


# Next Generation Halogen Free Solder Paste



## **S3X58-M555**

## Next Generation Halogen Free Solder Paste S3X58-M555

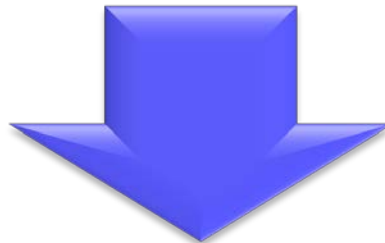
- HALOGEN FREE according to IPC-JSTD-004B (ROLO)  
= True Halogen Free
- POWERFUL WETTING regardless of surface finishes
- Very stable RHEOLOGY  
(viscosity variation <math><+/-10\%</math> at 30°C x 1 month)
- (ボノテスト、結露サイクル Pass)
- Designed to be Low VOIDS and ANTI-PILLOW

Trend in Automotive industry toward Halogen Free



European Automotive EMS is moving

Leaded solder paste → Lead free solder paste



Lead free Halogen Free solder paste

**Continental** 

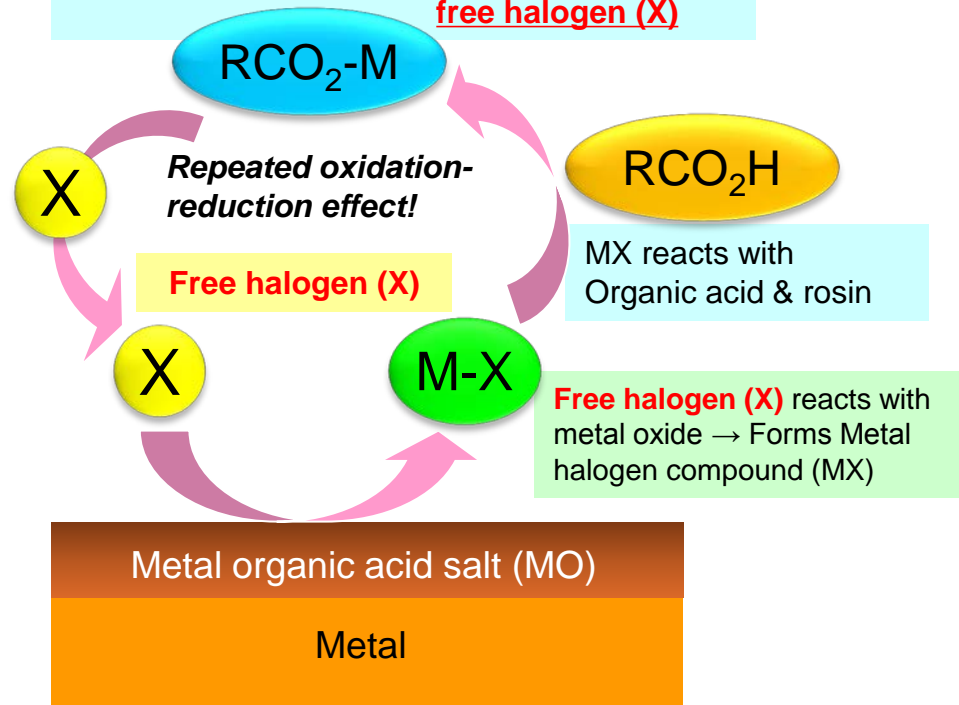
**BOSCH**

many more(?)

# Mechanism of oxide substance reduction reaction

## With Halogen

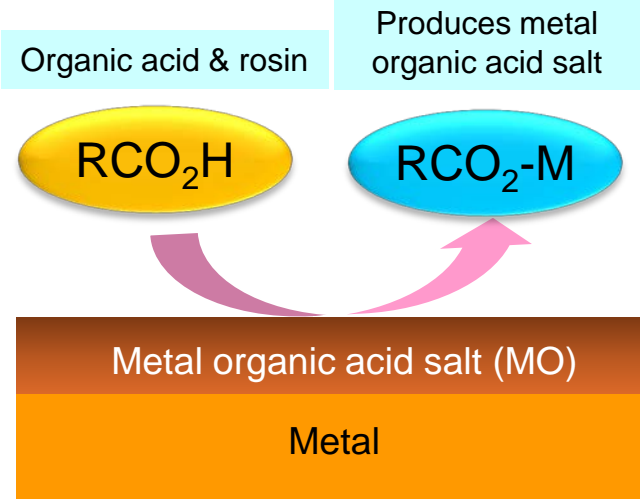
Produces metal organic acid salt (MO) and **free halogen (X)**



Halogen acts like a “catalyst”. It, thus, repeatedly, effectively and efficiently reduces the oxide substance, even with relatively low volume.

