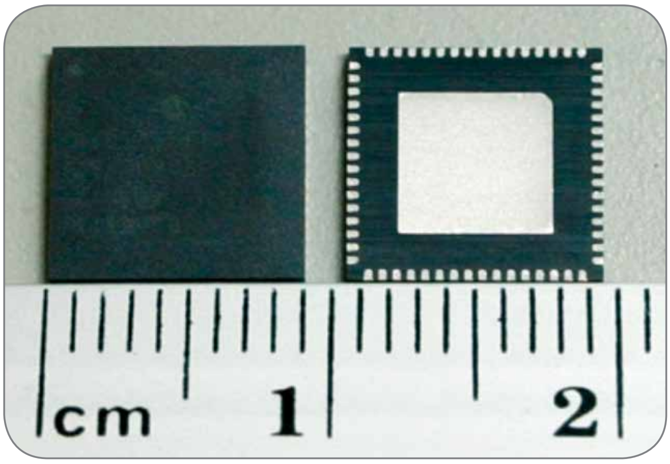
- **Reflow Profiles:**
  - Typical Pb-free air
  - Typical Pb-free nitrogen
  - Low-voiding optimized air
  - Low-voiding optimized nitrogen

Stencil

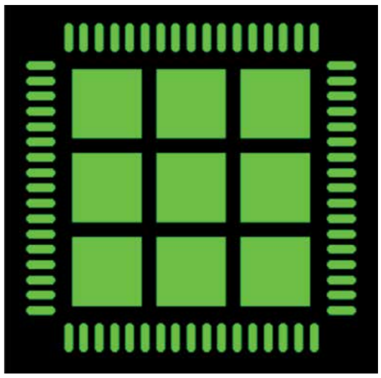
- 0.005" thick
- Laser cut (non-nanocoated)

QFN

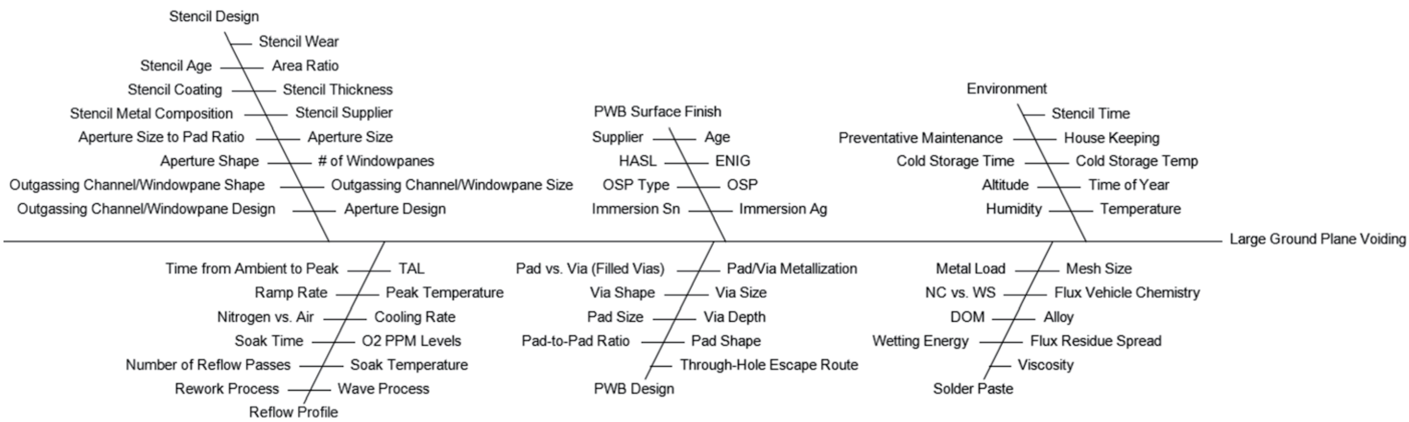
- Large 7.75mm square ground plane



- 9 – 0.088" square apertures



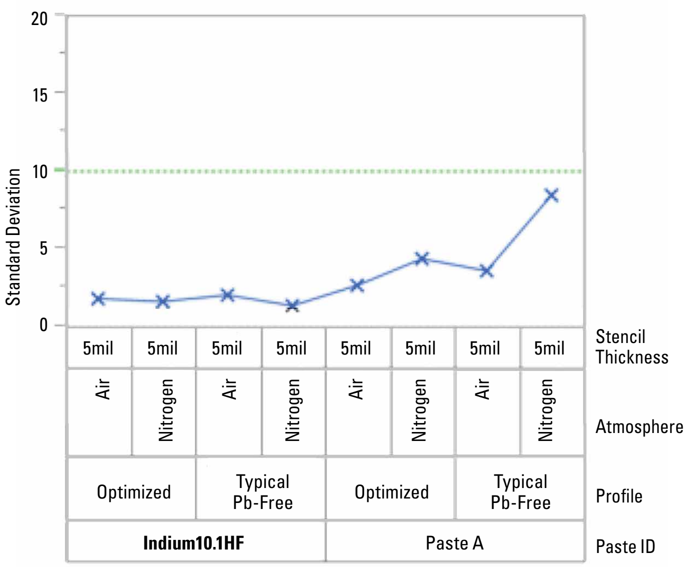
Large Ground Plane Voiding Ishikawa Diagram – Cause and Effect Diagram

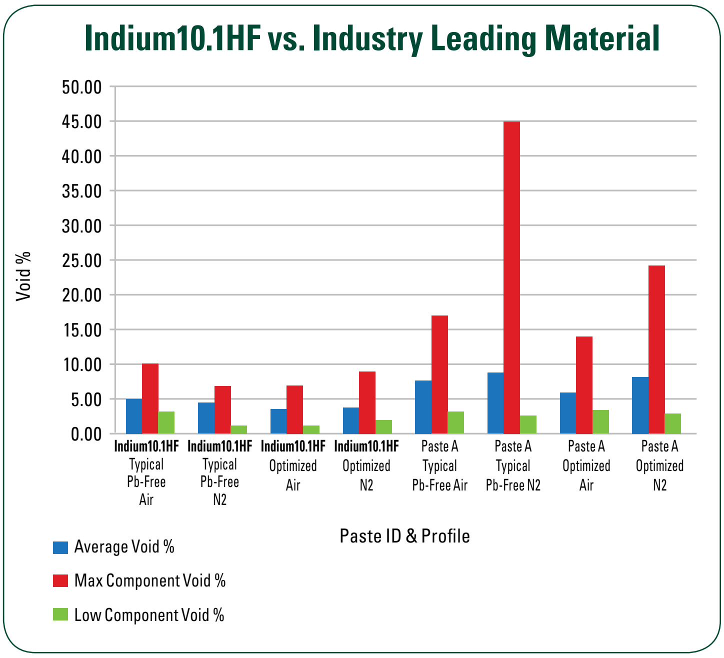


INDIUM10.1HF Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste

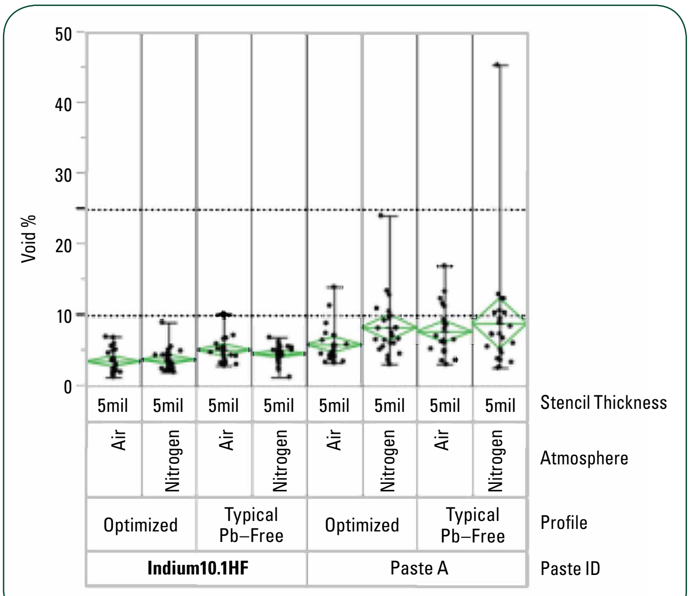
QFN Voiding Results

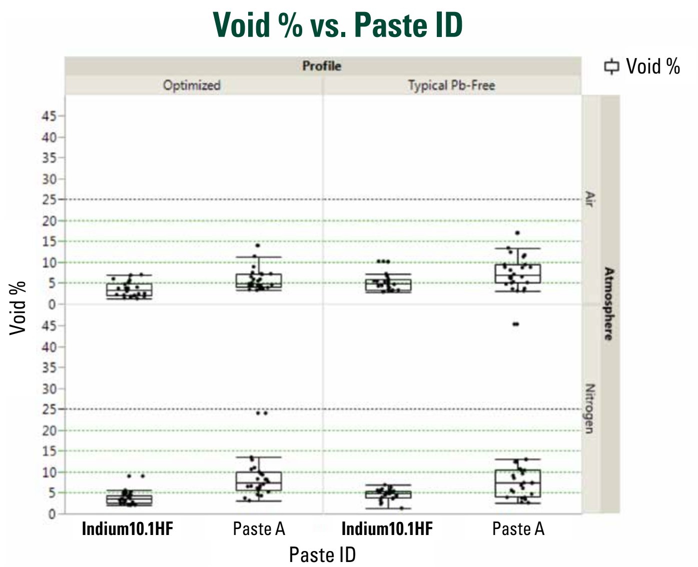
Indium10.1HF exhibits lower average voiding and lower standard deviation in all profile conditions when compared to Paste A.





Indium10.1HF did not have voiding above 10.2% in this study of 96 components.





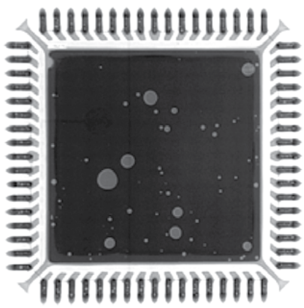
Indium10.1HF has a wide reflow process window and did not show a dramatic difference in voiding performance with different reflow profiles or reflow atmospheres.

