

# ***Ablestik***<sup>®</sup> ABP8302 Data Package

Robin FU, David HUANG

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# Agenda

- Product description
- Technical data sheet
- Dispensing performance
- Resin bleed out evaluation
- Curing condition evaluation
- Open time and stage time evaluation
- Work life evaluation
- Reliability performance
- Appendix

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# Product Description

- ABP8302 is conductive die attach paste designed to be used in leadframe packaging processes. It offers customers the following benefits: -
  - High Reliability performance for large die packages.
  - Suitable for use across a wide die size range.
  - Suitable for use on multiple leadframe surfaces e.g. Cu, AgCu and PPF (NiPdAu).

## SOIC

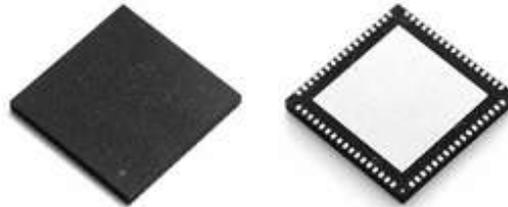
(Small Out-line Intergrated Circuit).



Small Die e.g. 2 x 2-mm

## QFN

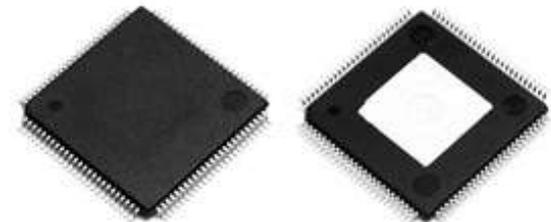
(Quad Flat No Leads).



Medium Die e.g. 5 x 5-mm

## TQFP

(Thin Quad Flat Pack).



Large Die e.g. 8 x 8-mm



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# Technical data sheet

<b>Product Name</b>	<b>ABP-8302</b>
<b>Application</b>	Leadframe Package
<b>Formulation :</b>	
Base Resin	Hybrid
Filler type	Silver
Filler loading (% by weight)	78%
<b>Uncured Properties :</b>	
Viscosity @ 25 °C (cps)	10,500
Thixotropic Index	5.00
Working Life @ 25 °C (hours)	24
storage temperature (°C)	-40
Storage Life (year)	1
Thawing Time @ 25 °C (hours)	1
<b>Cure condition recommendation :</b>	
DSC onset point (°C)	137.00
DSC peak (°C)	161.00
DSC Delta H (J/g)	65.00
Oven Cure	30min ramp to 175C hold 60min
Weight loss on cure (% by weight)	3.5
<b>Cured Properties :</b>	
Ionic Chloride (ppm)	<10
Sodium (ppm)	<10
Potassium (ppm)	<10
Glass Transition Temperature, T <sub>g</sub> (°C)	30
<b>Coefficient of Thermal Expansion</b>	
Below T <sub>g</sub> ( ppm/ °C)	60
Above T <sub>g</sub> ( ppm/ °C)	168
<b>Dynamic Tensile Modulus (Mpa )</b>	
@ -65 °C	6,500
@ 25 °C	2,000
@ 150 °C	490
@ 200 °C	190
@ 250 °C	180
Thermal Conductivity (W/mK)	0.8
Volume Resistivity (ohm-cm)	0.0001

<b>Die Shear Strength vs Temp. (kg/die)</b>		
Ag and 80*80mil Si Die	25C	8
Cu and 80*80mil Si Die	25C	6.5
PPF and 80*80mil Si Die	25C	7.5
Ag and 120*120mil Si Die	260C	6
Cu and 120*120mil Si Die	260C	5.5
PPF and 120*120mil Si Die	260C	6
Chip Warpage @ 25 °C Cu leadframe/350x350x15mil die		30 um
<b>Application properties :</b>		
Dispensability	UPH	6.8K
<b>Resin bleed out length (um)</b>		
Cu Leadframe and 2 hrs		0
Ag Leadframe and 2 hrs		0
PPF Leadframe and 2 hrs		0
<b>Reliability Performance :</b>		
MSL 1 260°C QFN7x7/2.5x2.5mm die/Cu Leadframe		Passed
MSL 3 260°C LQFP24x245x5 and /8x8mm die/ Ag,Cu and PPF leadframe		Passed
TCT1000 -55°C to 125°C		Passed

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# Dot dispensing methodology

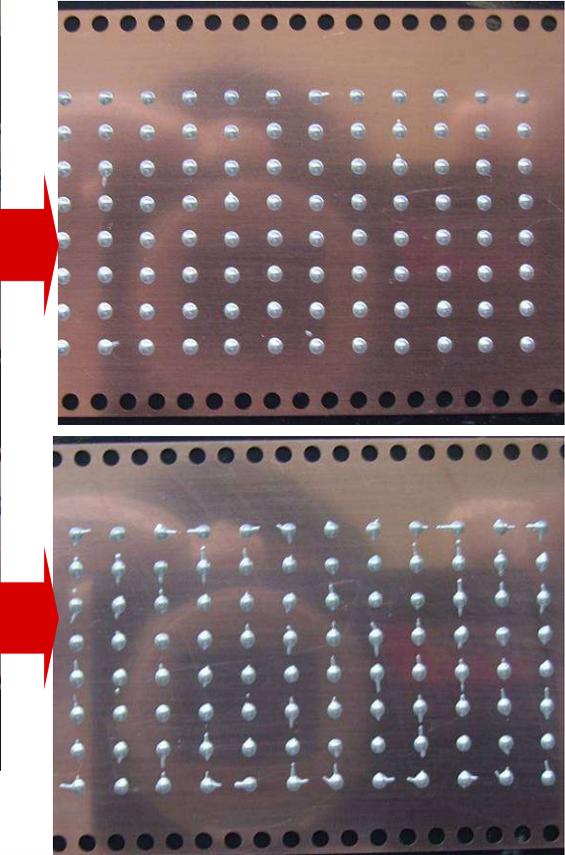
- Simulate different dispensing UPH, find the maximum UPH and without tailing/dripping defects
- In customer's real application, there are lots of factors may impact the dispensing UPH, so the real speed maybe lower than what we test here.

# Dot Dispensing UPH

UPH=6.8K, no defective dot

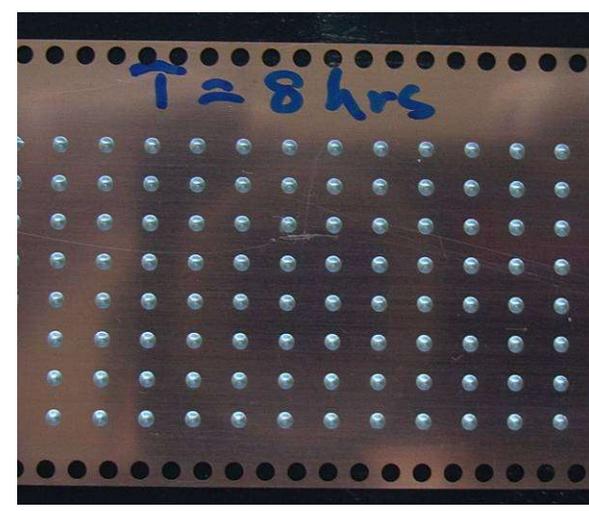
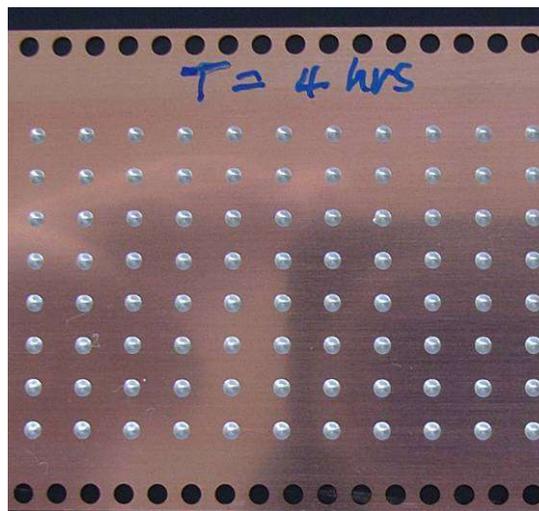
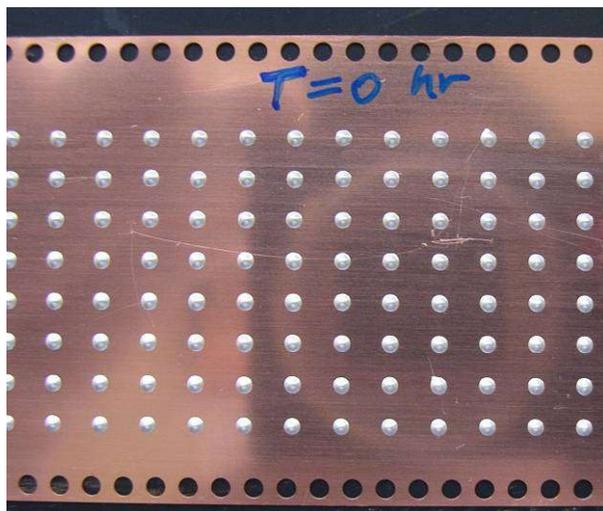
UPH=7.4K, some defective dots