## Without Halogen

**No repeated oxidation-reduction effect!**



Organic acids reduces the oxide substance, but as it does not have such an repeatable oxidation-reduction effect, its wetting power is weaker than the halogen containing flux formulation, and, therefore, requires relatively large volume of organic acids → concerns over electrical reliability

Requires activator to replace halogen



Must active enough with small content



Reactive activator deteriorates reliability



Solve drawback by new concept

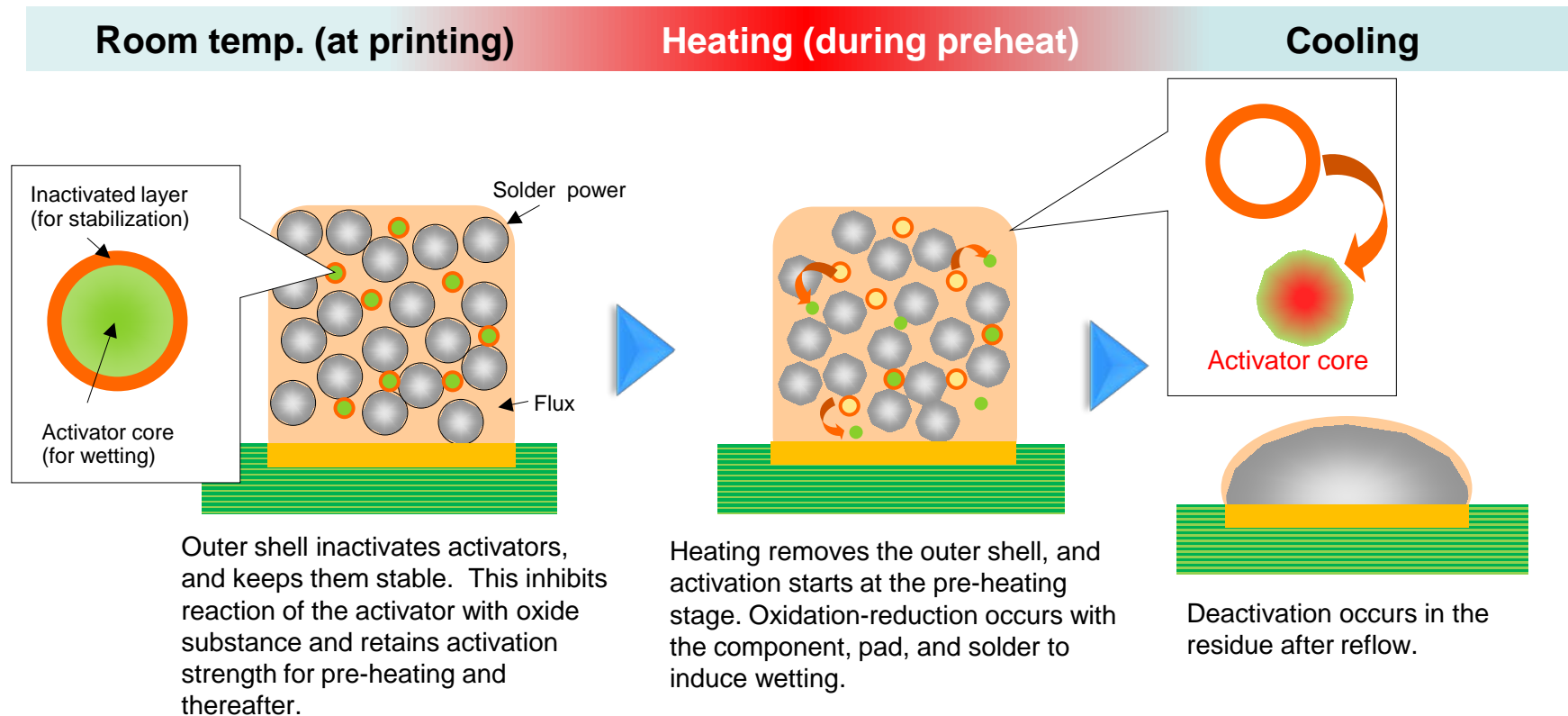
Highly reactive activator is required to compensate the loss of Halogen. Such activator reacts with metal oxide at room temperature, even during storage period of the solder paste, leading viscosity increase and other issues.

M555 employed a new unique technique succeeded to effectively inhibit such reactivity at room temp. and exert high activation strength during reflow process.

## Unique mechanism of activator for S3X58-M555

Powerful activators are added in an encapsulated form at room temperature to achieve stabilization and good wetting performance at the same time.

