

ECO SOLDER®

High performance Pb Free Solder paste improving wettability
for poor parts and fine pitch application

M731-GWS



SENJU METAL INDUSTRY CO.,LTD

M731-GWS

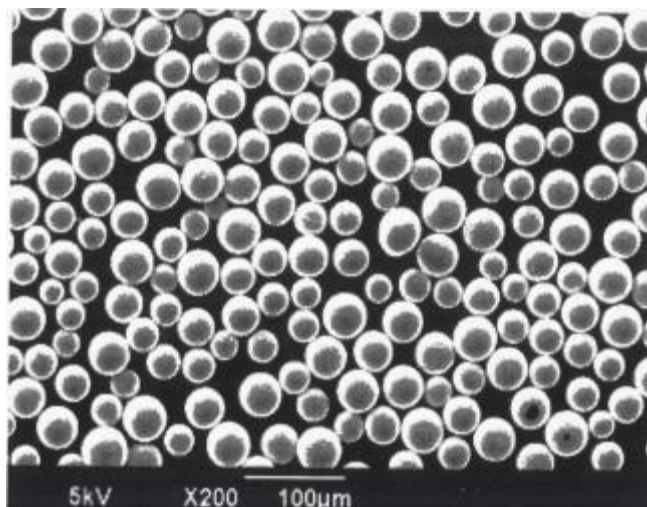
Ecosolder paste M731-GWS has high endurance on high temp & long preheat time and good printability for fine pitch application and also it is improved wettability for bad plated electrode. In addition, this paste prevent bubbling shape flux residue caused by void control effect and gas from substrate (it is often find on paper substrate) and achieve high finished quality.

This paste has general versatility such as prevent increasing viscosity, prevent side ball issue , high reliability and color of flux residue &crack.

M731 Alloy Characteristics

		M731	M705
Alloy composition (%)		Sn-3.9Ag-0.6Cu-3.0Sb	Sn-3.0Ag-0.5Cu
Specific gravity		7.4	7.4
Melting Temperature (°C)	Solid line	221	217
	Liquid line	226	220
Tensile strength (Mpa)		57.9	53.3
Elongation (%)		48	56
Young modulus (GPa)		50.1	46.9
0.2% Pressure strength (MPa)		37.1	37.4
Coefficient of thermal expansion (ppm/°C)		21.7	21.7
Vickers Hardness (Hv)		20.0	17.9

SEM micrograph of M731 Powder



Powder particular surface is less oxidized and spherical in shape. M731 powder is used for all our lead free solder paste, Eco Solder Paste

