SOLDER PASTE
NO-CLEAN
SIA® ALLOY
"LEAD FREE"

Created : 18/03/2022 Updated : 13/10/2022 Index : 03

DESCRIPTION

SP 350 no-clean solder paste has been developed in MBO laboratories. It is designed to offer a high level of activity by leaving low residues, clear and non-corrosive. This product, suitable for printing applications meets the international requirements of the electronics industry.

The purpose for the invention of this new lead-free alloy SIA® was to propose a substitute alloy for Sn/Pb with a temperature close to and allowing the temperature specifications of electronic components to be met. This has also made it possible to correct the defects of common alloys such as SAC305 or SnCu for example. The main advantages of SIA® are as follows:
- Reduced reflow peak temperature due to lower melting point and maintained bath temperature identical to Sn/Pb
- Compliance with component specifications. (Temperature), increased reliability over time.
- Very good wettability, improved solder quality
- Increased mechanical resistance to shock and elongation
- Power consumption reduced by 30% when using this alloy
- Recyclable and non-toxic
- No need for Nitrogen on production lines. Reduced scories.
- Improved productivity. Easier repair if necessary.

SP 350 no-clean solder paste is manufactured in compliance with the international standards.

- **ROL0 classification (J-STD-004)**
- Halide free.
- **RoHS compliant**.
- High activity.
- Low and neutral residues.
- Fast print capabilities (up to 80 mm/s). Best results between 30 to 60 mm/s.
- Long stencil-life (8 hours).
- Fine-pitch (400µm) and ultra-fine pitch (<300µm) capabilities.
- Type 3 to type 5 available. Other on request.

AVAILABLE ALLOY

Alloy	*Alloy number ISO 9453 (2014)*	*Melting Point (°C) DSC measurement*	*Metal content (%)*	*Viscosity (Pas) Malcom 10 rpm*
SIA®	NA	139-195	88-90	160

Characteristics of SIA® alloy :

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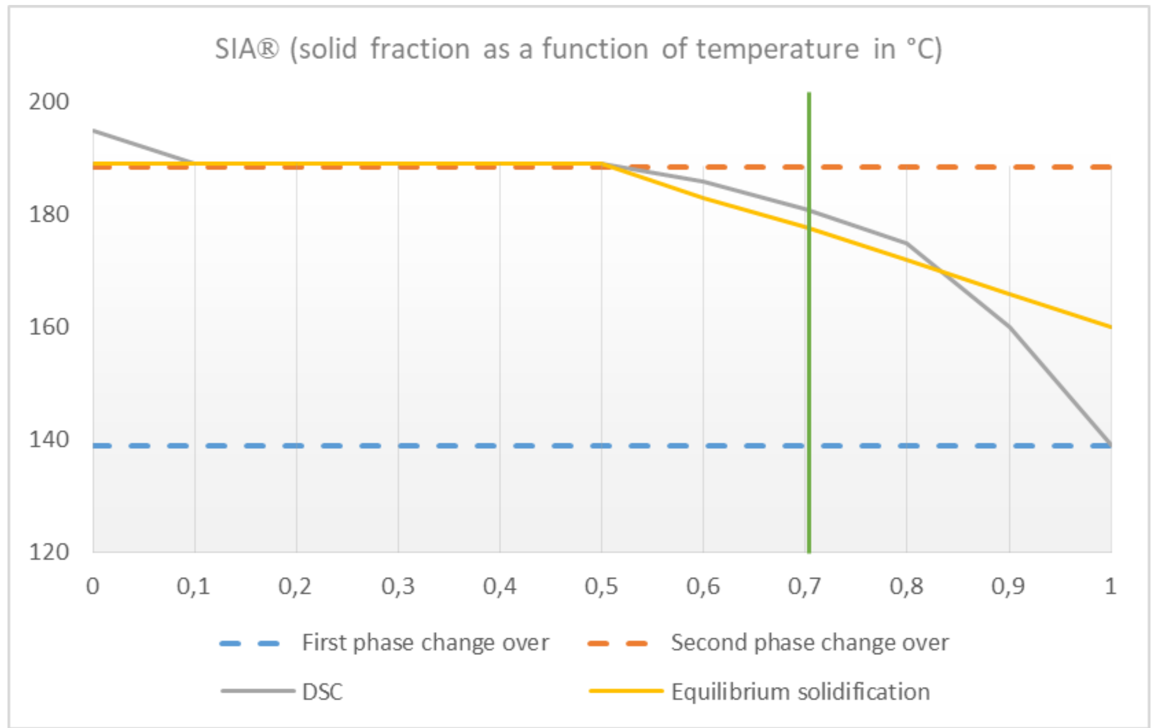
		SIA®
	Alloy composition (% of weight)	**SnBi + additives**
	Specific Gravity	**7.9**
Melting point °C (alloy solidification)	Solidus	**170**
	Liquidus	**189**
Melting point °C (DSC measurement)	Solidus	**139**
	Liquidus	**195**

Explanation of the differences between the DSC values and the « physically » measured values.