### Image of Encapsulation Technique





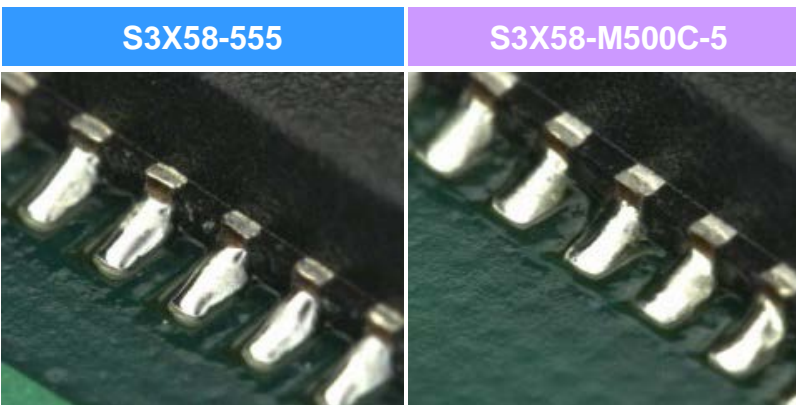
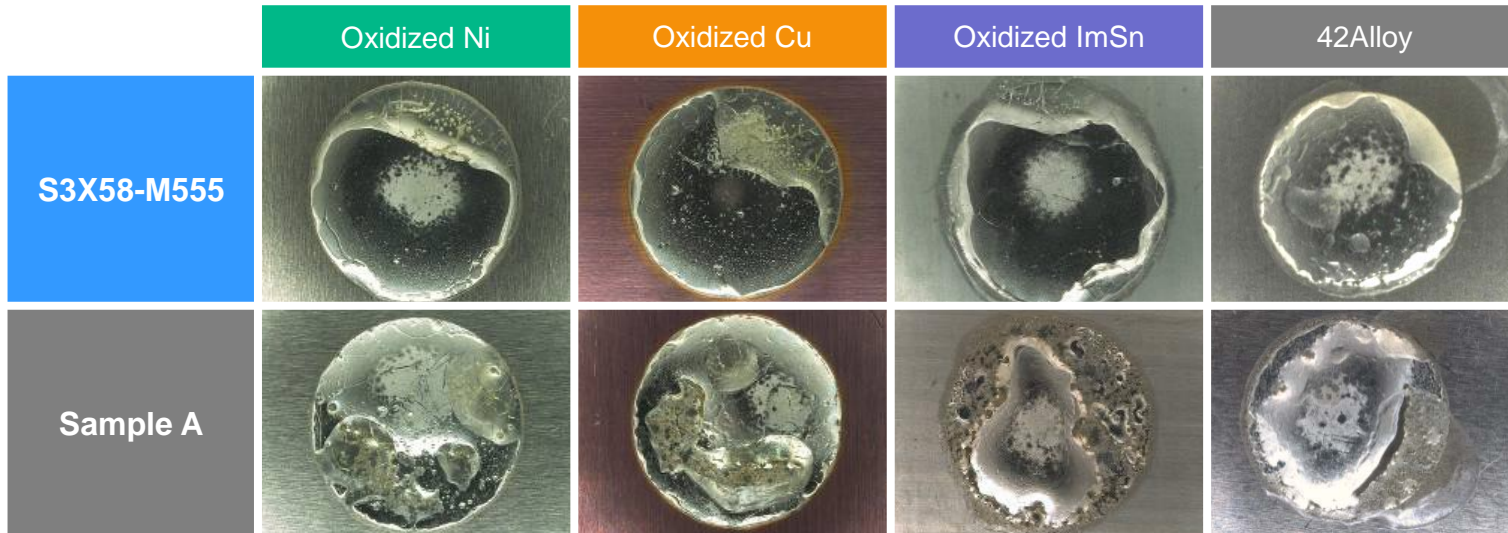
# Solder wetting vs. surface finishes

## Test condition

- Material pieces : Nickel, Copper, ImSn, Alloy 42
- Stencil thickness : 0.20mm (laser cut)
- Stencil aperture : 6.5mm diameter

