FORESITE

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FORMERLY CSL INC.

Solder Paste Classification Per IPC-J-STD-004

AMTECH
Project #: 1219-10
PO #: 0802051604-WWG

August 26, 2005

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ISO 9002
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Member
Since
1992

Report Approved by:

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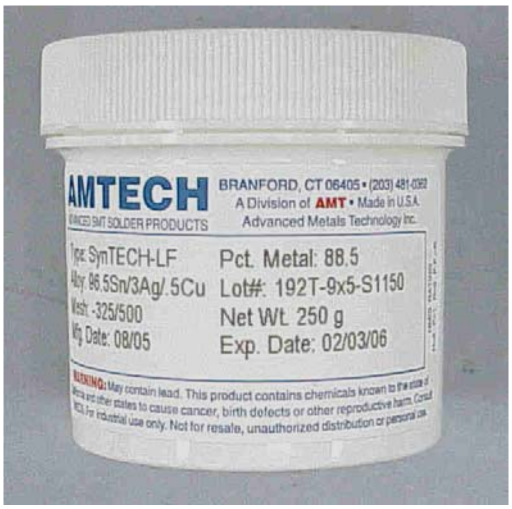
Solder Paste Classification per IPC-J-STD-004

Project # 1219-10

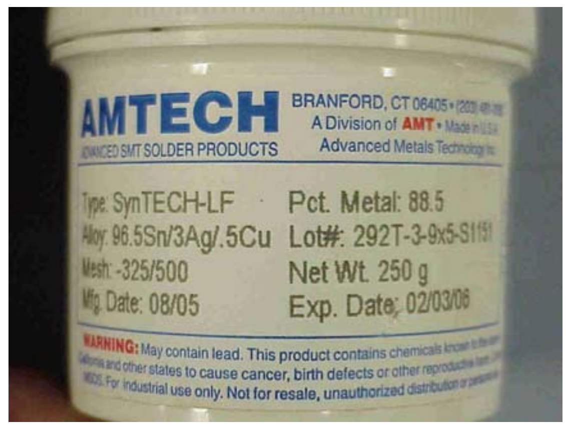
Ajith Premasiri

PROJECT GOAL

The goal of this project is to classify the SynTECH-LF solder pastes per J-STD-004. All residues in this evaluation were characterized using Ion Chromatography per IPC-TM-650, method 2.3.28.



SynTECH – LF
Lot# 192T-9x5-S1150



SynTECH- LF
Lot# 292T-9x5-S1151

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Qualification Test Report

I.D. Number: Sn96.5/Ag3/Cu.5 Metal 88.5 (Mesh-325/+500)	
Flux Designator: LO	**Date of Manufacture: 07-03**
Manufacturer's Identification: ***SynTECH-LF***	**Manufacturer's Batch Number:** ***#292T-3-9x5 S1151***
Tested By: Eric Camden **Witnessed By:** Terry Munson Foresite	**Pass [x]** **Fail [ ]**

Test	Paragraph Requirement	IPC-TM-650 Method	Test Requirement	Result Pass/Fail/NA
Copper Mirror	3.2.1	2.3.32		**Pass**
Qualitative (Optional) Sliver Chromate	3.3.2.1	2.3.33		**Pass**
Qualitative (Optional) Fluoride Spot	3.3.2.2	2.3.35.1		NA
Quantitative Halides Fluoride, Chloride, Bromide	3.3.3.1, 3.3.3.4	2.3.35, 2.3.28		**Pass**
ROSE Testing	3.3.3.2	2.3.25		**Pass**
Corrosion	3.3.4	2.6.15	Not Cleaned	**Pass**
SIR (Required) 85°C 85% R.H.	3.3.5.1	2.6.3.3	Cleaned	NA
			Not Cleaned	**Pass**
SIR (Optional) 40°C 93% R.H.	3.3.5.2	--	Cleaned	NA
			Not Cleaned	NA
SIR (Optional) 35°C 85% R.H.	3.3.5.2	--	Cleaned	NA
			Not Cleaned	NA
Electrochemical Migration (Optional)	3.3.6	2.6.14.1	Cleaned	NA
			Not Cleaned	NA
Telcordia TR-78 Electromigration	13.2.7	-	Not Cleaned	**Pass**

