

Ablestik ABP 8064T Data Package (Version 2)

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Excellence is our Passion

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Product description & key material properties

Product description & key material properties

-- Product Description

- Die attach paste ABP 8064T is designed for high power and high reliability applications with excellent thermal conductivity and low electrical resistance
- ABP 8064T can be used from small die to large die, suitable for wide package applications, such as SOP, QFN and QFP
- ABP 8064T is recommended for PPF leadframe

Product description & key material properties

-- key Material Properties

Product Name	ABP 8064T	Product Name	ABP 8064T
Base Resin	Hybrid	CTE Below T _g (ppm/ °C)	47
Filler type	Silver	CTE Above T _g (ppm/ °C)	136
Filler loading (% by weight)	85	Dynamic Tensile Modulus (Mpa)	
Density / Specific Gravity (g/cc)	4.4	@ -65 °C	7,570
Viscosity @ 25 °C(cps)	12,500	@ 25 °C	5,260
Thixotropic Index	6.9	@ 100 °C	2,154
Working Life @ 25 °C(hours)	24	@ 200 °C	1,423
DSC onset point (°C)	114.0	@ 250 °C	1,279
DSC peak (°C)	124.0	Thermal Conductivity (W/mK)	18.8
DSC Delta H (J/g)	34.0	Volume Resistivity (ohm-cm)	0.000019
Weight loss on cure (% by weight)	3.21%	Die Shear Strength vs Temp. (kg/die)	
Ionic Chloride (ppm)	<1	PPF, 80x80mil Si die, 270 °C after PMC	1.7Kg
Sodium (ppm)	<1	PPF, 200x200mil Si die, 270 °C after PMC	11.5Kg
Potassium (ppm)	0	PPF, 300x300mil Si die, 270 °C after PMC	18Kg
Glass Transition Temperature, T _g (°C)	44.5	Chip Warpage @ 25 °C after PMC, um PPF L/F, 300*300mils and 15mil thick	30um
Moisture Absorption	0.11%		

• This data is just lab data, not technical specification

Dispensing

Dispensing

-- Dot Dispensing UPH

- The purpose is to simulate different dot dispensing UPH and find the maximum UPH with no defects
- In customer's real application, there're a lot of factors which will affect the dispensing UPH. So, the real speed maybe higher or lower than what we tested here.
- 84-1LMISR4 which is widely used in die attach and has excellent dot dispensing performance was selected as the comparison, it will help us to understand the UPH data more clearly
- Test method:
 - ✓ Dot dispensing machine: CAMALOT FX-D
 - ✓ Needle size: EFD G22
 - ✓ Sample size: 800 dots each

Dispensing

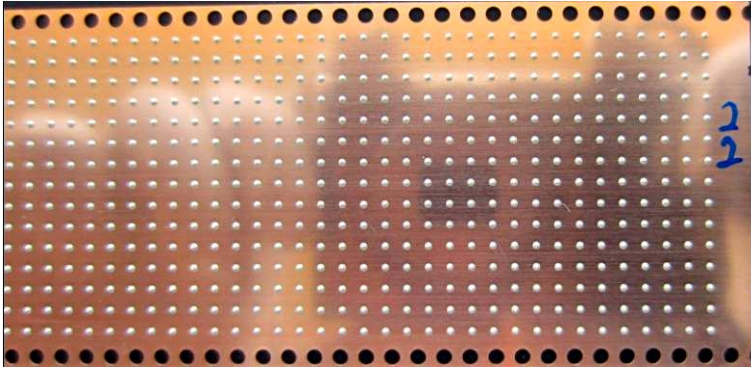
-- Dot Dispensing UPH



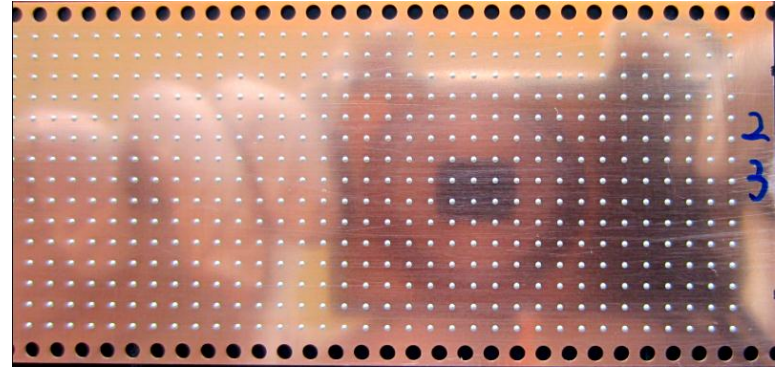
- ABP 8064T has good dot dispensing performance and can reach 7.8K UPH with no defective dots, little worse than 84-1LMISR4

Dispensing

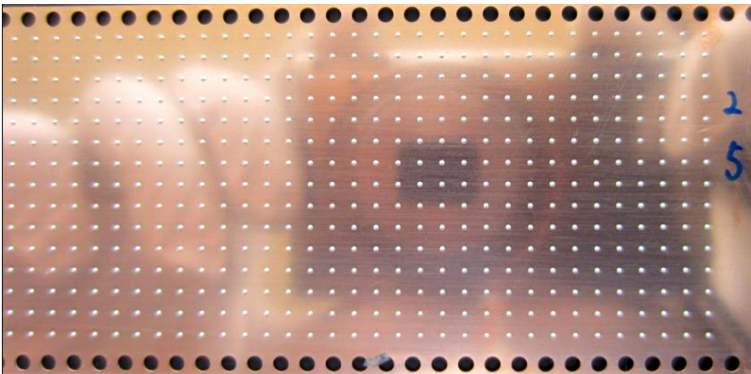
-- With Different Needle Size



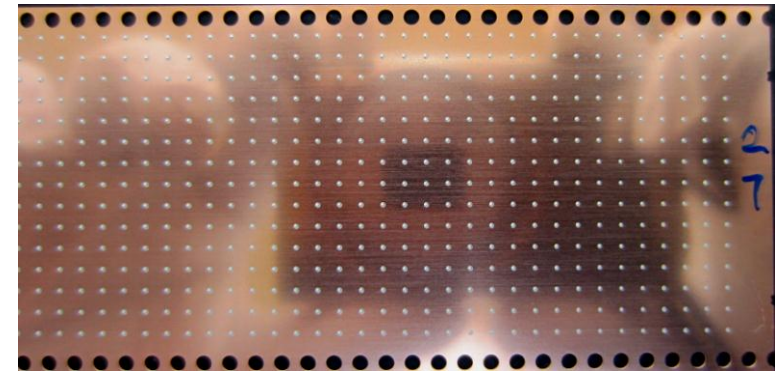
G22 0.41mm ID



G23 0.34mm ID



G25 0.26mm ID



G27 0.21mm ID

- Sample size: 3000 dots each, no clogging issue

Dispensing

-- Writing Performance

- Machine: Datacon 2200evo
- Needle: EFD G22, ID=0.41mm

Pattern: 4x4mm



Writing Speed

30mm/s

60mm/s

90mm/s

- ABP 8064T has excellent writing performance even with very fast speed

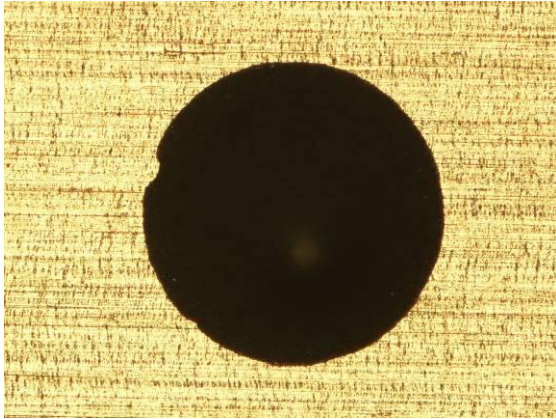
Dispensing

-- Summary

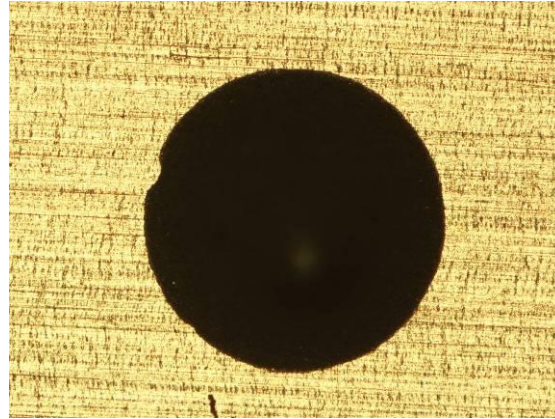
- ABP 8064T has 7.8K dot dispensing UPH and can reach higher with dual dispensing head.
- ABP 8064T can be used on wide range of needle size.
- ABP 8064T has excellent writing performance even with very fast speed