## Pre-conditioning

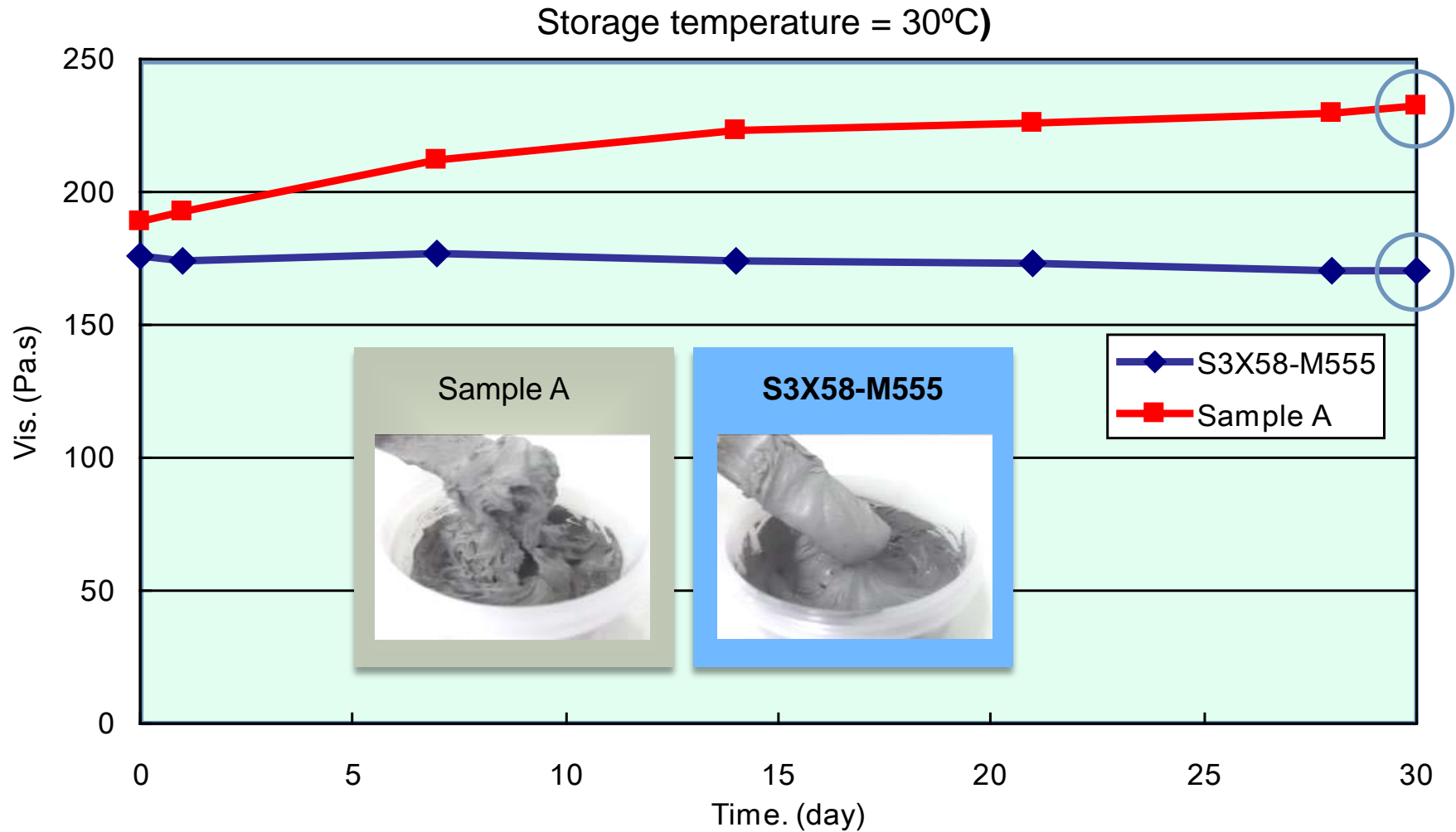
Store in constant temperature oven at 150°C for 16 hours



**S3X58-M555** adopts an activator use for S3X58-M500C-5, Halogen containing Powerful Wetting Solder Paste, together with a newly formulated high heat resistant activator.