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Qualification Test Report

I.D. Number: Sn96.5/Ag3/Cu.5 Metal 88.5 (Mesh-325/+500)				
Flux Designator: LO			**Date of Manufacture: 07-03**	
Manufacturer's Identification: ***SynTECH-LF***			**Manufacturer's Batch Number:** ***#192T-3-9x5 S1150***	
Tested By: **Eric Camden**		**Pass [x]**		
Witnessed By: **Terry Munson Foresite**		**Fail [ ]**		
Test	**Paragraph Requirement**	**IPC-TM-650 Method**	**Test Requirement**	**Result Pass/Fail/NA**
Copper Mirror	3.2.1	2.3.32		**Pass**
Qualitative (Optional) Sliver Chromate	3.3.2.1	2.3.33		**Pass**
Qualitative (Optional) Fluoride Spot	3.3.2.2	2.3.35.1		NA
Quantitative Halides Fluoride, Chloride, Bromide	3.3.3.1, 3.3.3.4	2.3.35, 2.3.28		**Pass**
ROSE Testing	3.3.3.2	2.3.25		**Pass**
Corrosion	3.3.4	2.6.15	Not Cleaned	**Pass**
SIR (Required) 85°C 85% R.H.	3.3.5.1	2.6.3.3	Cleaned	NA
			Not Cleaned	**Pass**
SIR (Optional) 40°C 93% R.H.	3.3.5.2	--	Cleaned	NA
			Not Cleaned	NA
SIR (Optional) 35°C 85% R.H.	3.3.5.2	--	Cleaned	NA
			Not Cleaned	NA
Electrochemical Migration (Optional)	3.3.6	2.6.14.1	Cleaned	NA
			Not Cleaned	NA
Telcordia TR-78 Electromigration	13.2.7	-	Not Cleaned	**Pass**

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Flux Induced Corrosion (Copper Mirror Method) 2.3.32

1.0 Scope

This test method is designed to determine the removal effect the flux has (if any) on the bright copper mirror film which has been vacuum deposited on clear glass.

5.2 Test

5.2.1 Place the copper mirror test panel on a flat surface, mirror side up, and protect from dust and dirt at all times.

5.2.2 Place one drop of test flux or extract to be tested on each copper mirror test panel. Do not allow the dropper to touch the test panel.

5.2.3 Solder-paste shall be applied directly to the mirror without scratching the copper mirror, with a volume approximating a 0.5 mm thickness and 8 mm diameter. (It has been determined that significant variations from this quantity have little effect for most materials.)

5.2.4 Immediately also place one drop of the control standard flux adjacent to the test flux. Do not allow drops to touch.

5.2.5 Place test panels in a horizontal position in the dust free cabinet at 23 ± 2°C and 50 ± 5% relative humidity for 24 ± ½ hours.

5.2.6 At the end of the 24 hour period, remove the test panels and remove the test flux and control standard fluxes by immersion in clean 2-propanol. copper only around the perimeter of the drop defines the flux as M. Complete removal of the copper places the flux in the H category. (See Figure 1).

5.3 Evaluation

5.3.1 Carefully examine each test panel for possible copper removal or discoloration.

5.3.2 If there is any complete removal of the copper film as evidenced by the background showing through the glass, the test flux has failed the L category. Complete removal of the copper only around the perimeter of the drop defines the flux as M. Complete removal of the copper places the flux in the H category. (See Figure 1).

5.3.3 If the control flux fails, repeat the entire test, using new copper mirror test panels.

5.3.4 Discoloration of the copper film due to a superficial reaction or only a partial reduction of the copper film thickness is not considered a failure.

Corrosion, Flux (2.6.15)

1.0 Scope

This test method is designed to determine the corrosive properties of flux residues under extreme environ-mental conditions. A pellet of solder is melted in contact with the

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test flux on a sheet metal test piece. The solder is then exposed to prescribed conditions of humidity and the resulting corrosion, if any, is assessed visually.

5.2.2.1 Solder Paste, Cored-Wire or Cored-Preform

Place 1 g of solder paste, flux-cored wire or cored-preform into the depression in the test panel.

5.2.3 Using tongs, lower each test panel onto the surface of the molten solder.

5.2.4 Allow the test panel to remain in contact until solder specimen in the depression of the test panel melts. Maintain this position for 5 ±1 seconds.