The SIA® alloy is solid when the solid fraction has a value greater than 0.7 (i.e. 70%).

The melting point of the SIA® alloy is therefore lower than the melting point of SAC 305 (217 °C-220 °C) by 25 °C and the melting point of SN100C® (227 °C) by 32 °C.

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	SIA®*	SAC 305	SN100C®
Tensile strength (MPa)	85.6	49	36
0.2 % Proof stress (MPa)	61	39	27
Tensile strength at breakage (MPa)	69.6	42	30
Young's modulus (GPa)	33	51	50
Linear expansion coefficient ($10^{-6}.°C^{-1}$) (40 to 100 °C)	21.57	23	24
Linear expansion coefficient ($10^{-6}.°C^{-1}$) (100 °C)	21.02		
Thermal conductivity ($W.m^{-1}.K^{-1}$)	37.25	58.5	64
Specific heat Cp (J/K.g)	0.206	0.23	0.22
Electrical conductivity ($MS.\ m^{-1}$)	6.80	9.80	8.50

***: All measurements were performed by a qualified external laboratory (SAYENS)**

WETTING PROPERTIES of SIA®:

Test performed regarding the IPC J-STD 002.

Solderability Testing Equipment used : **Metronelec Menisco ST 50 Wetting Balance Serial Number 611**

Calculated uncertainty 0.00215 mN/mm

Alloy temperature of the bath : **245** °C.

Test Flux Used : **IPC J-STD Test flux # 2**

Coupon : **Copper**.

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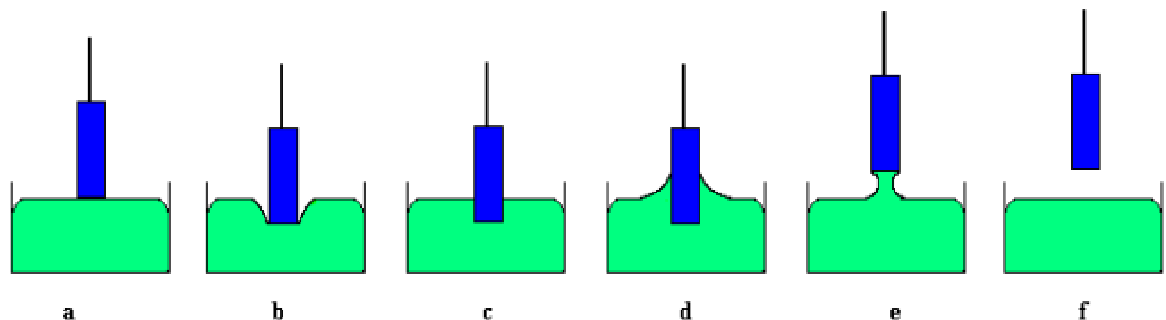
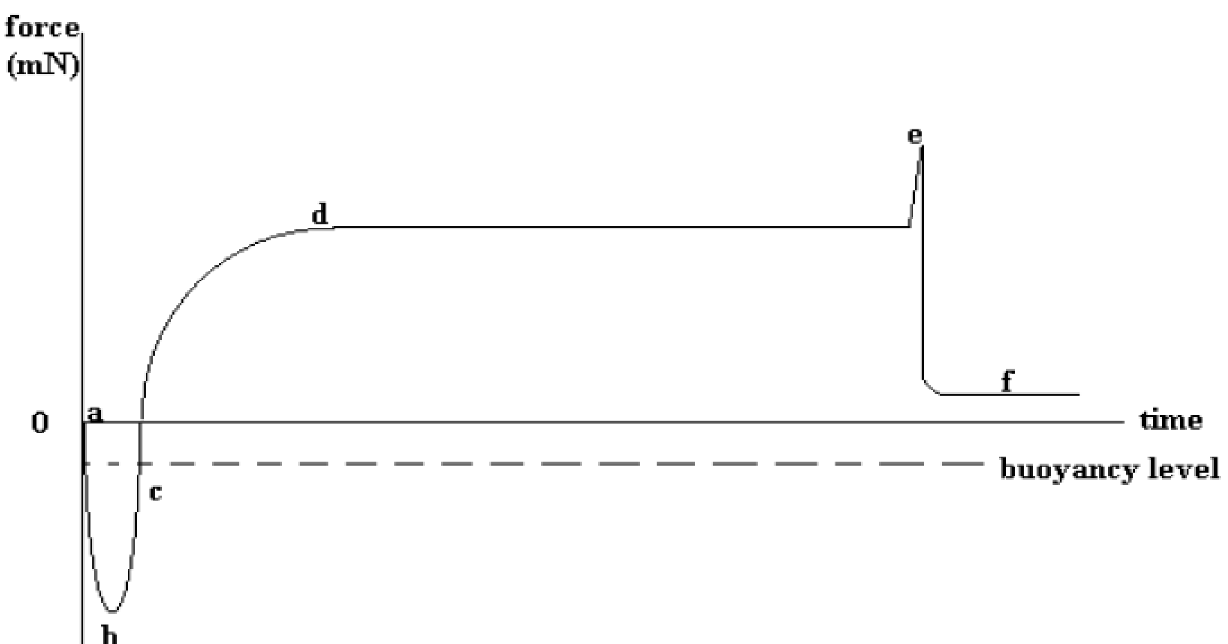
The Wetting Curve





