DP 5505

Delphine series

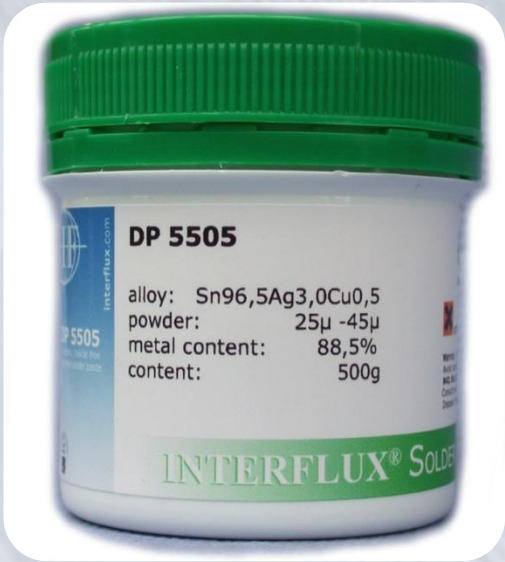
no-clean and lead-free

solder paste

DP 5505 solder paste

Key properties

- Anti hidden pillow defect
- Low voiding chemistry
- High stability
- High moisture resistance
- Suitable for vapour phase soldering
- Long profile capability
- No clean
- Absolute halogen free formulation
- RO/L0 (IPC-JSTD-004A)
- Good cosmetics, clear minimal residue
- Designed to be cleanable with most common cleaning liquids and processes



DP 5505 solder paste

Halogen free L0

SGS

Test Report No. 10134676/08 Date: August 26, 2008 Page 2 of 2

Test Result(s):

Sample Description : Extracted paste Flux of DP5505
Sample Ref/Marking : Paste Flux I

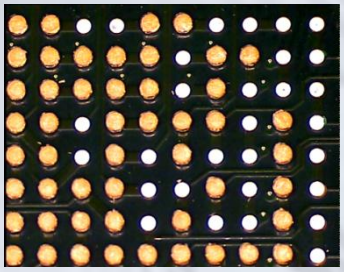
Test item	Result	Detection Limit
Halides, as % Chloride	n.d.	0.01

Note: (1) mg/kg = ppm ; 0.1% = 1000ppm
(2) n.d.= Not Detected (Denoted less than detection limit)
(3) The above reading is based on the solid (non-volatile) portion of the flux.

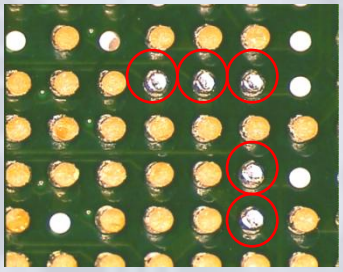
Lab Analyst: Jenny Yip.

DP 5505 solder paste

Hidden pillow (head-in-pillow)

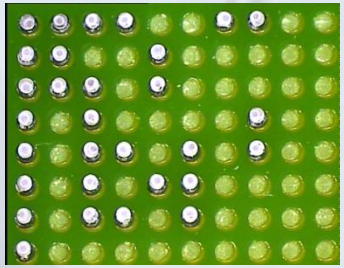


DP 5505 Peel-off BGA-side

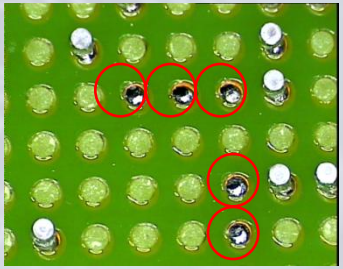


Peel-off BGA-side

Hidden pillow defect



DP 5505 Peel-off PCB-side



Peel-off PCB-side

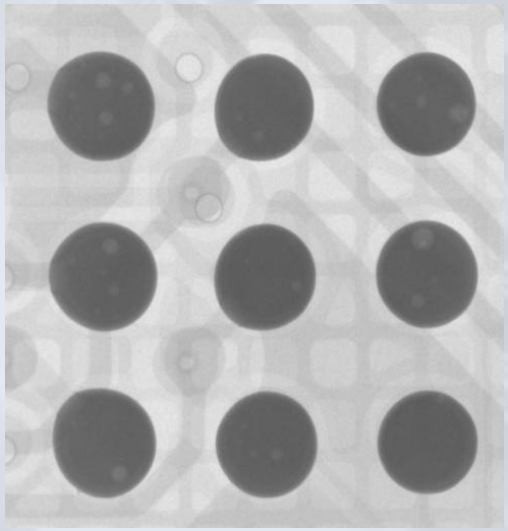
0 hidden pillow defects

161 hidden pillow defects

Parameters	
paste 1:	DP5505 SAC305 Typ3 88,5%
paste 2:	sensitive to hidden pillow
component:	BGA 256 (2x100 pcs)
profile:	Interflux P5 air
test:	peel off test

DP 5505 solder paste

Voiding



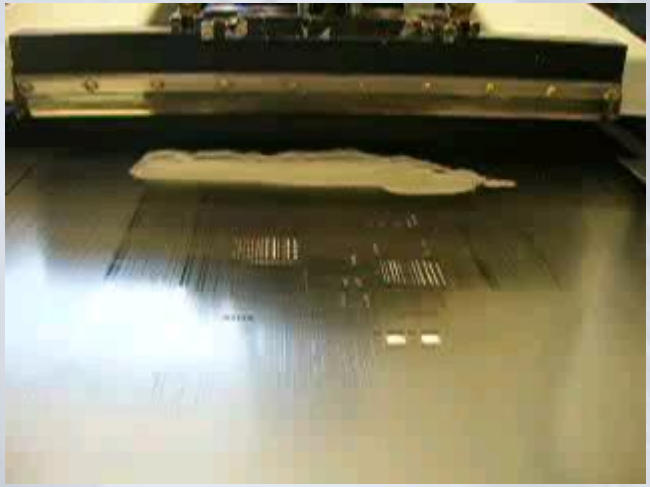
Parameters

paste:	DP5505 SAC305 Typ3 88,5%
component:	BGA 256 (50pcs)
profile:	Interflux P3 air
X-Ray:	Phoenix

- Passes IPC 7095 class 3 requirements (high reliability electronics)

DP 5505 solder paste

Rolling of the paste



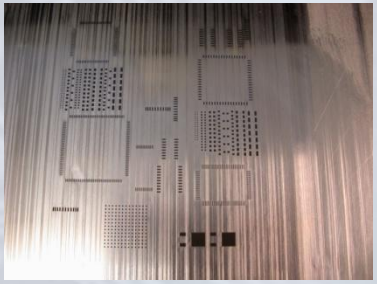
Parameters	
paste:	DP5505 SAC305 Typ3 88,5%
stencil:	150 µm laser cut 10% red.
print speed:	70mm/s
temperature:	22 C
humidity:	53% R.H.

- **Good rolling without kneading**

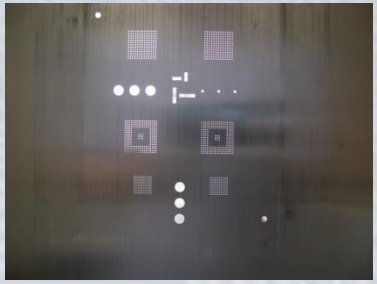
DP 5505 solder paste

Stencil thickness

120 µm µBGA



150 µm standard



200 µm

- Standard stencil thickness of Interflux test boards are 120µm-200µm

DP 5505 solder paste

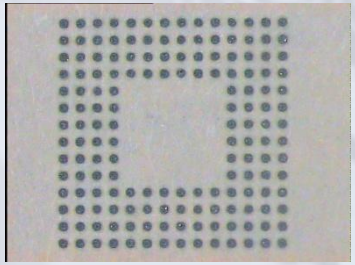
Apertures/pitch

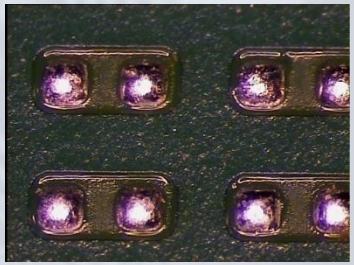
Parameters

paste: DP5505 SAC305 Typ4 88,5%
stencil: µBGA 0,5mm 120µm

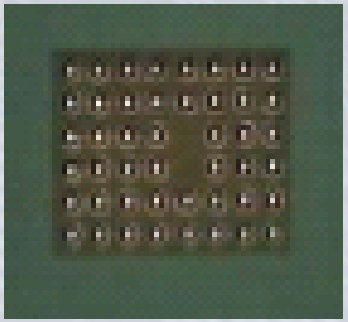
Parameters

paste: DP5505 SAC305 Typ4 88,5%
board: NiAu test board (Jumo)
profile: Jumo nr. 56 245 C 4min N2