Resin Bleed out (RBO) Evaluation

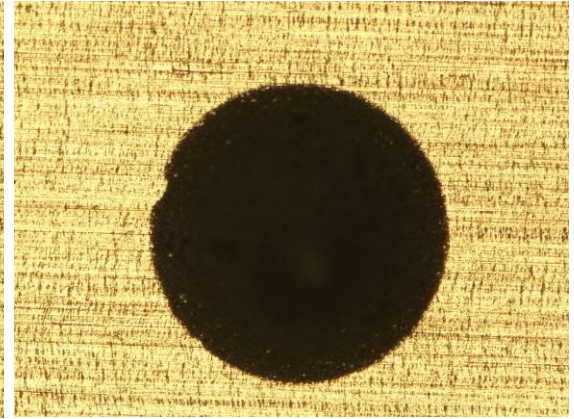
Resin Bleed out (RBO) Evaluation



0hr



2hr



Cure

- Henkel in-house PPF L/F

- ABP 8064T has excellent RBO performance on PPF leadframe

Resin Bleed out (RBO) Evaluation

-- Summary

- ABP 8064T has excellent RBO performance on PPF leadframe

Work Life Evaluation

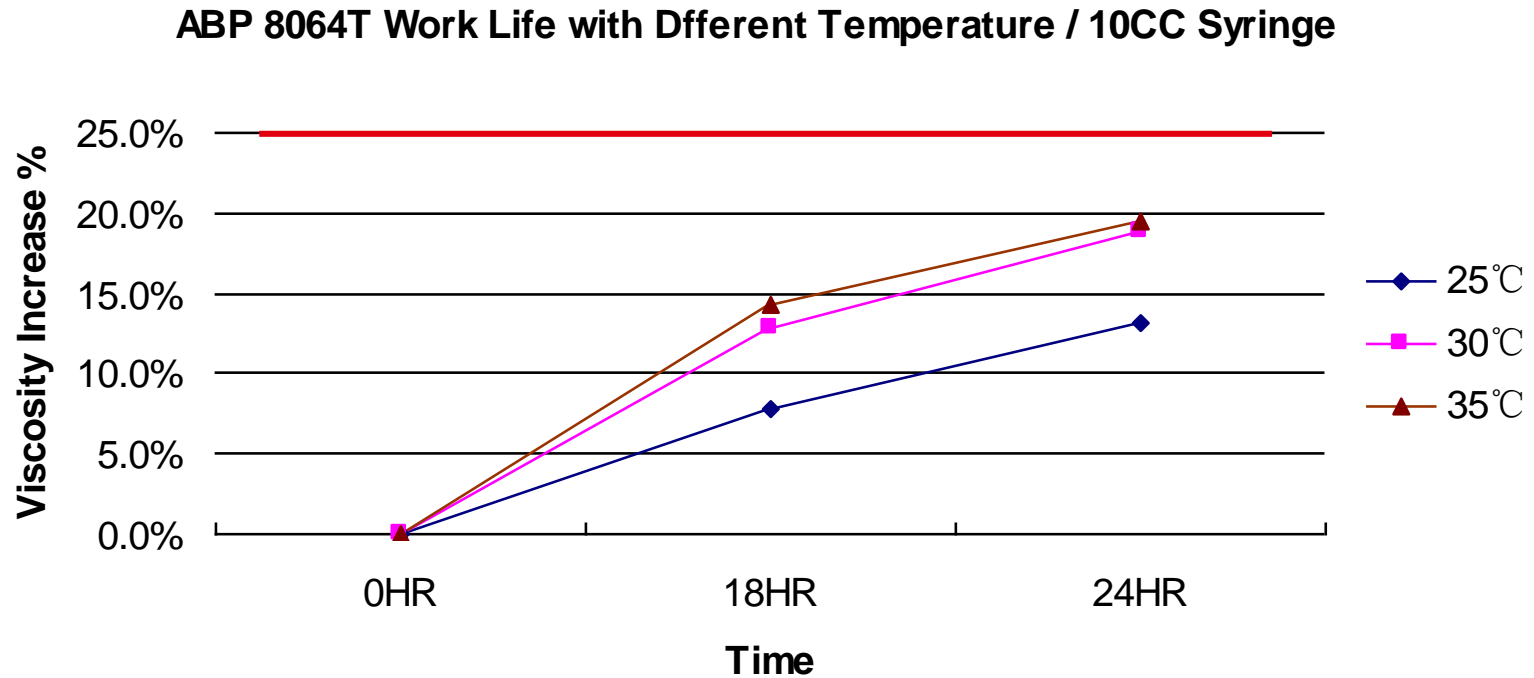
Work Life Evaluation

-- Work Life Definition

- 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%

Work Life Evaluation

-- Viscosity increasing @ Different Temperature



- The viscosity increase are all smaller than 25% even under 35°C

Work Life Evaluation

-- Summary

- ABP 8064T has 24 hours work life at room temperature and the viscosity increase is smaller than 25% within 24 hours even under 35°C

Oven Cure Condition Study

Oven Cure Condition Study

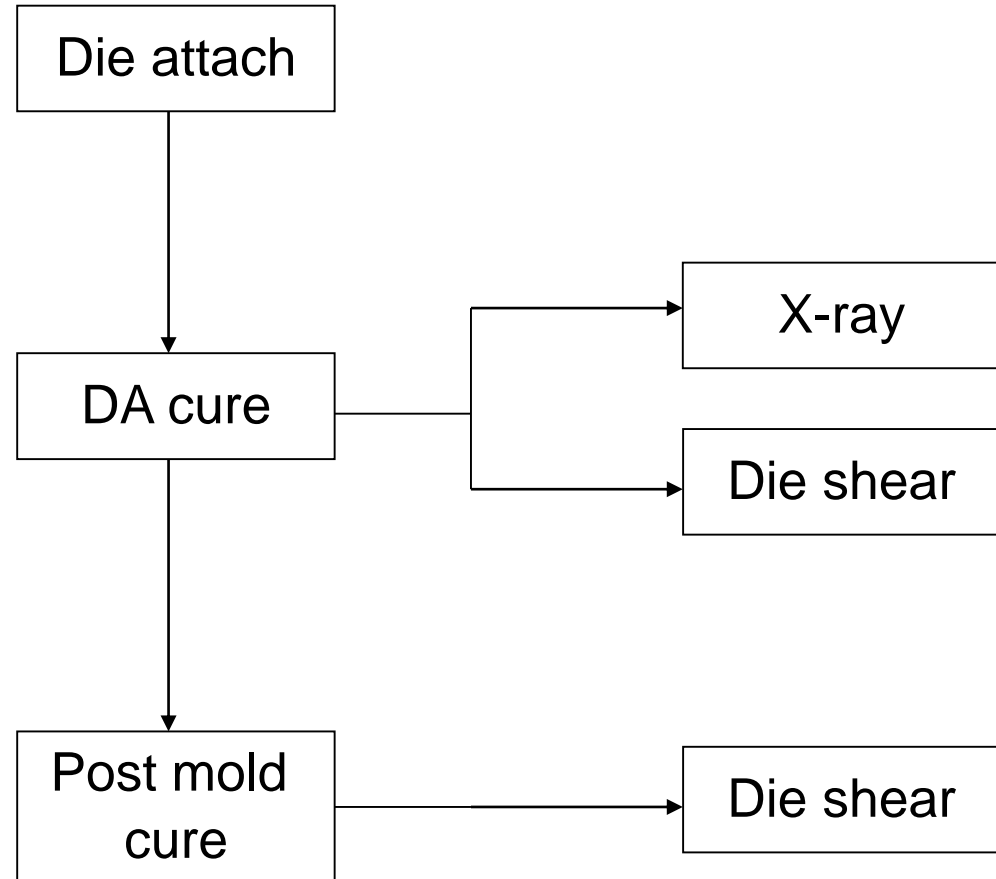
-- 5X5mm Die, DOE Plan

- DOE matrix

No.	Atmosphere	Temperature/°C	PMC
Leg 1	N2	180	No
Leg 2	N2	140	No
Leg 3	Air	180	No
Leg 4	Air	140	No
Leg 5	N2	180	Yes
Leg 6	N2	140	Yes
Leg 7	Air	180	Yes
Leg 8	Air	140	Yes

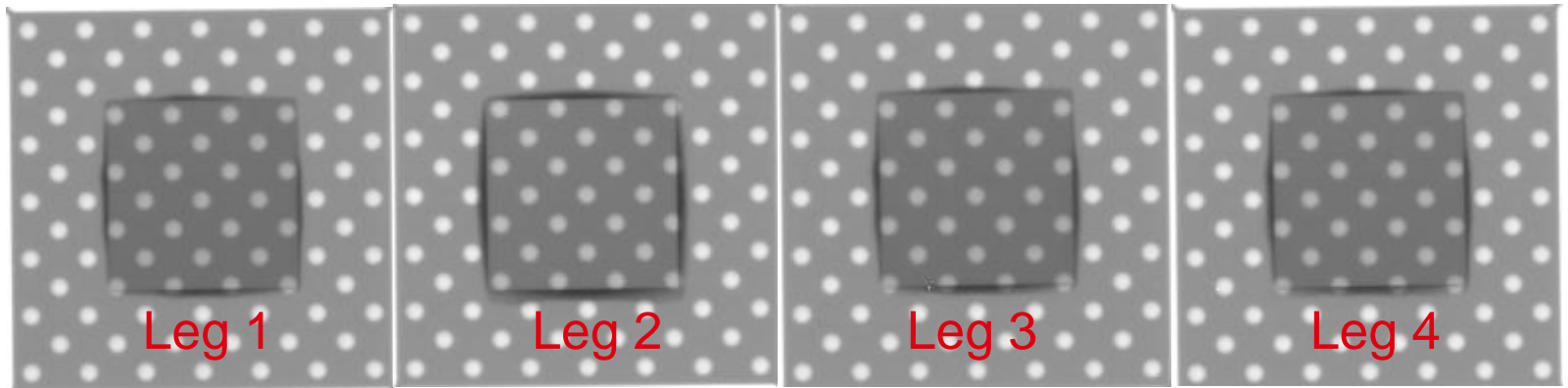
- L/F: Henkel in-house PPF L/F
- Die thickness: 15mil
- Curing profile: 30min ramp up to the setted temperature, hold 1 hour
- PMC: 175 °C, 4 hours