M731-GWS Properties

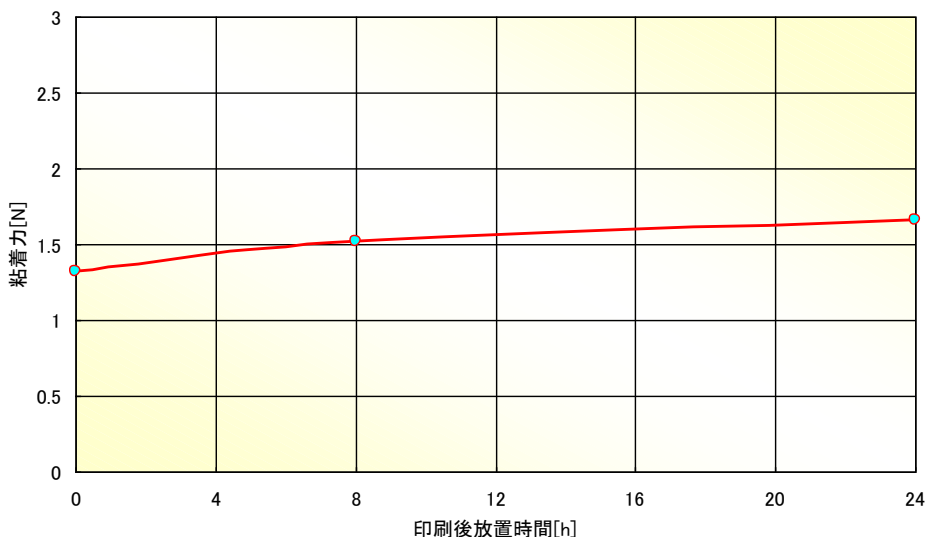
Items	M731-GWS	Test Methods
Powder		
Alloy composition	Ag3.9-Sb3.0-Cu0.6-Sn	— — —
Melting temperature	221~226°C	DSC
Powder shape	spherical	SEM
Powder grain size	T8J: 25~45um T7K: 20~38um	SEM & laser diffraction
Flux		
Flux components	RO	J-STD-004
Activity	M1	J-STD-004
Halogen content	0.00%/Flux	Potentiometric Titration Method
Surface insulation resistance (40°C90%RH, after 168hrs)	Above 1.0E+12	JIS Z 3197
Voltage-applied moisture resistance test (85°C85%RH, applied voltage DC45V, after 1000hrs)	Above 1.0E+10 No migration	JIS Z 3197
Copper mirror test	Passed	JIS Z 3197
Fluoride test	Passed	JIS Z 3197
Solder Paste		
Viscosity	200 Pa.s	JIS Z 3284
Thixotropic index	0.6	JIS Z 3284
Flux content	T8J: 11.5% T7K: 12.0%	JIS Z 3197
Hot slump	Below 0.2mm	JIS Z 3284
Tackiness	1.3N	JIS Z 3284
Tack time	Above 24h/1.0N	JIS Z 3284
Spreadability	78%	JIS Z 3197
Wetting and de-wetting effect	Rank 1~2	JIS Z 3284
Solder ball	Rank 1~2	JIS Z 3284
Copper plate corrosion test	Passed	JIS Z 3197
Product validity	6 months	Sealed and kept at 0~10°C

※ Data in this table are for reference only.

Tackiness & Tack Time of M731-GWS-T8J

Tackiness and Tack Time M731-GWS-T8J

Test condition
 Instrument : Tackiness Test Machine (Rhesca)
 Immersion speed : 2.0mm/s
 Preload : 0.49N
 Storage environment : 25°C50%RH
 Press time : 0.2s
 Test speed : 10.0mm/s



It was shown that the GWS has excellent tackiness and tack time in the preliminary period. Tackiness and tack time are critical requirements for paste performance in order to accommodate the lag between paste deposition on the board and the reflow and to avoid the problems of misalignment of clips and tombstoning etc.

Slump Behavior of M731-GWS-T8J

Slump-in-printing-test & Slump-in-heating test M731-GWS-T8J

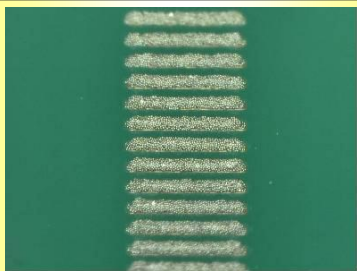
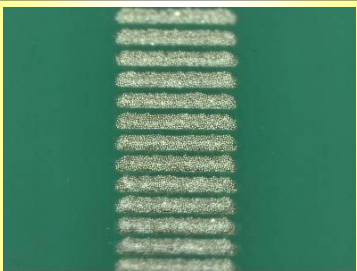
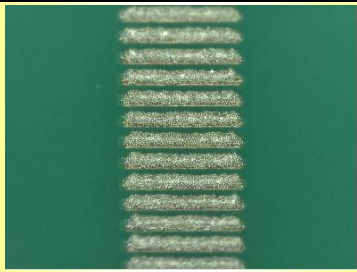
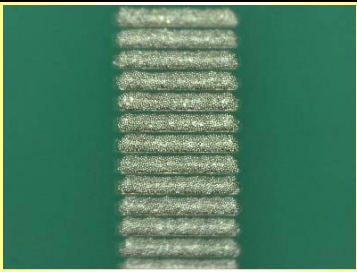
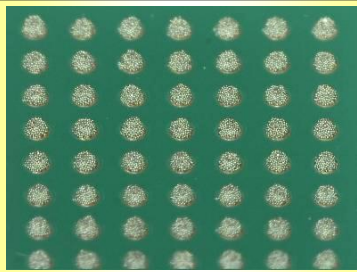
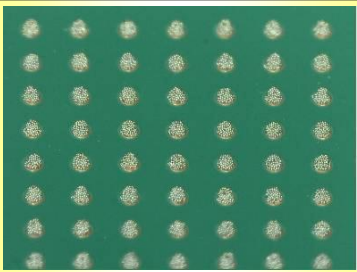
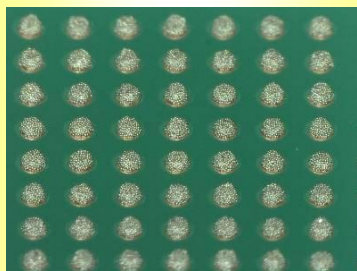
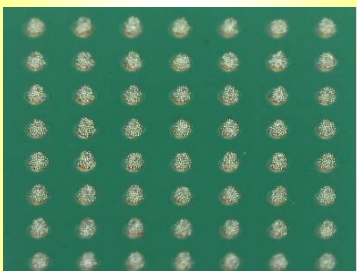
Test condition :
 Thickness of mask : 200um / specified pattern in
 JIS Z 3284