QFN VOIDING PERFORMANCE

Typical Pb-Free Air Profile

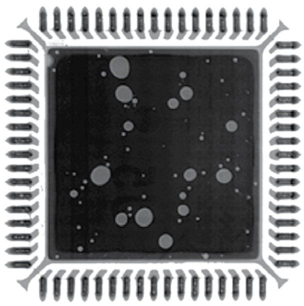
Indium10.1HF

Minimum Component Void %



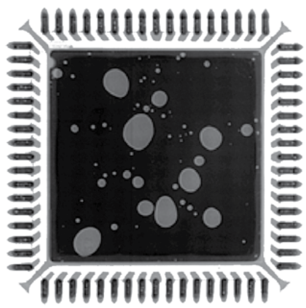
2.90%

Average Component Void%



5.11%

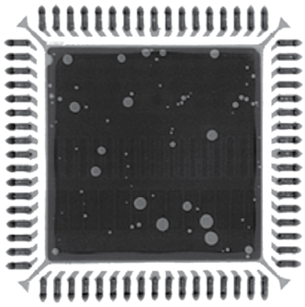
Maximum Component Void %



10.20%

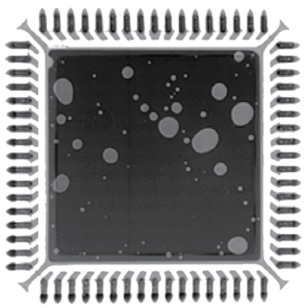
Paste A

Minimum Component Void %



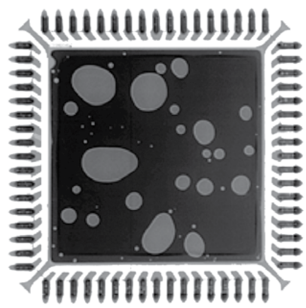
3.10%

Average Component Void%



7.72%

Maximum Component Void %

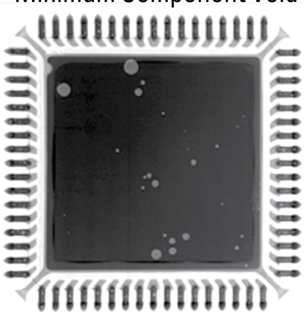


17.00%

Low-Voiding Optimized Air Profile

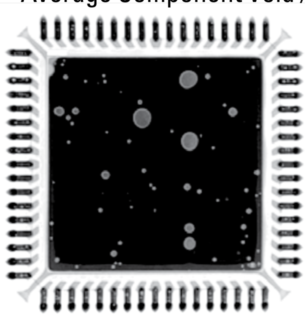
Indium10.1HF

Minimum Component Void %



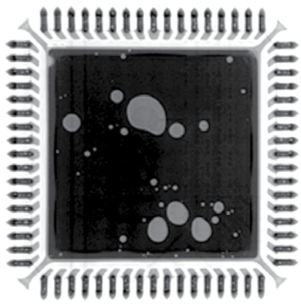
1.30%

Average Component Void%



3.49%

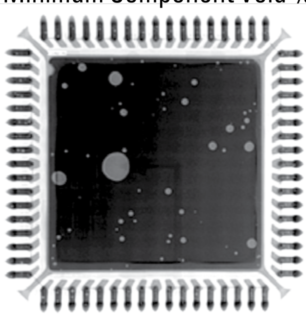
Maximum Component Void %



7.00%

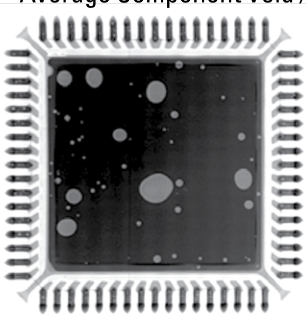
Paste A

Minimum Component Void %



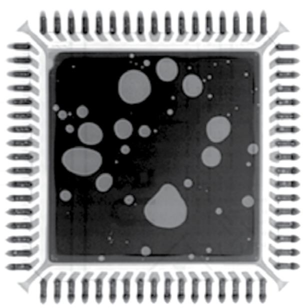
3.30%

Average Component Void%



5.87%

Maximum Component Void %



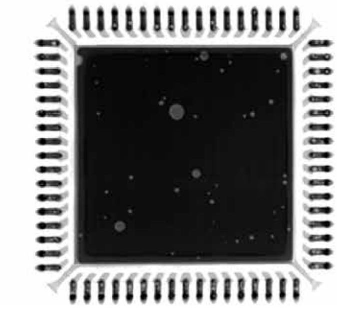
14.00%

INDIUM10.1HF Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste

Typical Pb-Free Nitrogen Profile

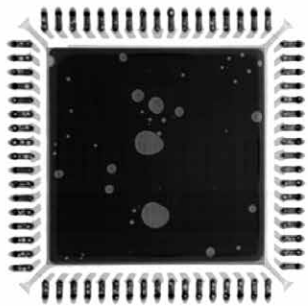
Indium10.1HF

Minimum Component Void %



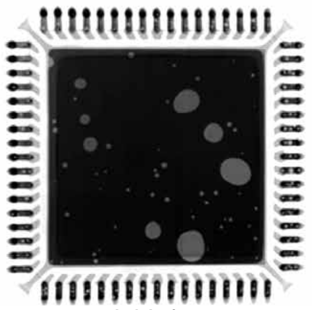
1.30%

Average Component Void%



4.57%

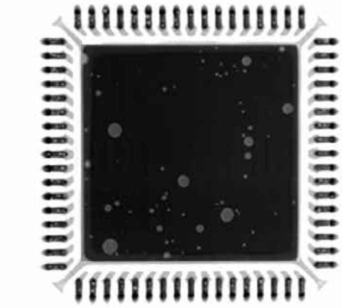
Maximum Component Void %



6.90%

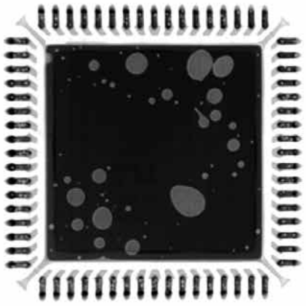
Paste A

Minimum Component Void %



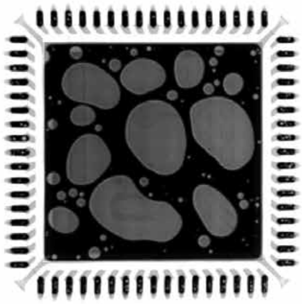
2.60%

Average Component Void%



8.86%

Maximum Component Void %

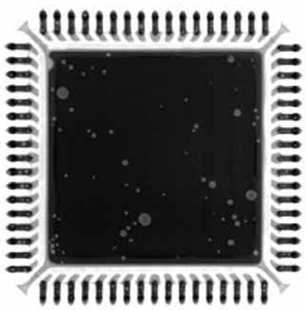


45.40%

Low-Voiding Optimized Nitrogen Profile

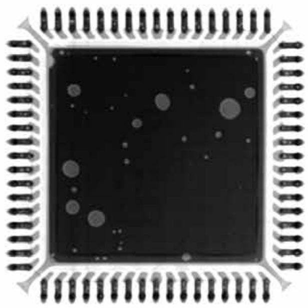
Indium10.1HF

Minimum Component Void %



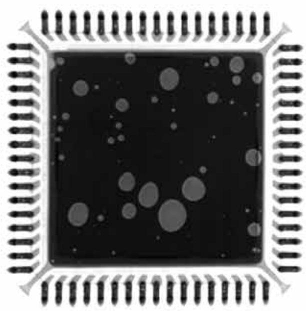
2.00%

Average Component Void%



3.74%

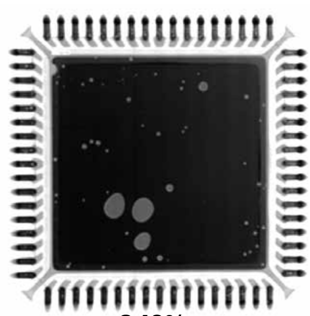
Maximum Component Void %



9.00%

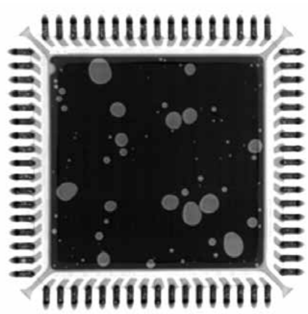
Paste A

Minimum Component Void %



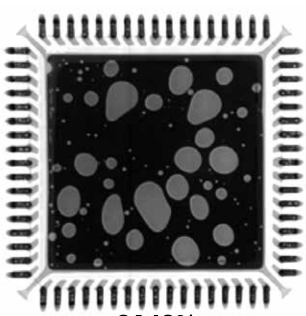
3.10%

Average Component Void%



8.29%

Maximum Component Void %



24.10%

INDIUM CORPORATION®

CSP VOIDING PERFORMANCE

Objective

Voiding in CSP solder balls can result in mechanical weakness in the solder joint that could result in reliability issues.

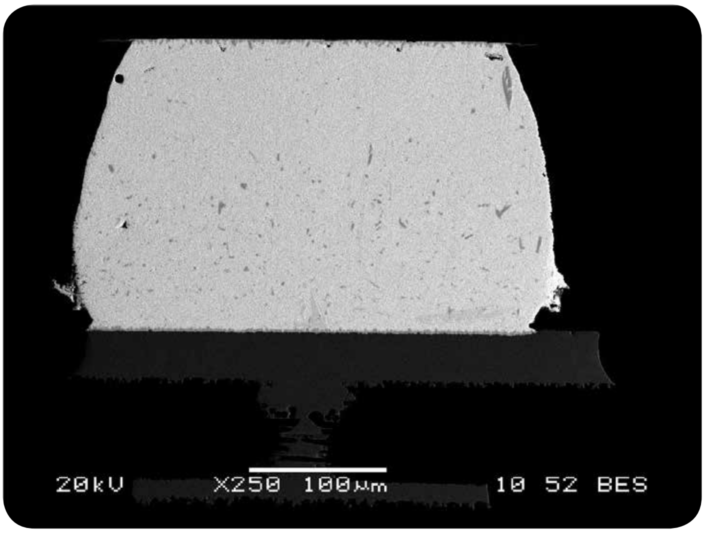
Results

Both pastes are well below IPC Standards (<25%).