a) Sample reach the surface of the Solder Bath
b) Sample at end of Immersion depth - (buoyancy)
c) Forces at Equilibrium
d) Maximum Wetting force
e) Sample lift out of the solder bath
f) Sample is out of the solder bath

Results :

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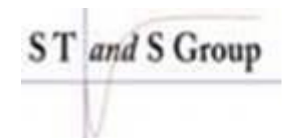
Sample	Time to cross zero in seconds	Force in mN/mm at 2 seconds	Force in mN/mm at 5 seconds	Force in mN/mm at 10 seconds	Pass/ Fail per IPC JSTD 002E
RA coupon tested with SIA®	**0.298**	**0.23**	**0.24**	**0.24**	**PASS**

Table of average values

Test realized by the following external laboratory :

S T & S Group. Testing & Analysis
Blair Park, 108 Rosedale Ave. Richmond KY 40475
Ph:859-353-5914 E-mail: jobrien@standsgroup.com
Website: www.standsgroup.com



TECHNICAL DATA

Category	Standard	Results
Activity Level (classification)	IPC J-STD-004	**ROL0**
Halide Content	IPC J-STD-004	**Halide free (by titration)**
Copper Mirror	IPC-TM-650 (2.3.32) /J-STD-004	**Pass** (no evidence of corrosion)
Silver Chromate	IPC-TM-650 (2.3.33)	**Pass**
Surface Insulation Resistance Test (SIR)	GR 78 Core Section 13, 13.1.3.2	**Pass, 1x10^{12} ohms**
Electromigration Resistance Testing	GR-78-Core Section 13.1.4	**Pass, >1x10^{10} ohms**
Visual aspect of residues	IPC-HDBK-005	**Clear**
Viscosity	Malcom spiral viscometer (J-STD-005)	**160 Pa.s (SIA®-4)**
Solder ball test	IPC J-STD-005	**Acceptable**

PRINTING

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Solder Paste use: When the solder paste is at room temperature (approximately 4 hours after the release of the fridge), manually stir it vigorously with a spatula for about thirty seconds before deposit it on the printing screen for a proper activation.

To avoid waiting for the solder paste warm-up, an automatic mixer dedicated to the solder paste can be used right out of the fridge. In this case, the increase of the temperature and stirring of the solder paste are performed simultaneously.

For any reuse of solder paste, a new activation of it is necessary.

Stencil
Stainless steel, brass or nickel. Chemical cut, laser cut or electroformed.

Squeegee
Stainless steel (recommended) or 80-100 durometer polyurethane.

Print speed
30-80 mm/s. Best results : 30 to 60 mm/s.

Squeegee pressure
0.15-0.3 Kg/cm of squeegee length

Snap-off
0 to 0.25mm. On contact printing is preferred.

Ambient conditions
20-30°C and 35% to 70% RH. Minimize exposure of solder paste direct to air flow.