M731-GWS-T8J has greater effect on reducing slumping and capillary ball problem.

Heat Temp.	Hot Slump 150°C 3min	170°C 3min	190°C 3min
0.7mm Slit			
1.5mm Slit			

Printability of M731-GWS-T8J

M731-GWS-T8J has high print resolution. Below photos are comparison of print shape of M731-GWS-T8J. This paste keeps good solder volume from beginning and holds good shape.

	0.5mm Pitch	
	0.20mm slit	0.25mm slit
1 st sheet		
21 st sheet		
	Φ0.40mm	Φ0.30mm
1 st sheet		
21 st sheet		

Test Condition

Printer: SP-28PD (PFSC)

Thickness of mask : 0.15mm

Mask cleaning : off

Printing speed : 30mm / sec.

Printing pressure : 0.2N (squeegee:1mm)

Snap-off : -0.5mm

Snap-off speed : 10mm / sec.

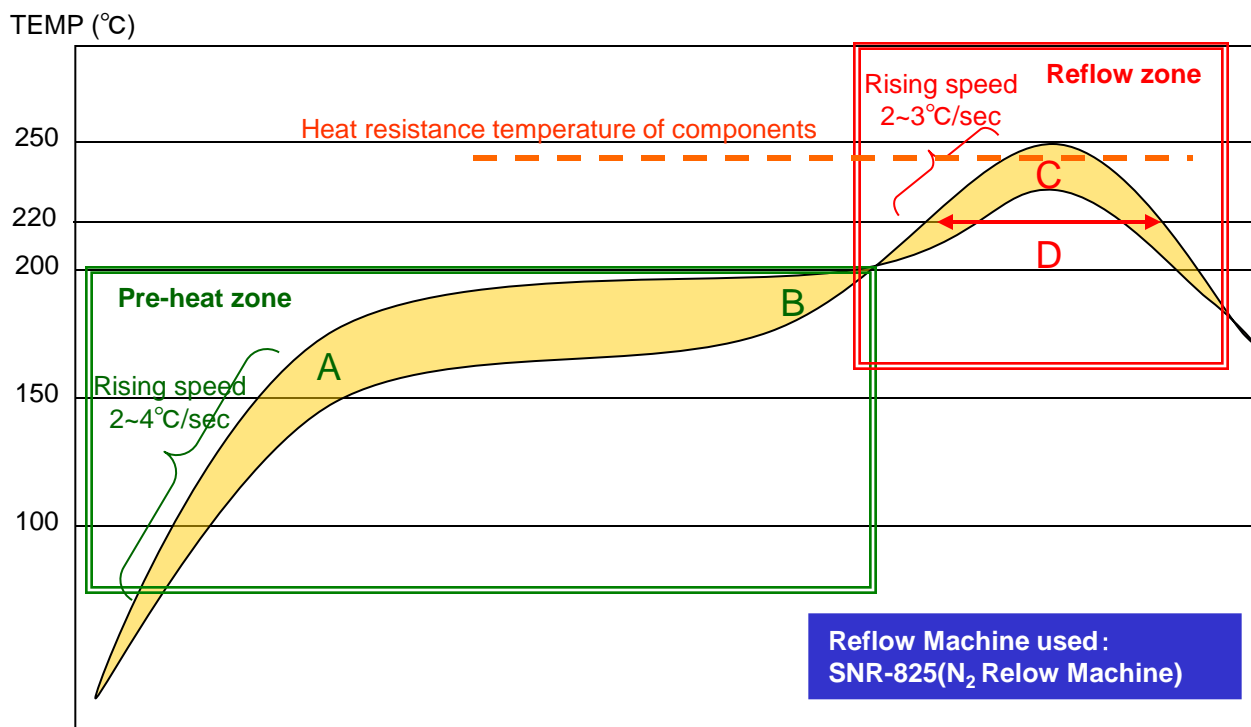
Environment : 25°C, 50%RH.