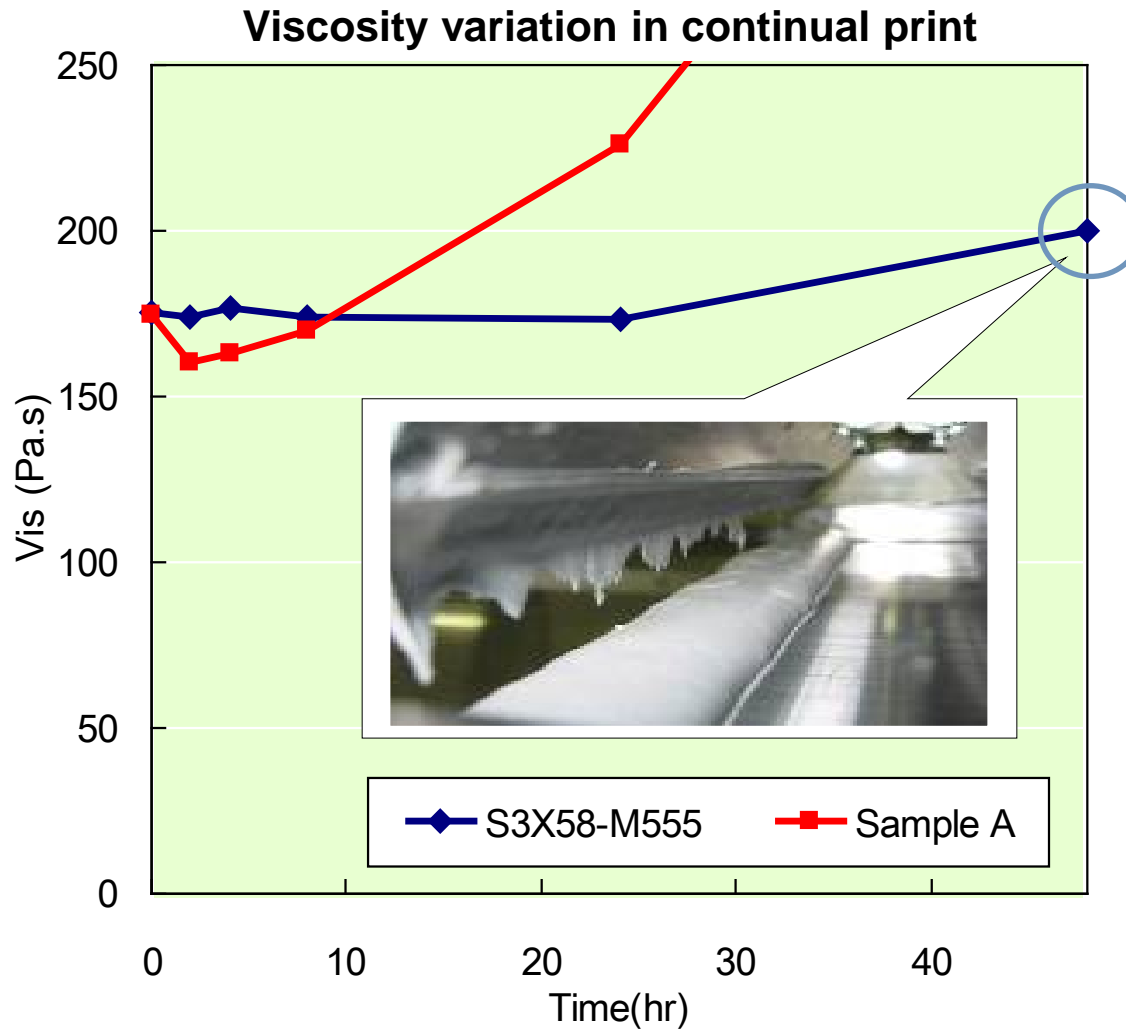
Though it is halogen free, **S3X58-M555** exhibits as powerful wetting as a halogen containing solder paste.

# Long term viscosity stability at high storage temp.

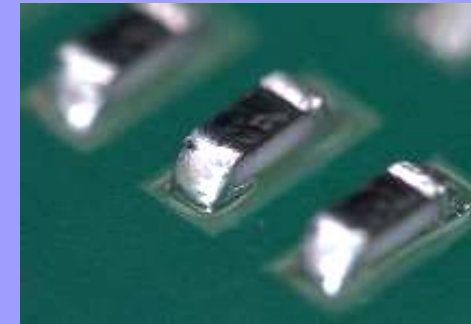




# Viscosity & wetting power stability in continual print



**S3X58-M555**  
After 48hrs rolling

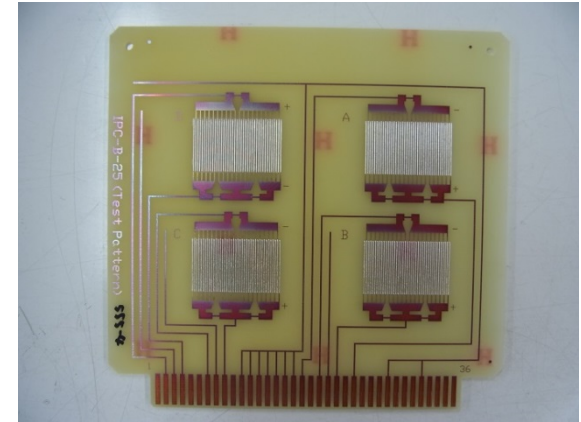
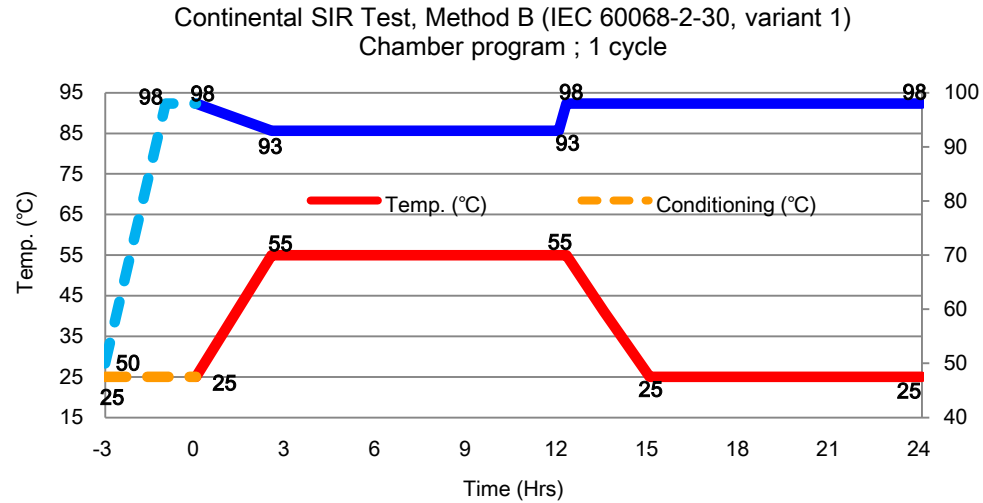