UPH=8.2K, lots of defective dots

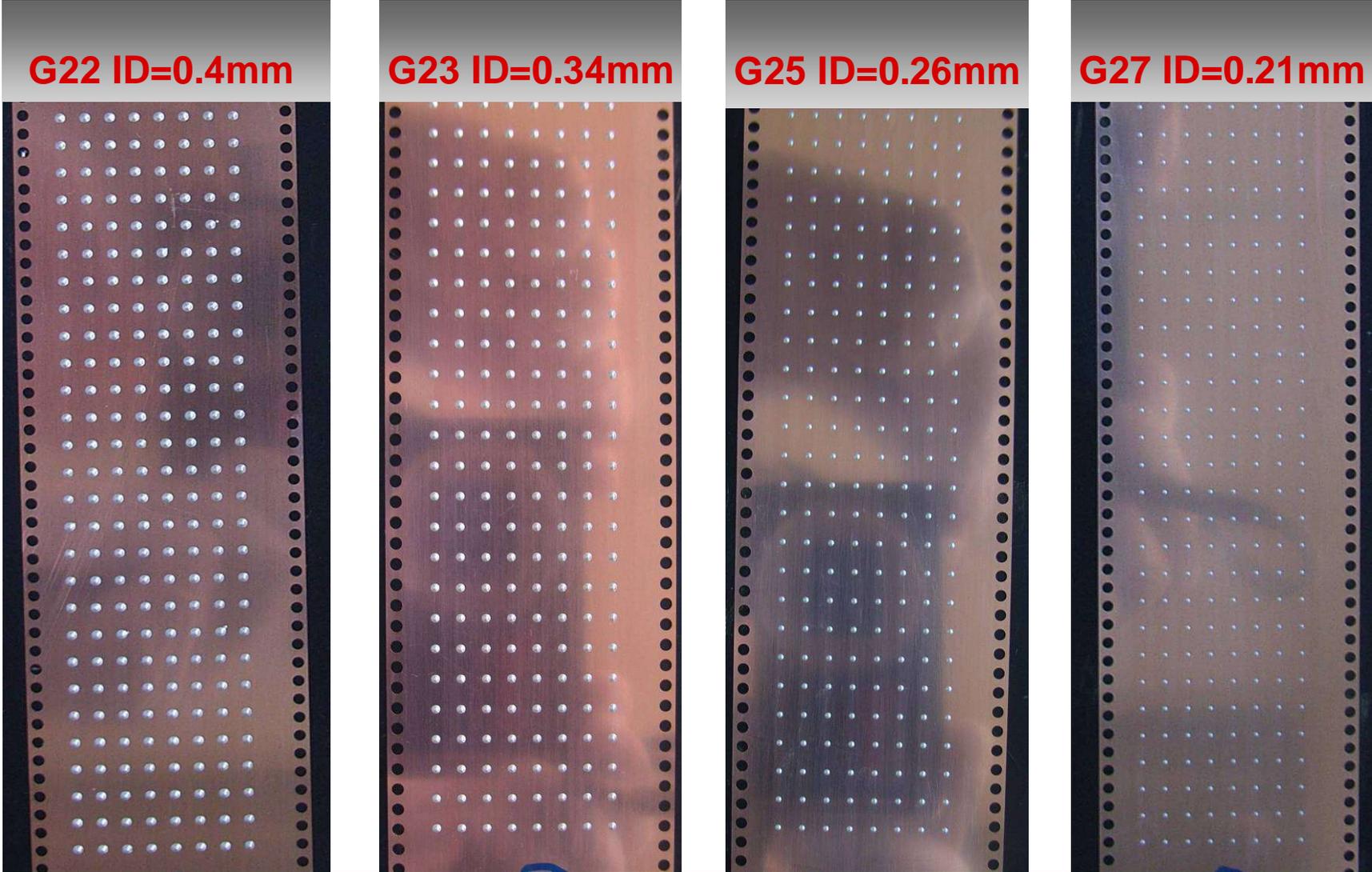


# Continual dispensing

- Use a ID (inner diameter)=0.4mm needle to continually dispense 10cc paste, no clogging, tailing and dripping was found, and the dot size is consistent.



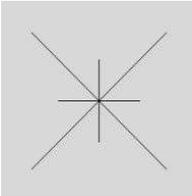
# Dispensing with different needle size



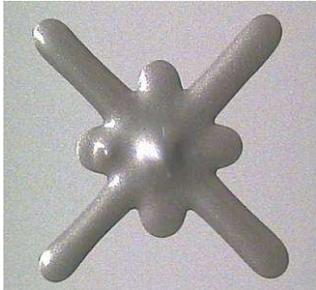
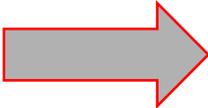
# Writing performance

Wring Pattern

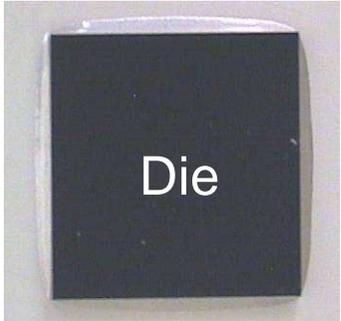
5x5mm



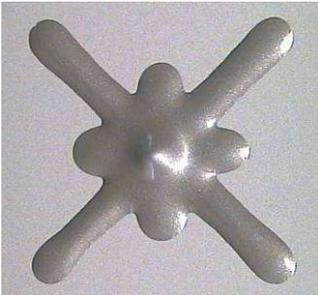
Slow speed



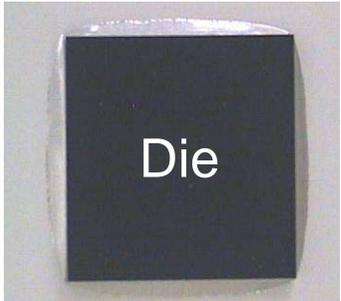
Bonding



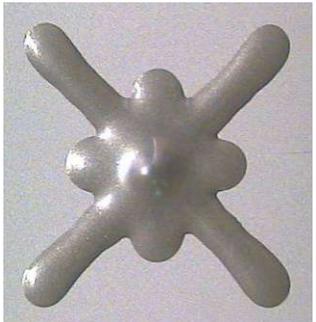
Media speed



Bonding



Fast speed



Bonding



# Summary of dispensing

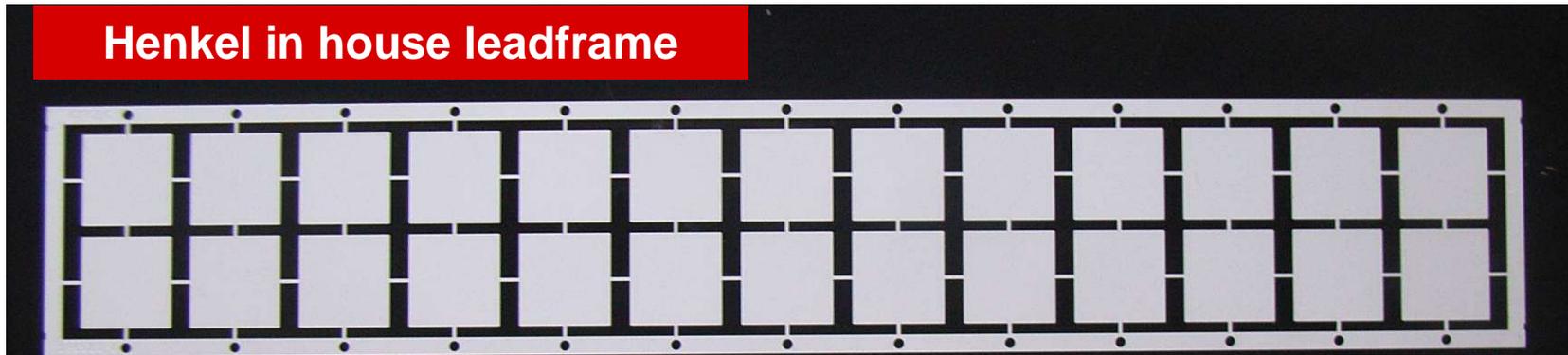
- ABP8302 can be used on applications where the UPH is less than 7K, customer can use it on higher UPH by dual dispensing head.
- ABP8302 has very stable dot dispensing and writing performance, and can be used on widely range needle size.

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# Substrate

- Use Henkel in house substrate, dispense the paste on leadframe surface, wait 2 hours in room temperature then put in oven cure.



# Resin bleed out

Cu leadframe	Cu leadframe and increased N2 flow	PPF leadframe	AgCu leadframe
			
Color change by out-gassing	Increase N2 may help eliminate color change		

ABP8302 has no bleeding on AgCu and PPF leadframe, but on Cu leadframe, slightly color change cause by out-gassing, and this color change has no impact on final properties.

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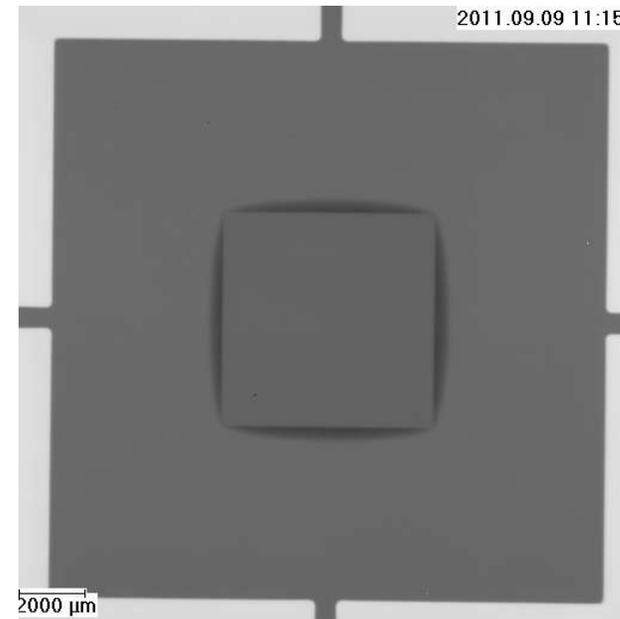
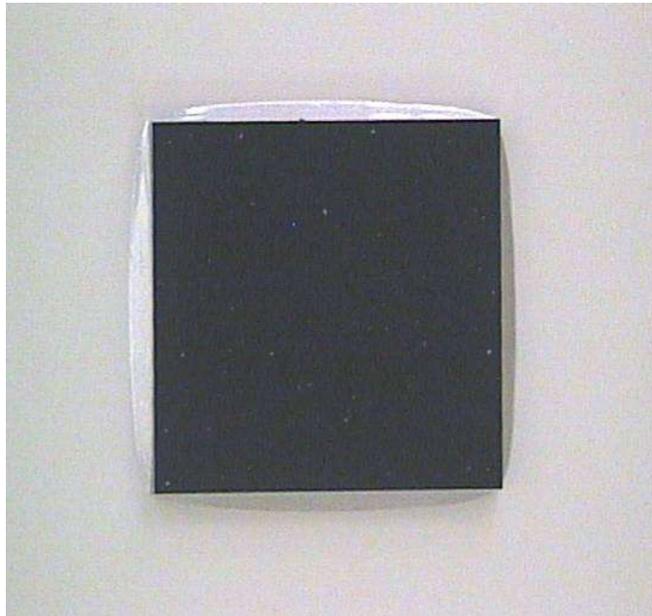
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# Experiment plan

- Die size: 80x80mil and 300x300mils
- Die bonder: Datacon 2200evo
- Material: ABP8302 and Henkel in house bare Cu and Ag/Cu leadframe
- Experiment flow: Die attach-> paste cure (DoE)->measure warpage and die shear strength.