* Optimized print setting is a key for fine pitch application and it is different between printing machines. To optimize print setting is also recommended.

Recommended Profile for M731-GWS

This is the recommended profile for M731-GWS-T8J. There is a temperature difference (ΔT) on PCB because of the heat capacity difference of PCBs and components. Despite of this, it is highly recommended to follow this profile to achieve good soldering of any points on PCB.

In addition, solderability varies with specification of reflow machines, PCBs and components placement. Particularly, in cases of small component or small opening of screen, this recommended profile may not be desired for these cases. However, this profile is highly recommended for your evaluation.



Temperature Range for Different Points

A / Starting point of pre-heat : 150~180°C
 B / Ending point of pre-heat : 170~200°C
 A~B zone : 90±30sec

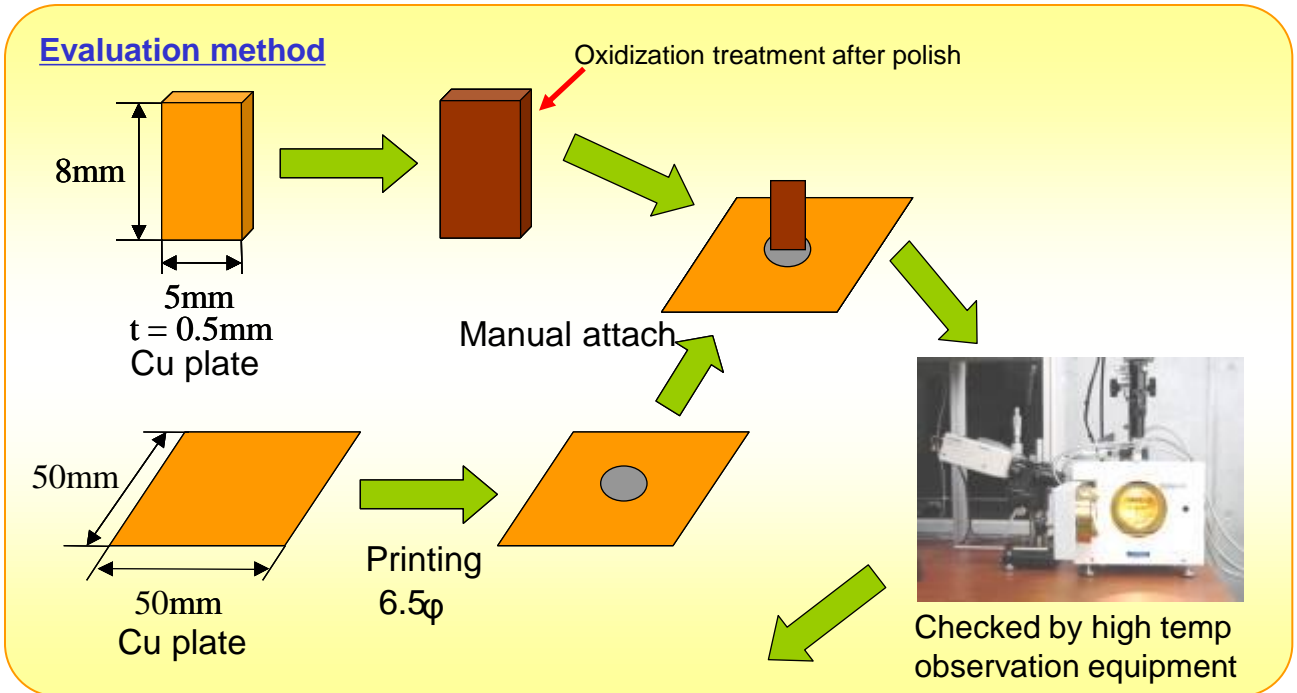
C / Peak temperature : 240~250°C
 D / Over 230°C(keeping time) : 20~60sec