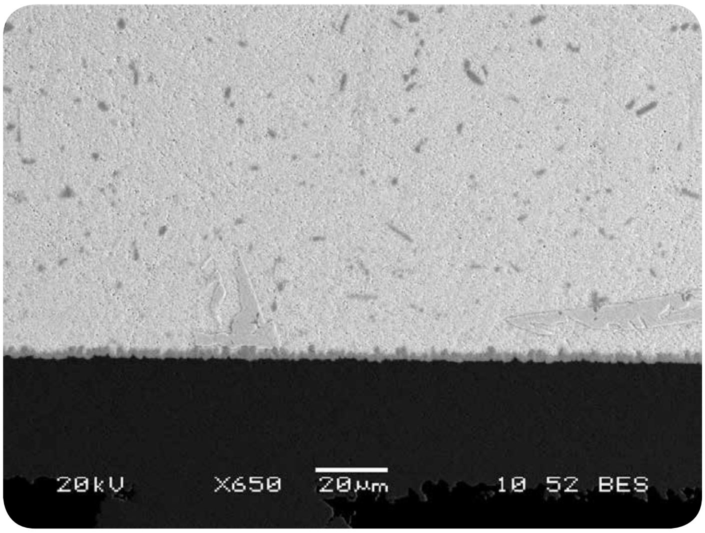
Paste/Board ID	Number of Voids			Percentage of Voids		
	Average	Standard Deviation	Maximum	Average	Standard Deviation	Maximum
Indium10.1HF (1)	0.89	0.62	2	0.91	0.77	4.48
Indium10.1HF (2)	0.91	0.47	3	1.30	1.05	4.72
Paste A (1)	1.00	0.65	2	0.82	0.53	1.61
Paste A (2)	0.65	0.55	2	0.55	0.57	3.34

Typical Cross Sectional Images

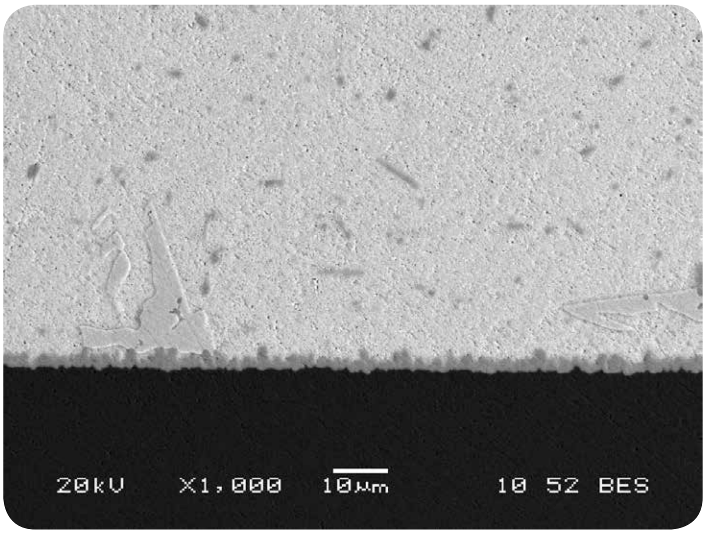
Air Reflow 250x



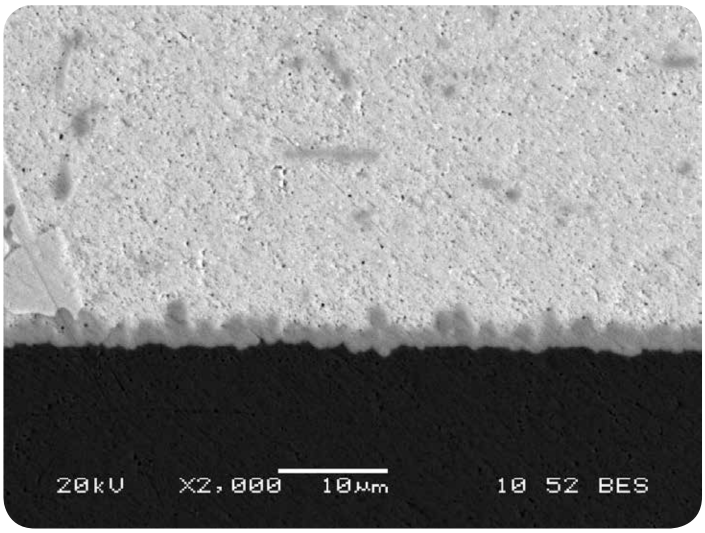
Air Reflow 650x



Air Reflow 1,000x



Air Reflow 2,000x



ELECTRICAL RELIABILITY PERFORMANCE

IPC-J-STD-004B Product Level Testing

Surface Insulation Resistance (SIR)

Test Method: 2.6.3.7

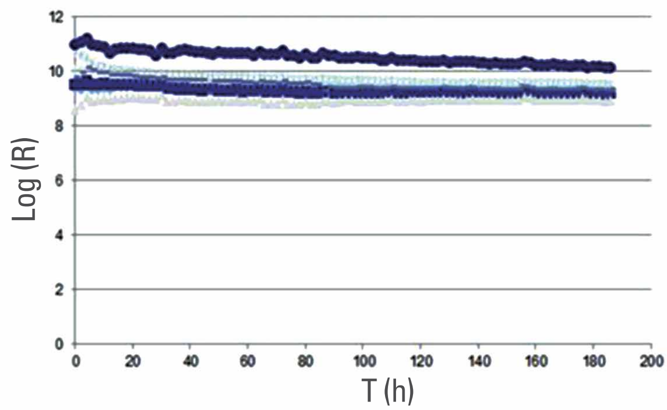
Objective

The purpose of this test is to determine the surface insulation resistance (SIR) of the flux residue after paste reflow.

Procedure

Paste is stenciled onto the clean test board and reflowed. The uncleaned board is then sent to a third-party laboratory for SIR testing.

SIR: J-STD-004B SIR – PASS



Electrochemical Migration (ECM)

Test Method: 2.6.14.1

Objectve

The purpose of this test is to determine the electrochemical migration and SIR of the flux residue after paste reflow.

IPC-TM-650 Test Method: 2.6.14.1 – PASS

RLI Lab Number	54323					
Board Identifier	Sample	Comb	Ambient prior to conditioning	96 hours at conditions	596 hours at conditions (500 hours of bias)	Ambient after conditioning
INDIUM10.1HF	1	1-2	12.69	11.39	13.25	13.61
		2-3	11.90	11.43	13.20	13.98
		3-4	13.55	11.09	12.75	13.44
		4-5	13.31	8.29	12.55	13.88
	2	1-2	13.44	11.30	13.07	14.98
		2-3	14.78	11.20	13.35	13.65
		3-4	13.47	10.97	12.99	13.58
		4-5	13.15	11.22	14.19	13.81
	3	1-2	13.84	11.68	13.62	13.47
		2-3	13.52	11.92	13.62	14.90
		3-4	13.67	11.63	13.47	13.69
		4-5	13.33	11.96	13.35	13.77
	4	1-2	13.74	11.49	13.98	14.06
		2-3	13.14	11.60	14.62	13.68
		3-4	13.69	11.21	13.76	14.48
		4-5	12.11	11.34	13.19	13.47
Controls	5	1-2	13.49	10.98	13.52	13.75
		2-3	14.09	11.02	13.41	13.50
		3-4	13.12	10.68	13.53	14.27
		4-5	13.16	10.81	13.51	13.81
	6	1-2	13.47	11.17	13.75	13.83
		2-3	13.99	11.11	13.39	13.50
		3-4	13.21	10.85	14.53	13.59
		4-5	12.50	10.47	12.61	13.60

All measurements in Log10	Average 96	Average 500	Delta
INDIUM10.1HF	11.23	13.43	2.20
Controls	10.89	13.53	2.64

Chamber Conditions 65+/-2C; 85+3/-0 % R.H. — Requirement < -1.0

Procedure

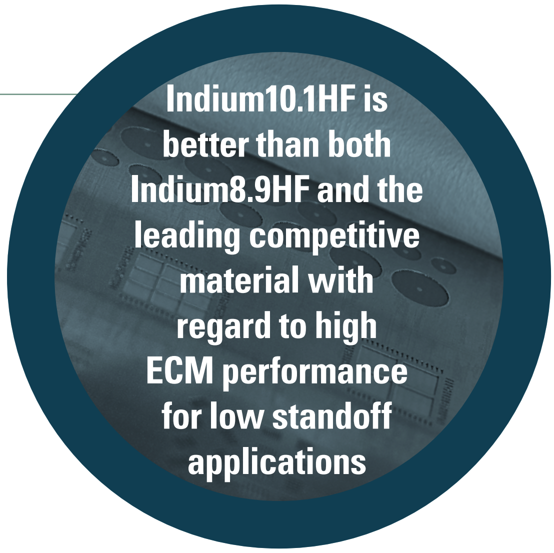
Paste is stenciled onto the clean test board and reflowed. The uncleaned board is then sent to a third-party laboratory for ECM testing.

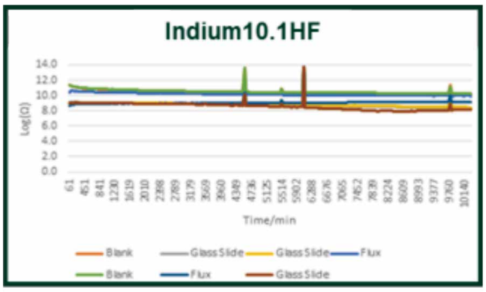
ELECTRICAL RELIABILITY PERFORMANCE

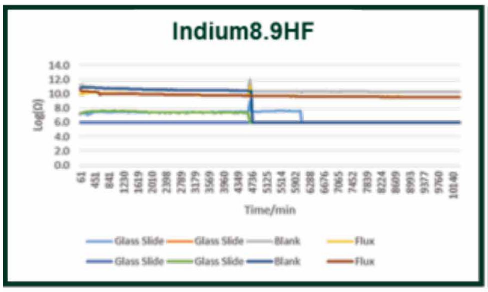
Glass Slide SIR (Flux)

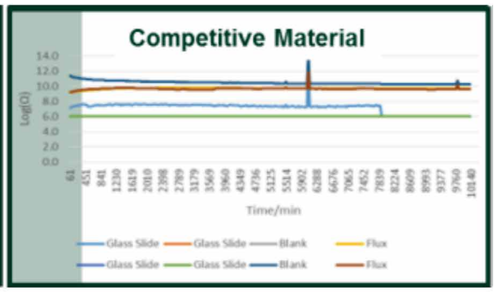
Glass Slide SIR is performed with the flux vehicle only to provide a worst-case scenario test. The glass slide is meant to mimic the bottom of a low standoff component. If solder paste was to be used, the traces would have solder present, which would produce higher standoff and, therefore, higher SIR values.