5.2.5 Carefully examine test specimen at 20X magnification for subsequent comparison after humidity exposure. Record observations, especially any discoloration.

5.2.6 Preheat test panel to 40 ±1°C for 30 ±2 minutes.

5.2.7 Preset humidity chamber to 40 ±1°C and 93 ±2% relative humidity.

5.2.8 Suspend each test specimen vertically (and separately)

5.2 Test

5.2.1 Heat solder pot so that solder bath stabilizes at 235 ±5°C.

5.2.2 Liquid Flux Place 0.035 g of flux solids into the depression in the test panel. Add solder sample.

5.2.9 Expose specimens to the above environment for 240 hours (10 days). M and H may be tested in the cleaned, as well as uncleaned, condition.

5.3 Evaluation Carefully examine specimens prior to placing them in the environmental chamber. Note any discoloration.

5.3.1 After the appropriate exposure period, remove test specimens from humidity chamber, examine at 20X magnification and compare with observations noted in paragraph 5.2.5.

5.3.2 Corrosion is described as follows:

A. Excrescences at the interfaces of the flux residue and cop-per boundary, or the residues or discontinuities in the residues.

B. Discrete white or colored spots in the flux residues.

5.3.3 An initial change of color which may develop when the test panel is heated during soldering is disregarded, but sub-sequent development of green-blue discoloration with observation of pitting of the copper panel is regarded as corrosion.

6.0 Notes

6.1 Definition of Corrosion For purposes of this test method, the following definition of corrosion shall prevail. ‘‘A chemical reaction between the copper, the solder, and the constituents of the flux residues, which occurs after soldering and during exposure to the above environmental conditions.’’

6.2 Color photos before and after the test are valuable tools in identifying corrosion. (See 5.2.5.)

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6.3 Safety Observe all appropriate precautions on MSDS for chemicals involved in this test method.

TEST PROCEDURE – QUANTITATIVE HALIDES TEST
ION CHROMATOGRAPHY (IPC-TM-650, METHOD2.3.28)

This evaluation used Ion Chromatography per IPC-TM-650, method 2.3.28 to characterize process residues.

1. The test samples were placed into clean KAPAK™ (heat-sealable polyester film) bags.

2. A mixture of isopropanol (75% volume) and deionized water (25% volume) was introduced into the bags, immersing the test samples. NOTE: The heat-sealed bags included an opening for ventilation.

3. The bags were inserted into an 80°C water bath for one hour. After one hour, the bags were removed from the water bath and the test samples removed from the bags. The test samples were placed on a clean holding rack for air drying at room temperature.

4. Controls and blanks were performed on a Dionex DX-120 ion chromatography system before the test began. NOTE: CSL used NIST-traceable standards for all system calibrations.

5. A 1.5mL sample of each test sample's extract solution was analyzed using a 1.7mM sodium bicarbonate/1.8mM sodium carbonate eluent.

DATA DISCUSSION - ION CHROMATOGRAPHY

The attached page(s) show the data for this evaluation. The data table lists the ion chromatography data in micrograms of the residue species per square inch of extracted surface ($\mu g/in^2$), unless otherwise noted. One should not confuse this measure with micrograms of sodium chloride equivalent per square inch, which is the common measure for most ionic cleanliness test instruments.

Ion chromatography detected the following anion residues: weak organic acids (WOA). The following ions were analyzed for but not detected: fluoride (F^-), chloride (Cl^-), bromide (Br^-), sulfates (SO_4^{2-}), nitrates (NO_3^-), phosphates (PO_4^{2-}), methane sulfonic acid (MSA), and conductive organic elements.

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Weak Organic Acids (WOAs)

Weak organic acids, such as adipic or succinic acid, serve as activator compounds in many fluxes, especially no-clean fluxes. WOAs are typically benign materials and are therefore not a threat to long term reliability. In order to avoid formulation disclosure difficulties with flux manufacturers, we group all detected weak organic acid species together and refer to them collectively as WOAs.

Weak Organic Acids on Assemblies

WOA levels vary greatly, depending on the delivery method (e.g. foam vs. spray) and the preheat dynamics. In general, water-soluble fluxes have a much lower WOA content than do low-solids (no-clean) fluxes, and the amount of residual WOA is proportional to the amount of residual flux. Bare boards typically do not contain WOA residues. When WOA levels are under 400 $\mu g/in^2$, the residues are generally not detrimental.