Points

- ◇ Pre-heating : Pre-heating drives off solvents in paste and removes the oxides from powder surfaces and areas to be soldered. However, excessive pre-heating will result in the re-oxidation of powder affecting the melting behavior of solder paste. The ideal way is to achieve a minimum temperature difference (ΔT) on PCB by setting an appropriate time and temperature.
- ◇ Main heating : Excessive main heating (time & temperature) lowers the heat resistance of PCBs and components. Therefore please manage the reflow profile within the times and temperatures recommended above.
- ◇ Rising speed : Rising speed of temperature in preheating and main heating may affect the slump behavior of solder paste which is related to solder balling and side balling. Please pay attention in case of using reflow machine of fewer zones, clips of low heat capacity and PCBs of high heat sensitivity.

Reflowability M731-GWS-T8J (wetting)

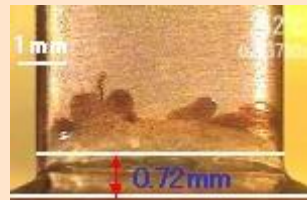
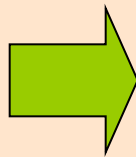
One Characteristics of M731-GWS-T8J is improvement of wettability compare to current Pb free paste product. To confirm it we performed below observation. Used intentionally oxidized Cu plate as test sample and put it on printed paste and observed movement during melting using by high temp observation equipment.



Right after

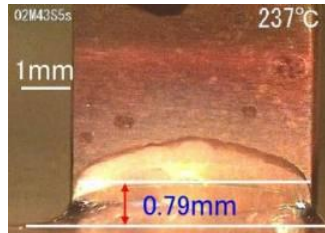
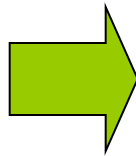
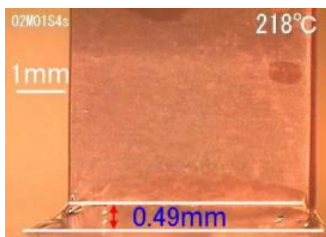
Start cooling

**M731
GWS**



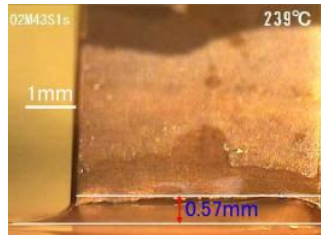
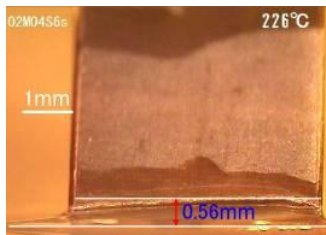
	Height (mm)
Right after	0.43
Start cooling	0.72
Difference	0.29

**M705
GWS**



	Height (mm)
Right after	0.49
Start cooling	0.79
Difference	0.30

**Standard
Product**



	Height (mm)
Right after	0.56
Start cooling	0.57
Difference	0.01

Attendant upon the Pb free conversion of part plating, the various metal are used for also plating and some plating makes wettability worse than Pb contained products. However, as it is showed above GWS has good characteristics of wettability and it can achieve good finish at various scene.



Reflowability GWS series (wetting for poor plating QFP)

Now it is clear that M731-GWS-T8J has better wettability on oxidized Cu plate compare to current product. However someone still has question about performance on the actual parts . Below photos show wettability for actual parts which is usually said that it has bad wettability.

	Ordinary	GWS
After printing		
After reflow		
Close up Back Fillet		

Solder could not cover lead top area due to poor plating

Plating condition is poor but solder could cover lead top area and form good fillet.