REFLOW

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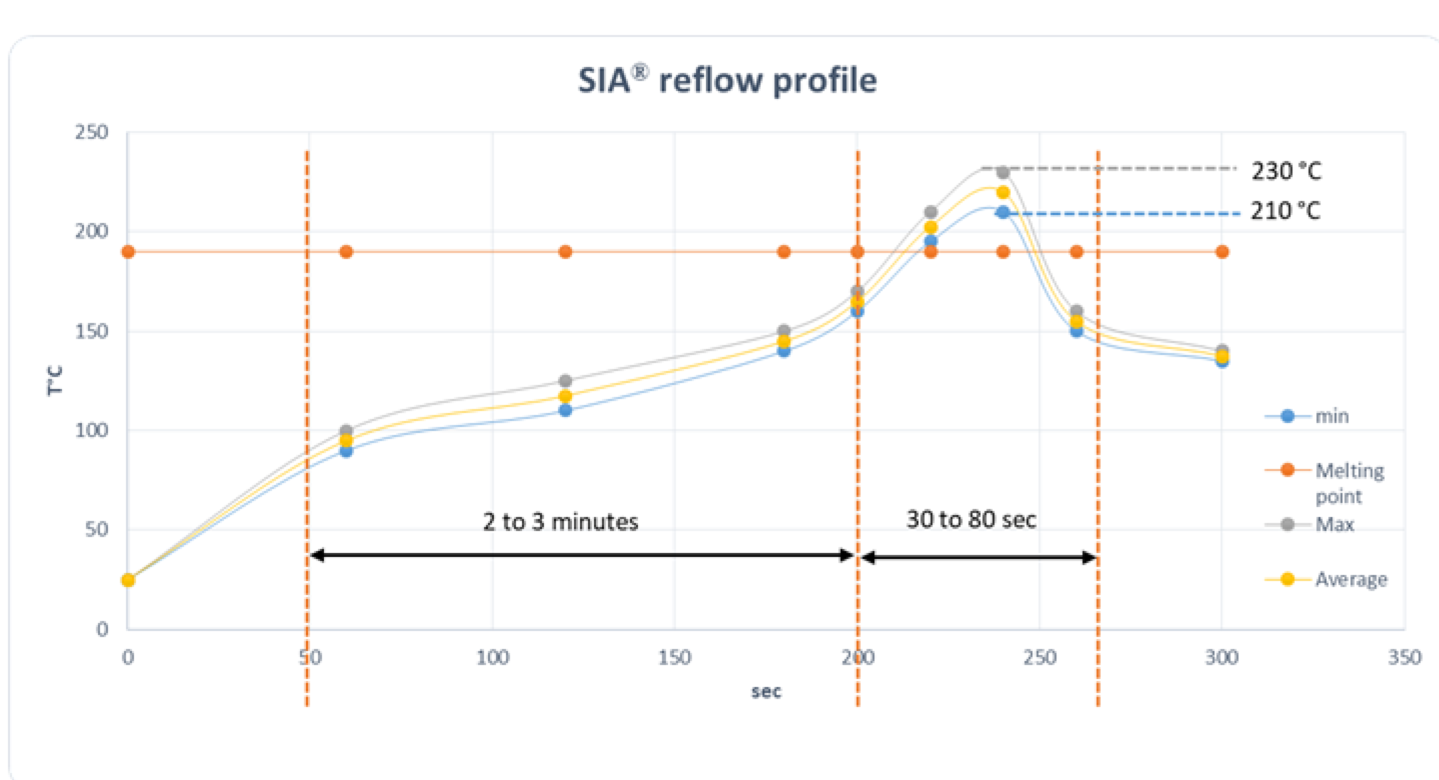
Heating Methods
Convection, infrared, vapour phase, hot plate, hot bar, laser and others. Aerobic or inerted.
Heating Profile
See suggested reflow profile for SIA® alloy
Cleaning Equipment
Spray, immersion, vapour degreaser or scrubber.
Cleaning solvents
Most stencil cleaners, stencil wipes and saponifiers. Although this product is no-clean , if a cleaning card is required, the use of **ZESTRON products (VIGON A200, A201, N600 …)** gives excellent results and is especially recommended .
Temperature
35-60°C.
Spray Pressure
20 to 40 psi.