Paste Cure				
Leg 1	Leg 2	Leg 3	Leg 4	Leg 5
30mins to 150°C and hold 30mins	30mins to 175°C and hold 15mins	30mins to 175 °C and hold 30min	30mins to 175 °C and hold 60min	40mins to 200 °C and hold 30min

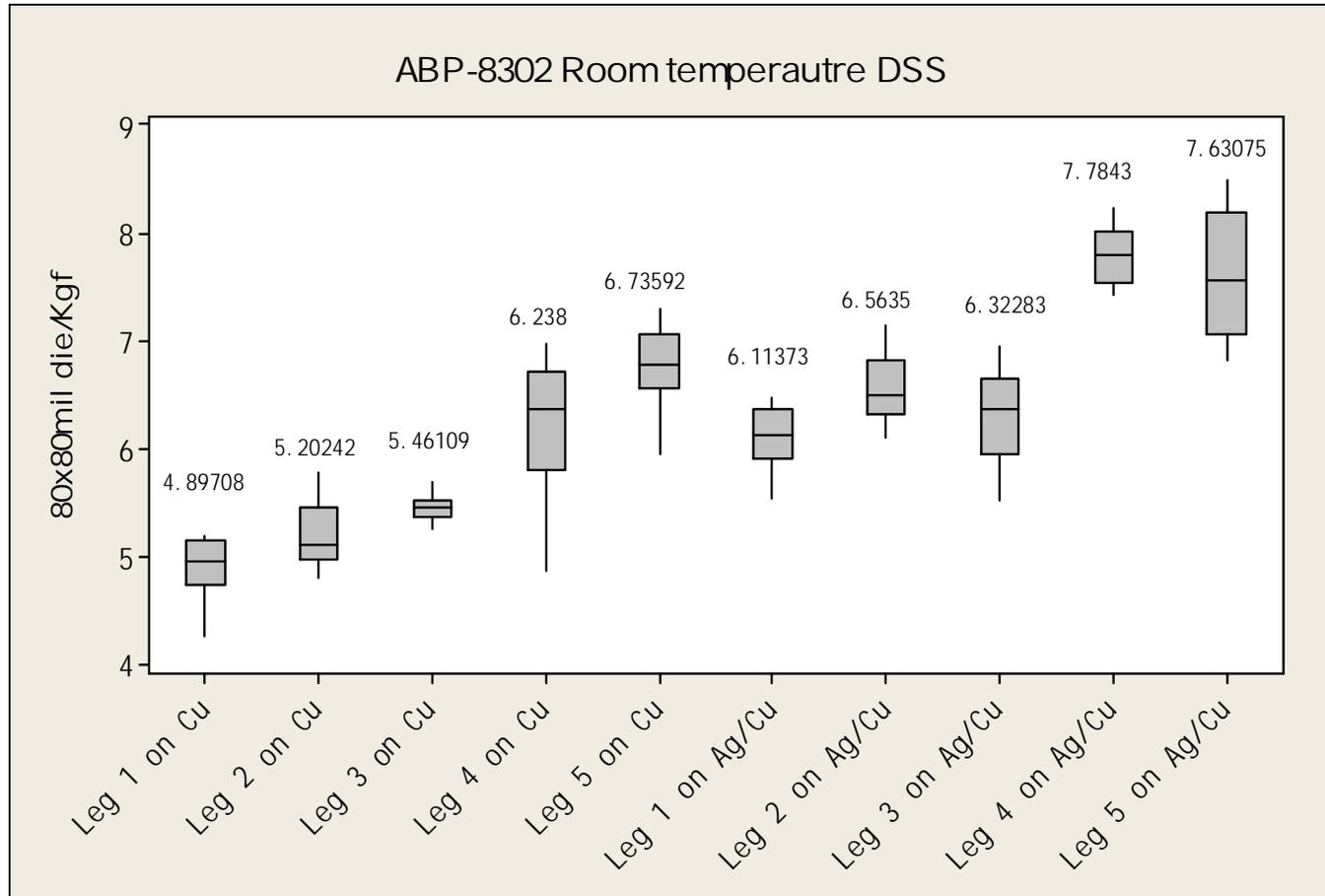
# Good coverage after DA



Void free by X-ray.

# Die Shear Strength

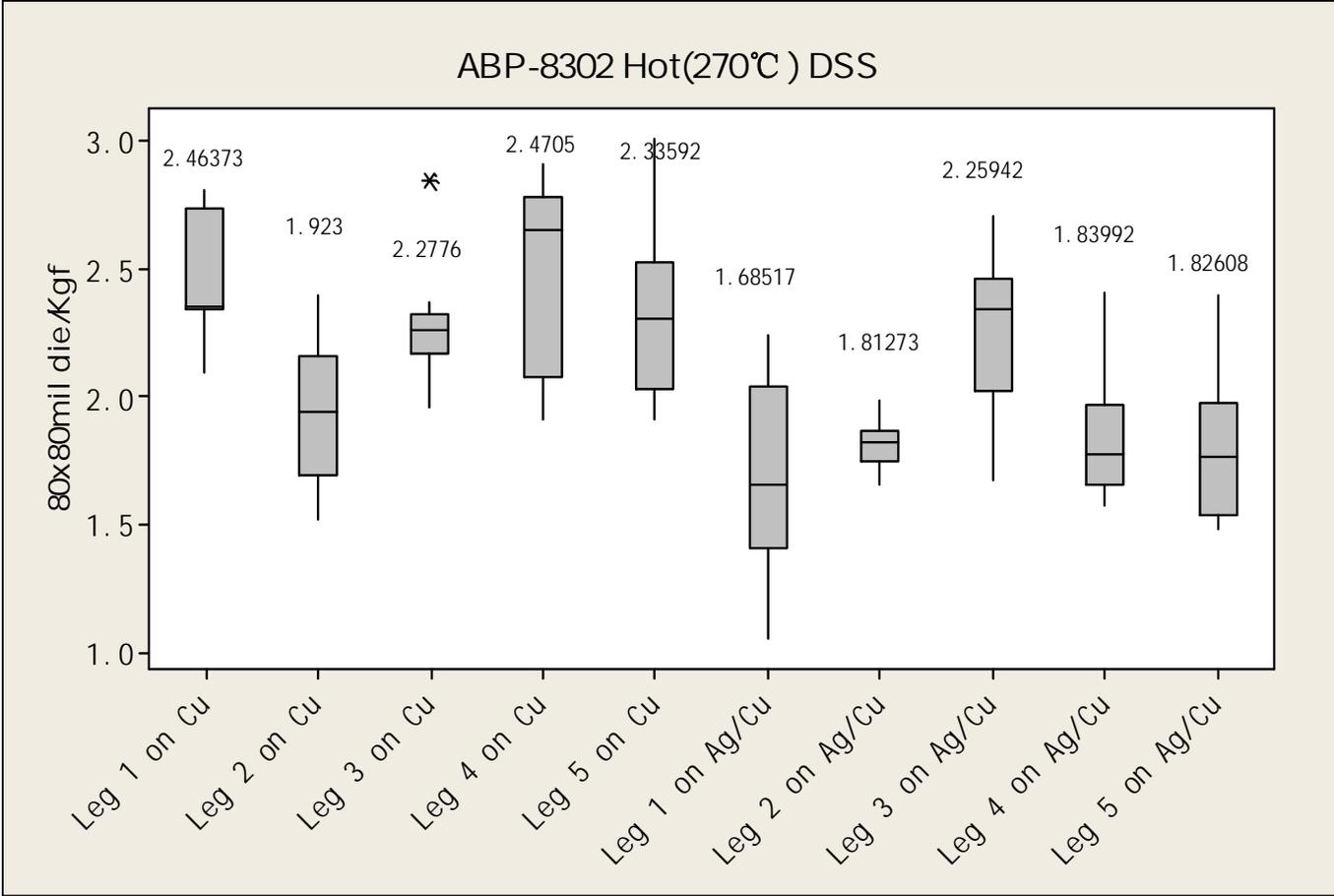
80x80mils die



- Leg 4 and 5 provide higher room temperature DSS on both surfaces.