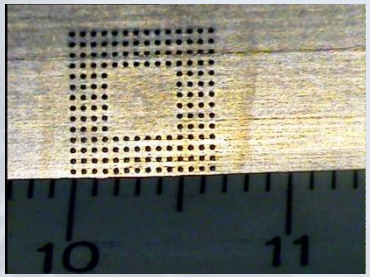




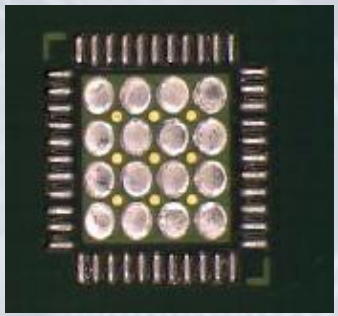
0201



µBGA 0,75 mm



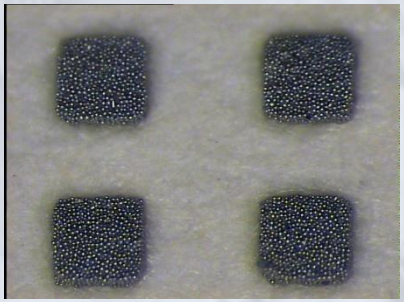
µBGA 0.5 mm



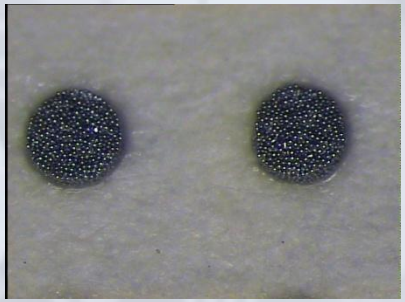
leadless package

DP 5505 solder paste

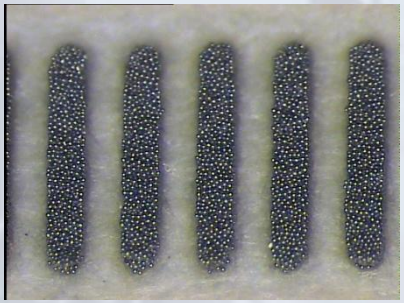
Stencil separation



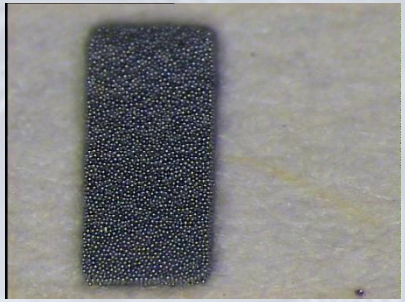
0402



BGA



0,5mm pitch



Large pad

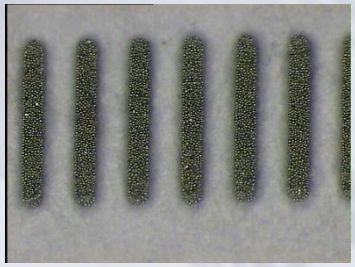
Parameters	
paste:	DP5505 SAC305 Typ3 88,5%
stencil:	150 µm laser cut 10% red
print speed:	70mm/s
temperature:	22 C
humidity:	53% R.H.

- **Clear print definition**
- **No dogearing**

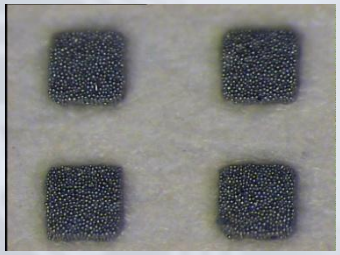
DP 5505 solder paste

Open time / Stencil life

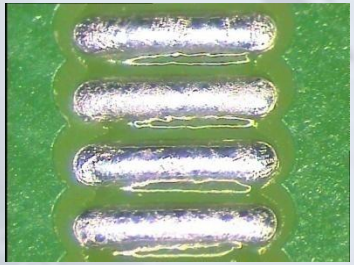
- **8 hrs stencil life**

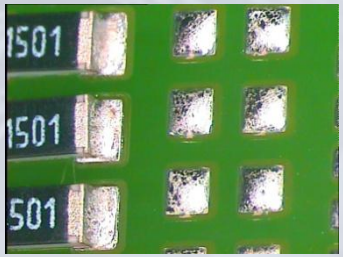


1st print



1st print





Parameters	
paste:	DP5505 SAC305 Typ3 88,5%
stencil:	150 µm laser cut 10% red.
print speed:	70mm/s
profile:	Interflux P2.11 Air
temperature:	24 C
humidity:	53% R.H.

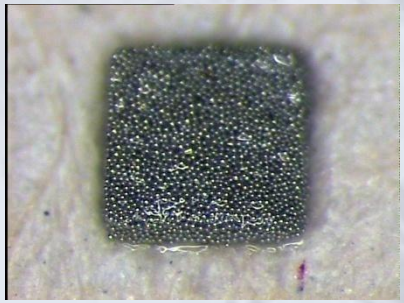
- **Good print definition**
- **Good soldering**

DP 5505 solder paste

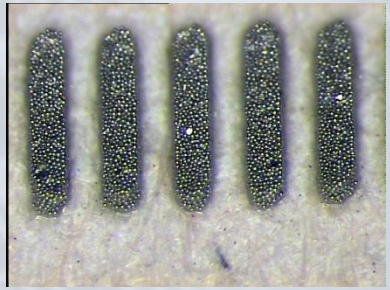
Open cartridge storage time

- **Opened and used jar**
- **3 weeks at room teperature**

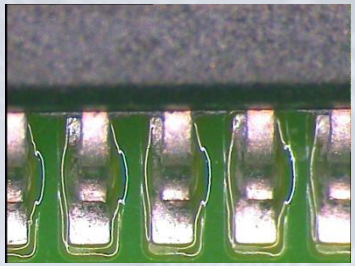
Parameters	
paste:	DP5505 SAC305 Typ3 88,5%
stencil:	150 µm laser cut 10% red.
print speed:	70mm/s
profile:	Interflux P2.11 Air
temperature:	21 C - 24 C
humidity:	50%R.H. - 56%R.H.



1st print



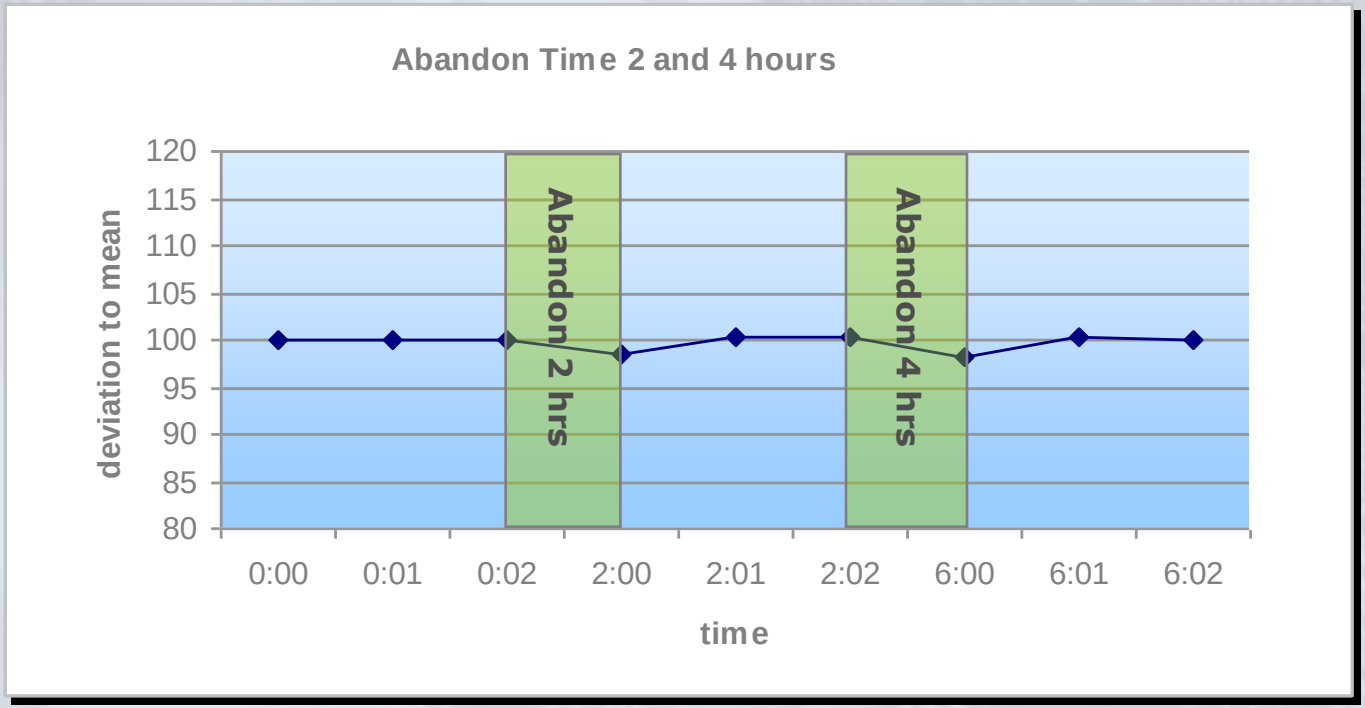
1st print



- **Good printing performance**
- **Good soldering**

DP 5505 solder paste

Abandon time



1st print after 2hrs : ~ 1.55 % mass deviation

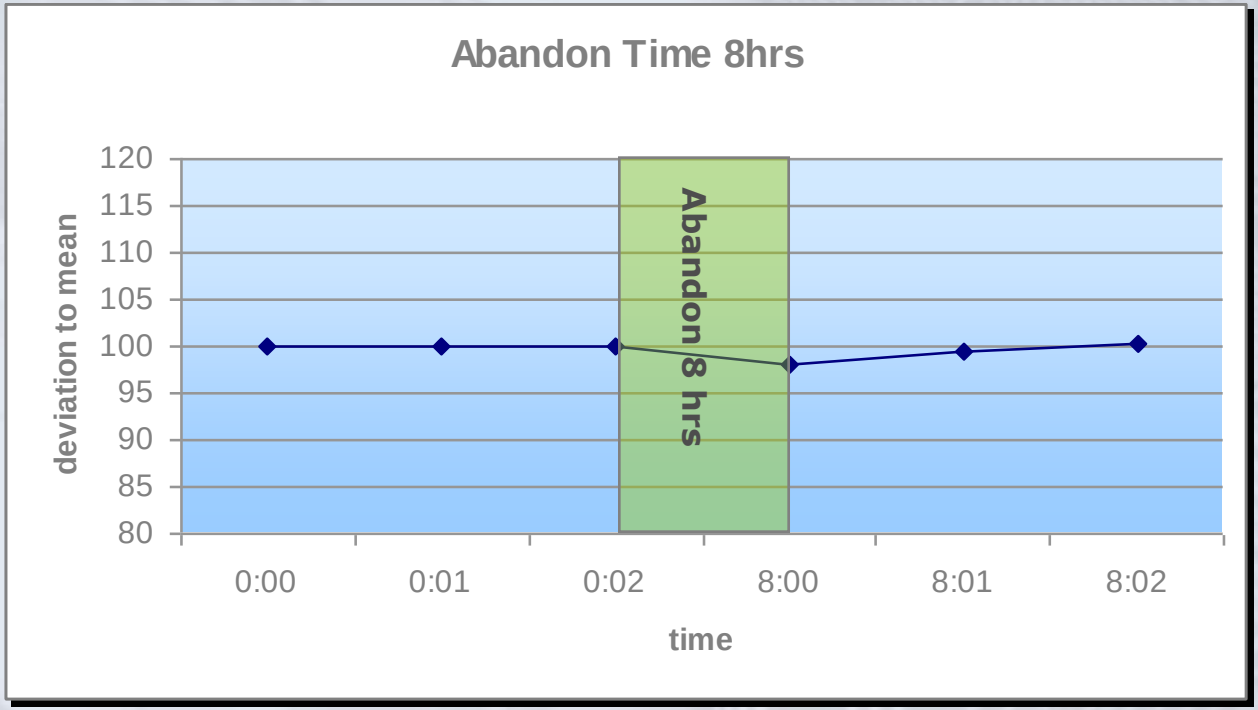
1st print after 4 hrs: ~ 1.72 % mass deviation