Process	Level
Low solids solder paste	0 – 20 $\mu g/in^2$
Spray-applied, low-solids flux	20 – 120 $\mu g/in^2$
Foam-applied flux process	250 – 400 $\mu g/in^2$
Water soluble flux with good cleaning	0 – 15 $\mu g/in^2$

TABLE 6
CSL WOA Guidelines for Assemblies

Excessive WOA amounts (appreciably greater than 400 $\mu g/in^2$) present a significant reliability threat for finished assemblies. An excessive amount of flux can produce the situation in which the thermal energy of preheat is spent driving off the solvent thereby not allowing the flux to reach its full activation temperature. Unreacted flux residues readily absorb moisture that promotes the formation of corrosion and the potential for current leakage failures.

Conclusions

The SynTECH-LF solder cream from AMTECH passes the IPC and J-STD-004 testing for an LO type flux.

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AMTECH

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Date:	August 26, 2005		Branford, CT 06405
Contact:	Ajith Premasiri	**Phone:**	203-481-0362
P.O. Number:	0802051604-WWG	**Fax:**	203-481-5033

Solder Paste Classification Per IPC-J-STD-004

CSL ID#	Sample Description	Copper Mirror Test / British Corrsion Test			
		Mirror 1	Mirror 2	Copper 1	Copper 2
1219-10-01	Syntech LF lot 292T				
	Mfg date 08-05 Lot# 292T-3-9x5-S1151	Pass	Pass	Pass	Pass
1219-10-04	Syntech LF lot 192T				
	Mfg date 08-05 Lot# 192T-3-9x5-S1150	Pass	Pass	Pass	Pass

Foresite ID#	Sample Description (all values are in ug/in2)	Ion Chromatography Cl$^-$	Br$^-$	F-	WOA	Silver Chromate	Omega Meter 600
1219-10-01	Syntech LF lot 292T	33 ppm	4 ppm	0	513 ppm	Negative	NA
	Mfg date 08-05 Lot# 292T-3-9x5-S1151						
	Solder Paste Reflowed on a B-24 test board						NaCl
1219-10-01	Syntech LF lot 292T on the B24 test board	1.89	0.78	0	4.36	NA	2.0
1219-10-04	Syntech LF lot 192T on the B-24 board	1.53	0.94	0	2.95	NA	1.9
1219-10-05	B-24 unprocesed control board	1.22	0.58	0	0	NA	2.2

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			SIR / Electromigration Testing					
CSL ID#	**Sample Description**	**Pattern**	**Initial**	**24 Hrs**	**96 Hrs**	**168 Hrs**	**Final**	Visuals
		Number	(ambient)	(85/85)	(85/85)	(85/85)	(ambient)	
	SynTECH -LF #S1151							
1219-10-11	B-24 Board #1	average	2.12E+12	1.58E+09	2.74E+09	1.24E+10	2.74E+12	No Dendrites
1219-10-12	B-24 Board #2	average	1.33E+12	6.54E+09	8.12E+09	5.32E+10	3.26E+12	No Dendrites
1219-10-13	B-24 Board #3	average	3.30E+12	5.14E+09	7.15E+09	8.25E+10	3.69E+12	No Dendrites
	SynTECH -LF #S1150							
1219-10-20	B-24 Board #1	average	1.97E+12	1.11E+09	6.56E+09	1.24E+10	1.24E+12	No Dendrites
1219-10-21	B-24 Board #2	average	4.21E+12	1.05E+09	7.24E+09	1.33E+10	9.89E+11	No Dendrites
1219-10-22	B-24 Board #3	average	5.05E+11	2.14E+09	6.21E+09	2.08E+10	1.62E+12	No Dendrites
1219-10-23	Unprocessed Control B-24 #1	average	3.26E+12	4.15E+09	6.08E+09	6.12E+09	2.05E+12	No Dendrites
1219-10-24	Unprocessed Control B-24 #2	average	2.46E+12	3.65E+09	4.31E+09	8.24E+09	1.39E+12	No Dendrites
1219-10-25	Unprocessed Control B-24 #3	average	1.08E+12	4.11E+09	5.14E+09	7.41E+09	1.17E+12	No Dendrites

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