- Test flow



Oven Cure Condition Study

-- 5X5mm Die, X-ray

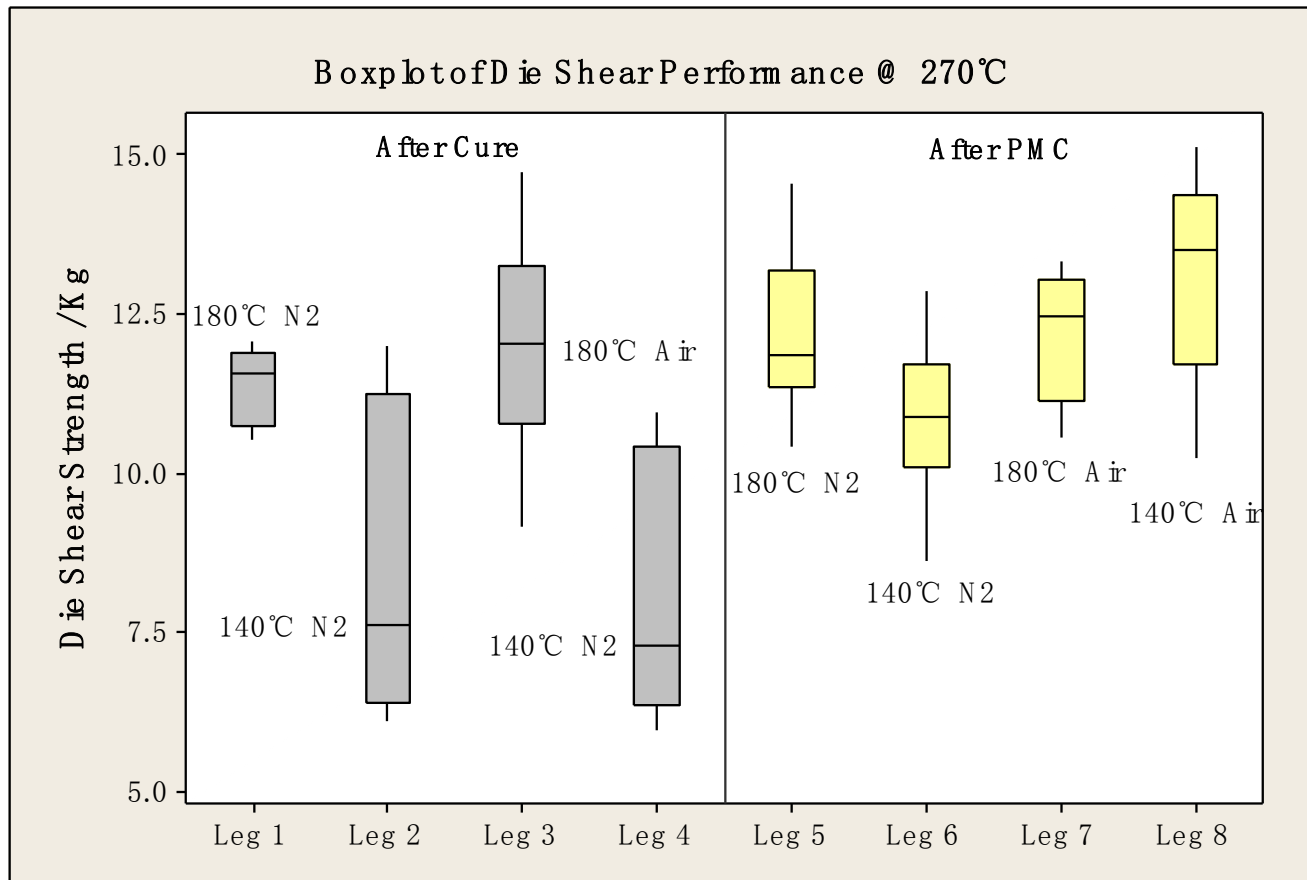


- Void free after cure with different curing profile

Oven Cure Condition Study

-- 5X5mm Die, Die Shear

- Die shear summary



Oven Cure Condition Study

-- 5x5mm Die, Die Shear

Factorial Fit: DSS versus Temperature, Atmosphere, PMC

Estimated Effects and Coefficients for DSS (coded units)

Term	Effect	Coef	SE Coef	T	P
Constant		11.1048	0.2075	53.52	0.000
Temperature	1.7005	0.8502	0.2075	4.10	0.000
Atmosphere	0.4895	0.2347	0.2075	1.13	0.263
PMC	2.1256	1.0628	0.2075	5.12	0.000
Temperature*Atmosphere	-0.1622	-0.0811	0.2075	-0.39	0.697
Temperature*PMC	-1.8627	-0.8314	0.2075	-4.01	0.000
Atmosphere*PMC	0.4467	0.2233	0.2075	1.08	0.286
Temperature*Atmosphere*PMC	-0.7523	-0.3761	0.2075	-1.81	0.075

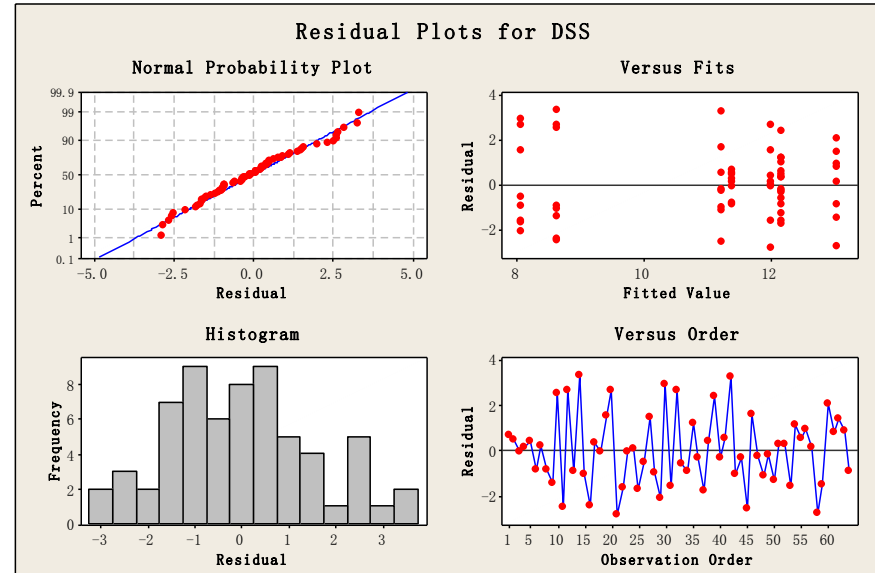
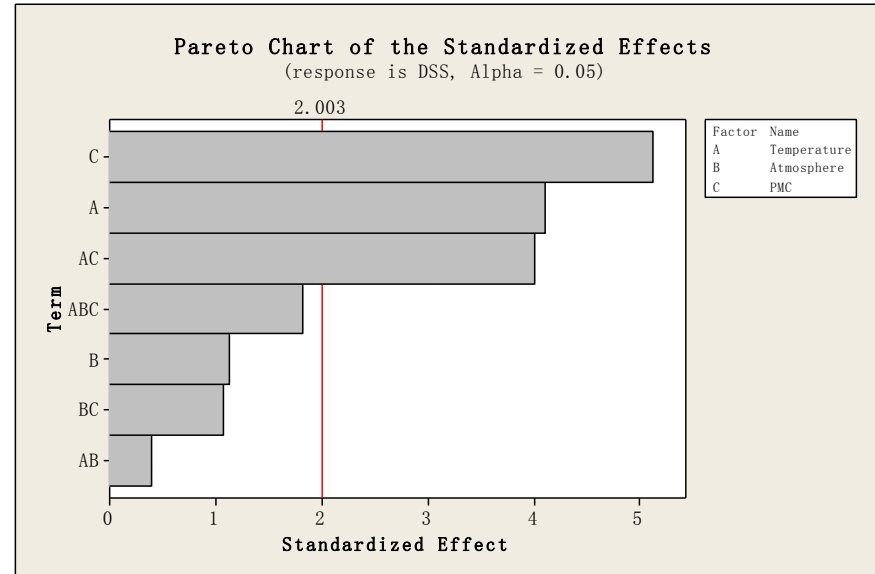
S = 1.65982 PRESS = 201.510
R-Sq = 53.71% R-Sq(pred) = 39.53% R-Sq(adj) = 47.92%

Analysis of Variance for DSS (coded units)

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	3	122.082	122.082	40.694	14.77	0.000
2-Way Interactions	3	47.847	47.847	15.949	5.79	0.002
3-Way Interactions	1	9.055	9.055	9.055	3.29	0.075
Residual Error	56	154.281	154.281	2.755		
Pure Error	56	154.281	154.281	2.755		
Total	63	333.265				