Parameters

paste:	DP5505 SAC305 Typ3 88,5%
temperature:	24 C
humidity:	53% R.H.

DP 5505 solder paste

Abandon time



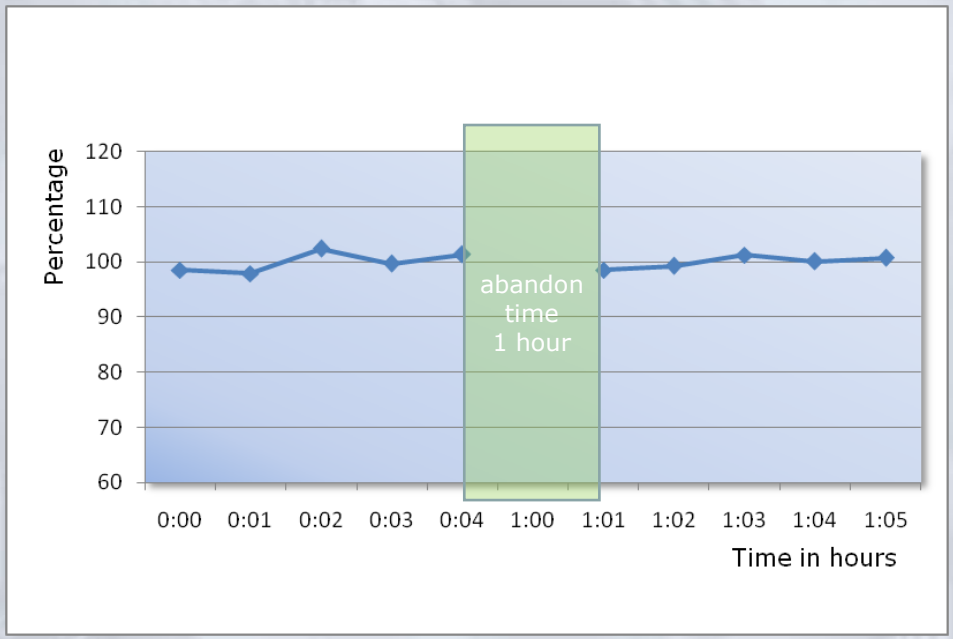
1st print after 8hrs : ~ 1.87 % mass deviation

Parameters

paste:	DP5505 SAC305 Typ3 88,5%
temperature:	24 C
humidity:	53% R.H.

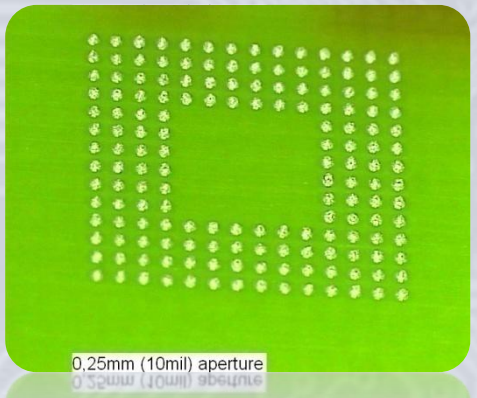
DP 5505 solder paste

Ultra fine pitch capability



Parameters

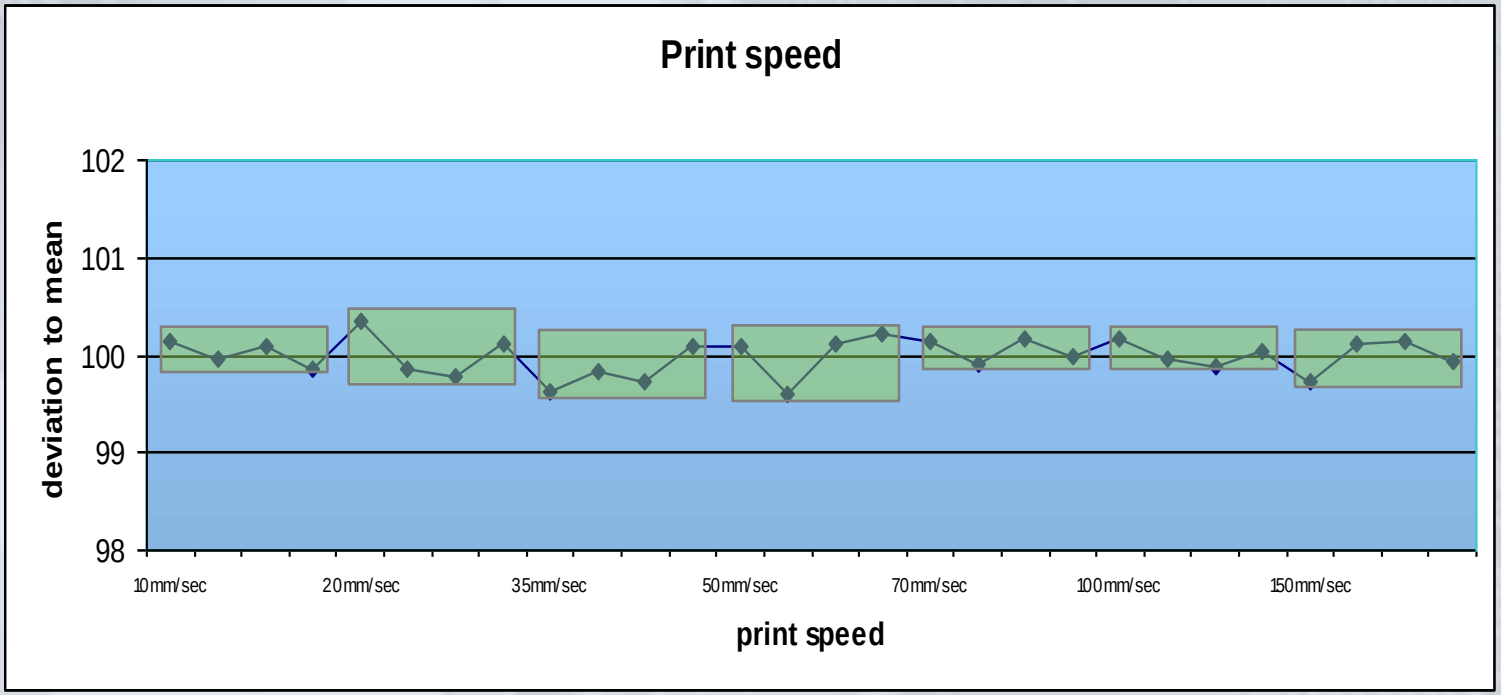
paste:	DP5505 SAC305 Typ3 88,5%
stencil:	120µm laser cut µBGA 0,5mm
temperature:	22 C
humidity:	55% R.H.