Indium10.1HF > Indium8.9HF and Competitive Material



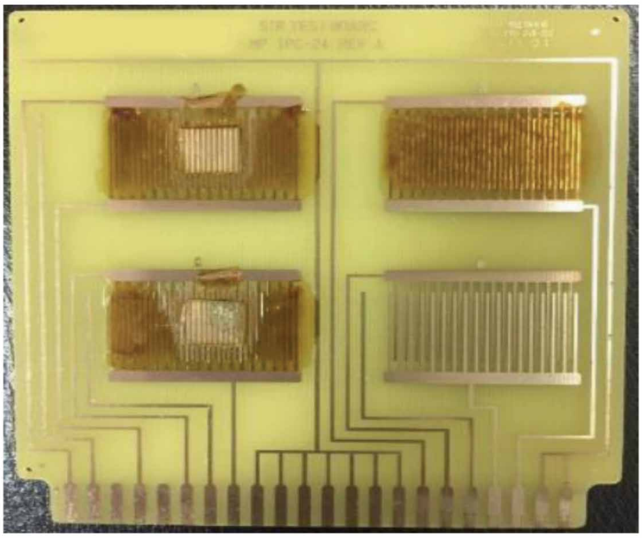




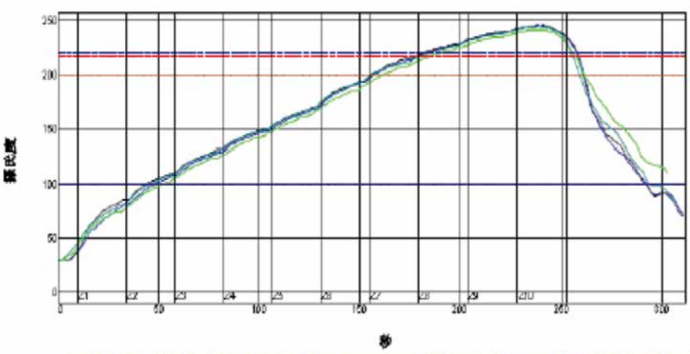


Glass Slide SIR Test

1. Cleaned B-24 IPC test coupons
2. One comb pattern used as blank
3. Other three comb patterns printed with flux
4. Two comb patterns covered by glass slides
5. One comb pattern does not have a glass slide cover
6. Glass is 1cm x 1cm
7. Reflow profile:



温度设置 (摄氏度)										
温区	1	2	3	4	5	6	7	8	9	10
上温区	100	120	140	160	180	210	230	240	250	255
下温区	100	120	140	160	180	210	230	240	250	255
传送带速度 (公分/分): 80.0										



[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
TC3	1.76	-12%	-3.76	-38%	193.99	60%	79.41	94%	245.45	118%	104.32	395%	1.14	195%	32.90	-28%	49.95	66%
TC5	1.94	-9%	-3.68	-59%	188.64	86%	79.86	99%	245.44	118%	104.94	400%	1.11	171%	30.99	-31%	52.94	76%
TC7	1.73	-13%	-3.31	-32%	140.68	107%	75.40	54%	244.67	87%	102.45	383%	1.11	172%	35.38	-21%	51.86	73%
TC9	1.61	-20%	-2.75	0%	199.46	95%	72.34	23%	242.01	-20%	99.94	300%	1.09	165%	35.31	-22%	52.88	70%
温差	0.38		1.01		4.69		7.52		3.44		5.00		10.05		4.39		2.99	

PRINTING PERFORMANCE

SAC305 Indium10.1HF Type 4 88.5% vs. SAC305 Indium8.9HF Type 4 88.5%

Printing Design of Experiment

Purpose

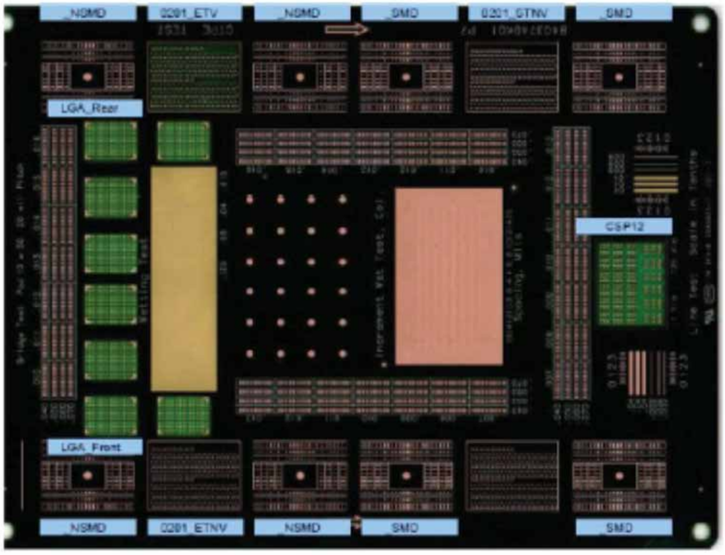
To obtain data/information on how the solder paste will perform with 20 consecutive prints without wiping.

Procedure

- Stencil: 100µm nanocoated
- Perform process set-up and print set-up boards
- Wipe
- Print 20 boards consecutively without wiping
- Collect and statistically compile data
- Apertures printed:
  - – 0201
  - – 0.009" SMD square (AR: 0.5625)
  - – 0.010" NSMD square (AR: 0.625)
  - – 0.011" SMD circle (AR: 0.69)
  - – 0.012" NSMD circle (AR: 0.75)

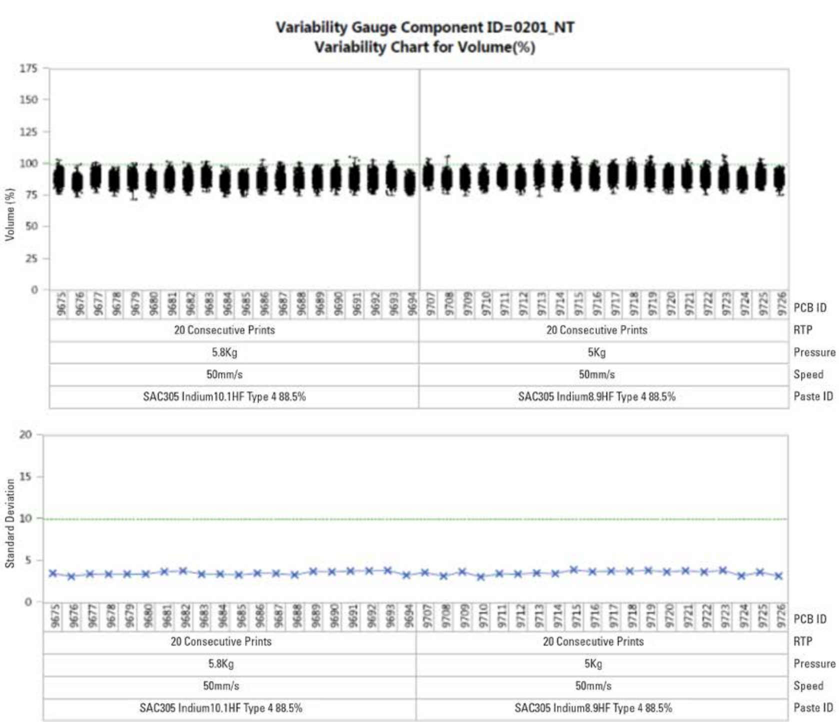
Transfer Efficiency = *Measured Solder Volume per Aperture* / *Theoretical Maximum Aperture Volume*

Board:



Print Performance Summary

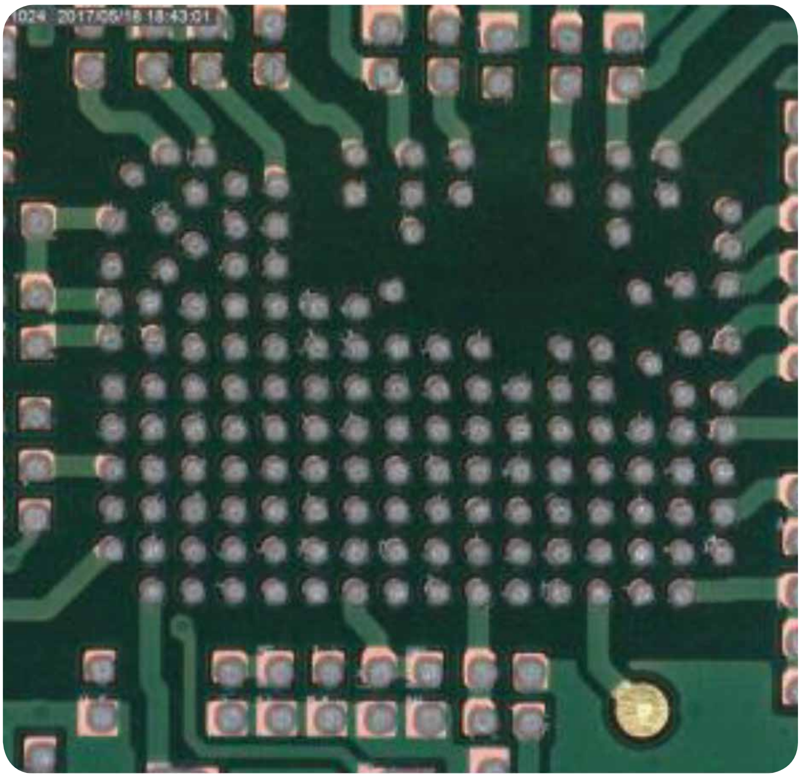
0201: Note the Print Consistency

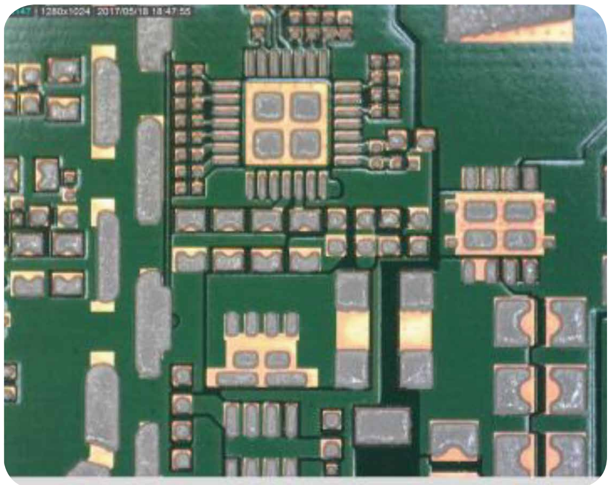


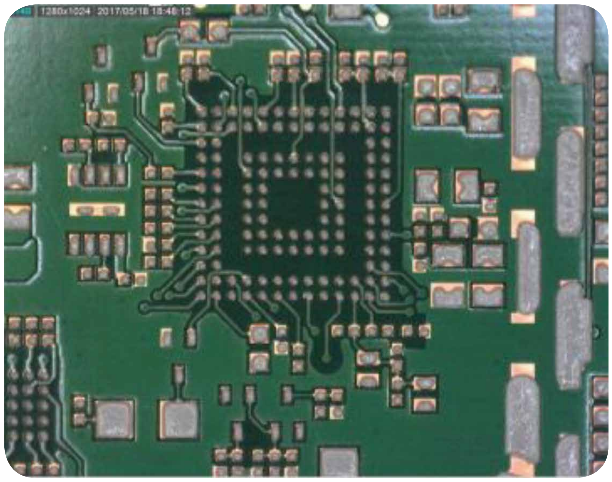
- **Indium10.1HF** exhibits high transfer efficiency with low variation, well within typical 50-150% process specifications with a wide range of area ratios and pad designs, even for ARs of 0.60
- **Indium10.1HF** displayed excellent print consistency over 20 consecutive prints without an understencil wipe
- Less frequent wiping can significantly decrease cycle time
- Overall, reduces the potential for process interruptions
- Robust printing process window to accommodate everyday process variations