Estimated Coefficients for DSS using data in uncoded units

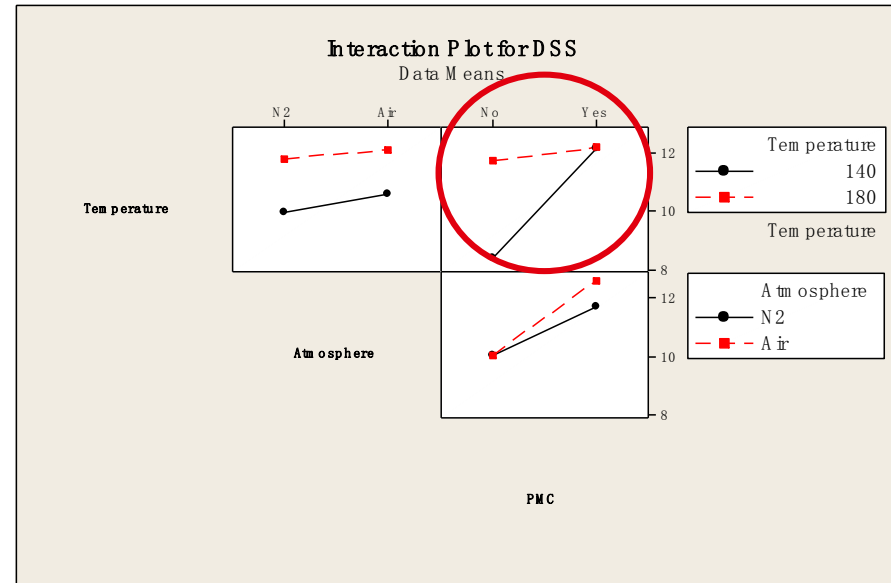
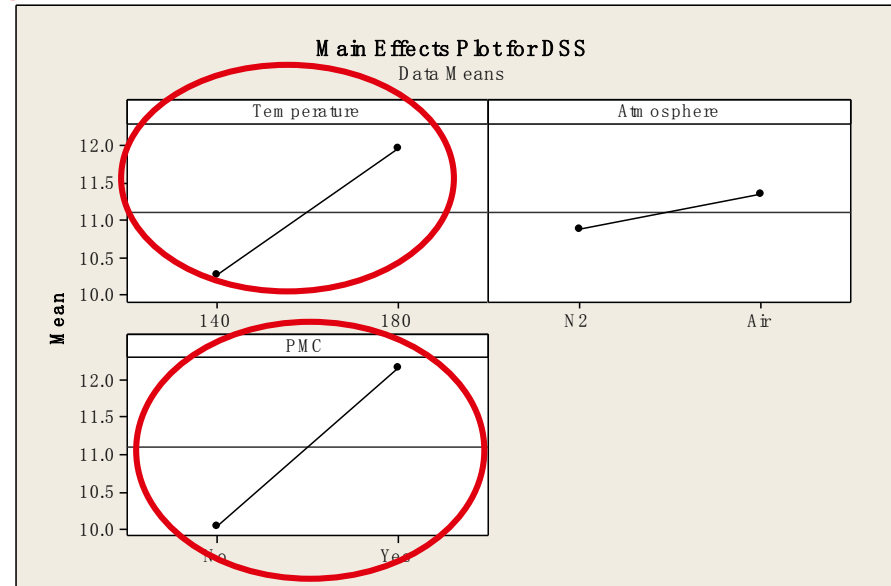
Term	Coef
Constant	4.30277
Temperature	0.0425117
Atmosphere	0.88361
PMC	7.71367
Temperature*Atmosphere	-0.0040555
Temperature*PMC	-0.0415680
Atmosphere*PMC	3.23245
Temperature*Atmosphere*PMC	-0.0188070



Oven Cure Condition Study

-- 5x5mm Die, Die Shear

- The die shear performance of ABP 8064T with 5x5mm die has significant effect with A (temperature) and C (PMC), and the interaction between A and C is also significant
- Residual plot show the residual matching the criteria of random distribution, symmetry zero, fitting balance and no special trend
- Without PMC, lower curing temperature will get smaller die shear strength, but after PMC, both of them will increase and become no big difference. Curing atmosphere is not a significant factor



Oven Cure Condition Study

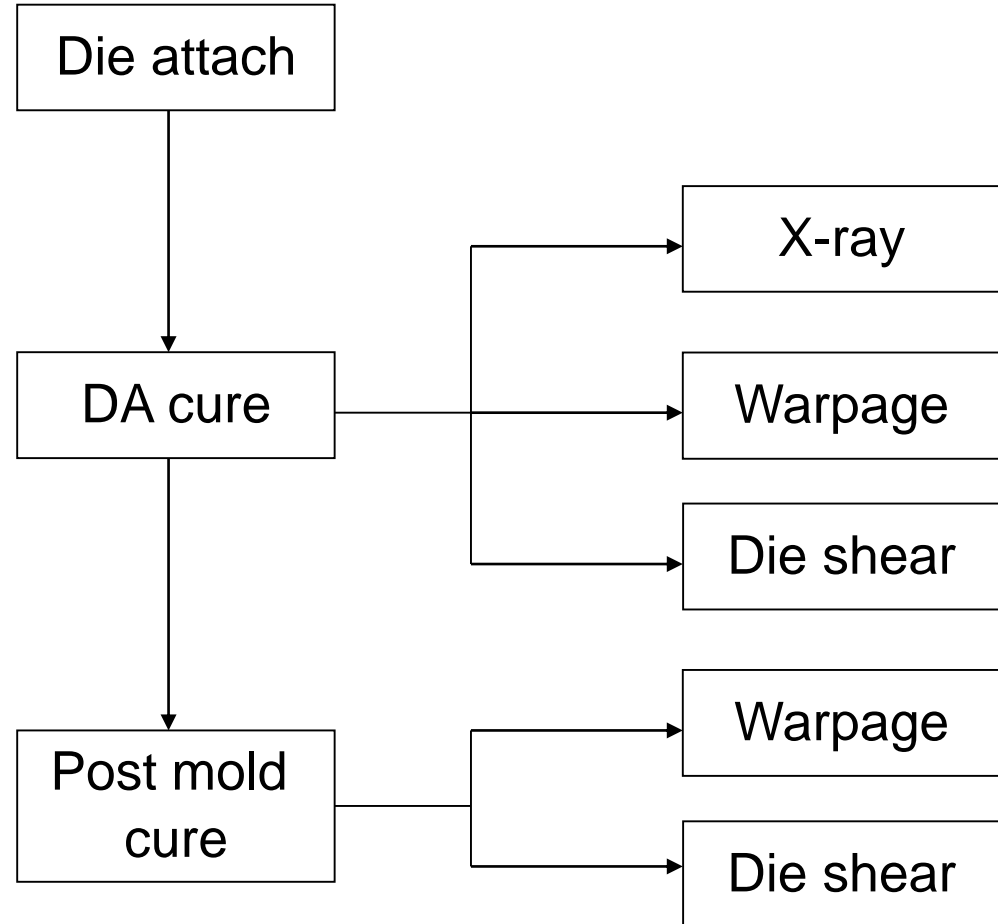
-- 7.6x7.6mm Die, DOE Plan

- DOE matrix

No.	Atmosphere	Temperature/°C	PMC
Leg 1	N2	180	No
Leg 2	N2	140	No
Leg 3	Air	180	No
Leg 4	Air	140	No
Leg 5	N2	180	Yes
Leg 6	N2	140	Yes
Leg 7	Air	180	Yes
Leg 8	Air	140	Yes

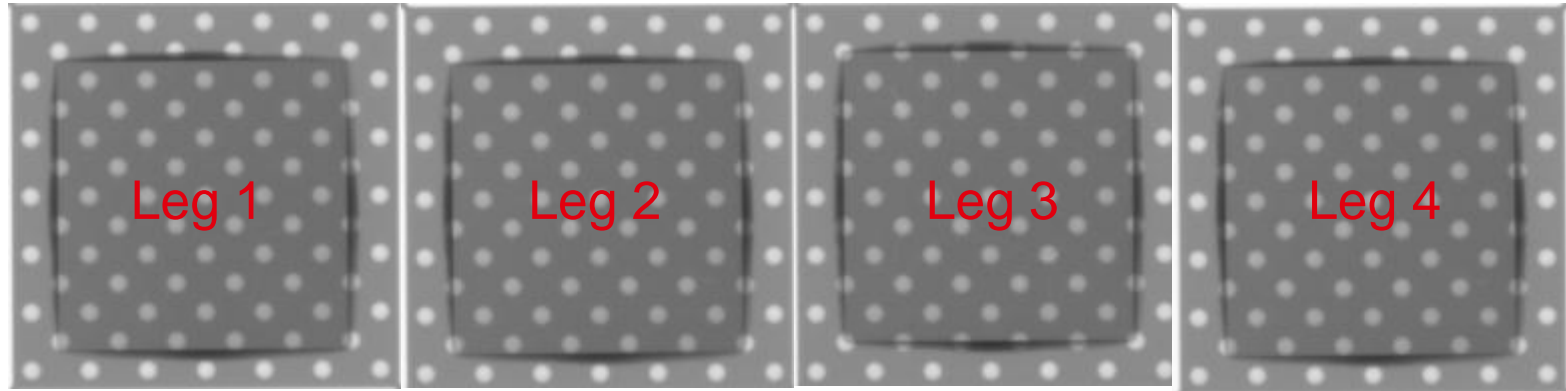
- L/F: Henkel in-house PPF L/F
- Die thickness: 15mil
- Curing profile: 30min ramp up to the setted temperature, hold 1 hour
- PMC: 175 °C, 4 hours