# Die Shear Strength

80x80mils die

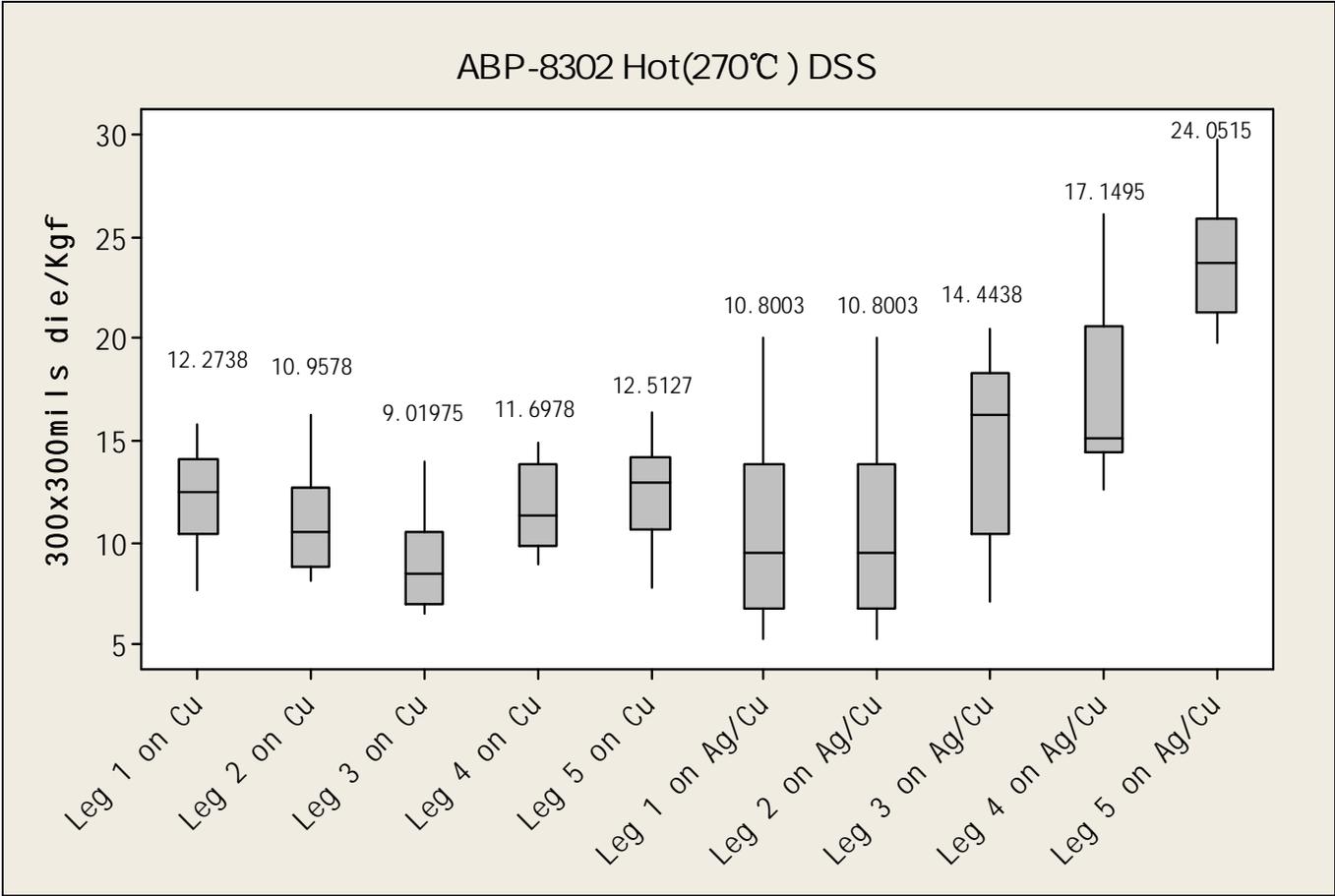


- There is no clear trend on hot DSS.



# Die Shear Strength

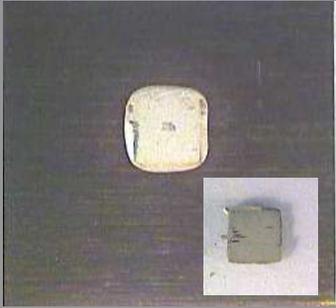
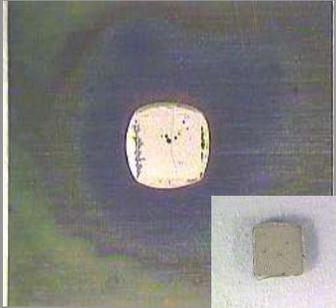
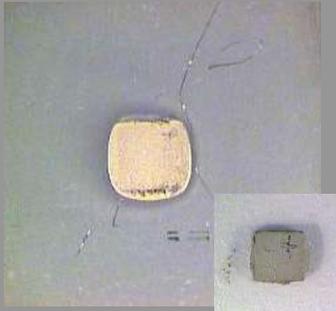
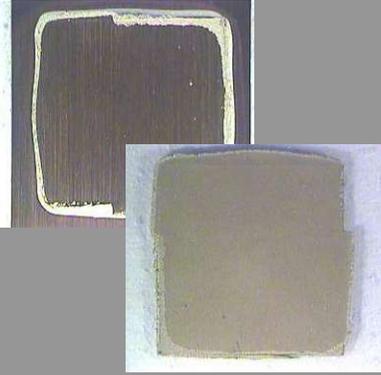
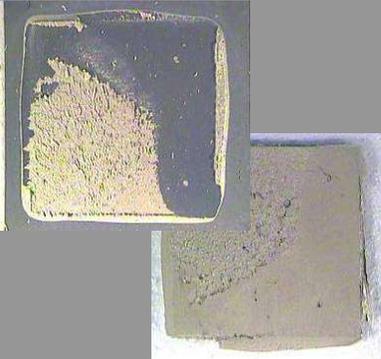
300x300mils die



- On Ag/Cu Hot DSS will increase as curing time and temperature increasing.

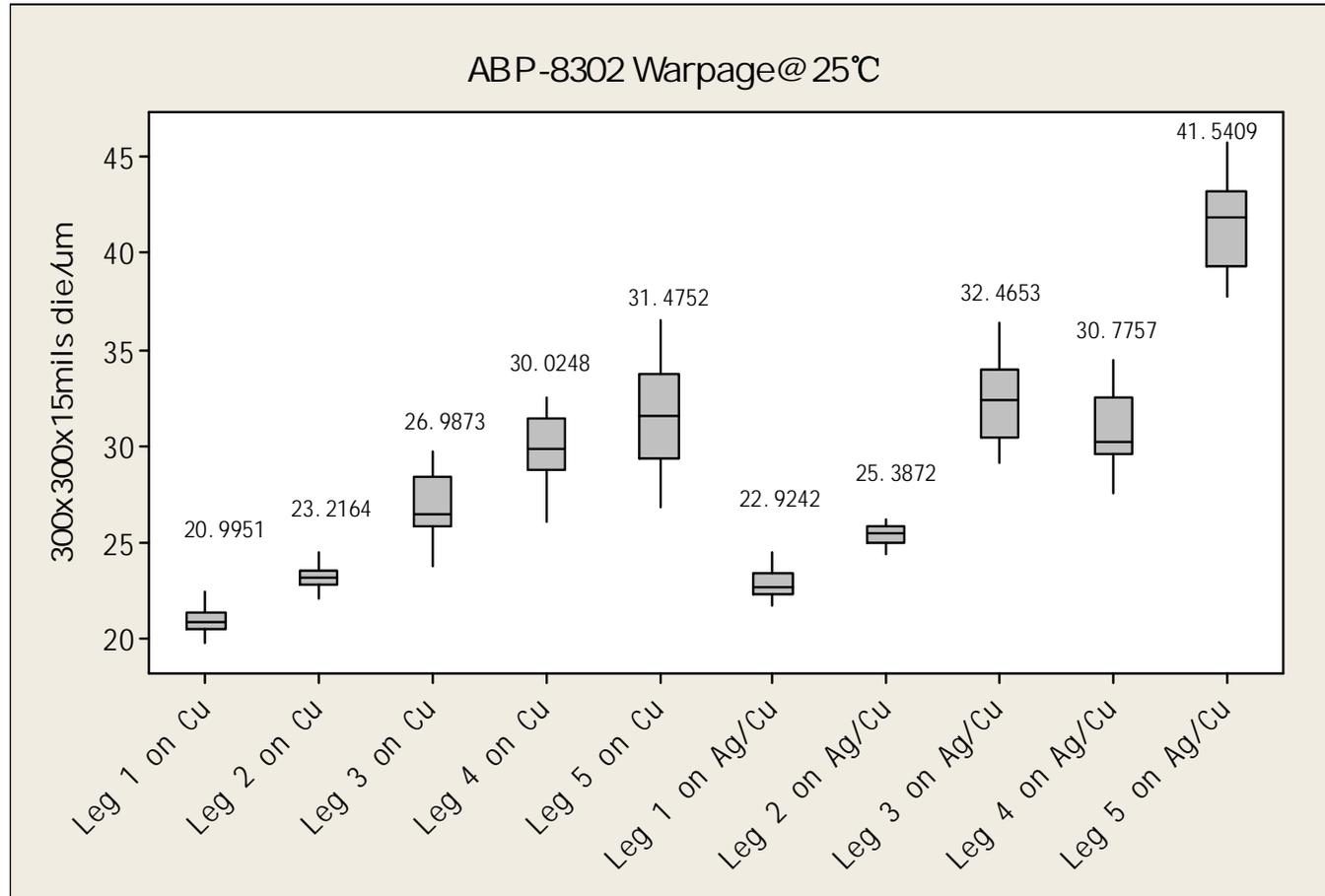


# Failure mode

On Bare Cu		On Ag/Cu	
RT	Hot(270°C)	RT	Hot(270°C)
			
			

On Cu leadframe, the failure mode of 300mil die hot DSS is adhesive, the others is cohesive or partial cohesive.

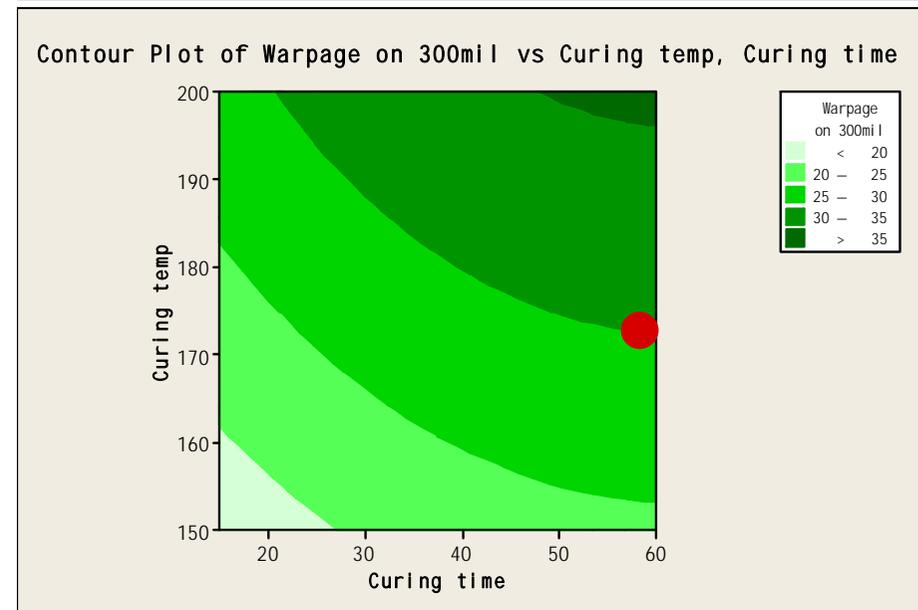
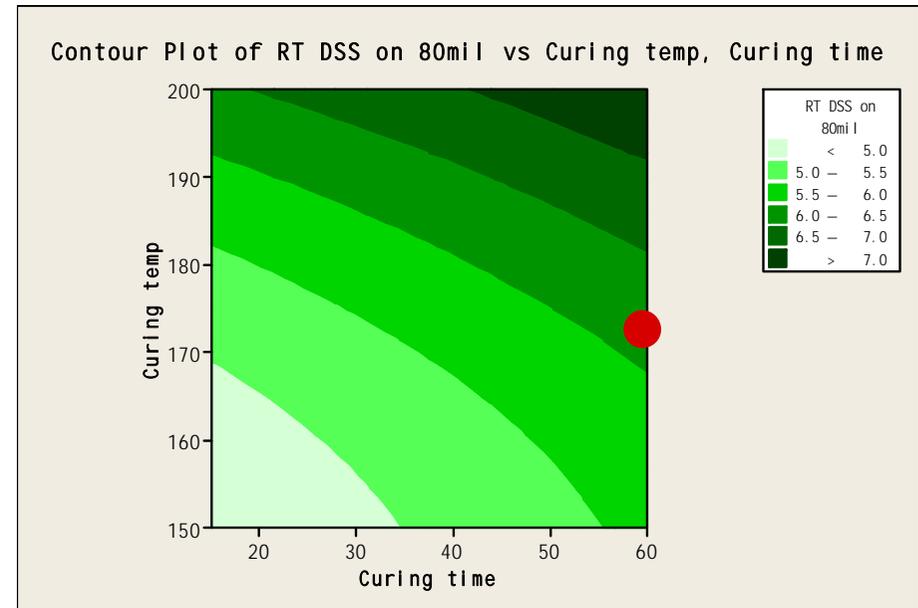
# Warpage



- Basically, lower curing temperature and shorter curing time can deliver lower warpage on both surfaces.