**Sample A**  
After 8hrs rolling

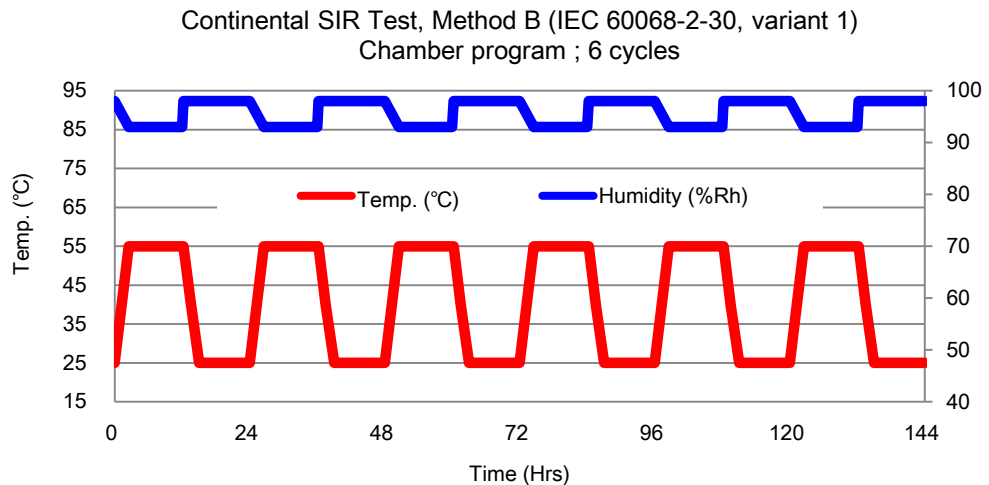


# Damp Heat Cycle SIR Test

We conducted DHC SIR with IPC-B25 test coupon to see if the similar resistance behavior (sudden drop) occurs.

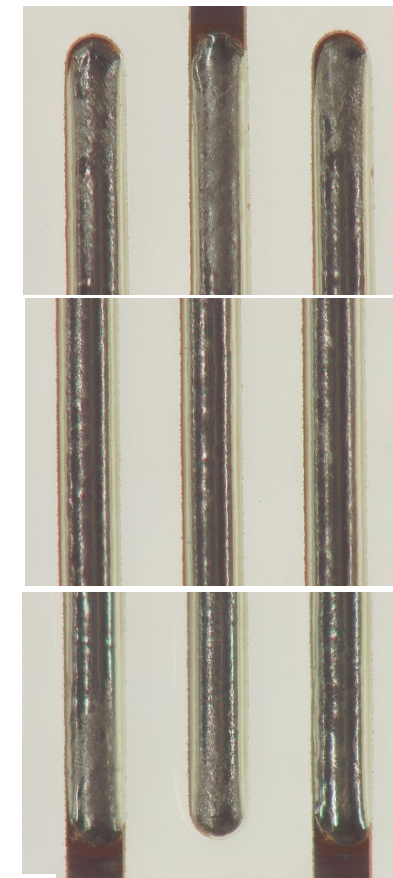
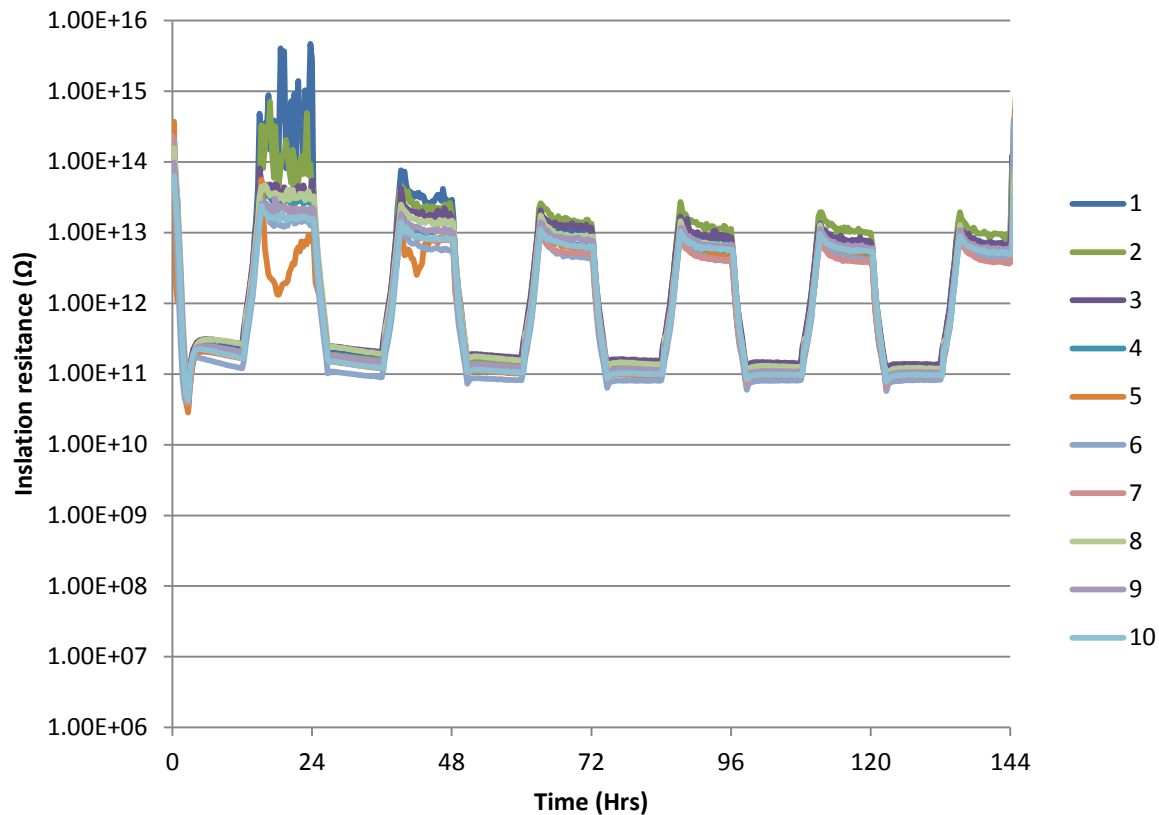