STORAGE AND PACKAGING

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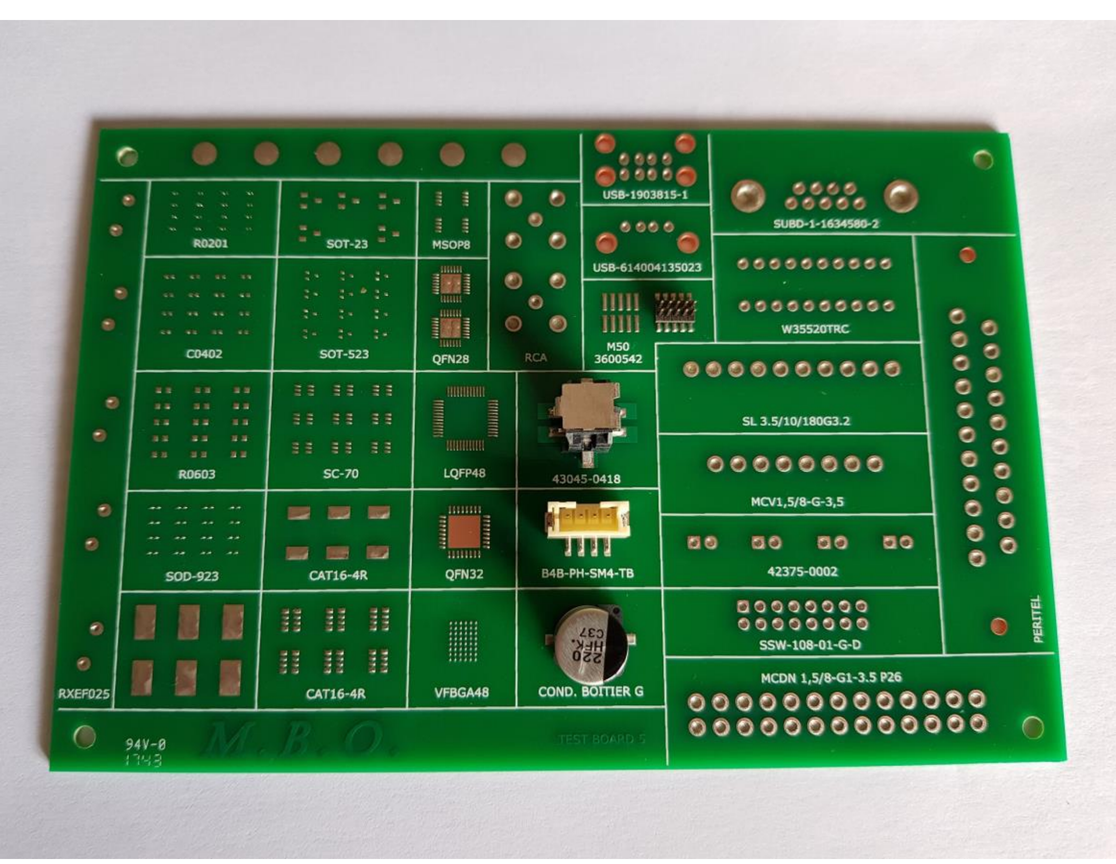
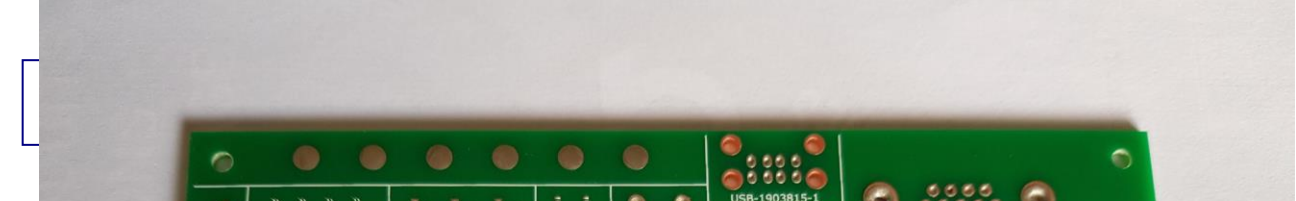
Packaging: jars of 250g, 500g - cartridges of 500 and 1000 g - Proflow® of 750g - others on request.

Storage: in original container between 5 and 10°C for up to 12 months. Wait until the pot has reached the ambient temperature before opening to avoid water condensation on the surface of the paste. Once opened, do not return to the fridge if all the jar is consumed in 5 days.

REFLOWABILITY





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COLD / HOT SLUMP

IPC TM 650 2.4.35	**0.15 mm**

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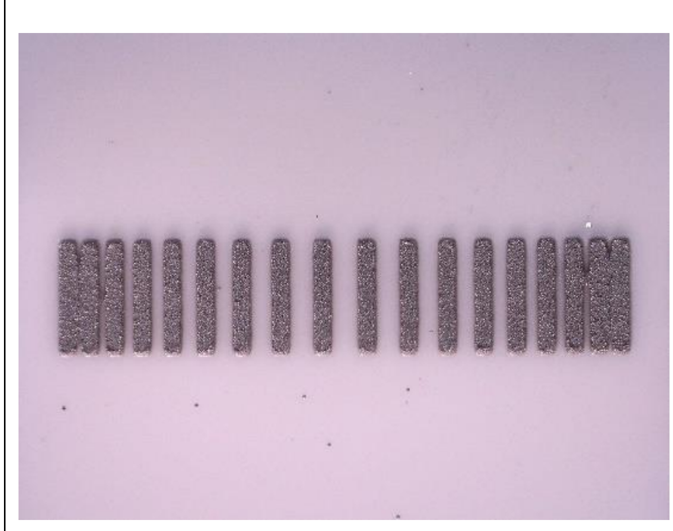
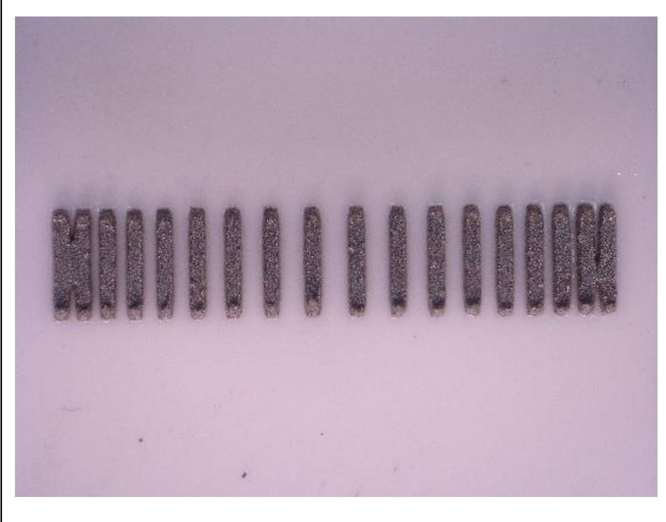
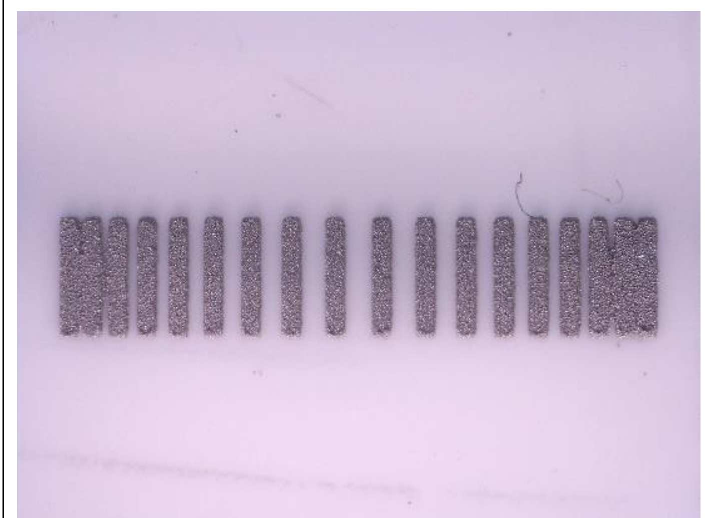
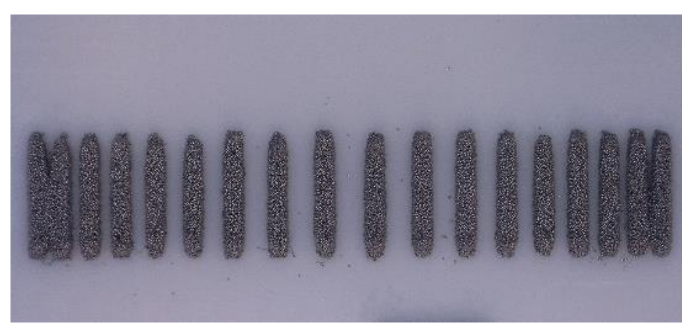
(A-20 = 0.1 mm thick 25 °C)	
IPC TM 650 2.4.35 (A-21 = 0.2 mm thick 25 °C)	**0.10 mm** 