PRINTING PERFORMANCE

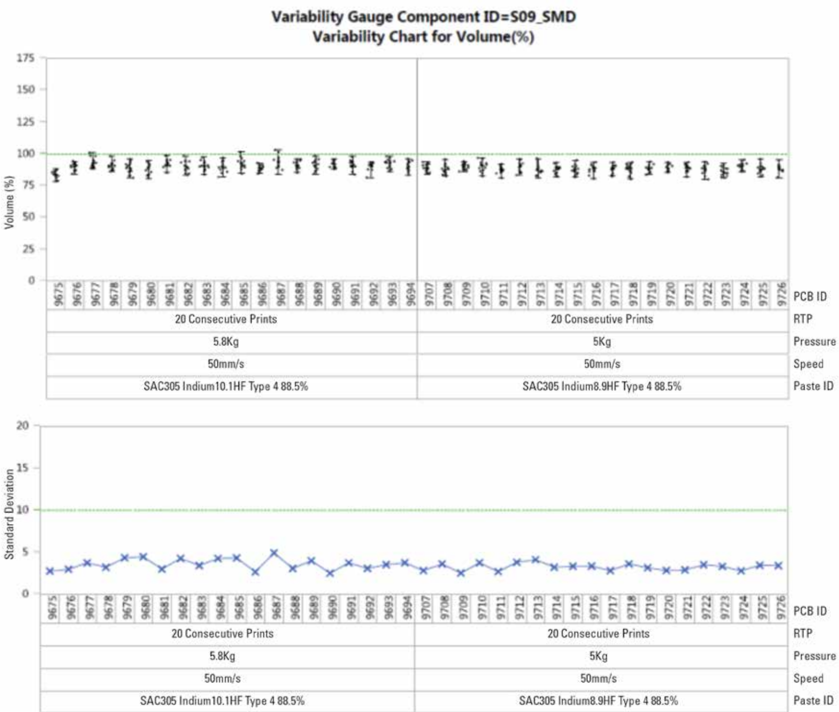
Indium10.1HF Print Images







0.009" SMD Square (AR: 0.5625)



The Most Challenging Print, Produces TEs over 80%

INDIUM10.1HF Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste

Stencil Printing Speed Performance

Purpose

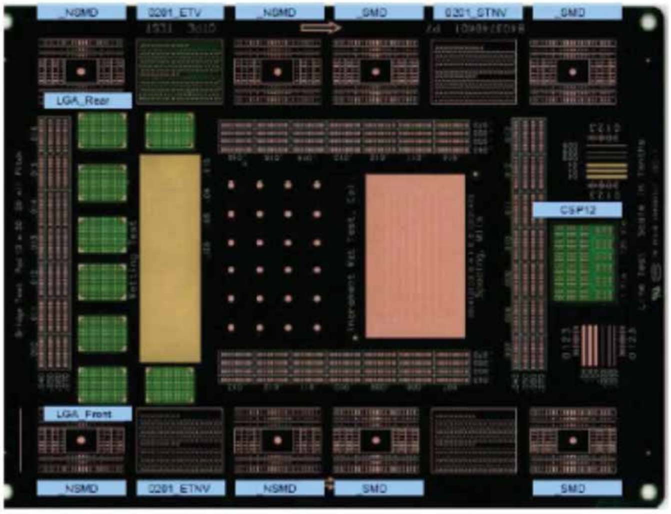
A designed experiment (DOE) was performed to determine how **Indium10.1HF** solder paste performs at different print speeds with different apertures as compared to Indium 8.9HF.

Procedure

- 100µm nanocoated stencil
- Perform printing process optimization
- Print at 25, 50, 75, and 100mm/s
- 6 prints at each speed
- Apertures for CSP 12, 0201, S08-S12, solder mask defined and non-solder mask defined pads

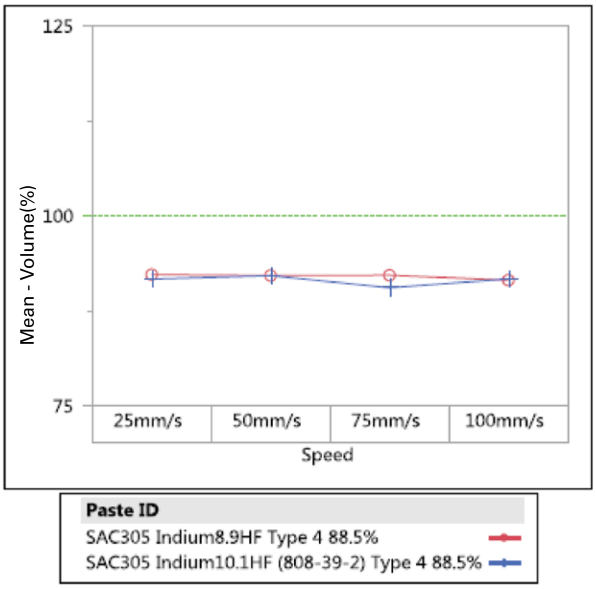
Results

Indium10.1HF prints comparably to Indium8.9HF, with a mean transfer efficiency of 90% and a standard deviation of less than 5%.

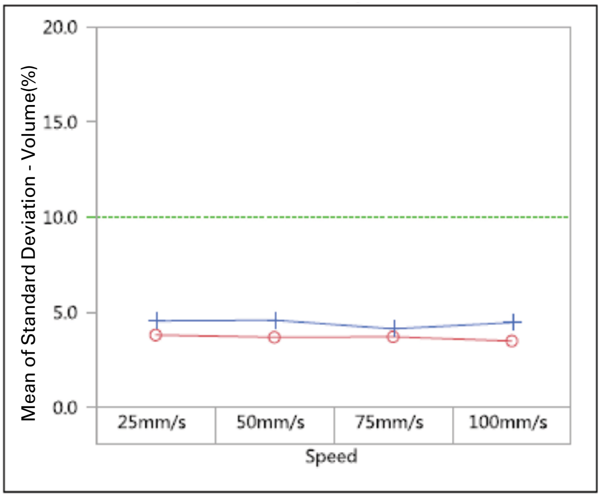


Test Board

Mean Volume All Aperature Sizes Combined (%)
Paste Speed Interaction



Mean Standard Deviation – Paste Speed Interaction



EXCELLENT WETTING IN BOTH AIR AND NITROGEN

(J-STD) IPC-TM-650 Test Method: 2.4.45

Reflow Performance Wetting

Objective

The purpose of this test is to ensure that the solder paste has sufficient capability to wet a surface.

Procedure

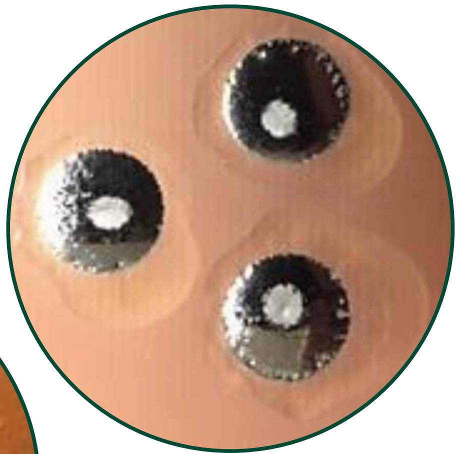
Solder paste is printed on a clean coupon and reflowed using the manufacturer's recommended reflow profile. The coupon is then inspected to ensure uniform wetting and no evidence of de-wetting or non-wetting.

Results

Pass with both OSP and copper surfaces.

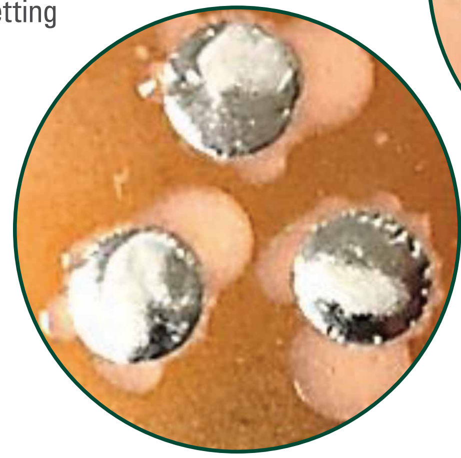
Indium 10.1HF wets well on both OSP and copper surfaces.

OSP

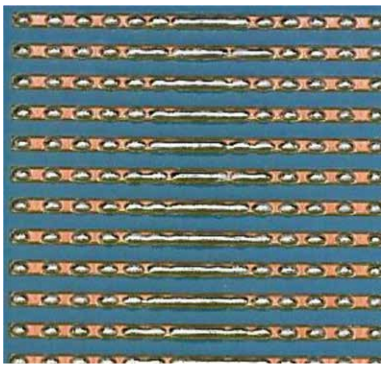


Pass

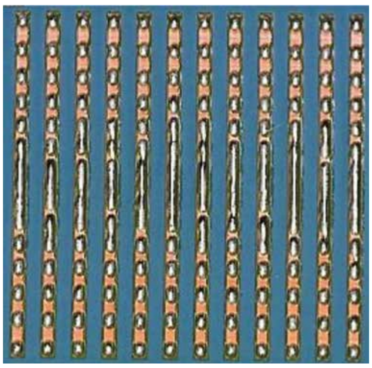
Copper



Pass



Indium10.1HF Air



Indium10.1HF Nitrogen

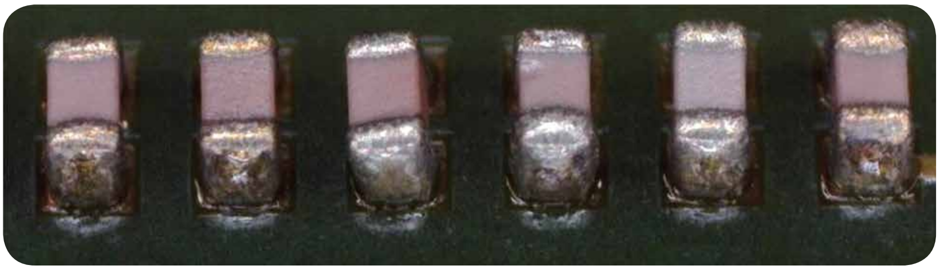
Wetting Summary

- Excellent wetting to fresh and aged common metalizations and surface finishes, including, but not limited to:
  - OSP
  - ENIG
  - Immersion Ag
  - Immersion Sn
- **Indium10.1HF's** ability to spread slightly better than Indium8.9HF in air and nitrogen typical Pb-free profiles.