IPC-B-25Pattern



SIR auto measurement system (ESPEC AMI)

# Damp Heat Cycle SIR Test



## ►Observation:

Though there is some variation among the test patterns, all of them resulted  $>1E+10$ . No evidence of the dendrite growth can be seen.

## Corrosion tests

### Copper mirror test

Test method: IPC J-STD-004B TM-650 2.3.32

►Result: No evidence of breakthrough.



S3X58-M555

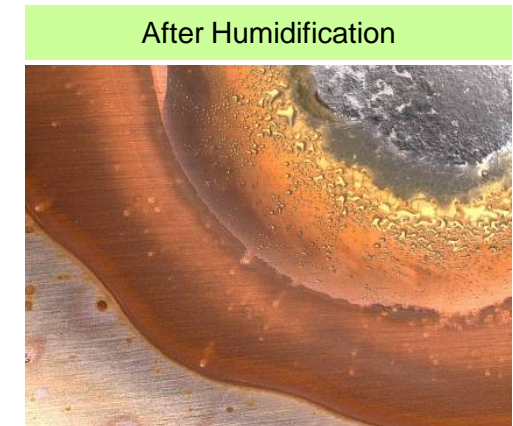
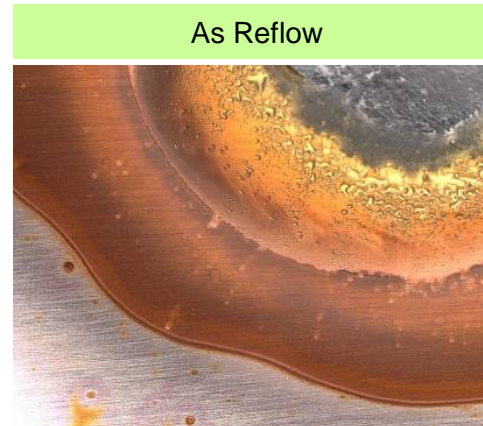
WW rosin

### Copper plate corrosion

Test method: IPC J-STD-004B TM-650 2.6.15

Test conditions: Heat condition - 260°C, 60sec  
Storage condition - 40°C/90RH%, 240h

►Result: No minor or major corrosion occurred.