<table>
<tr><td>IPC TM 650 2.4.35 (A-20 = 0.1 mm thick 130 °C)

Test at 130 °C due to the low melting point of the alloy.</td><td>0.15 mm
</td></tr>
<tr><td>IPC TM 650 2.4.35 (A-21 = 0.2 mm thick 130 °C)

Test at 130 °C due to the low melting point of the alloy.</td><td>0.10 mm
</td></tr>
</table>

SOLDER BALL TEST

IPC TM 650 2.4.43	**Acceptable** **T = 0 h** **T = 2 h** **T = 4 h**

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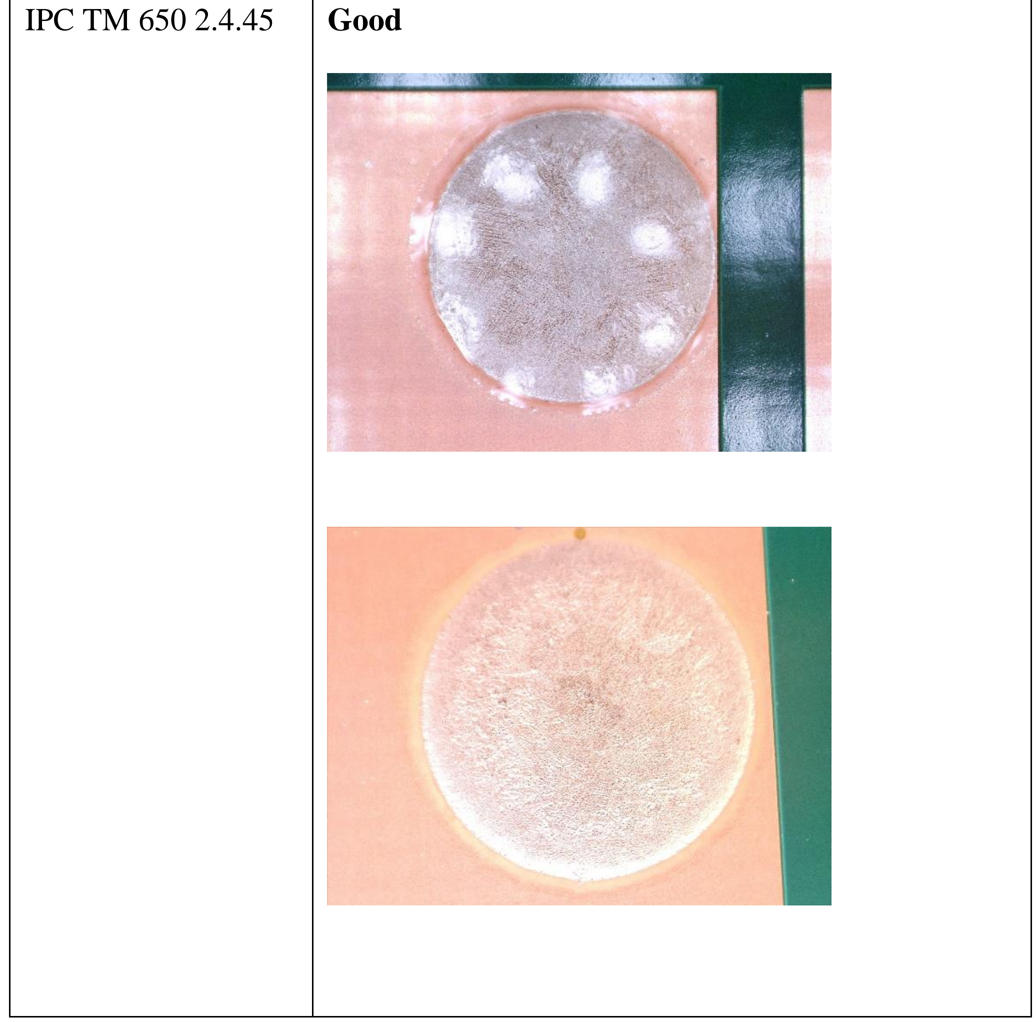
WETTING TEST