# Summary of Curing

- Longer curing time and higher curing temperature can help increase room temperature DSS
- But the longer curing time and higher curing temperature will result in higher room temperature warpage
- All failure mode is cohesive except 300mils die on Cu leadframe.
- It is recommended cure ABP8302 by 30mins ramp to 175°C and hold 60mins to get leverage performance.

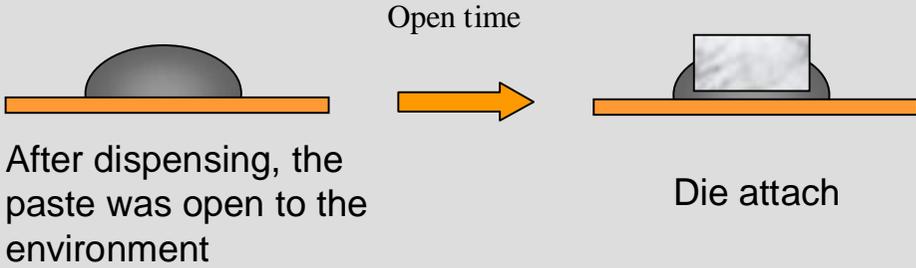


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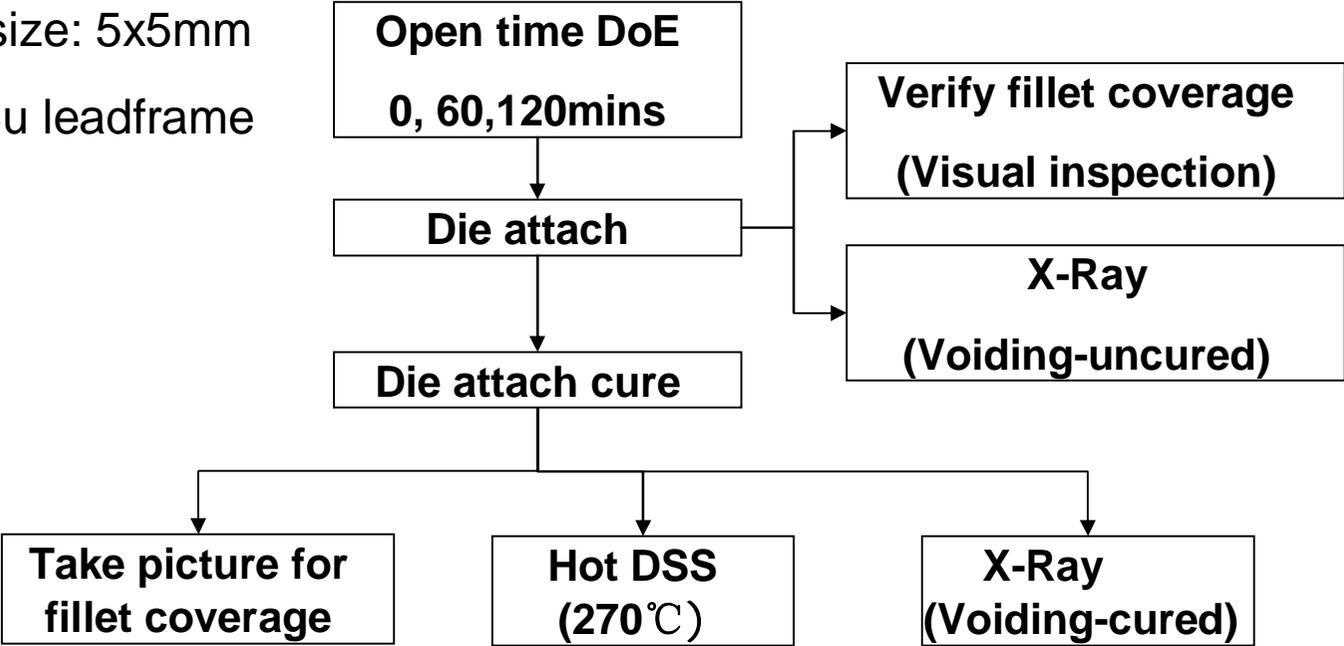
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# Open time study

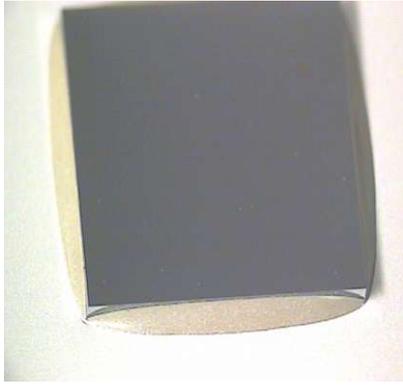
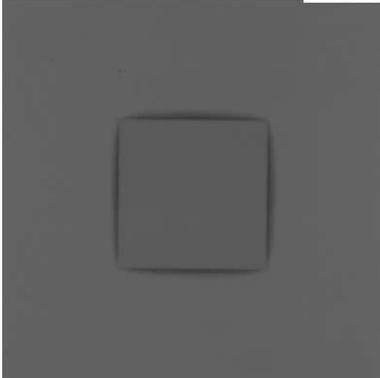
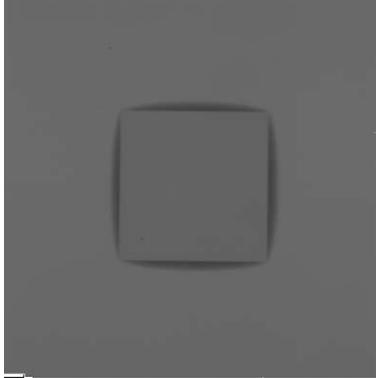
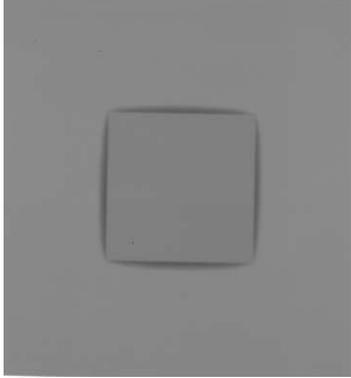
- Open time: the time after dispensing and before DA, at that moment the paste was open to the environment



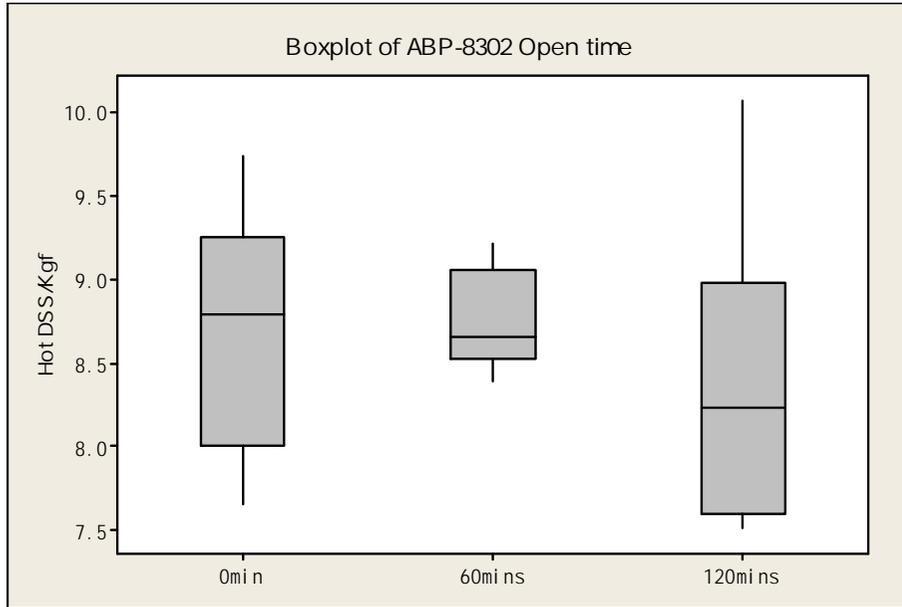
Die size: 5x5mm  
Ag/Cu leadframe



# Coverage and X-ray void

Open time	0min	60mins	120mins
Side view			
X-ray			

# Hot DSS(270°C)



There is no significant Hot DSS drop even after 120mins open time.