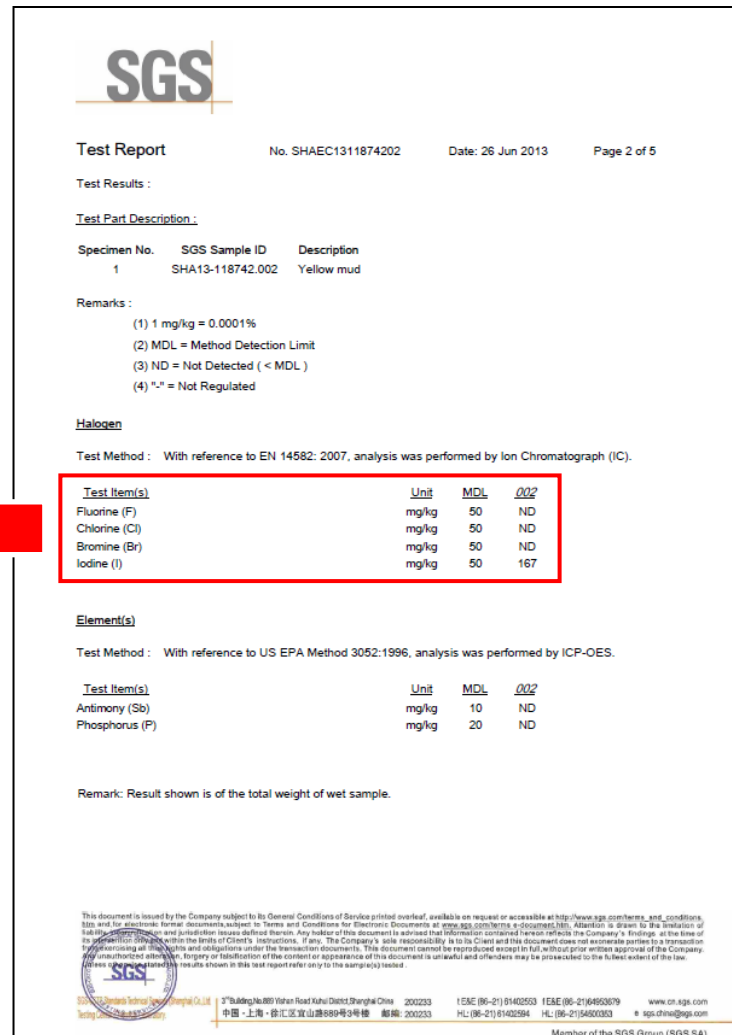
# Halogen content

Testing institute: SGS China  
 Test method: BS EN 14582: 2007  
 Test material: 13SP034S3X(S3X58-M555)

Fluorine (F)	ND
Chlorine (Cl)	ND
Bromine (Br)	ND
Iodine (I)	167ppm

\*ND: Not detected

▶Result: Total halogen content = <500ppm



**SGS**

**Test Report** No. SHAEC1311874202 Date: 26 Jun 2013 Page 2 of 5

Test Results :

Test Part Description :

Specimen No.	SGS Sample ID	Description
1	SHA13-118742.002	Yellow mud

Remarks :

(1) 1 mg/kg = 0.0001%  
 (2) MDL = Method Detection Limit  
 (3) ND = Not Detected (< MDL )  
 (4) "\*" = Not Regulated

Halogen

Test Method : With reference to EN 14582: 2007, analysis was performed by Ion Chromatograph (IC).

Test Item(s)	Unit	MDL	002
Fluorine (F)	mg/kg	50	ND
Chlorine (Cl)	mg/kg	50	ND
Bromine (Br)	mg/kg	50	ND
Iodine (I)	mg/kg	50	167

Element(s)

Test Method : With reference to US EPA Method 3052:1996, analysis was performed by ICP-OES.

Test Item(s)	Unit	MDL	002
Antimony (Sb)	mg/kg	10	ND
Phosphorus (P)	mg/kg	20	ND

Remark: Result shown is of the total weight of wet sample.

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**SGS**

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## Other properties



Item	Result	Method
Tack time	> 48 hours	JIS Z 3284-3
Heat slump	0.3mm pass	JIS Z 3284-3
Solder balling	< Category 3	JIS Z 3284-4
Copper mirror corrosion	Type L	IPC-TM-650 2.3.32
Copper plate corrosion	Pass	IPC-TM-650 2.6.15
Voltage applied SIR	> 1E+9	IPC-TM-650 2.6.3.3 JIS Z 3197

# Specification



Application		Printing - Stencil
Product		<b>S3X58-M555</b>
Alloy	Alloy Composition (%)	<b>Sn 3.0Ag 0.5Cu</b>
	Melting point (°C)	217 - 219
	Shape	Spherical
	Particle size (µm)	20 – 38
Flux	Halide Content (%)	0
	Flux Type	ROLO* <sup>3</sup>
Product	Flux Content (%)	12.0 ± 1.0
	Viscosity* <sup>1</sup> (Pa.s)	220 ± 30
	Copper plate corrosion* <sup>2</sup>	Passed
	Tack Time	> 48 hours
	Shelf Life (0-10°C)	6 months
	Optional powder size (µm)	20 - 45: S3X48-M555