- **< 3% mass deviation**

DP 5505 solder paste

Print speed range



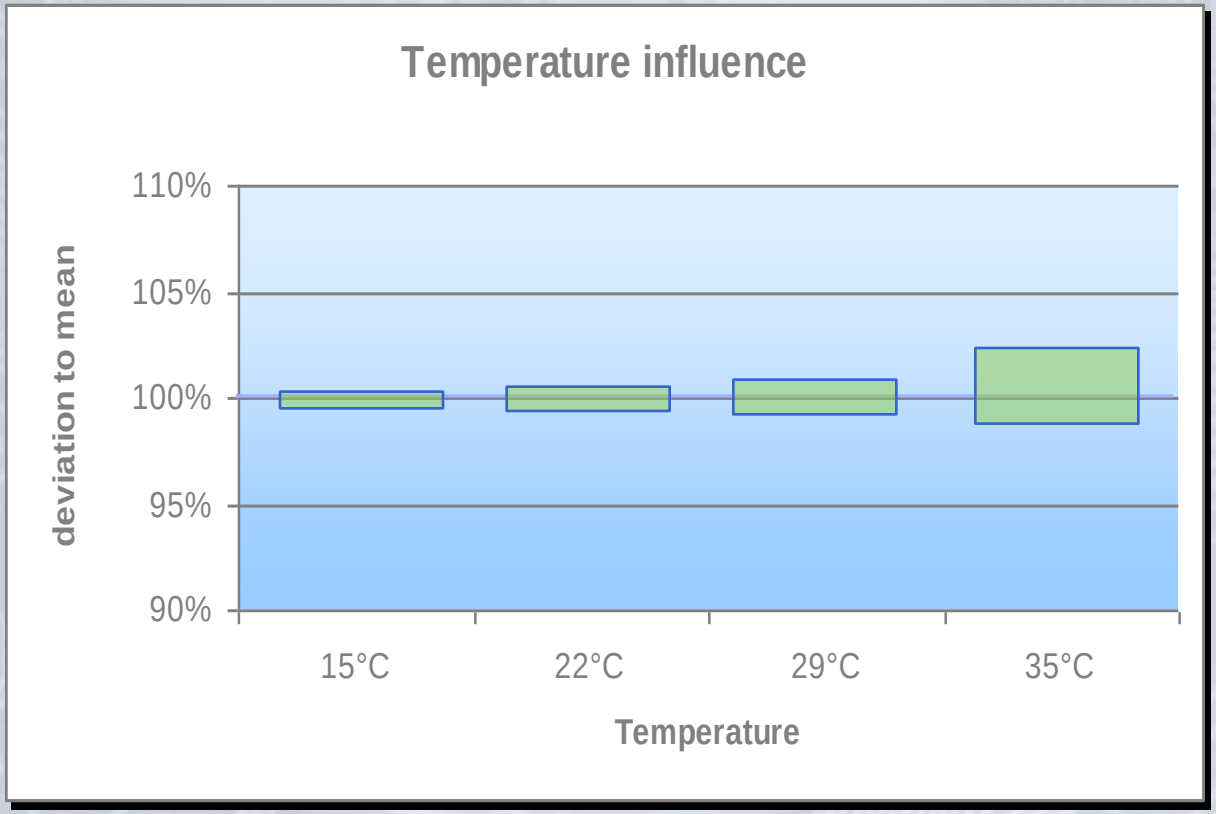
- 10mm/s: < 0,2% mass deviation
- 20mm/s: < 0,4% mass deviation
- 35mm/s < 0,4% mass deviation
- 50mm/s < 0,2% mass deviation
- 70mm/s: < 0,2% mass deviation
- 100mm/s < 0.2% mass deviation
- 150 mm/s < 0,4% mass deviation

Parameters

paste:	DP5505 SAC305 Typ3 88,5%
stencil:	150 µm laser 10% red.
print speed:	variable
temperature:	24 C
humidity:	53% R.H.

DP 5505 solder paste

Temperature range



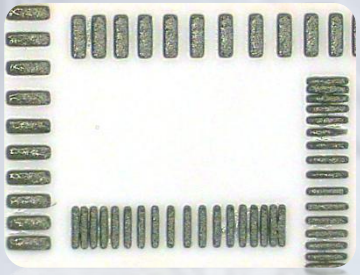
Parameters

paste: DP5505 SAC305 Typ3 88,5%
stencil: 150µm laser cut 10% red.
speed: 70mm/s
temp.: 15 C-22 C -29 C-35 C

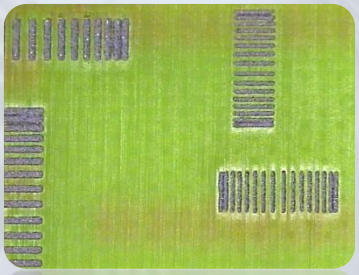
- **15 C : < 0,6 % mass deviation**
- **22 C : < 0,8% mass deviation**
- **29 C : < 1,5% mass deviation**
- **35 C : < 4% mass deviation**

DP 5505 solder paste

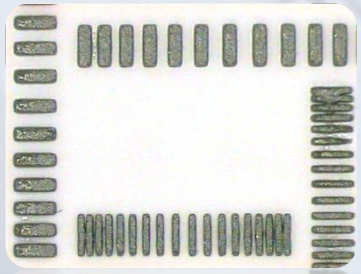
Bridging/slump



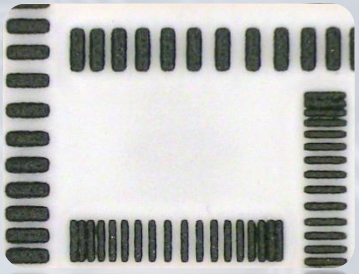
pre slump
pattern A-21



Hot slump: pass
pattern A-20



Cold slump: pass
pattern A-21



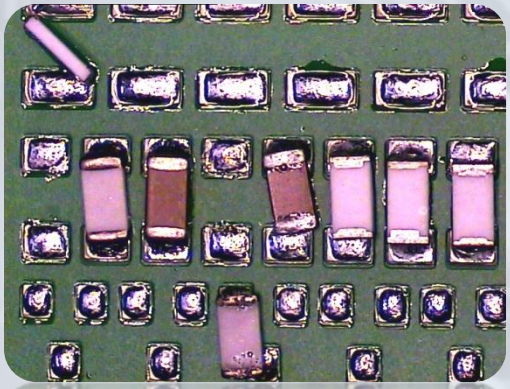
Hot slump: pass
pattern A-21

Parameters

paste:	DP5505 SAC305 Typ3 88,5%
test:	IPC J-STD-005 TM-650 2.4.35
temperature:	22 C / 150 C
humidity:	52% R.H.

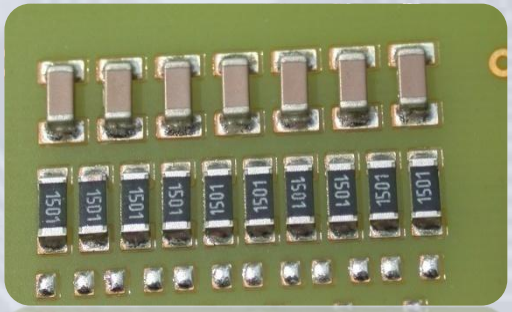
DP 5505 solder paste

High humidity resistance



A paste suffering from humidity resulting in displaced components after 4 hrs @ 26 C-96 R.H. prior to reflow

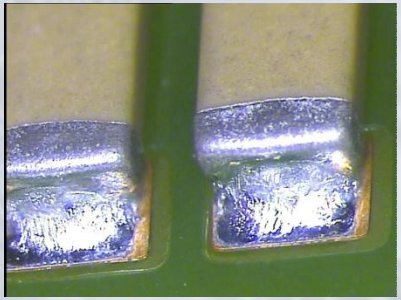
Parameters	
paste:	DP5505 SAC305 Typ3 88,5%
test:	4h high humidity test
temperature:	26 C
humidity:	96% R.H.
profile:	Interflux P3 Air



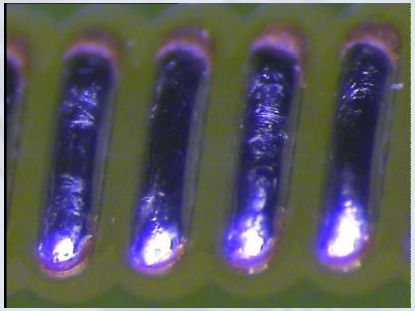
DP 5505: no displaced components or spatter

DP 5505 solder paste

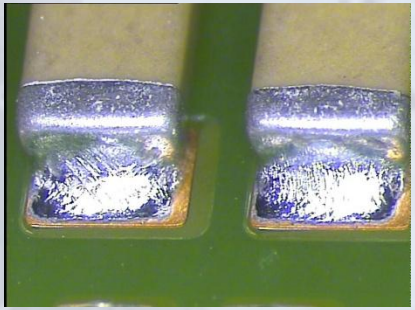
Low humidity resistance



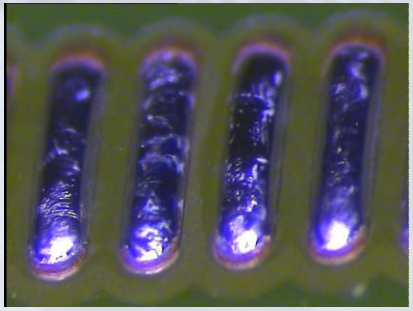
1206 after 4h



Fine pitch pattern after 4h



1206 after 24h

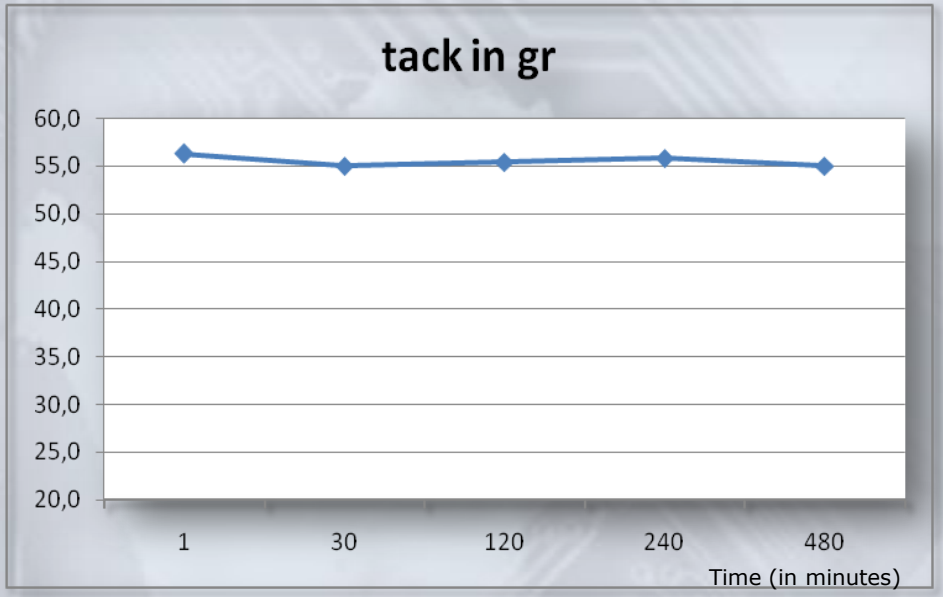


Fine pitch pattern after 24h

Parameters	
paste:	DP5505 SAC305 Typ3 88,5%
test:	24h low humidity test
temperature:	25 C
humidity:	27% R.H.
Board:	Interflux standard Cu OSP
Profile:	Interflux P2.11 Air