## Two-Sample T-Test and CI: 0min, 120mins

Two-sample T for 0min vs 120mins

	N	Mean	StDev	SE Mean
0min	7	8.679	0.708	0.27
120mins	8	8.376	0.894	0.32

Difference =  $\mu$  (0min) -  $\mu$  (120mins)

Estimate for difference: 0.303

95% CI for difference: (-0.599, 1.206)

T-Test of difference = 0 (vs not =): T-Value = 0.73 P-Value = 0.478 DF = 12

## Two-Sample T-Test and CI: 0min, 60mins

Two-sample T for 0min vs 60mins

	N	Mean	StDev	SE Mean
0min	7	8.679	0.708	0.27
60mins	8	8.756	0.298	0.11

Difference =  $\mu$  (0min) -  $\mu$  (60mins)

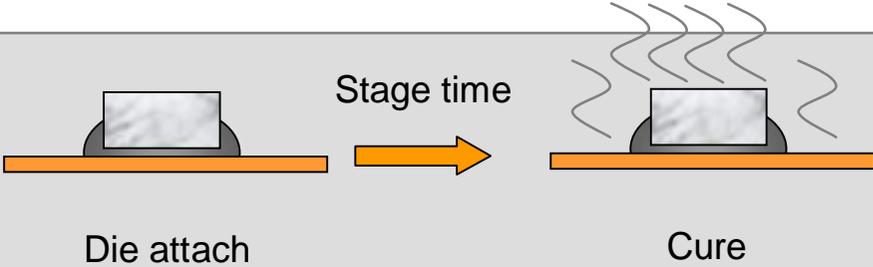
Estimate for difference: -0.077

95% CI for difference: (-0.756, 0.603)

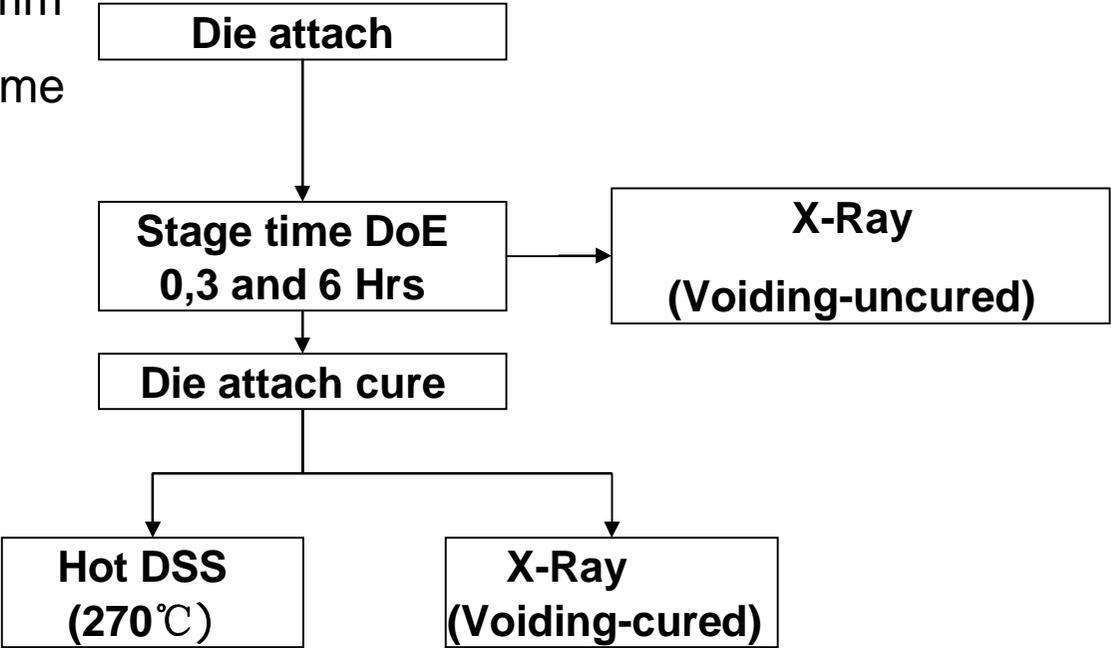
T-Test of difference = 0 (vs not =): T-Value = -0.27 P-Value = 0.798 DF = 7

# Stage time

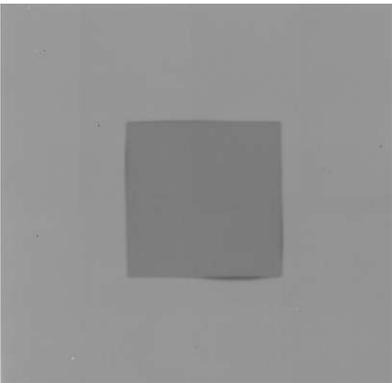
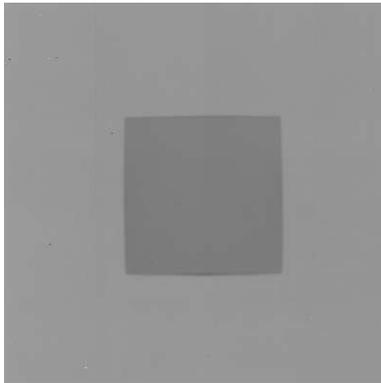
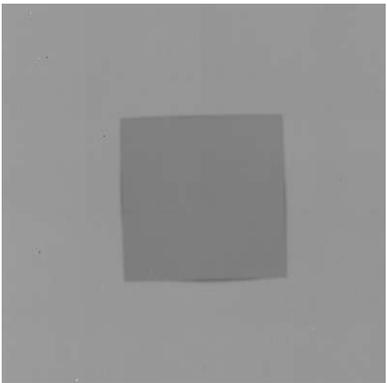
- Stage time: After die attach, it will take some time to put the packages into oven, when it's called stage time.



Die size: 5x5mm  
Ag/Cu leadframe

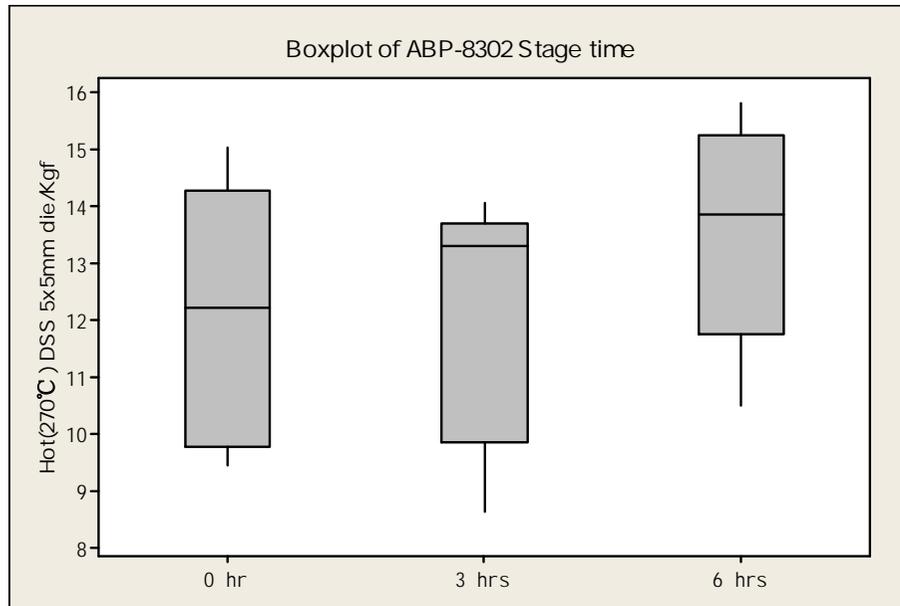


# X-ray Void

Stage time	0 hr	3 hrs	6 hrs
X-ray			

Void free after curing in all conditions.

# Hot DSS(270°C)



**There is no significant Hot DSS drop even after 6 hrs stage time.**

## Two-Sample T-Test and CI: 0 hr, 3 hrs

Two-sample T for 0 hr vs 3 hrs

	N	Mean	StDev	SE Mean
0 hr	8	12.17	2.34	0.83
3 hrs	8	12.17	2.12	0.75

Difference = mu (0 hr) - mu (3 hrs)

Estimate for difference: 0.00

95% CI for difference: (-2.41, 2.42)

T-Test of difference = 0 (vs not =): T-Value = 0.00 P-Value = 0.999 DF = 13

## Two-Sample T-Test and CI: 0 hr, 6 hrs

Two-sample T for 0 hr vs 6 hrs

	N	Mean	StDev	SE Mean
0 hr	8	12.17	2.34	0.83
6 hrs	8	13.50	1.93	0.68

Difference = mu (0 hr) - mu (6 hrs)

Estimate for difference: -1.33

95% CI for difference: (-3.64, 0.99)

T-Test of difference = 0 (vs not =): T-Value = -1.24 P-Value = 0.238 DF = 13

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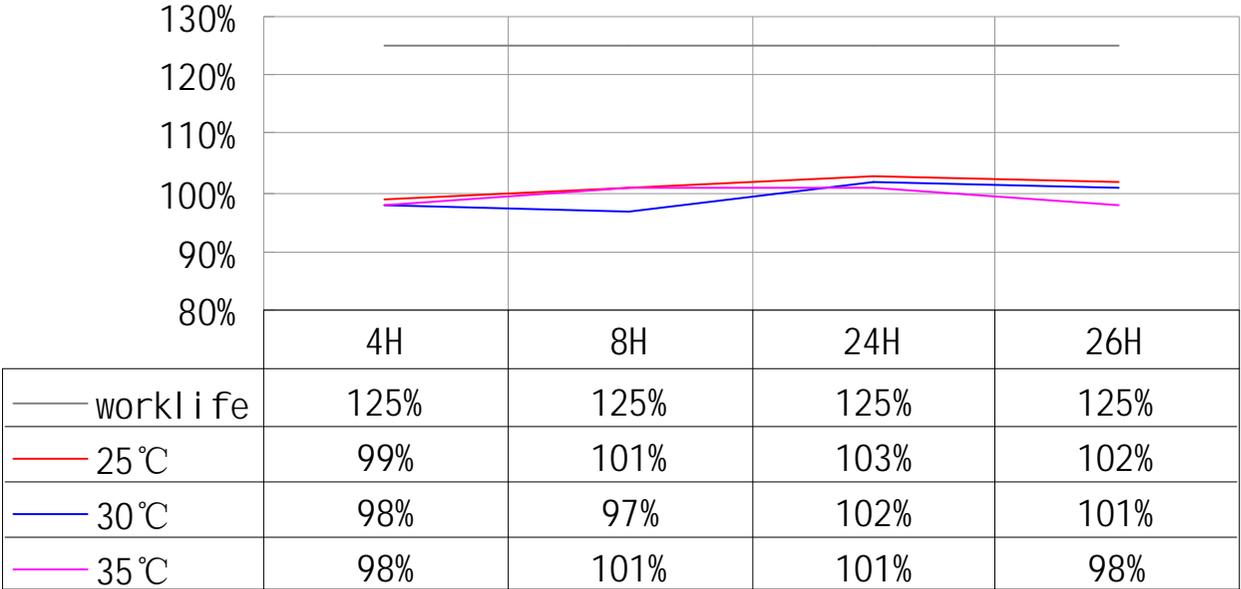
# Work life

- Henkel define the product's work life by **chemical work life**
  - **Chemical work life** is determined by under room temperature, the viscosity increase is less than 25%.