- Test flow



Oven Cure Condition Study

-- 7.6x7.6mm Die, X-ray

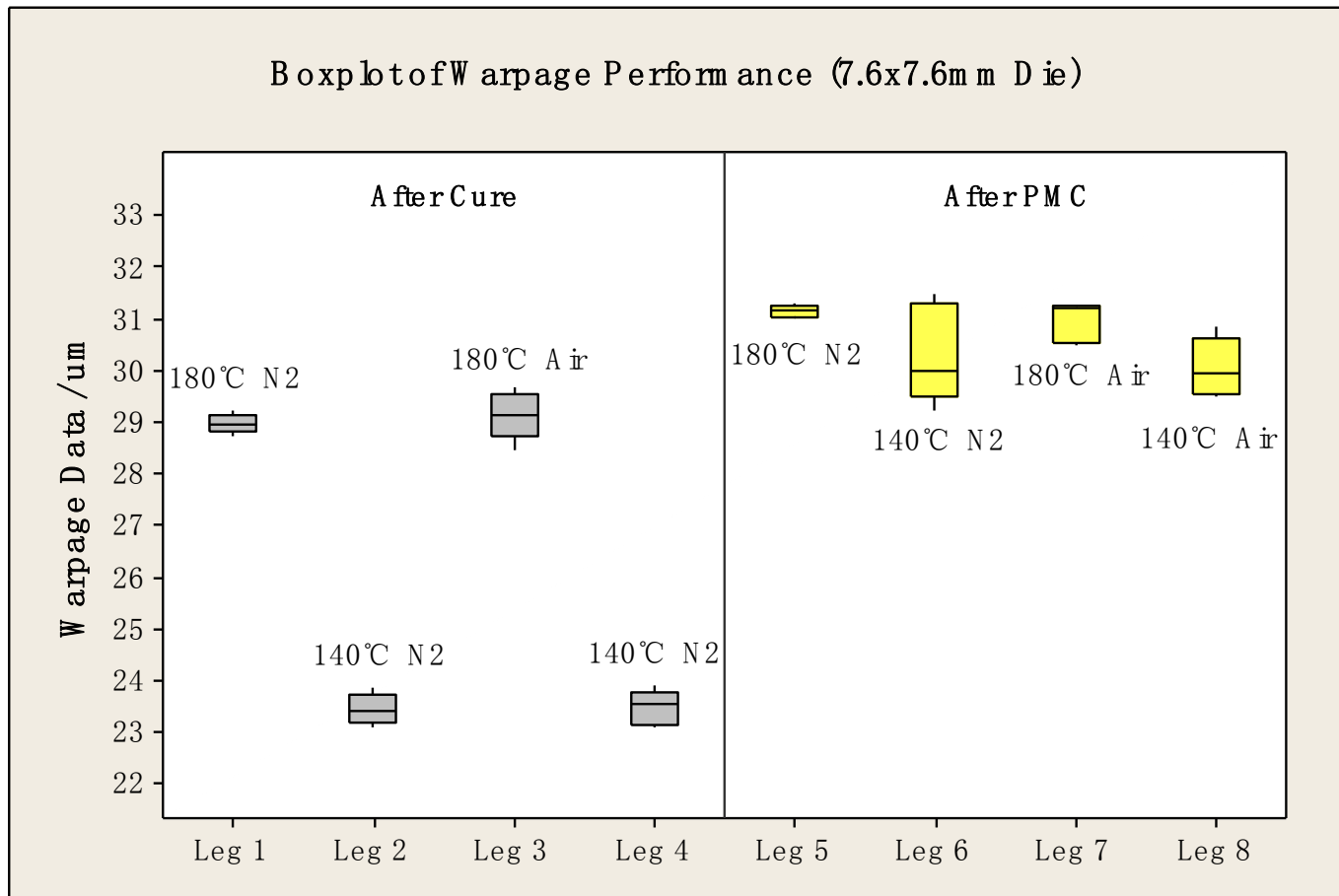


- Void free after cure with different curing profile

Oven Cure Condition Study

-- 7.6x7.6mm Die, Warpage

- Warpage performance summary



Oven Cure Condition Study

-- 7.6x7.6mm Die, Warpage

Factorial Fit: Warpage versus Temperature, Atmosphere, PMC

Estimated Effects and Coefficients for Warpage (coded units)

Term	Effect	Coef	SE Coef	T	P
Constant		28.435	0.07595	374.38	0.000
Temperature	3.233	1.616	0.07595	21.28	0.000
Atmosphere	-0.057	-0.029	0.07595	-0.38	0.708
PMC	4.360	2.180	0.07595	28.70	0.000
Temperature*Atmosphere	0.059	0.029	0.07595	0.39	0.702
Temperature*PMC	-2.366	-1.183	0.07595	-15.58	0.000
Atmosphere*PMC	-0.166	-0.083	0.07595	-1.10	0.281
Temperature*Atmosphere*PMC	-0.015	-0.007	0.07595	-0.10	0.923

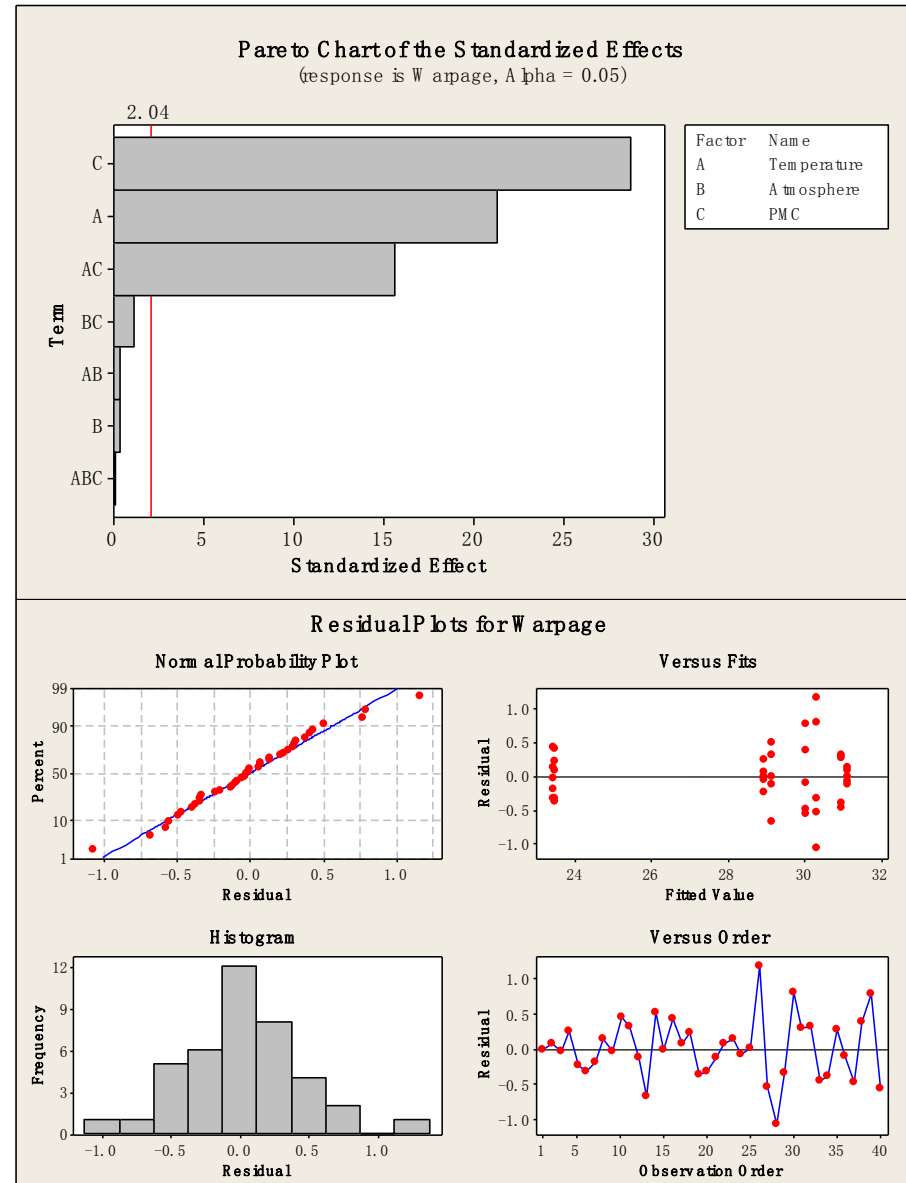
S = 0.480353 PRESS = 11.5369
R-Sq = 97.94% R-Sq(pred) = 96.78% R-Sq(adj) = 97.49%

Analysis of Variance for Warpage (coded units)

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	3	294.645	294.645	98.2149	425.65	0.000
2-Way Interactions	3	56.303	56.303	18.7676	81.34	0.000
3-Way Interactions	1	0.002	0.002	0.0022	0.01	0.923
Residual Error	32	7.384	7.384	0.2307		
Pure Error	32	7.384	7.384	0.2307		
Total	39	358.333				