DP 5505 solder paste

Solder paste tack



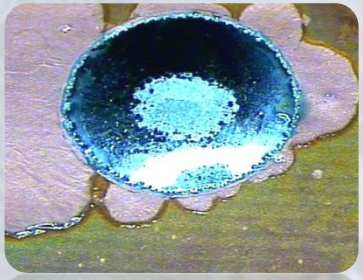
Parameters

paste:	DP5505 SAC305 Typ3 88,5%
test:	IPC J-STD-005 and TM-650 2.4.44
temperature:	25+/-2 C
humidity:	50% R.H. 10%

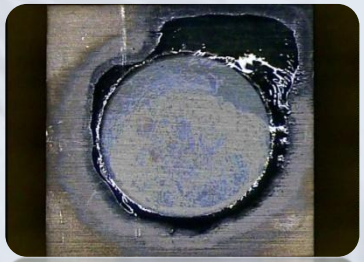
- **< 3% over 8hours**

DP 5505 solder paste

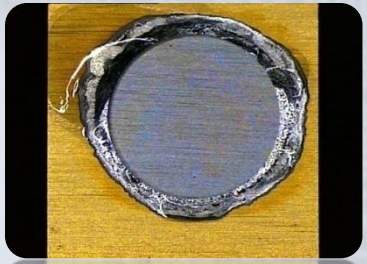
Wetting



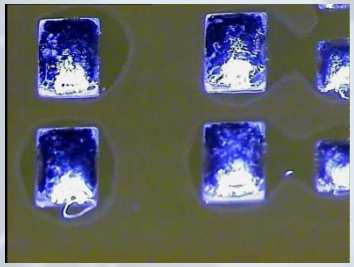
Wetting on Cu

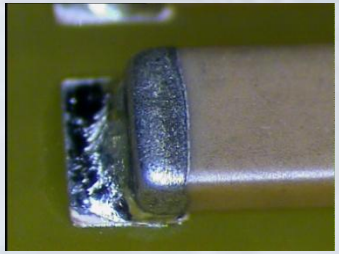


Wetting on I-Sn



Wetting on NiAu





Wetting on I-Ag > 6 months

Parameters

paste:	DP5505 SAC305 Typ3 88,5%
profile:	Interflux P2.11 Air

DP 5505 solder paste

Solder balling

result: pass as preferred
15 min

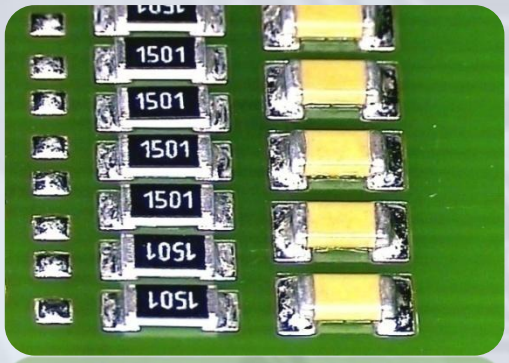
Parameters

paste:	DP5505 SAC305 Typ3 88,5%
test	IPC J-STD-005 TM-650 2.4.34
stencil:	200 µm laser cut stainless steel
temperature:	22 C
humidity:	53% R.H.

result: pass as preferred
4 hours

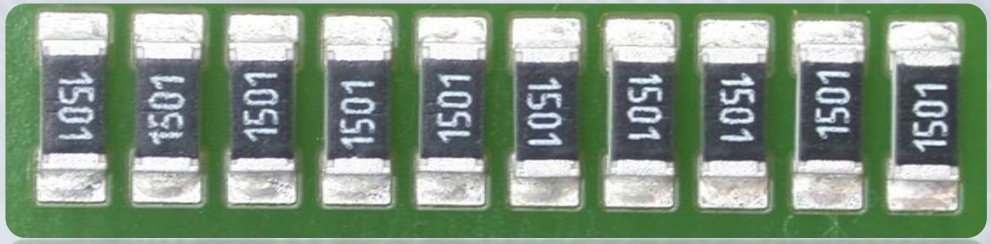
DP 5505 solder paste

Solder beading



Parameters	
paste:	DP5505 SAC305 Typ3 88,5%
stencil:	150 µm laser cut 0% red.
print speed:	70mm/s
profile:	Interflux P3 profile air
temperature:	22 C
humidity:	55% R.H.

- **No solder beading**



DP 5505 solder paste

PIP / PIH

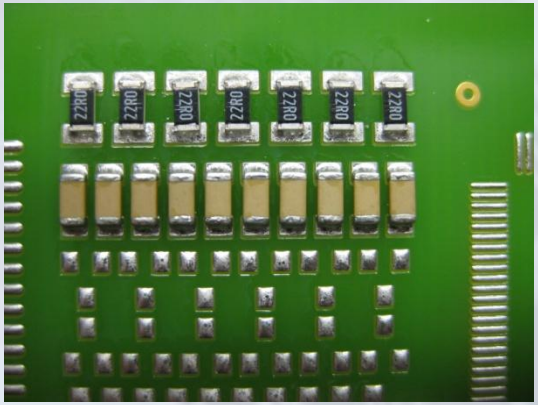
Parameters

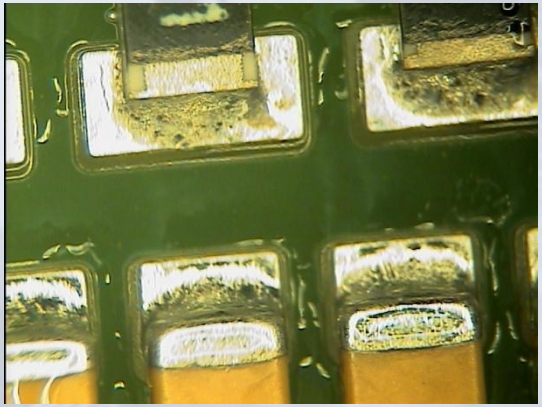
paste:	DP5505 SAC305 Typ3 88,5%
temperature:	24 C
humidity:	53% R.H.
Profile:	Interflux P2.11 Air

- **Good hole filling**
- **No dropping of the paste**
- **Good soldering**

DP 5505 solder paste

Vapour phase



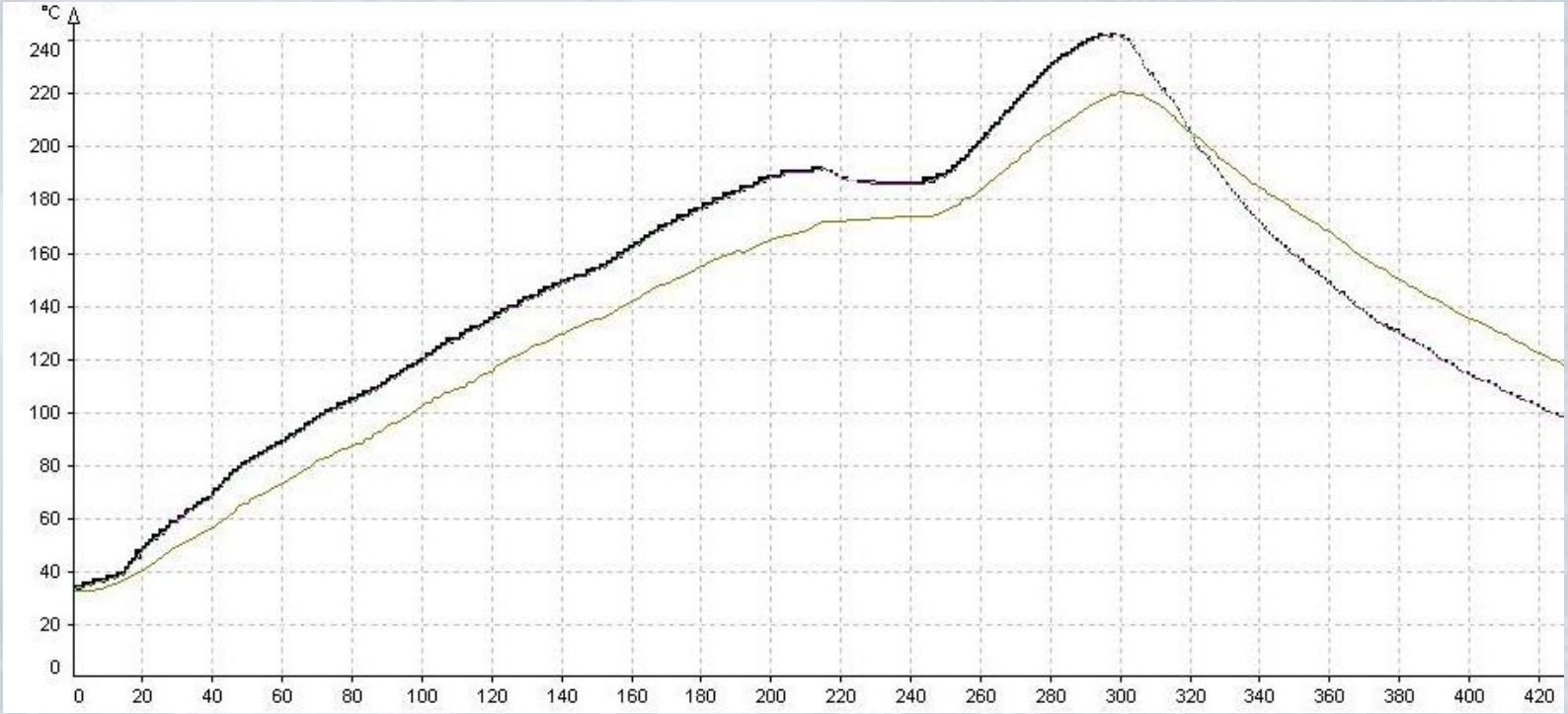


Parameters

paste:	DP5505 SAC305 Typ3 88,5%
board:	Interflux standard NiAu
machine:	Exmore VS500 vapor phase
liquid:	Galden LS230
temperature:	230 C