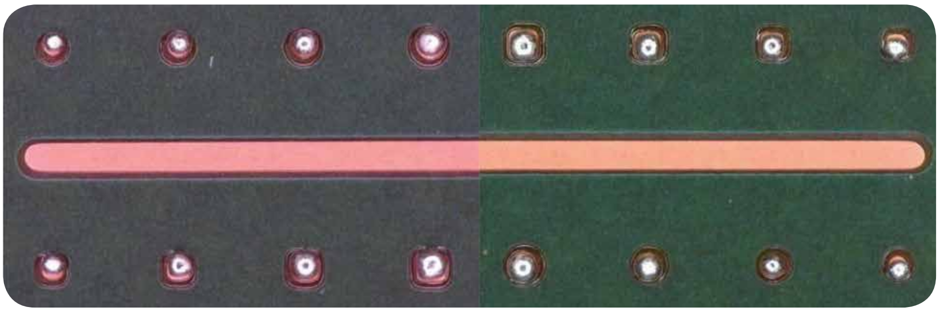
DEFECT ELIMINATION

Coalescence/Graping

0201 Coalescence/Graping in Air: Indium10.1HF



Fine Feature Coalescence/Graping in Air: Indium10.1HF



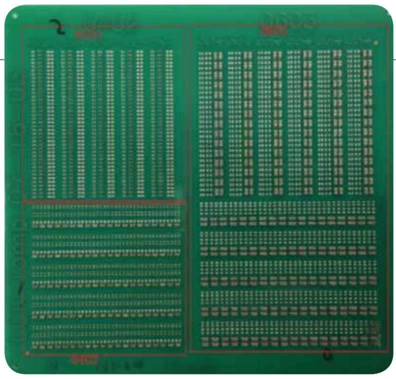
Graping happens because:

- Small paste deposits with fine solder particles have a much lower ratio of flux-to-surface area of oxide
- High reflow temperatures and long soak profiles promote more oxidation
- Flux spreading can leave some areas starved for flux
- Oxide is not cleaned from the surface; particles fail to coalesce properly

Indium10.1HF

- Excellent coalescence on NSMD and SMD 0201 chip capacitors and 8, 9, 10, and 11mil apertures
- No presence of graping in a typical Pb-free profile

Solder Beading



Objective

The solder beading test is designed to be a worst-case scenario and uses pad designs that aggravate solder beading.

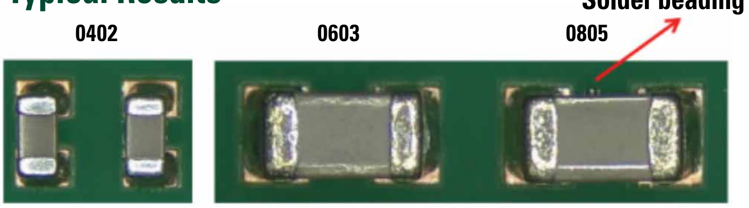
Procedure

Experiments were performed as described below:

- Stencil:
  – Aperture design: 1:1
  – Stencil thickness: 0.005"
- Components:
  – 0402 chip caps (200/board)
  – 0603 chip caps (100/board)
  – 0805 chip caps (360/board)
- Two boards/paste

Solder Beading Test			
Paste	0402	0603	0805
Competitive Material	65	16	0
Indium10.1HF	7	6	0

Typical Results



Result

Indium10.1HF has outstanding solder beading minimization performance compared to the competitive material in this aggravated testing.

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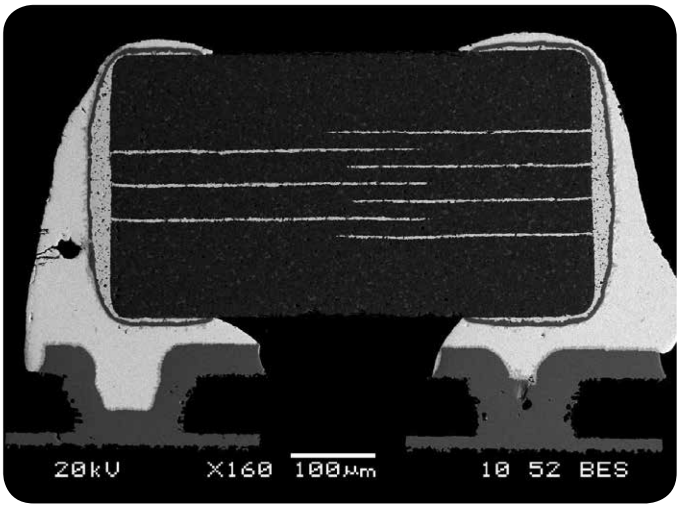
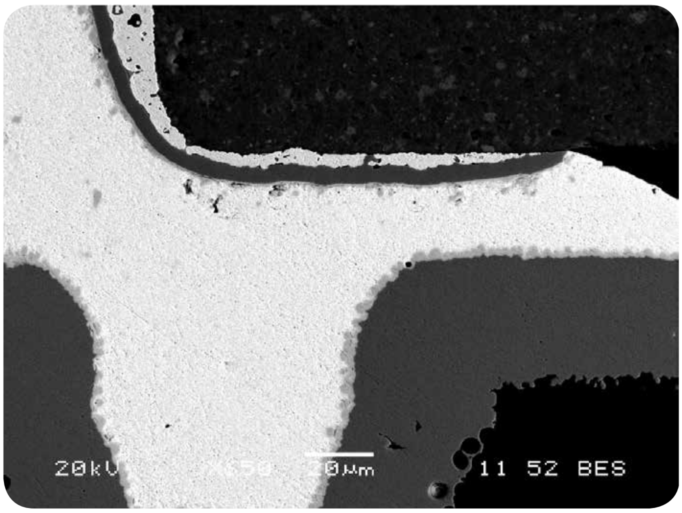
DEFECT ELIMINATION

Typical 0201 Cross Sectional Images

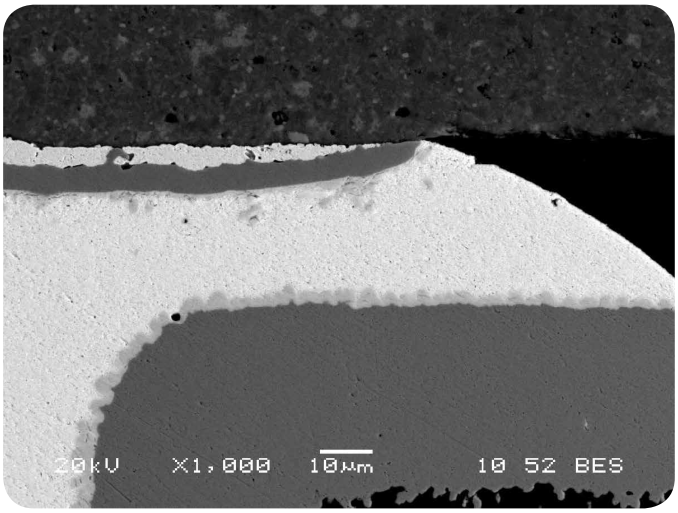
Air Reflow 160x



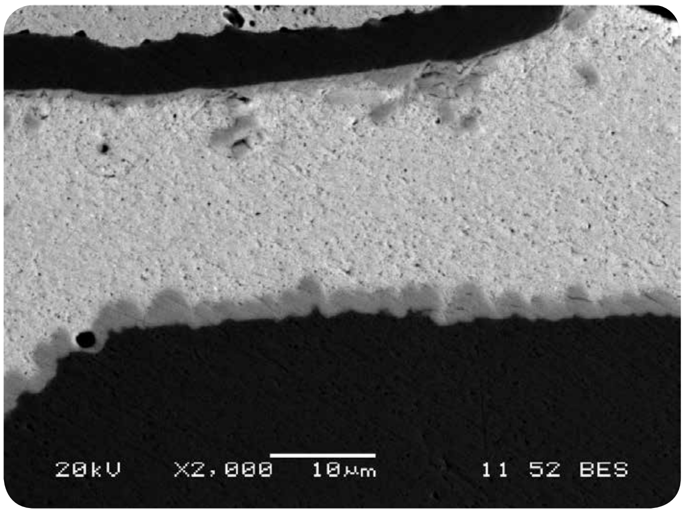
Air Reflow 650x



Air Reflow 1,000x



Air Reflow 2,000x



Head-in-Pillow

How does it happen?

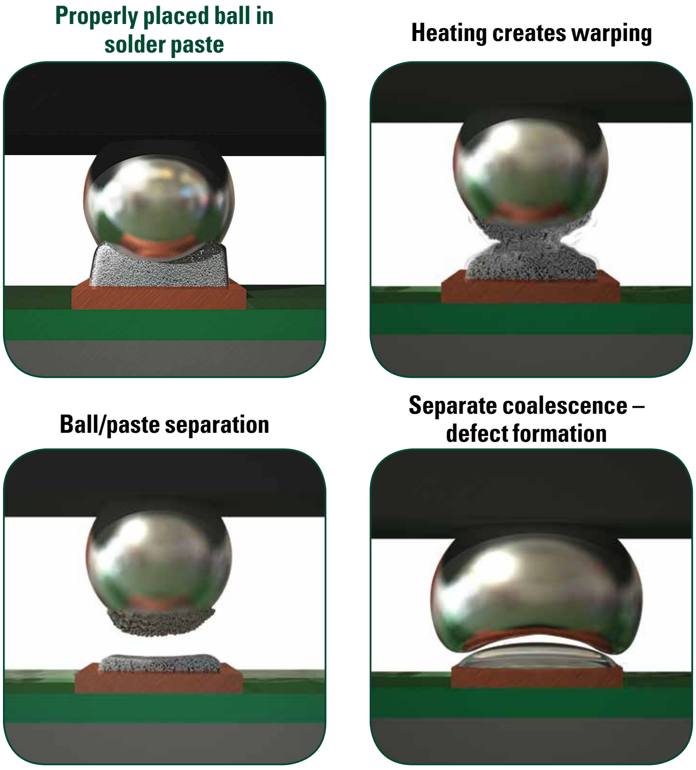
1. Component warps during preheat and soak profile
2. Paste and ball separate prior to melting
3. Paste and ball melt separately and solidify separately
4. Oxide layer forms on surface of molten solder
5. Component warps back during cool down but has already solidified, or oxide layer is too thick for paste and ball to coalesce

How can it be eliminated?

The head-in-pillow defect can be minimized with a solder paste that has a flux with excellent oxygen barrier properties, even if the solder ball on the BGA or CSP is oxidized.