Estimated Coefficients for Warpage using data in uncoded units

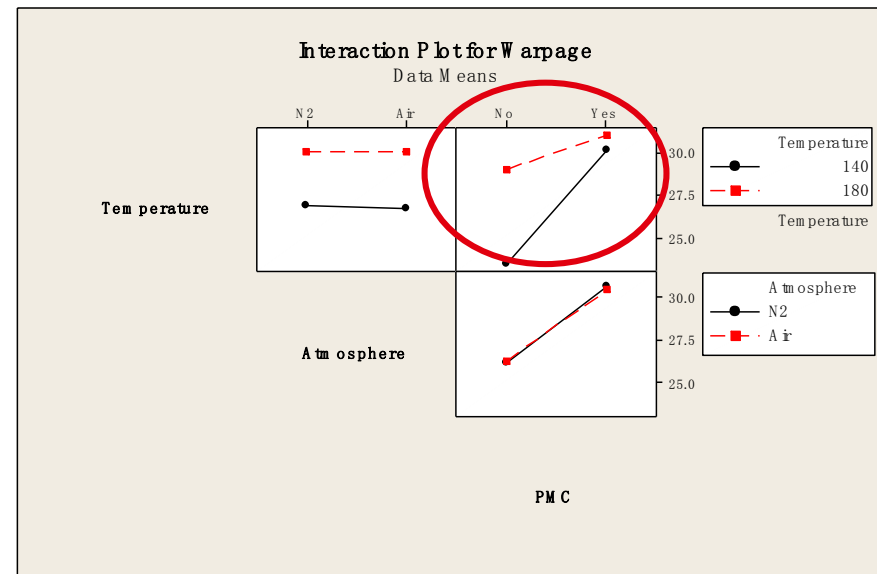
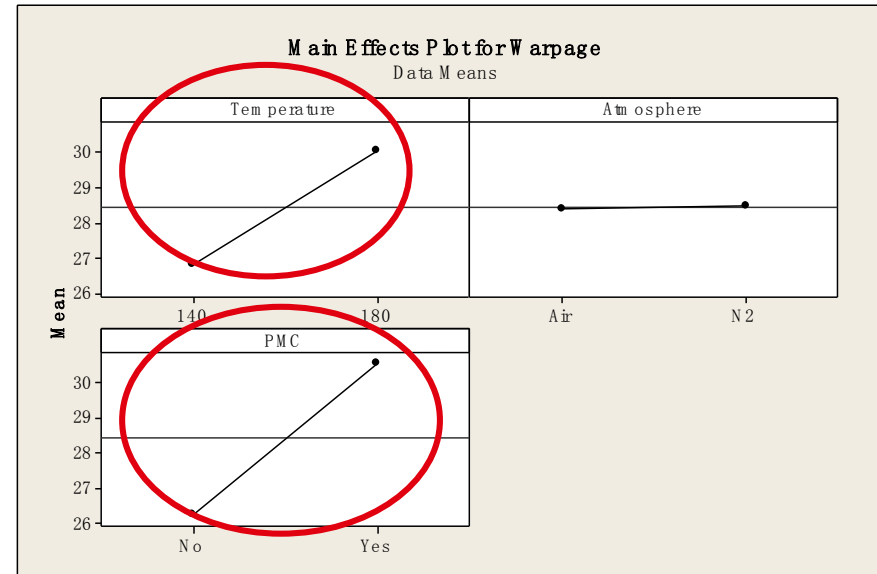
Term	Coef
Constant	15.5043
Temperature	0.0808137
Atmosphere	-0.263325
PMC	11.6451
Temperature*Atmosphere	0.00146625
Temperature*PMC	-0.0591563
Atmosphere*PMC	-0.024225
Temperature*Atmosphere*PMC	-0.00036875



Oven Cure Condition Study

-- 7.6x7.6mm Die, Warpage

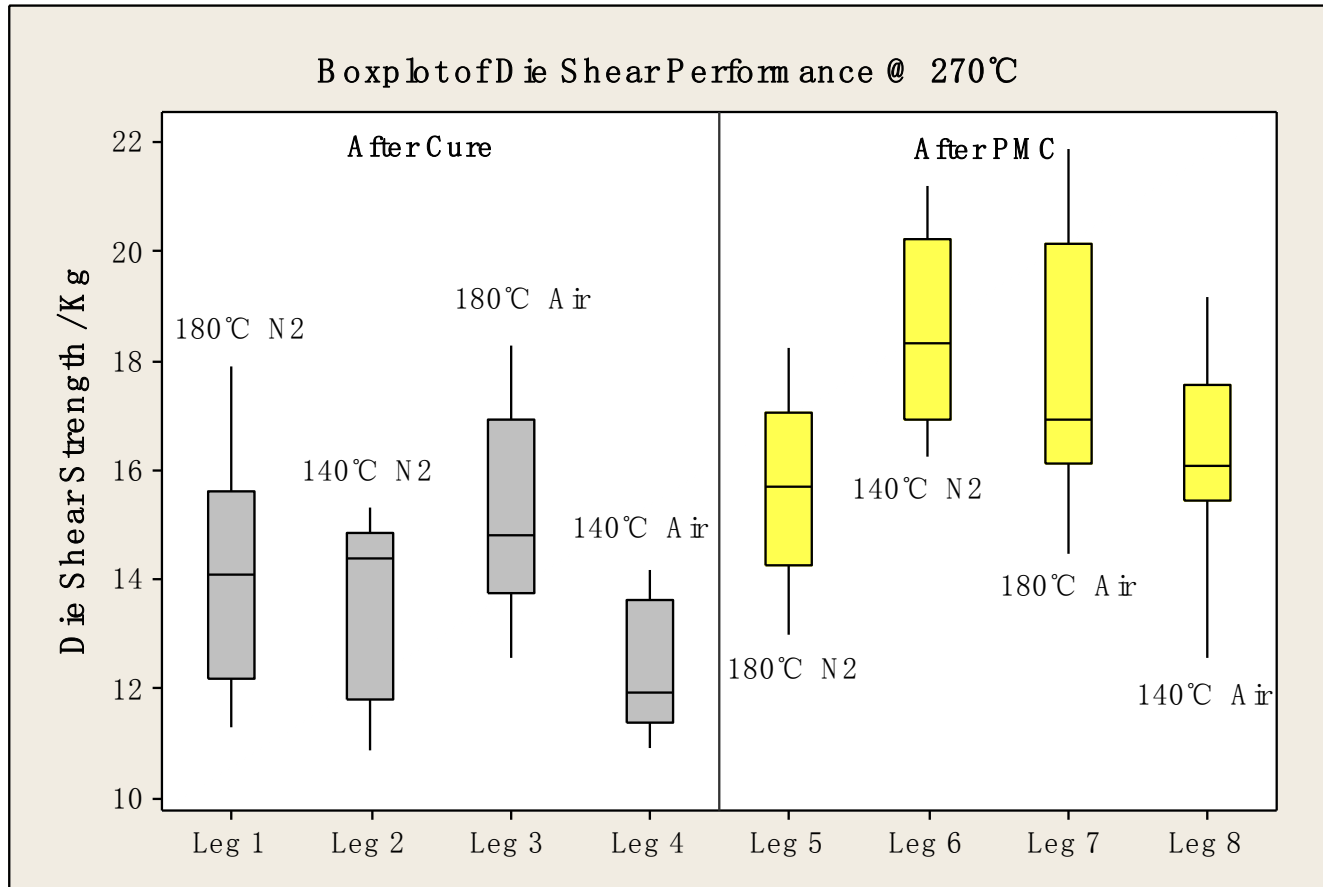
- The warpage performance of ABP 8064T has significant effect with A: (temperature) and C (PMC), and the interaction between A and C is also significant
- Residual plot show the residual matching the criteria of random distribution, symmetry zero, fitting balance and no special trend
- Without PMC, lower curing temperature will get smaller warpage, but after PMC, both of them will increase and become no big difference. Curing atmosphere won't affect warpage



Oven Cure Condition Study

-- 7.6x7.6mm Die, Die Shear

- Die shear summary



Oven Cure Condition Study

-- 7.6x7.6mm Die, Die Shear

Factorial Fit: DSS versus Temperature, Atmosphere, PMC

Estimated Effects and Coefficients for DSS (coded units)

Term	Effect	Coef	SE Coef	T	P
Constant		15.2387	0.2046	74.48	0.000
Temperature	-0.1733	-0.0867	0.2046	-0.42	0.674
Atmosphere	-0.2028	-0.1014	0.2049	-0.49	0.623
PMC	3.3869	1.6934	0.2046	8.28	0.000
Temperature*Atmosphere	1.3335	0.6668	0.2049	3.25	0.002
Temperature*PMC	-1.2723	-0.6361	0.2046	-3.11	0.003

S = 1.56666 PRESS = 161.252
R-Sq = 63.70% R-Sq(pred) = 55.00% R-Sq(adj) = 60.27%

Analysis of Variance for DSS (coded units)