# Chemical work life

- Under different temperature, ABP8302 shows very stable viscosity.

*ABP-8302* chemical worklife under different temperature

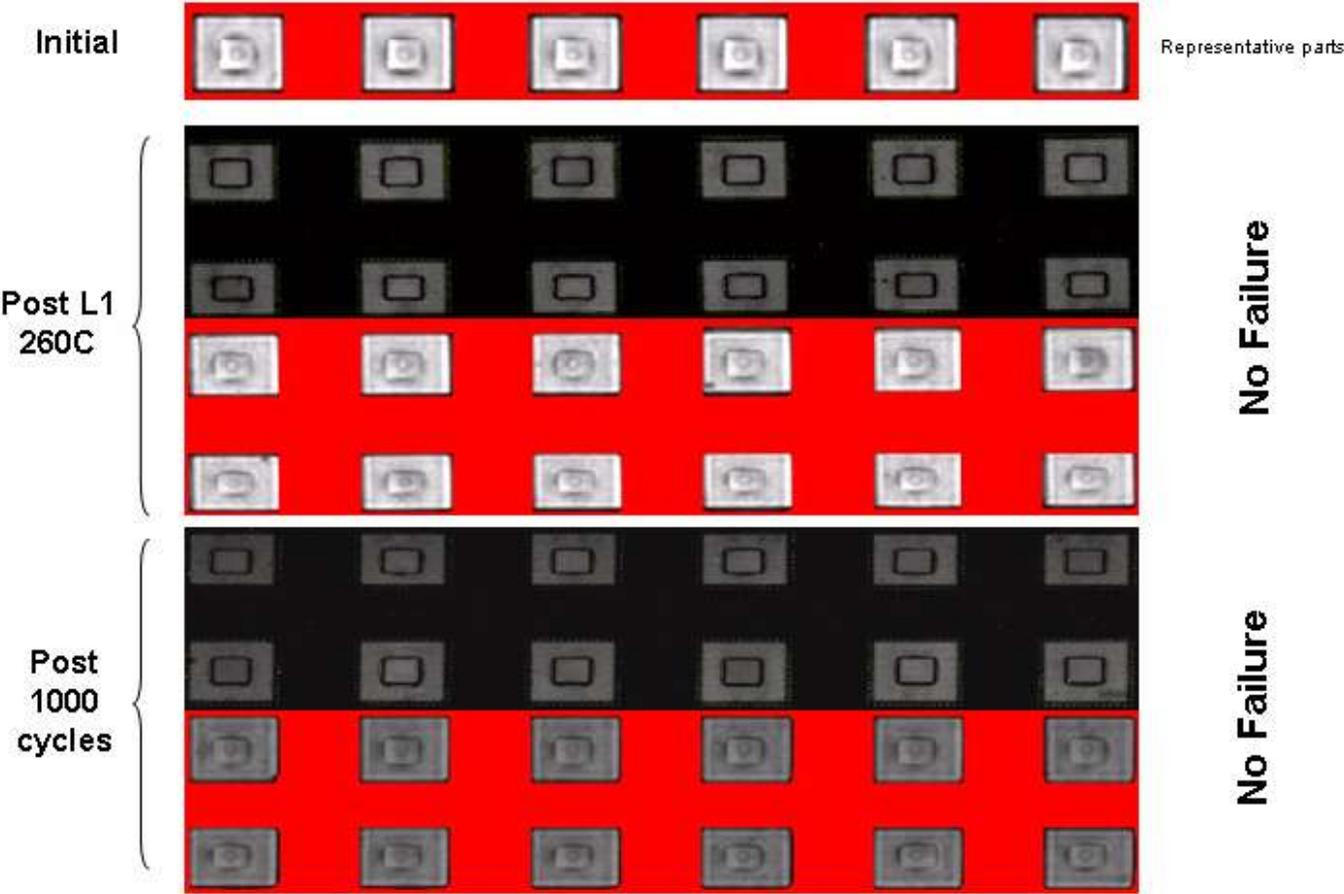


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# Reliability performance

- Package: QFN7x7
- Die size: 2.5x2.5mm
- Leadframe: Cu
- ABP8302 passed MSL 1 260°C and TCT 1000



# Reliability performance cont.

- Package: LQFP24x24
- ABP8302 passed MSL 3 260°C on three surfaces with both die size



## Contact details for Technical support

Chemist---David Huang  
Phone: +86.21 38984800-2310  
Email: [David.Huang@cn.Henkel.com](mailto:David.Huang@cn.Henkel.com)  
Shanghai, China

Marketing Manager---Qunce FU  
Phone: +86.21 38984800-2180  
Email: [Qunce.FU@cn.Henkel.com](mailto:Qunce.FU@cn.Henkel.com)  
Shanghai, China

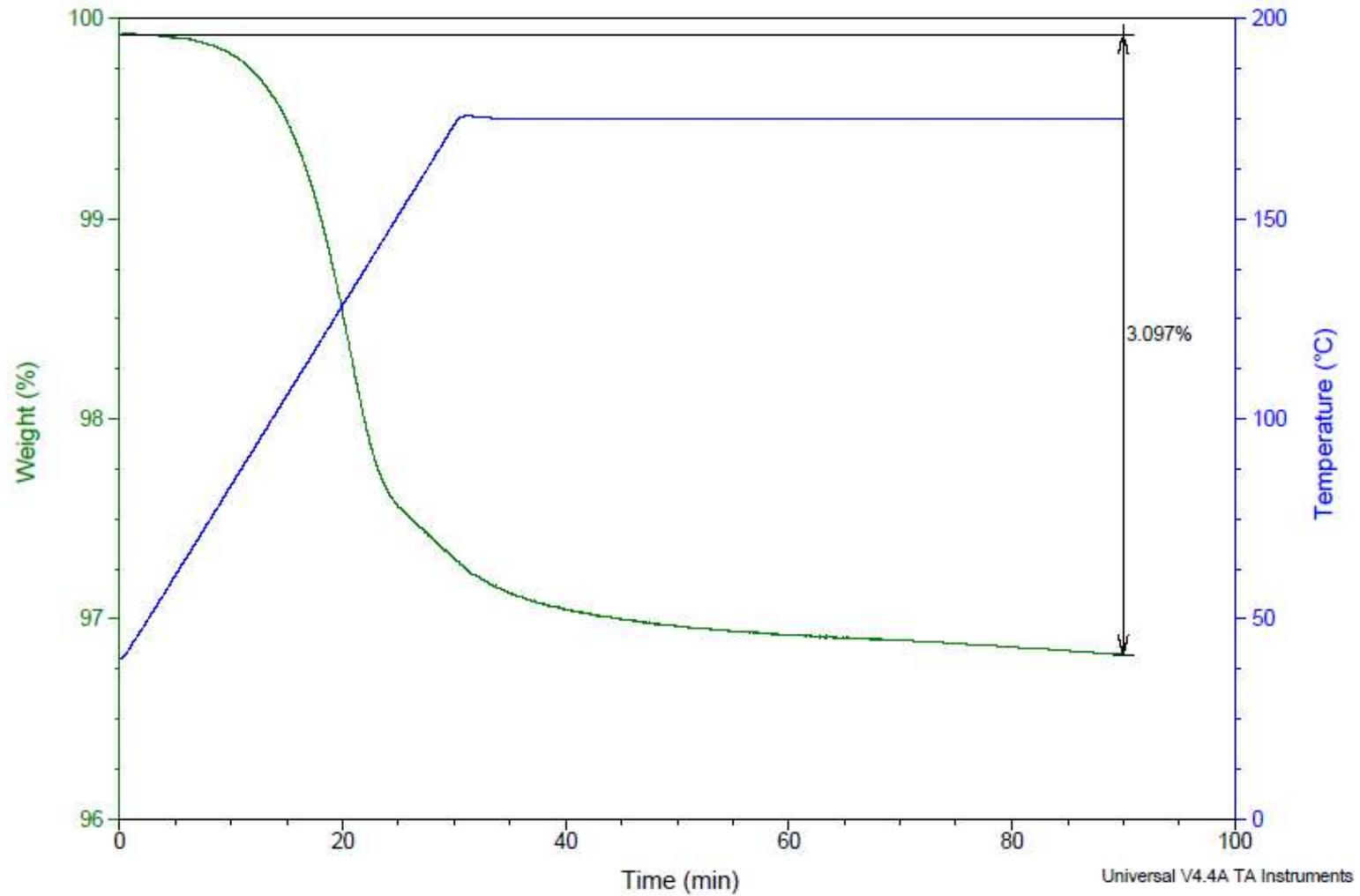
Technical Service---Paul Gleeson  
Phone: +1. 714-368-8000  
Email: [Paul.Gleeson@us.Henkel.com](mailto:Paul.Gleeson@us.Henkel.com)  
CA, USA

Technical Service---Robin Fu  
Phone: +86.21 38984800-2307  
Email: [Robin.FU@cn.Henkel.com](mailto:Robin.FU@cn.Henkel.com)  
Shanghai, China