IPC TM 650 2.4.45	**Good**

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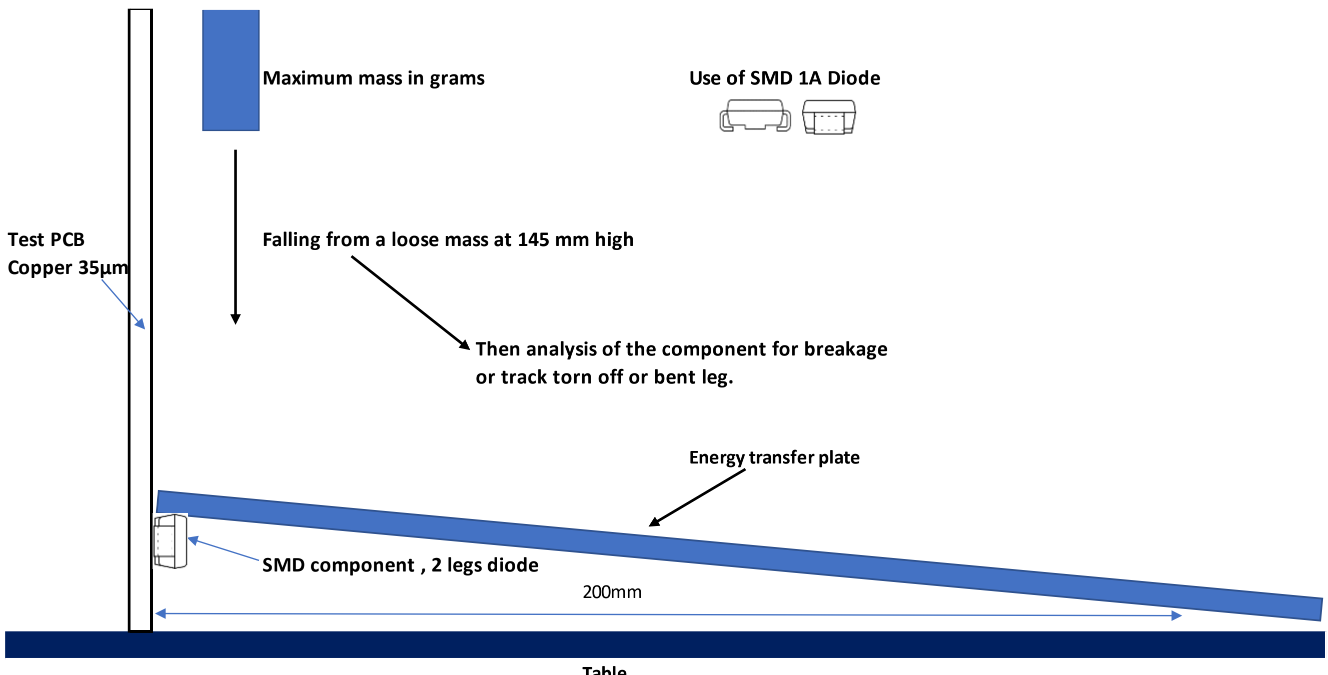
RELIABILITY TESTS

SHOCK RESISTANCE:

35 measurements on SMD 1A diode component with the following mounting at 25 °C:



Results :

Alloy	*SnCu*	*SAC 305*	*SIA®*	*SnPb*
Mass (gram)	52.8	65	**114**	115
Standard deviation	6.79	8.67	**0.15**	0.14
Difference in % compared to SAC 305	81	0	**175**	177

The shock resistance is almost twice as high as that of the SAC 305.