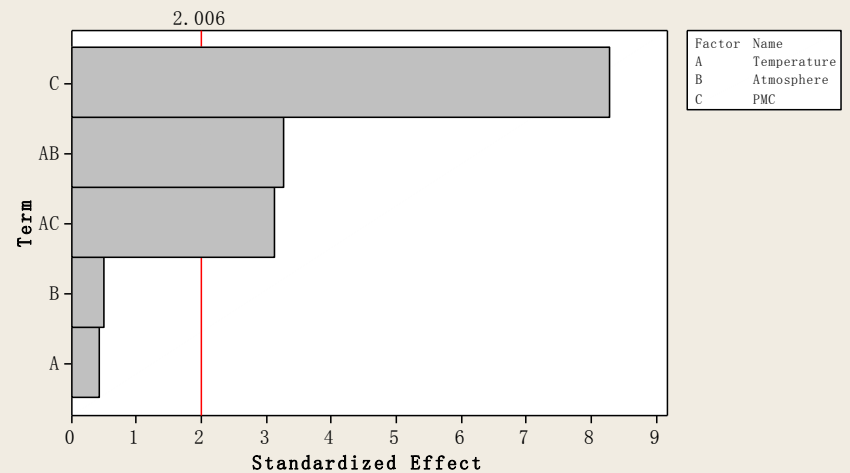
Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	3	175.708	170.510	56.8366	23.16	0.000
2-Way Interactions	2	52.528	52.528	26.2641	10.70	0.000
Residual Error	53	130.084	130.084	2.4544		
Lack of Fit	2	0.496	0.496	0.2479	0.10	0.907
Pure Error	51	129.588	129.588	2.5409		
Total	58	358.320				

Estimated Coefficients for DSS using data in uncoded units

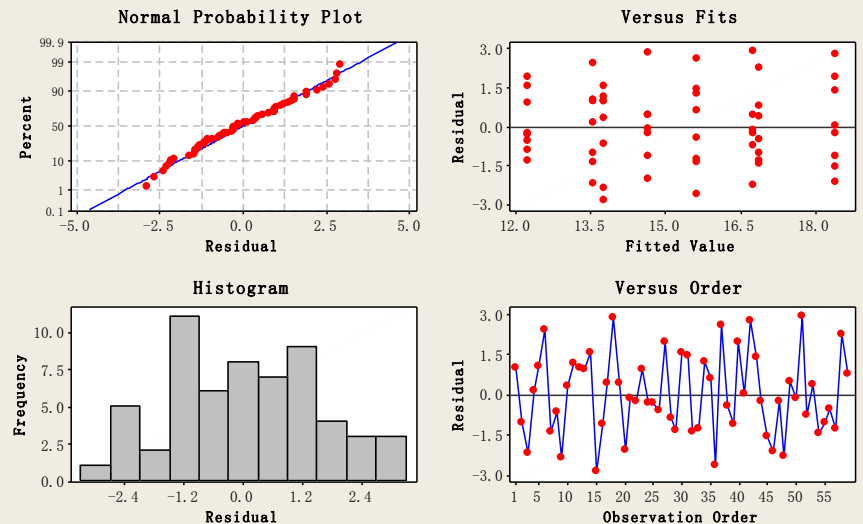
Term	Coef
Constant	15.9319
Temperature	-0.0043327
Atmosphere	-5.43557
PMC	6.78254
Temperature*Atmosphere	0.0333386
Temperature*PMC	-0.0318068

Pareto Chart of the Standardized Effects

(response is DSS, Alpha = 0.05)



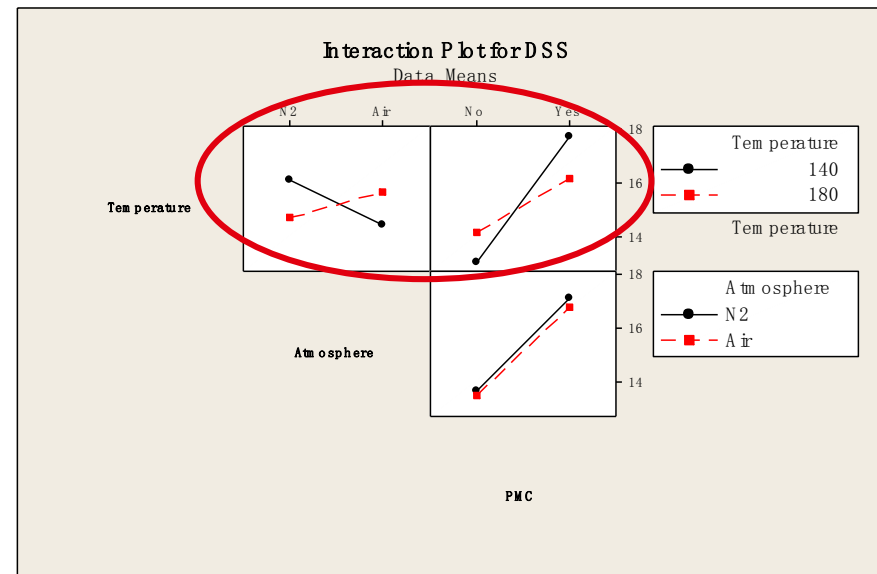
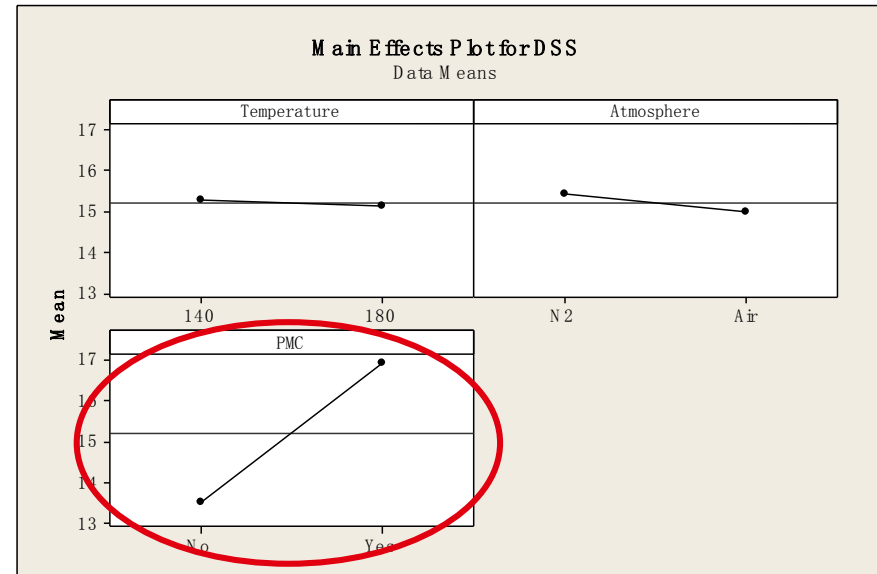
Residual Plots for DSS



Oven Cure Condition Study

-- 7.6x7.6mm Die, Die Shear

- The die shear performance of ABP 8064T with 7.6x7.6mm die has significant effect with C (PMC), and the interaction between A (temperature) and B (atmosphere), A and C are also significant
- Residual plot show the residual matching the criteria of random distribution, symmetry zero, fitting balance and no special trend
- Curing temperature and atmosphere are not the significant main effects, lower temperature isn't mean lower die shear strength. Die shear strength will increase after PMC



Oven Cure Condition Study

-- Summary

- Curing Temperature

Different curing temperature will get almost the same high temperature die shear strength (HDSS) and warpage after PMC

- Atmosphere

Curing in air or N2 won't significantly affect both HDSS and warpage

- PMC

PMC will increase HDSS and warpage significantly

✓ Recommended Curing condition: Ramp up to 175°C within 30min, hold 1hour, because temperature won't affect HDSS and warpage significantly with PMC and it's the normal DA paste curing condition