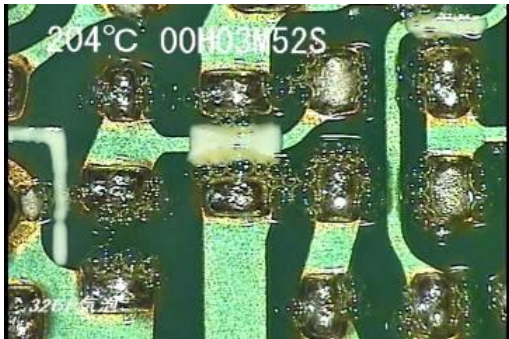
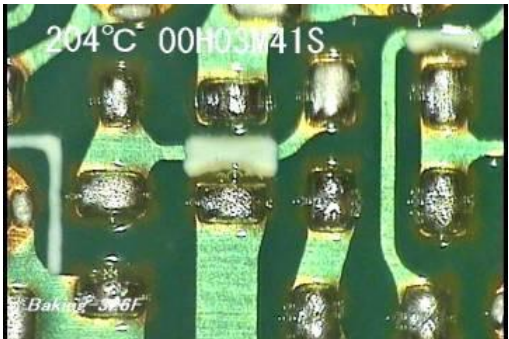
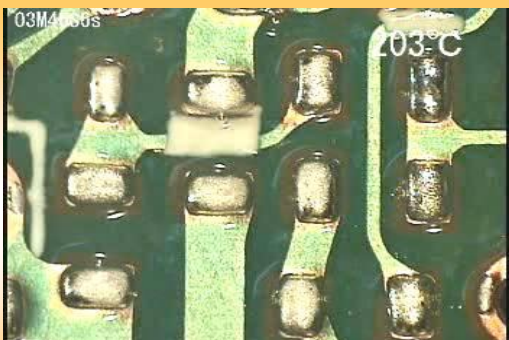
Reflowability of GWS series

GWS series designed to minimize flux bubbles caused by gas generated from PCB (mostly happened in phenolic PCB). Photos below showed the flux bubbles developed on phenolic PCB during reflow.

Photo 1-a, gas was generated from PCB resulting in flux bubbles.

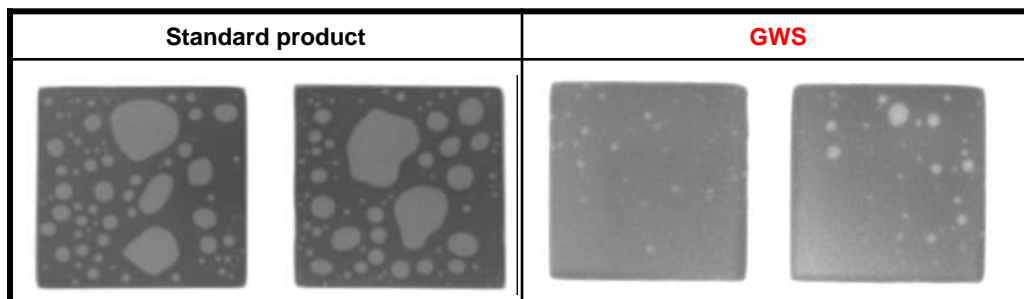
Photo 1-b, due to the baking treatment, gas could be reduced and hence reducing flux bubbles. So, it is recommended to have baking treatment on PCB which is easy to absorb moisture.

Photo 2, GWS series paste was used, flux bubbles were reduced even without the baking treatment of PCB. So, it is desired for applications where baking treatment is not allowed.

	Without Baking Treatment	With Baking Treatment
Standard product	 <p>Photo 1-a</p>	 <p>Photo 1-b</p>
GWS	 <p>Photo 2</p>	