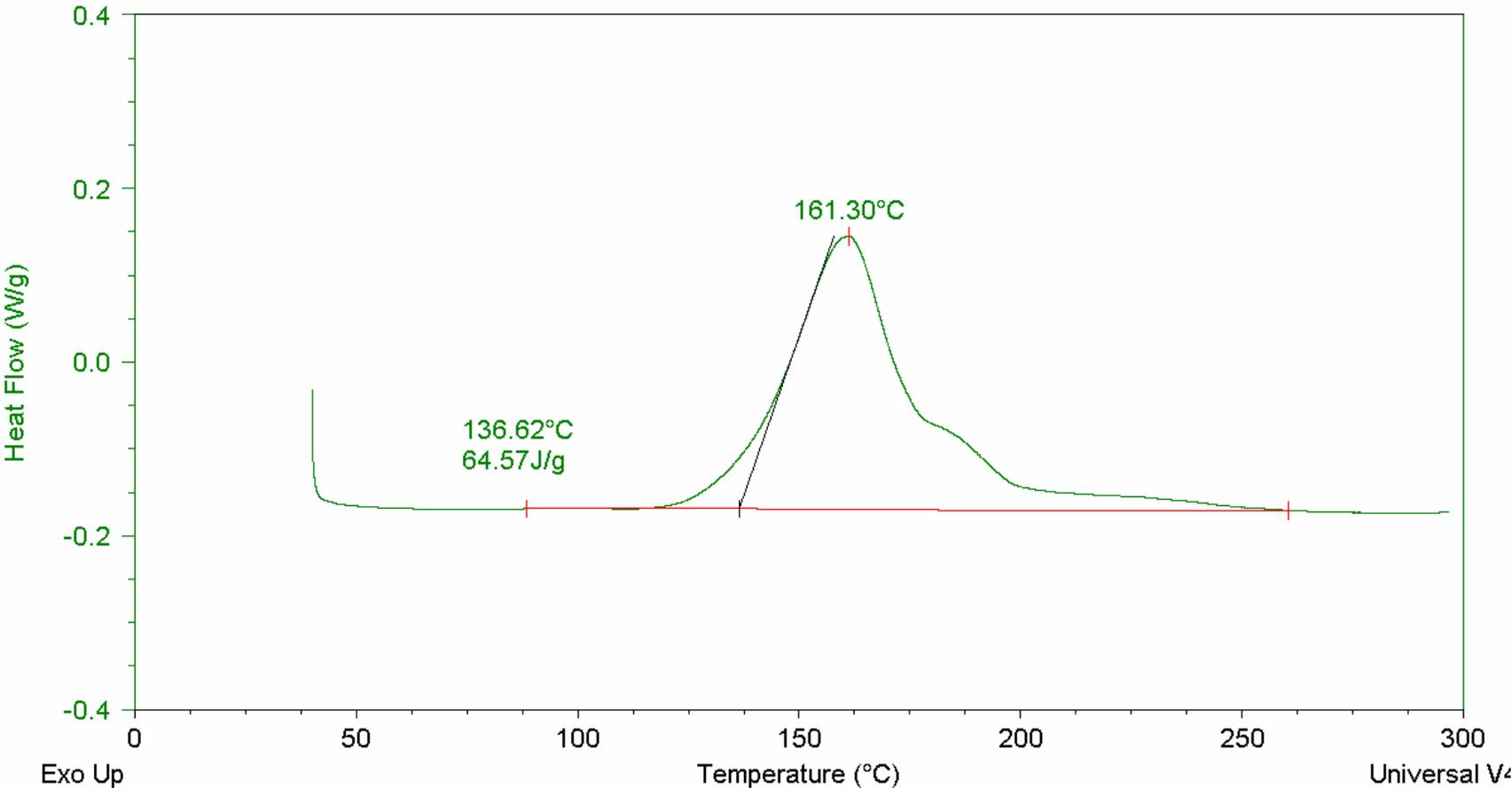
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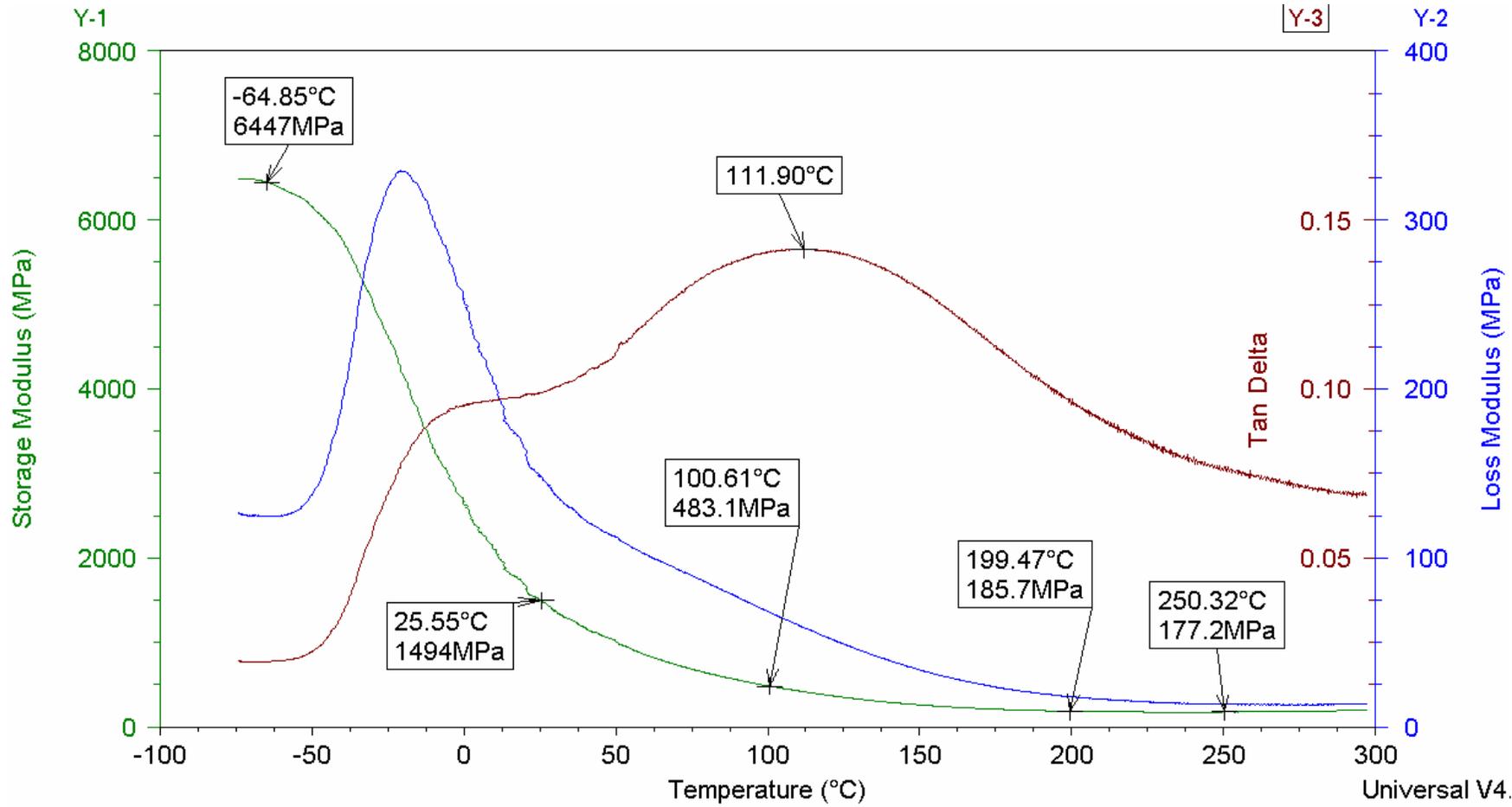
# TGA( on cure)



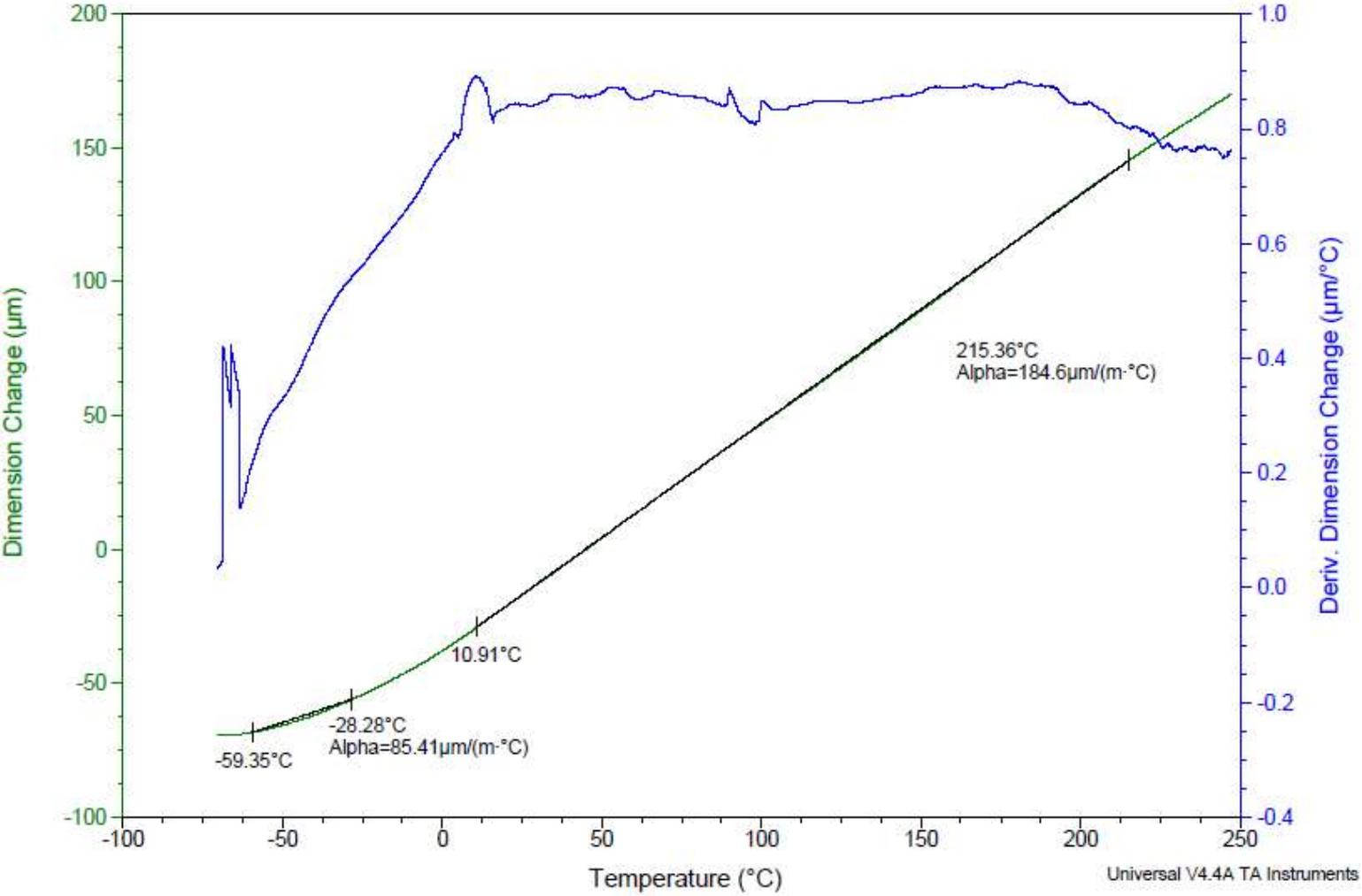
# DSC



# DMTA



# CTE



Thank you!