DP 5505 solder paste

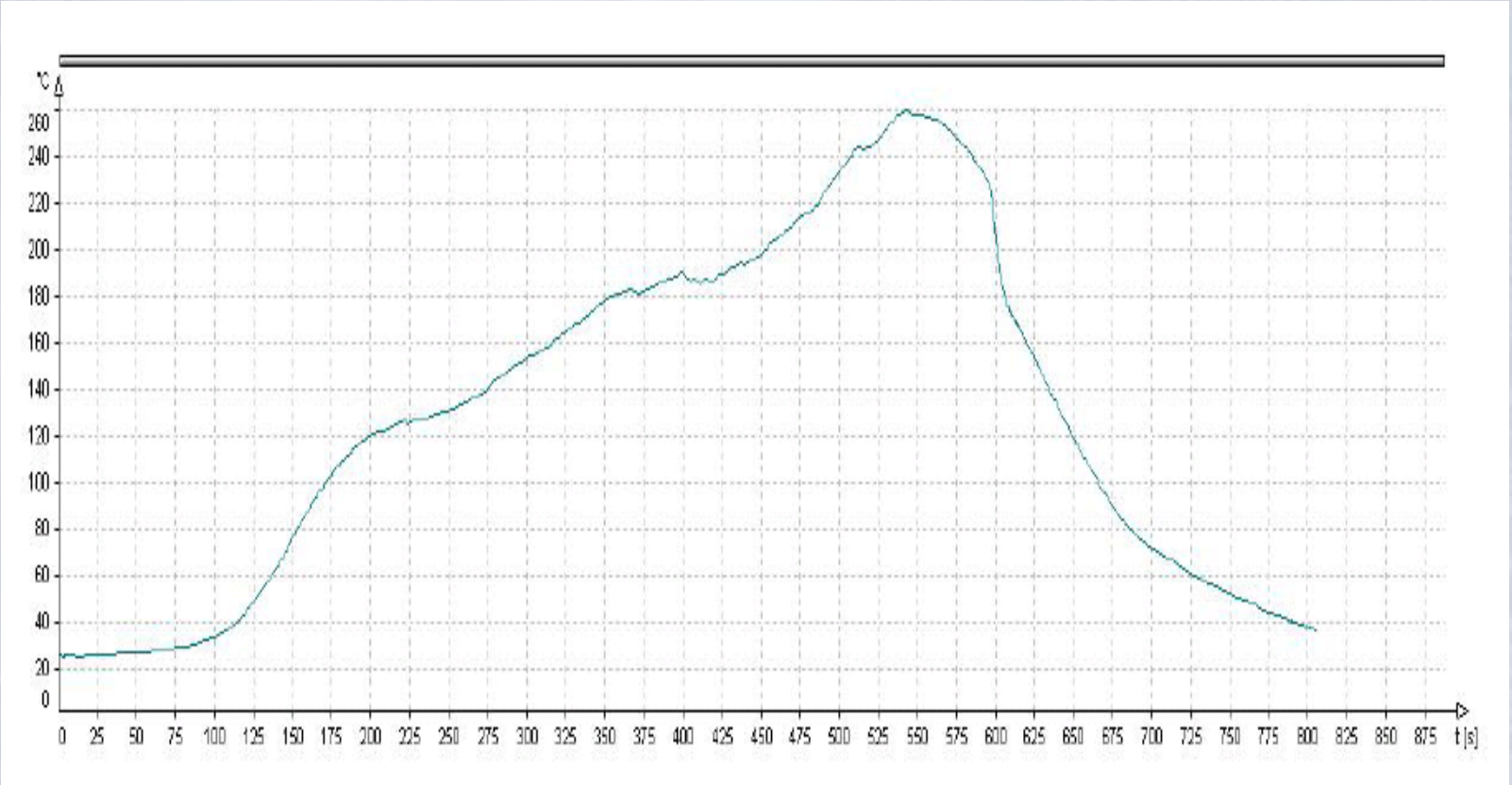
Profiles



- **Interflux P2.11 5 min 240°C: ~ medium range profile**

DP 5505 solder paste

Profiles



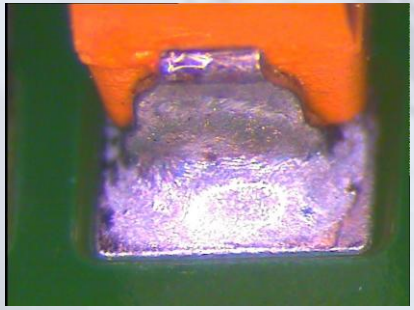
- **Interflux P5 7,5 min 260°C ~ Jedec 20D high profile**

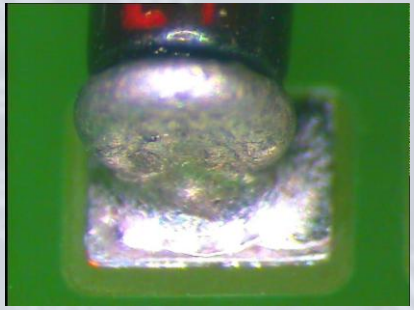
DP 5505 solder paste

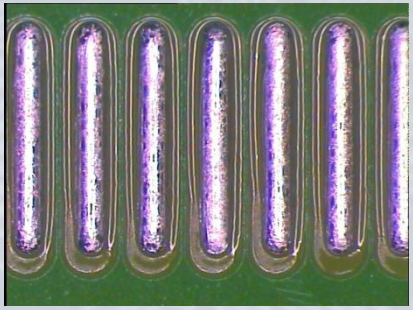
Profiles

Parameters

paste:	DP5505 SAC305 Typ3 88,5%
board:	Interflux standard NiAu
profile:	Interflux P5 air

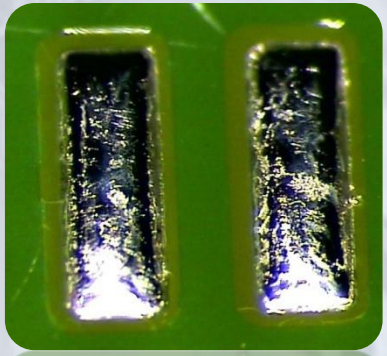


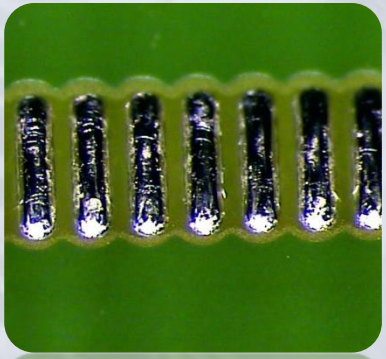


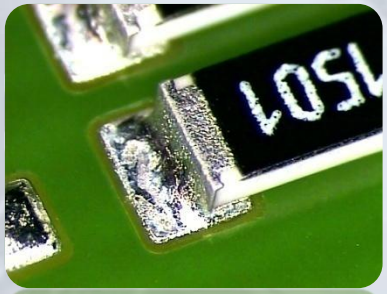


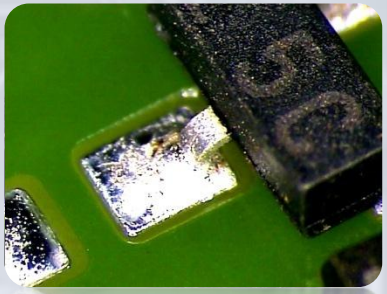
DP 5505 solder paste

Residues









Parameters

Paste:	DP5505 SAC305 Typ3 88,5%
profile:	Interflux P2.11 air

- Low residue
- Clear residue
- Pin testable
- 56,55% of originally deposited volume of flux

DP 5505 solder paste

Cleaning process

Solder Paste (unsoldered): We recommend the following cleaning agents

Interflux Solder Paste	VIGON®			ZESTRON®		ATRON®
	SC 200	SC 202	SC 400 *	SD 300	SD 301	SP 200
Interflux Delphine 5502	+	+	+	+	+	+
Interflux Delphine 5503	+	+	+	+	+	+
Interflux Delphine 5503/2	+	+	+	+	+	+
Interflux Delphine 5504	+	+	+	+	+	+
Interflux DP 5505	+	+	+	+	+	+
Interflux IF 9002	+	+	+	+	+	+
Interflux IF 9007'	+	+	+	+	+	+
Interflux IF 9009 LT	+	+	+	+	+	+
Interflux NX 9900 i	+	+	+	+	+	+

The results were obtained under the following conditions:

Spray-in-air process in stencil cleaning equipment

+	Easily removable with standard process parameters
o	Remove able with process optimisation (e.g. with additives and/or longer cleaning time) or other ZESTRON cleaning agents
-	Difficult to remove with this cleaning agent, process optimisation necessary
n	not tested yet

Process Parameters (depending on cleaning application): 2-10 minutes at 20-50°C/ 68-122°F

- **For stencil cleaning Interflux ISC8020 is recommended**

DP 5505 solder paste

Cleaning process

Solder Paste (reflowed): We recommend the following cleaning agents

Interflux Solder Paste	VIGON® A 200	VIGON® A 250	VIGON® A 300	VIGON® US	VIGON® SC 202	ZESTRON® FA+	ZESTRON® VD	ATRON® AC 205
Interflux Delphine 5502	+	n	+	0	0	+	+	n
Interflux Delphine 5503	+	n	+	0	0	+	+	n
Interflux Delphine 5503/2	+	+	0	0	+	+	0	+
Interflux Delphine 5504	0	0	0	0	0	+	0	0
Interflux DP 5505	0	0	+	0	0	+	0	0
Interflux IF 9002	+	n	+	+	-	+	-	n
Interflux IF 9007'	0	n	+	+	0	0	n	n
Interflux IF 9009 LT	+	n	+	+	+	+	+	n
Interflux NX 9900 i	+	n	+	+	0	+	n	n