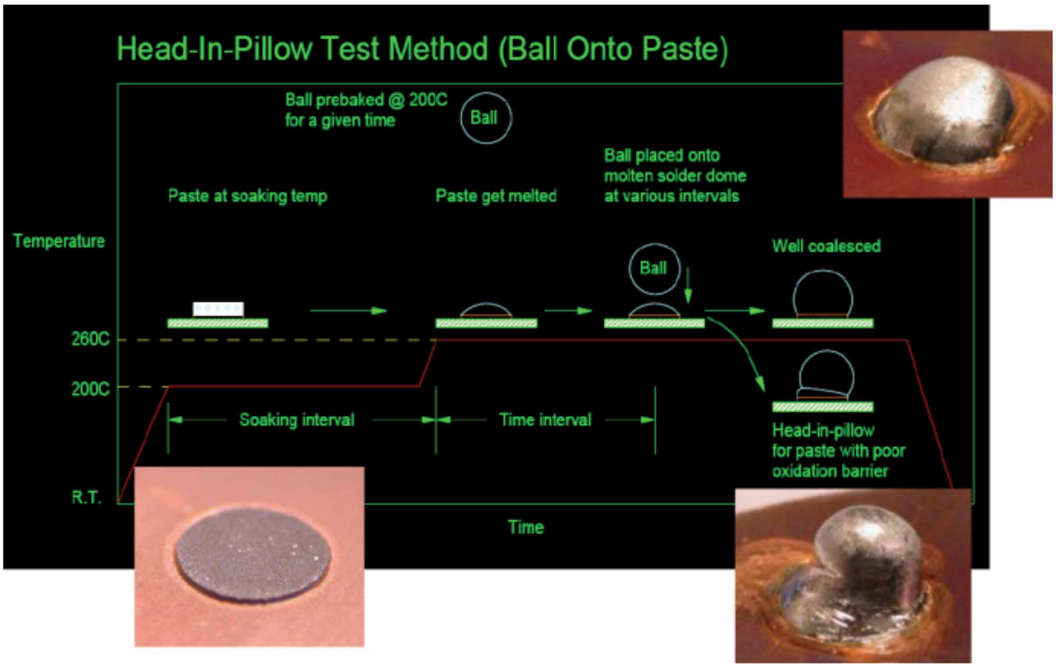
Head-in-Pillow Defect Formation

Problem:

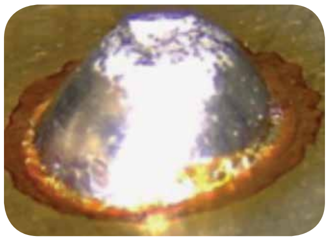


Procedure

Solder balls were oxidized at 200°C and then reflowed with **Indium 10.1HF.**



Results



Indium10.1HF = 70 Seconds

Indium8.9HF = 80 Seconds

Competitive Material (HF) = 30 Seconds

Indium10.1HF provided excellent reflow with oxidized solder balls.

TEST RESULTS

Copper Mirror – "L"

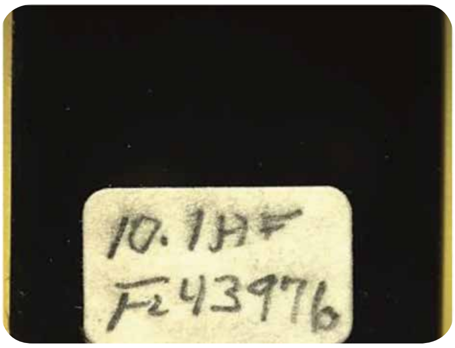
IPC-TM-650 Test Method: 2.3.32

Objective

The purpose of this test is to determine the corrosive (free-halide) properties of a flux.

Procedure

Flux is applied to a copper-coated glass slide that then sits in a controlled environment for 24 hours. The flux is cleaned and the copper inspected for corrosion.



Result – No break through

Solder Ball – PASS

IPC-TM-650 Test Method: 2.4.43

Result – Pass

Objective

The purpose of this test is to validate soldering perfromance of a specific lot of solder paste. Solder ball testing is a fundamental test that ensures consistent performance from lot to lot.

Procedure

Three small deposits of solder paste are printed onto a ceramic coupon and reflowed at a temperature of approximately 240°C (for SAC alloys). The coupon is then inspected to ensure complete coalescence of the solder paste, and that there are no extraneous solder balls in the flux pool. Results are compared to images in the J-STD-005 to determine whether it passes or fails.

Viscosity – TYPICAL

IPC-TM-650 Test Method: 2.4.34.2

Objective

The purpose of the test is to determine the viscosity of a specific lot of solder paste. Viscosity testing is a fundamental test that ensures consistent performance from lot to lot.

Procedure

Approximately 500g of solder paste is stabilized at 25 =/- 1°C and the viscosity is measured using a Malcom spiral pump viscometer at 5rpms. The results are measured and compared to the nominal value. Solder paste lots with values outside the expected variation (USL and LSL) need to be investigated for possible performance-related issues.

Result – Typical Viscosity

(SAC305 **Indium10.1HF** Type 4 89%): 1,900 Poise

IPC-TM-650 Test Method: 2.4.34.3

INDIUM10.1HF Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste

Oxygen Bomb with Ion Chromatography Halogen Testing

IEC 61249-2-21 Test Method: EN 14582

Objective

The purpose of this test is to isolate and quantify any halogen (ionic or covalently bonded) that is present in flux residues once assembly is complete.

Procedure

A sample is combusted in oxygen at very high temperatures, burning off any organic materials. The remaining ash will contain halogens and other inorganic substances that can be characterized by ion chromatography to determine the halogen content.

Result

- Br < 10ppm
- Cl < 10ppm

Test Item	Results (mg/kg) Sample # S-160316-014	Detection Limit (mg/kg)
Chlorine (Cl)	ND	10
Bromine (Br)	ND	10
Fluorine (F)	ND	10
Iodine (I)	ND	10
Sulfur (S)	ND	10

Tack vs. Time vs. Humidity

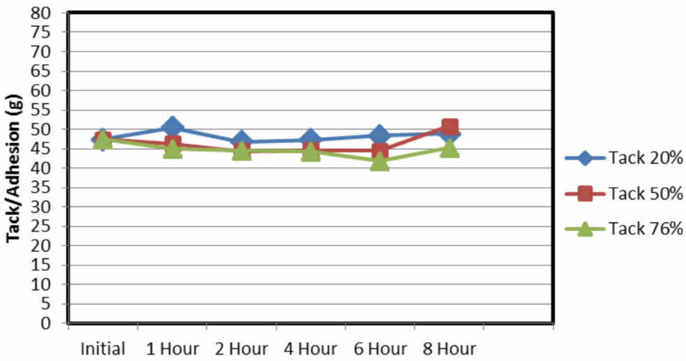
Objective

Tack is the amount of adhesion with which the printed solder paste holds the placed components. It is desirable that tack remain constant as a function of humidity.

Result

As seen from this graph, **Indium 10.1HF** exhibits very consistent tack as humidity varies from 20 to 76%.

Indium10.1HF Tack vs. Time and Humidity



Tack remains consistent through 8 hours with humidity varying from 20 to 76%.

Acid Value

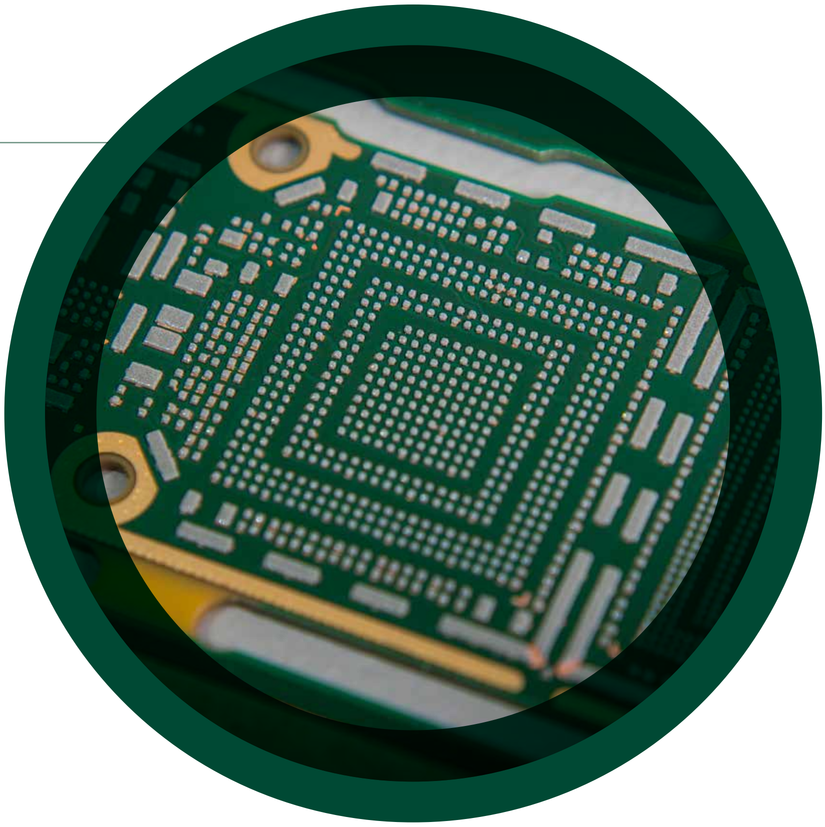
IPC-TM-650 Test Method: 2.3.13

Acid Value – 133mg KOH/g

SLUMP TESTING RESULTS

Slump Testing

IPC-TM-650 Test Method: 2.4.35



What causes hot slump and bridging?

- Viscosity drops with increased temperature
- Solder deposits “slump” and risk connection to adjacent deposits

Slump Resistance

- Tests the propensity of solder deposits to retain their shape and size over time after printing
- Prevents bridging

Objective

The purpose of this test is to determine the potential for slumping with a given solder paste.

Procedure

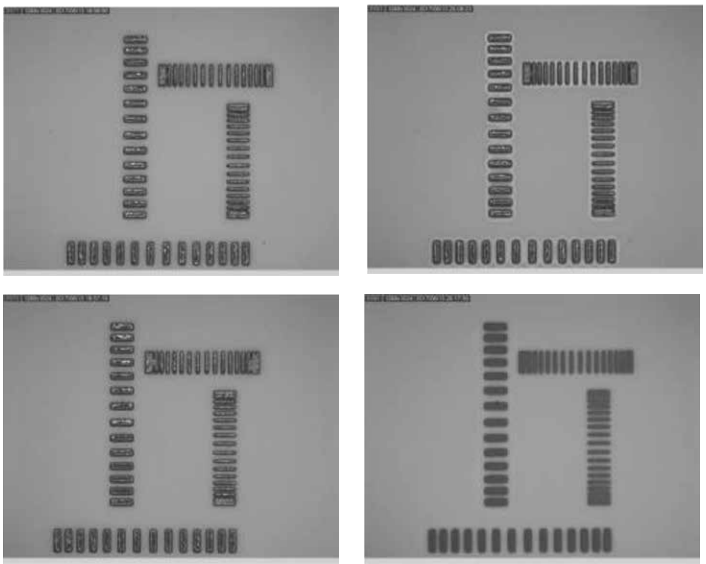
For cold slump, solder paste is printed using an IPC-A-20 stencil on an alumina substrate and examined for maximum spacing bridged. Samples are stored at 50% relative humidity at room temperature (approx. 25 =/-5°C) for 20 minutes. Samples are then re-examined for maximum spacing bridged. For hot slump, samples are again printed with an IPC-A-20 stencil on an alumina substrate and examined for maximum spacing bridged. Samples are then heated to 150°C for 15 minutes and allowed to cool. Samples are re-examined immediately for maximum spacing bridged.