PULL OUT/ TEAR STRENGTH:

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Tested component: **Encoder wheel**

Speed : **10 mm/min**

Standard test equipment:

Direction of force on the component:

Results :

Strength in Newtons	SAC 305	SIA®
Direction A	**Not tested**	**190**
Direction B	**56**	**78.3**

The SIA® alloy is at least 40% better than SAC 305 in the pull-out test.

CROSS SECTION ANALYSIS :

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Measurements performed by CTIF (Centre Technique des Industries de la Fonderie), 69771 Saint-Didier au Mont d'Or, France on behalf of the Customer EATON COOPER SECURITE, 63200 RIOM.

Analysis on 2 batches of PCB :

- BATCH A : NEE3215200 PCB wave soldered in RIOM with SIA® and tested in oven cycle 0°C to 40°C with 90% humidity, 96H (repeat 2 times).
- BATCH B : NEE3215200 PCB wave soldered in RIOM with SIA® and oven tested for 500 hours at 70°C.

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3.2. (Lot A)	Observations
200 µm	R1G Largeur de la brasure : 1,89mm. Angle de mouillabilité externe : Θ = 22° Angle de mouillabilité interne : Θ = 18°
200 µm	R1D Largeur de la brasure : 2,02mm. Angle de mouillabilité externe : Θ = 17° Angle de mouillabilité interne : Θ = 18°

R2G

Largeur de la brasure : 1,89m.

Angle de mouillabilité externe :
Θ = 17°

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8.2.1 (Lot B)	Observations
	R1D

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R2G

Largeur de la brasure : 1,73m.
Angle de mouillabilité externe :
Θ = 22°
Angle de mouillabilité interne :
Θ = /

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INTERMETALLIC COMPOUND (IMC) :

Measurements performed by IFTEC ; 33, rue Ravon 92340 Bourg-la-reine – France ; tél. +33(0)1 45 47 02 00 - fax. +33(0)1 45 47 39 79 ; site web www.iftec.fr

INSTITUT IFTEC

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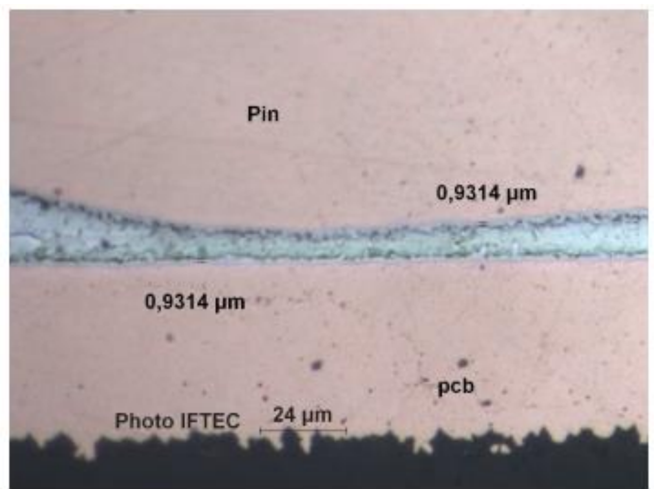

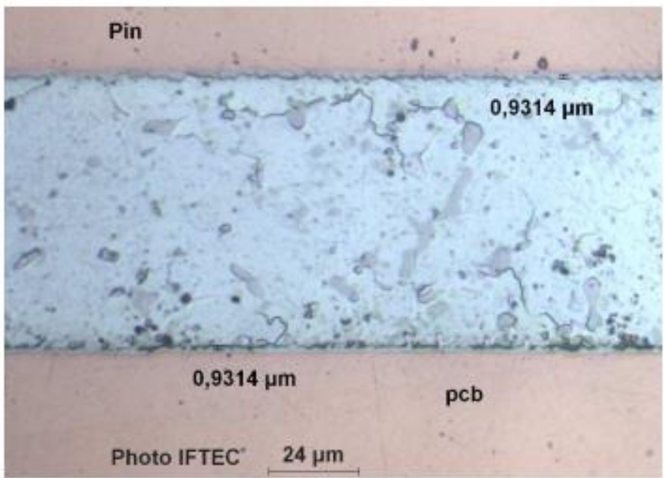

Intermetallic are present along interfaces

Additional information:

Our manufacturing processes have been subjected to FMECA analysis (equivalent of AMDEC in France).

We cannot anticipate any and all conditions and situations under which the information and our products or the combination of both with others will be used. We do not assume any liability in the safety and suitability of our products alone or in combination with others. Users must make their own tests to determine the safety and suitability of each product used alone or with other products for their own use. Except any previous written agreement, our products are sold without guarantee and customers must assume all liability for any loss or damage suffered by themselves or by third parties, either from handling or use of our products alone or with others. In case of any difference or variation seen during the use of the products we request that you contact our technical department.

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