The results were obtained under the following conditions:

Spray-in-air cleaning process (VIGON® A 200, VIGON® A 250, VIGON® A 300, VIGON® SC 202, ATRON® AC 205) or Ultrasonic cleaning process (ZESTRON® FA+, ZESTRON® VD, VIGON® US)

Maintenance cleaning of Interflux products

- For the cleaning of condensation traps of reflow ovens we recommend ATRON® SP 200
- For the manual cleaning of reflow ovens we recommend VIGON® RC 101
- For the manual removal of residues from solder pastes we recommend VIGON® EFM

+	Easily removable with standard process parameters
o	Remove able with process optimisation (e.g. with additives and/or longer cleaning time) or other ZESTRON cleaning agents
-	Difficult to remove with this cleaning agent, process optimisation necessary
n	not tested yet

Process Parameters (depending on cleaning application): 2-10 minutes at 20-50°C/ 68-122°F

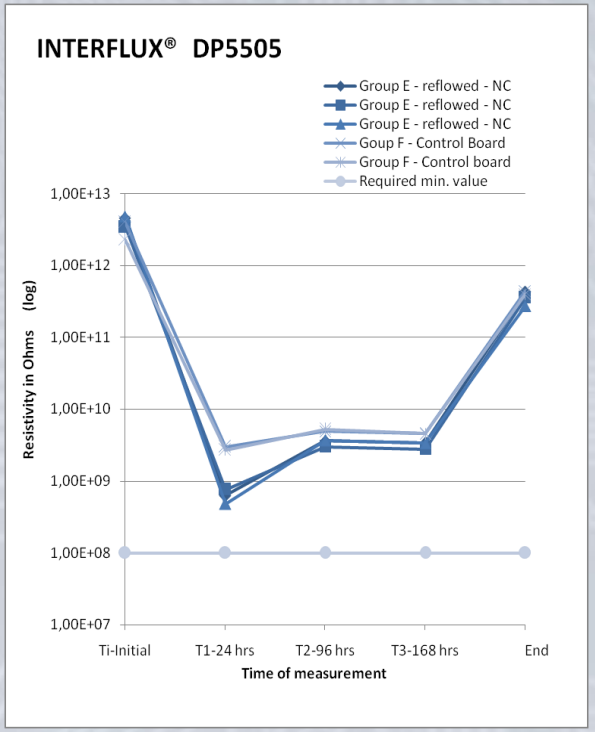
DP 5505 solder paste

Reliability Data / SIR

Electrical properties (details)

DP 5505 boards (group E)			Control boards (group F)		
Board 1			Board1		
Pattern	T1	$6{,}23 \times 10^{08}\ \Omega$		Ti	$3{,}96 \times 10^{12}\ \Omega$
	T3	$9{,}86 \times 10^{08}\ \Omega$		T1	$3{,}01 \times 10^{09}\ \Omega$
				T3	$2{,}72 \times 10^{09}\ \Omega$
Board 2			Board2		
Pattern	T1	$7{,}54 \times 10^{08}\ \Omega$		Ti	$2{,}28 \times 10^{12}\ \Omega$
	T3	$1{,}18 \times 10^{09}\ \Omega$		T1	$2{,}70 \times 10^{09}\ \Omega$
				T3	$2{,}16 \times 10^{09}\ \Omega$
Board 3					
Pattern	T1	$4{,}82 \times 10^{08}\ \Omega$			
	T3	$5{,}32 \times 10^{08}\ \Omega$			

Ti pattern initial measurements
T1 pattern measurements after 24 hours
T3 pattern measurements after 168 hours



Parameters

paste:	DP5505 SAC305 Typ3 88,5%
test:	IPC J-STD-005 and TM-650 2.6.33
temperature:	85 C
humidity:	85%
time:	168 hrs

DP 5505 solder paste

Chemical Data

Test		
• **Copper Mirror**	IPC-J-STD-004	2.3.32
• **Viscosity**	IPC-TM-650	2.4.34
• **Classification**	IPC-J-STD-004A	
• **Halide Content**	IPC-TM-650	2.3.28.1
• **Halide Content**	IPC-TM-650	2.3.35

Result

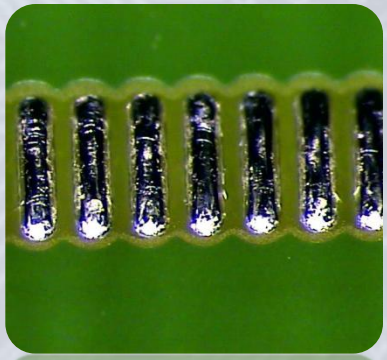
- **Pass**
- **800.000cPs**
- **RO L0**
- **N.D. (None Detected)**
- **Pass**

Quality Control

Solder paste quality control

- A quality test is carried out on every single batch before shipping.

  - Viscosity
  - Solderball test
  - Reflow test
  - Metal content test



DP 5505 solder paste

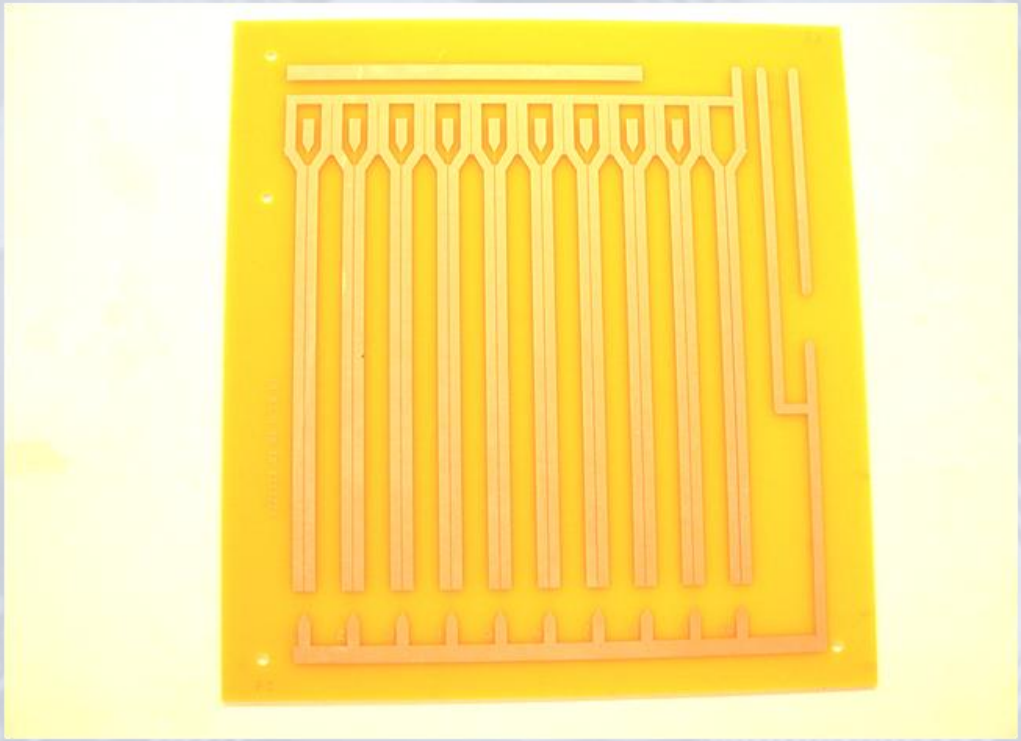
Other properties

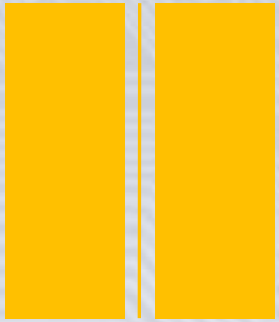
- Traceability guaranteed (batch number)
- Shelf life 9 months
- Availability in jars, cartridges, syringes and Proflow™ cassette
- Also available in **SnPb-alloys**

DP 5505 solder paste

Reliability Data / Test BONO

Purpose of the test is to create a very sensitive situation where the interaction of all fluxes can be measured. It uses a very fine Cu structure from a built up process. The test is designed that if the test would continue, all fluxes and solder pastes would fail in the end.