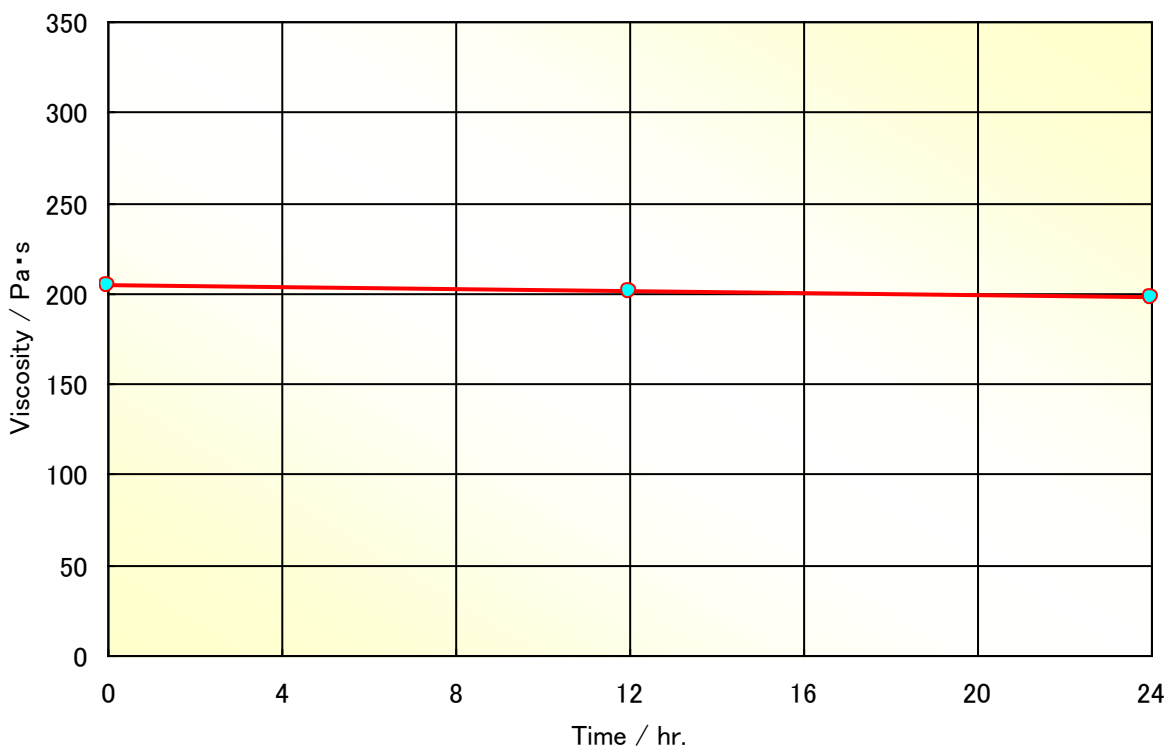
Reflowability GWS series (Void)

Print solder paste on 5mm x 5 mm land, then put a same size copper plate on it and observe the happening of void. GWS series paste has significantly reduced the voiding.



Viscosity change of M731-GWS-T8J during continuous printing

One characteristics of M731-GWS-T8J is stability of viscosity under continuous printing
 We checked viscosity change during 24hrs by using actual printing equipment. As the result of this no viscosity change is seen and keep primary fluidity.
 Below photo is the metal mask condition after 24hrs squeezing (about 28,00 times squeezing)



Test Condition

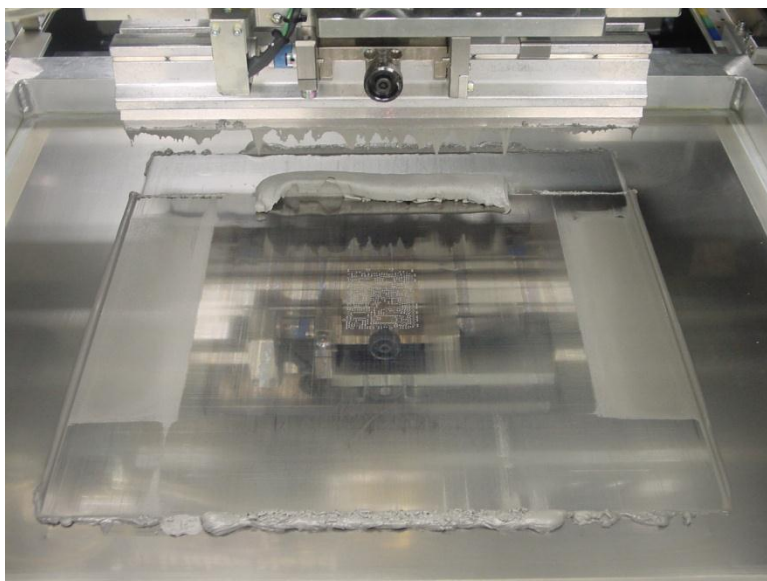
Tackt : 30sec. / sheet

Metal squeegee : 60deg

Printing speed : 30mm / sec.