INDIUM10.1HF Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste

Reflow Oven

Cold Slump					
Pad size 0.63mm x 2.03mm			Pad size 0.33mm x 2.03mm		
Spacing (mm)	Horizontal	Vertical	Spacing (mm)	Horizontal	Vertical
0.79			0.45		
0.71			0.40		
0.63			0.35		
0.56			0.30		
0.48			0.25		
0.41			0.20		
0.33			0.15		
			0.10	X	X
			0.06	X	X
X = Bridging					

Hot Slump					
Pad size 0.63mm x 2.03mm			Pad size 0.33mm x 2.03mm		
Spacing (mm)	Horizontal	Vertical	Spacing (mm)	Horizontal	Vertical
0.79			0.45		
0.71			0.40		
0.63			0.35		
0.56			0.30		
0.48			0.25		
0.41			0.20		
0.33			0.15	X	X
			0.10	X	X
			0.06	X	X
X = Bridging					



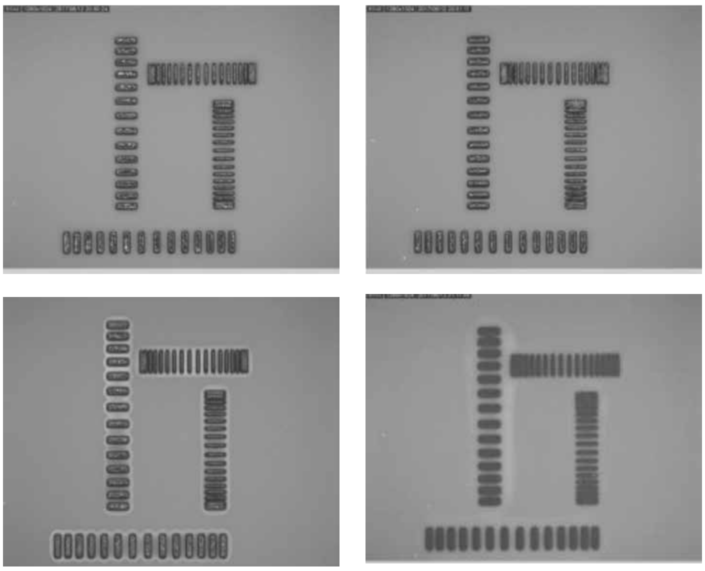
IPC-TM-650 Test Method: 2.4.35
IPC-A-21 0.2mm Thick

Key		
Key	Acceptable Range =	
	Unacceptable Range =	
	X =	Bridging

Static Oven

Cold Slump					
Pad size 0.63mm x 2.03mm			Pad size 0.33mm x 2.03mm		
Spacing (mm)	Horizontal	Vertical	Spacing (mm)	Horizontal	Vertical
0.79			0.45		
0.71			0.40		
0.63			0.35		
0.56			0.30		
0.48			0.25		
0.41			0.20		
0.33			0.15		
			0.10	X	X
			0.06	X	X
X = Bridging					

Hot Slump					
Pad size 0.63mm x 2.03mm			Pad size 0.33mm x 2.03mm		
Spacing (mm)	Horizontal	Vertical	Spacing (mm)	Horizontal	Vertical
0.79			0.45		
0.71			0.40		
0.63			0.35		
0.56			0.30		
0.48			0.25		
0.41			0.20	X	X
0.33		X	0.15	X	X
			0.10	X	X
			0.06	X	X
X = Bridging					



IPC-TM-650 Test Method: 2.4.35
IPC-A-21 0.2mm Thick

Key		
Key	Acceptable Range =	
	Unacceptable Range =	
	X =	Bridging

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SOLDER PRINTING BASICS

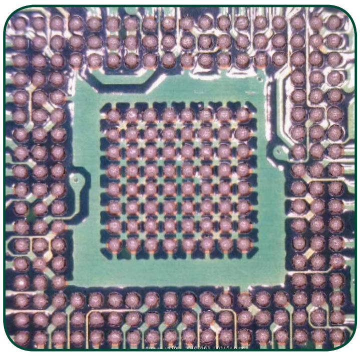
Best Practices for Solder Paste Storage and Handling

1. Paste is packaged for overnight shipping and should arrive at room temperature (<25°C).
2. Upon arrival, remove paste containers from cooler and store in <10°C.
3. Solder paste should be allowed to reach ambient working temperature prior to use. Generally, paste should be removed from refrigeration at least two hours before use. Actual time to reach thermal equalibrium will vary with container size. Paste temperature should be verified before use. Jars and cartridges should be labeled with date and time of opening.

Note: Paste containers opened while still cold can absorb water from condensation, affecting the integrity of the paste; likewise, exposing paste to temperatures above 25°C can cause performance degradation.

Measurable Attributes of Good Paste Performance and Print Quality

- Transfer efficiency
  - Small apertures
  - Varying shapes and area ratios
  - Fine pitch
  - Print speed variation
- Slump
  - Under hot and cold conditions
- Reflow performance
  - Oxidation resistance
  - Wetting



Factors that Cause Variation in Transfer Efficiency

Cause and Effect Diagram

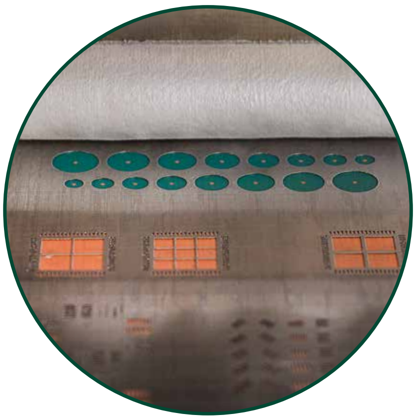
INDIUM10.1HF Ultra-Low Voiding, Halogen-Free, No-Clean Solder Paste

Stencil Printing Settings

- Squeegee Speed: 50-100mm/sec
  - Avoid using speeds lower than 50mm/sec
- Squeegee Pressure: 4-6kg is typical for a 250mm squeegee length
  - Use just enough pressure to obtain a clean stencil wipe
  - Longer blades will require more pressure
  - Avoid excessive pressure that can damage stencils
- Separation Speed: 5mm/sec or a fast drop
  - Fast drop can be obtained on a DEK by setting the distance to zero
  - Avoid using a separation speed <5mm/sec; this will also increase printer cycle time
- Squeegee Lift Height: 10-25mm maximum
  - A lower lift height reduces stringing/solder paste trails and decreases printer cycle time
- Squeegee Hop Over/Paste Recovery: This function can be enabled, which alternates the starting point of the squeegee to capture the leftover paste upon completion of a print stroke, minimizing paste trails.
- Temperature: 22-28°C is ideal
  - Warmer is better than colder for paste roll, aperture fill, and release.
- Underside Stencil Wipe: A wet or dry wipe can be used. Frequency is dictated by board density, layout and printer setup; decrease frequency as process and setup allows.
  - A low VOC water-based underside stencil wiping solvent should be avoided.
  - Avoid over application and aperture flooding of solvent when using a wet wipe.

Stencil Printing Best Practices

- Stencil quality and condition is important.
  - Make sure stencil is within wear limit (# of allowed prints) and not damaged.
  - A new stencil is recommended for first runs and **Indium10.1HF** evaluations.
- A tight board to stencil gasket during the print stroke is critical to successful printing.
- Make sure squeegee blades are sized correctly for the board length and are not damaged or worn.
- Verify proper tooling is used and the board is properly supported during the print stroke.
- Any type of over-the-top clamping can induce a standoff between the board and the stencil, especially if recommended keep-out distances are violated.



Reflow Profile General Settings

- A standard ramp-to-spike or linear profile is preferred
- Preheat Ramp Rate: 1-2°C/sec is typical
- Peak Temperature: 235-260°C
- Time Above Liquidus: 45-60 seconds
- Ambient-to-Peak: 4 to 5 minutes
- Avoid using soak profiles with the soak temperature above 180°C to prevent excessive flux burn-off

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Our Goal

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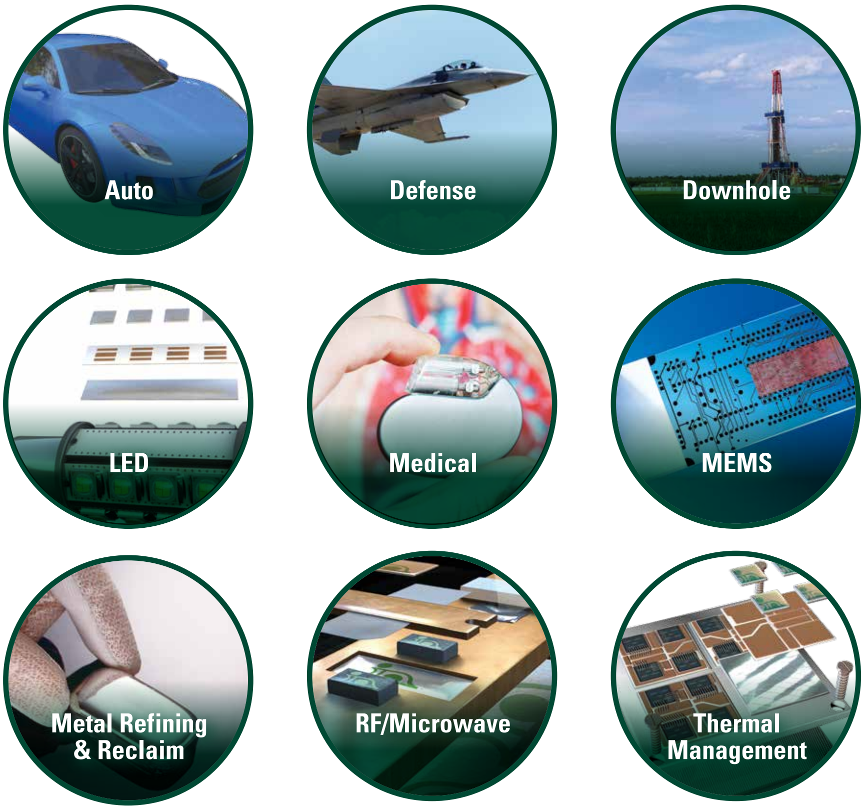

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