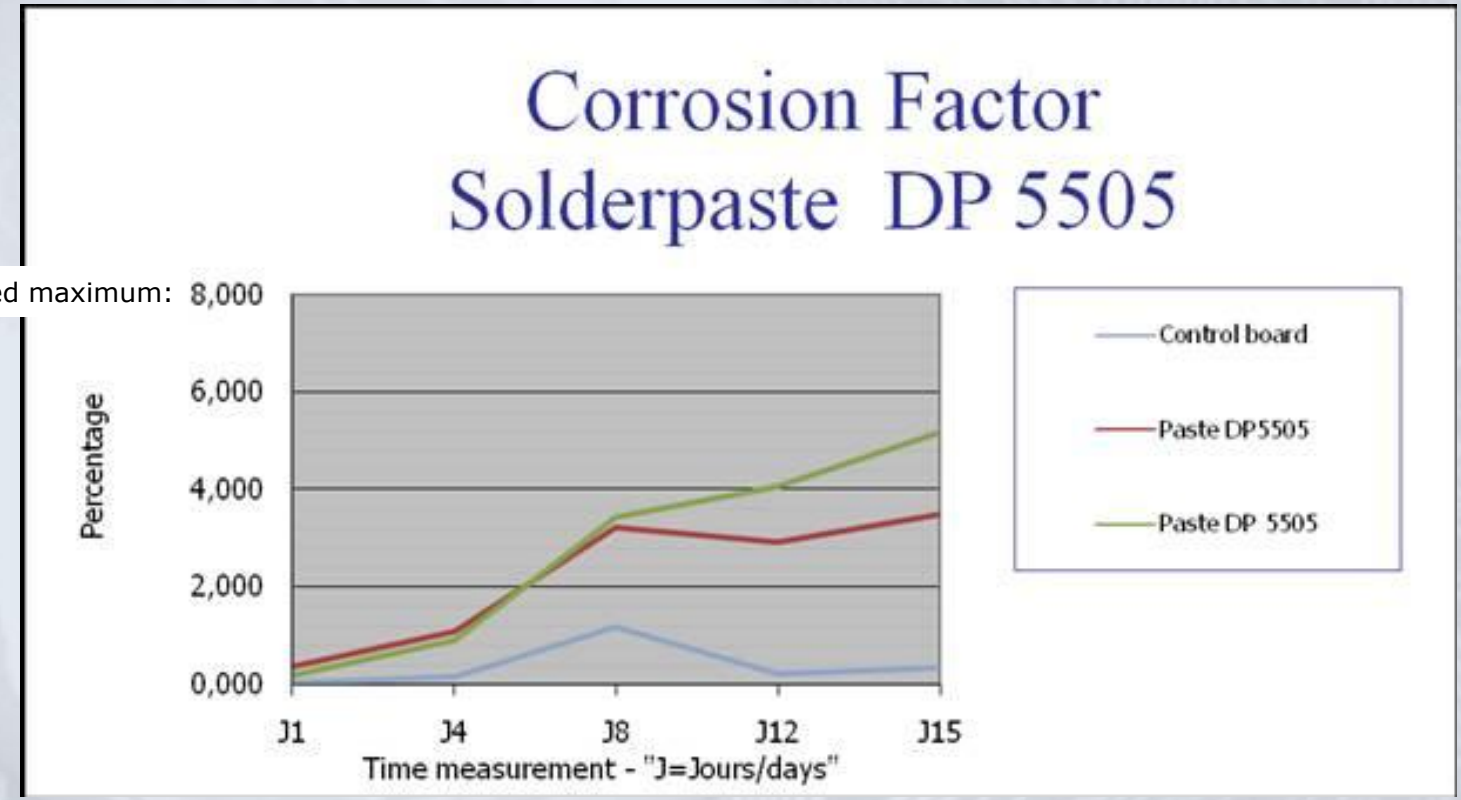


Reliability Data / Test BONO

- In between to wide cathodes, there is a very fine anode of 9µm by 75µm. The resistance of the track is about 3 Ohms
- - Solder paste is printed on the cathodes
  - Reflow profile
  - Residues must flow out over the anode
- One untreated control board runs with the processed boards
- After 2 hours at 25°C and 50% R.H. the atmosphere is changed to 85°C and 85% R.H.
- After 16hrs of stabilisation, the initial resistances (Ro) of the anodes are measured
- A Bias Voltage of 20VDC is applied for 15 days
- The resistances of the anodes (Rj) are measured with 11V DC at 24, 96, 168, 288 and 360 hrs
- A corrosion factor is calculated: F_c : (Rj-Ro) / Ro x 100
- The corrosion factor must be **< 8%**

DP 5505 solder paste

Reliability Data / Test BONO



Why absolutely halogen free ?

What is absolutely halogen free?

→ 0 ppm = absolutely halogen free

→ "L0" allows 500 ppm halogens : IPC J-STD-004A (2004)

→ "L0" allows 100 ppm halogens: EN 61190-1-2 (2002)

L0 is no guarantee for chemical reliability

→ Detecting halides in ppm levels is possible but no easy/quick test exists

→ Customer depends on the information provided by the manufacturer.

Why absolutely halogen free ?

What is chemical reliability?

- The residues and reaction products of the soldering process cannot influence the functionality of the electronic circuit.

What can go wrong?

Electromigration

- Drop of the Surface Insulation Resistance (SIR)
- Leakage currents
- Corrosion/Pickling (Removal of surface metal)
- Electro migration (metal atoms are disolved and deposited somewhere else)

Why absolutely halogen free ?

The reaction products

- The surfaces that have to be soldered have to be free from oxides. The flux does this job.
- A flux with halogens (Cl,Br,F,…) reacts with the metal and produces metal salts. The water solubility of these metal salts can be very high.

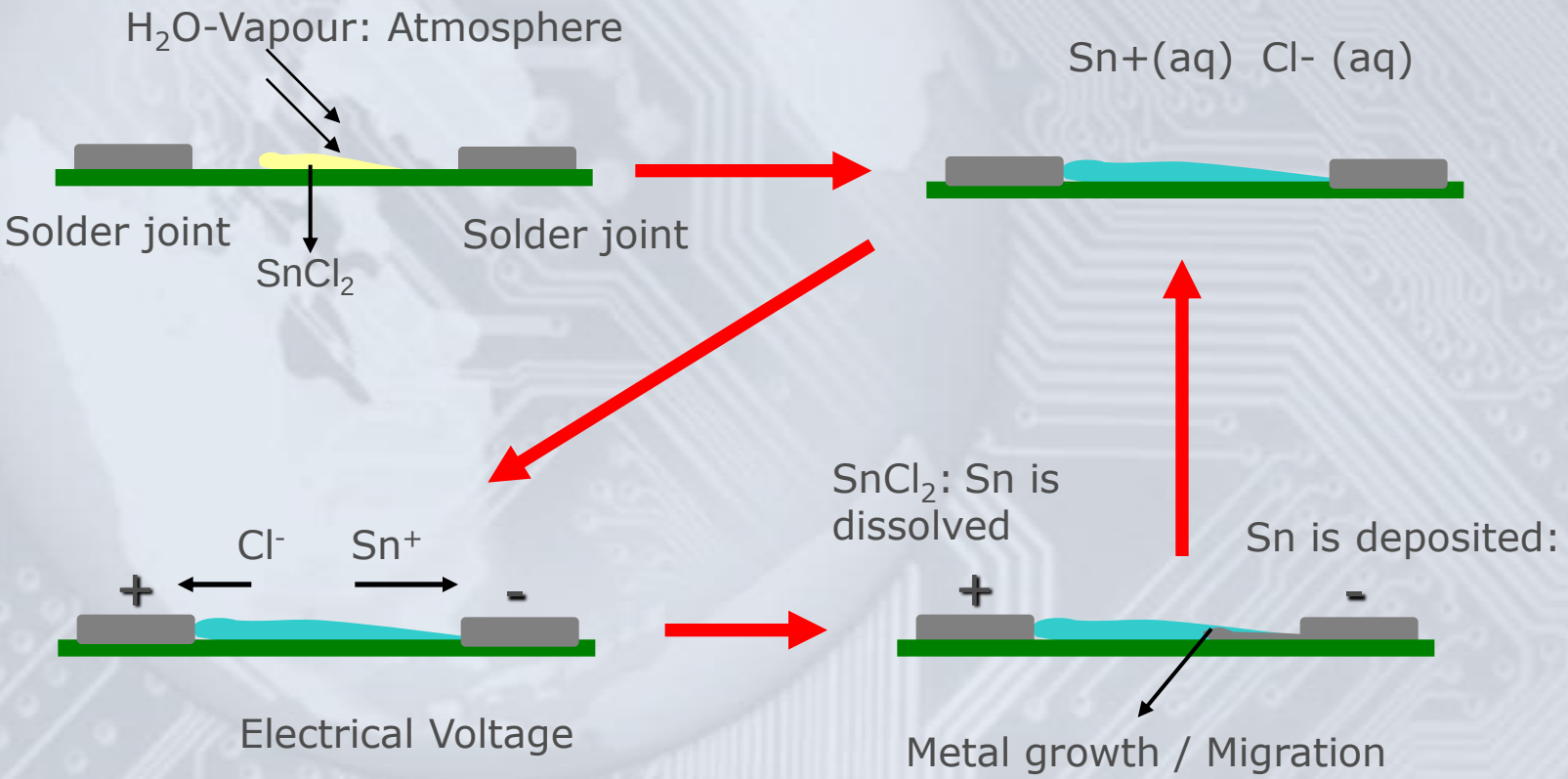
→ SnO + 2Cl- → SnCl2 + O-

- The reaction products of a flux without halogens, when designed well,will produce reaction products that have very low water solubility.

Why absolutely halogen free ?

What can happen with the halogenated metal salts ?

Standard electrolytical process or electro migration



Why absolutely halogen free ?

What are the parameters ?

- Atmospherical Conditions: Temperature, Moisture
- **Water solubility of the reaction products**
- Protection capacity of the body (Rosin/ Resin,…)
- ON/OFF - Frequency (Fatigue properties of the body)

Why absolutely halogen free ?

What is the difference between lead-free alloys and SnPb?

Metal salt	Chemical designation	Solubility in cold water (g/100cc)
Lead chloride	$PbCl_2$	0,99
Copper chloride	$CuCl_2$	70,6
Silver chloride	AgCl	$89x10^{-6}$
Tin chloride	$SnCl_2$	83,9

Water Solubility of the metal salts

- The water solubility of the metal salts is an indicator for corrosion/migration sensitivity.
- High Sn-content has the largest influence
- The metal salts formed between SnAgCu and Cl are theoretically about 50% more water soluble than the SnPb-salts.

Why absolutely halogen free ?

How to predict corrosion?

- Standard corrosion tests give no guarantee for corrosion safety.

- Corrosion tests under static conditions (e.g. 85 C,85% r.h.) Don't take into acount fatigue mechanismes of the body (cracking of the Rosin/Resin) who protect the reaction products from the atmosphere.

- Standard corrosion tests don't take into acount unused soldering chemistry. (e.g.. selective soldering, selective soldering carriers, …)

- Automotive, Siemens and others have developed their own corrosion tests

Absolutely halogen free soldering chemistry is the safest way!