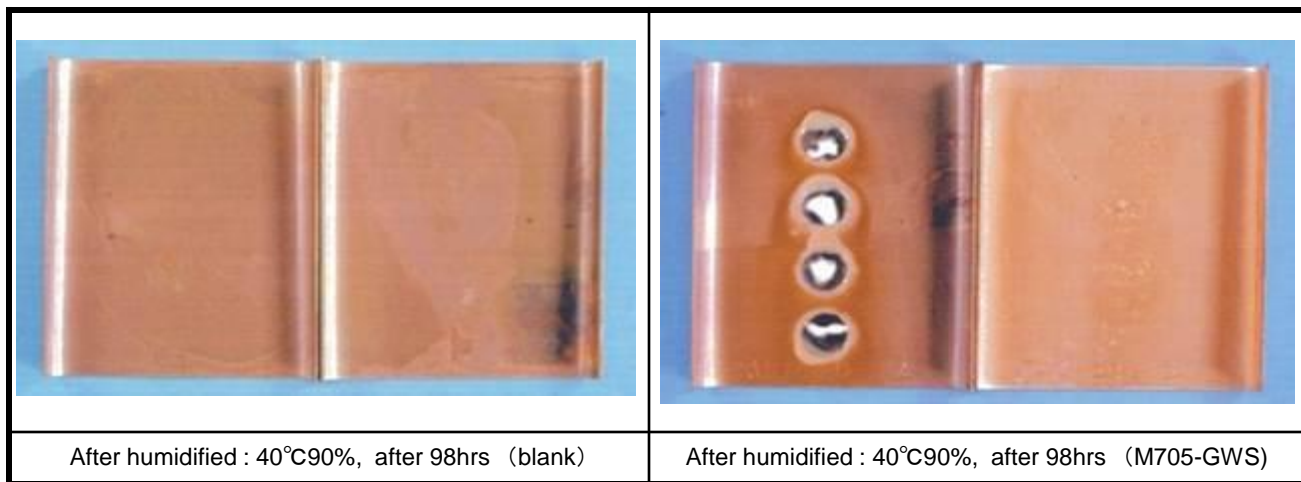
Printing pressure : 0.2N(squeegee:1mm) Environment : 25°C

After 24hrs continuous squeezing

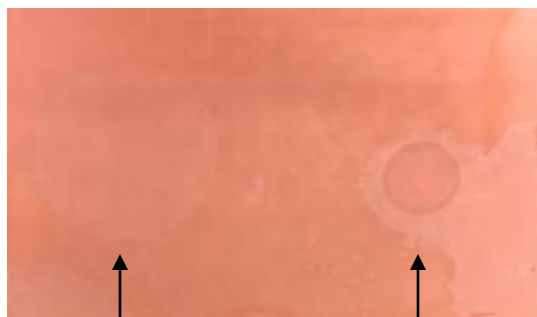


Reliability of GWS series

Copper Plate Corrosion Test
GWS series
Test condition : specified by JIS Z 3284



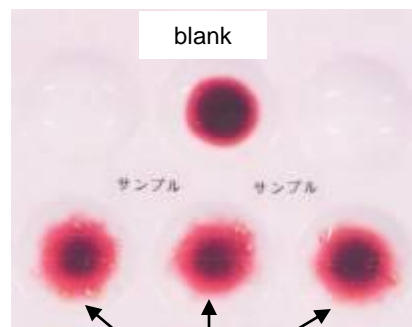
Copper Mirror Test
GWS series
Test condition : specified by JIS Z 3197



IPA solution of WW Rosin 25%

GWS

Fluoride Test
GWS series
Test condition : specified by JIS Z 3197



GWS

Silver Chromate Paper Test
GWS series
Test condition : specified by JIS Z 3197



IPA solution of WW Rosin 25%



GWS

Reliability of GWS

Voltage-Applied Moisture Resistance Test / GWS series

Test environment : 85°C85RH
 Applied voltage : 45V
 Measuring voltage : 100V
 (specified by JIS Z 3284)