Adhesion Performance

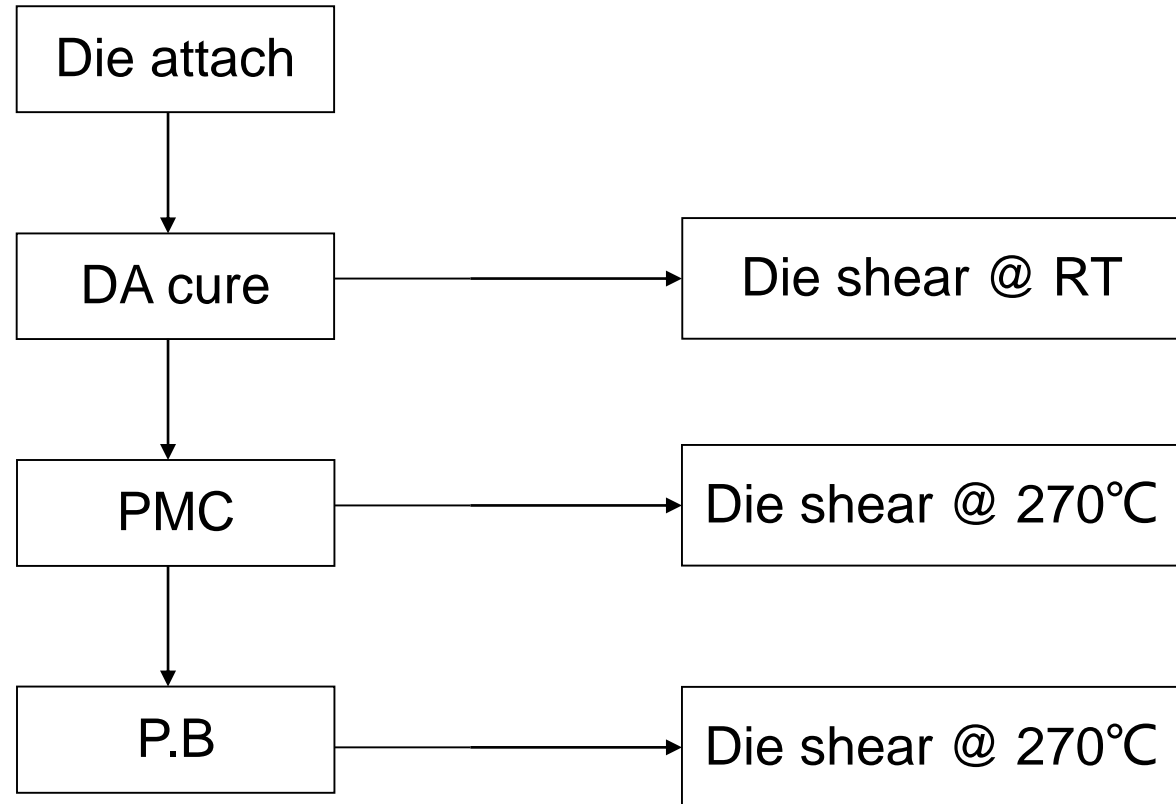
Adhesion Performance

-- Test Condition

- L/F: Henkel in-house PPF leadframe
- Curing profile:
 - 2x2mm & 5x5mm die, 30min ramp up to 180°C, hold 1 hour, in N2
 - 7.6x7.6mm die, 30min ramp up to 140°C, hold 1 hour, in N2
- Post mold cure (PMC): 175 °C, 4 hours
- Parr bomb (PB) condition: 121°C, 2atm, 100%RH, soaking 16 hours. The purpose is to get the hot die shear strength data after moisture soaking to simulate pre-condition test

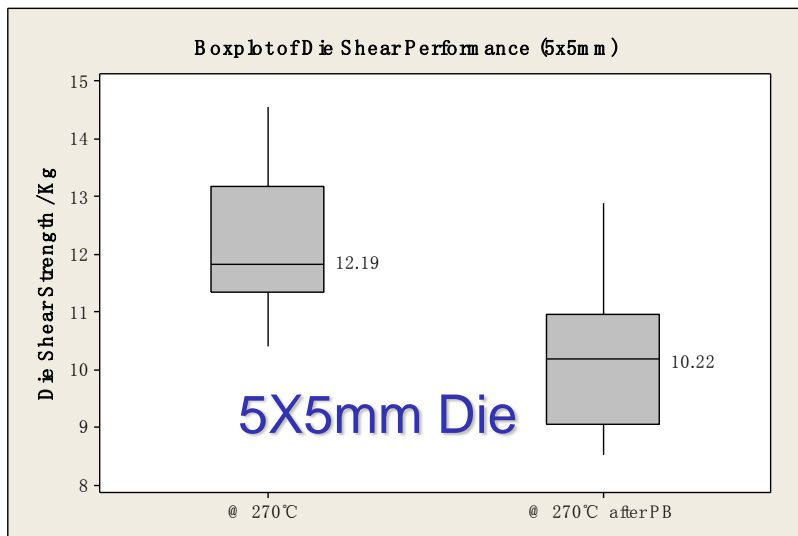
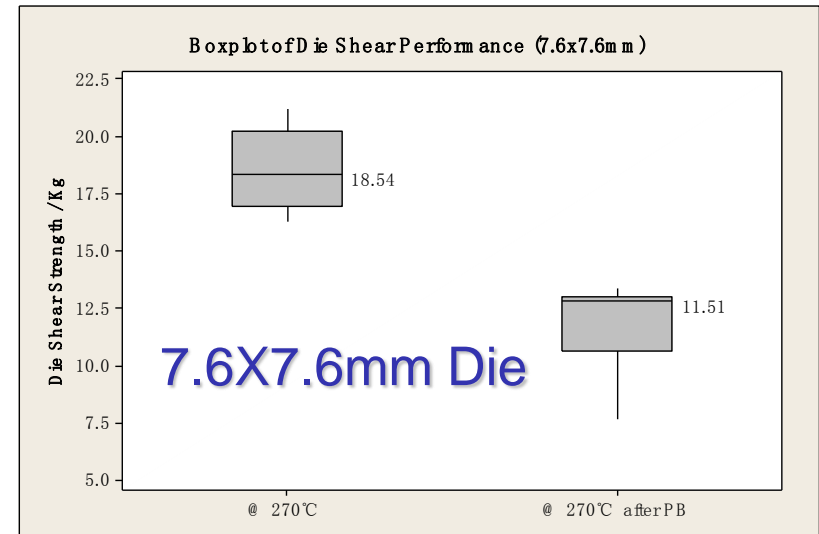
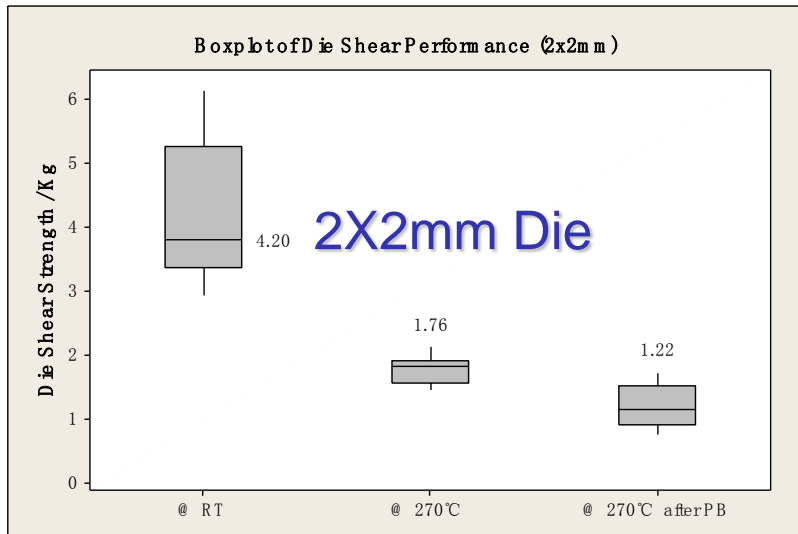
Adhesion Performance

-- Test Flow



Adhesion Performance

-- Die Shear Strength



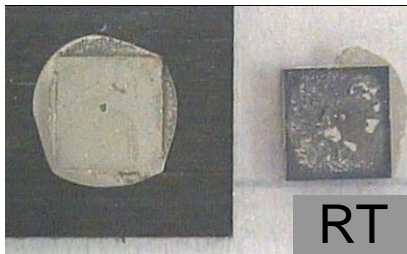
- ABP 8064T has excellent adhesion performance on PPF leadframe, especially for medium and large die.

Adhesion Performance

-- Failure Mode

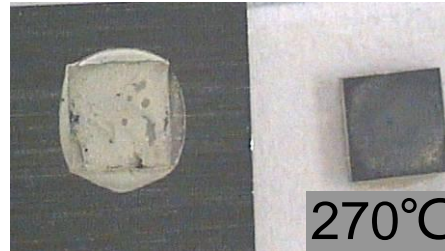
2x2mm

Die



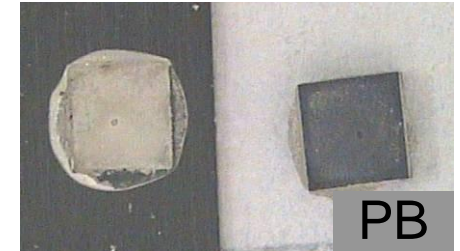
RT

Cohesive



270°C

Adhesive to L/F

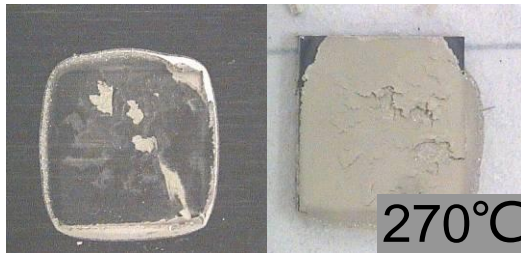


PB

Adhesive to L/F

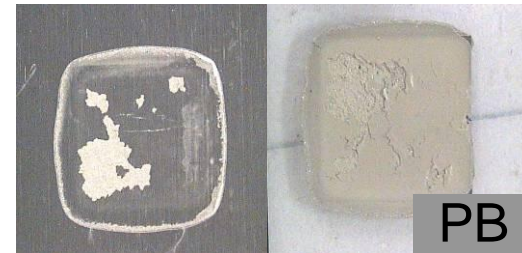
5x5mm

Die



270°C

Adhesive to die

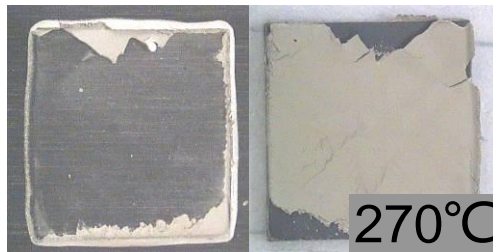


PB

Adhesive to die

7.6x7.6mm

Die



270°C

Adhesive to die



PB

Cohesive

Adhesion Performance

-- Summary

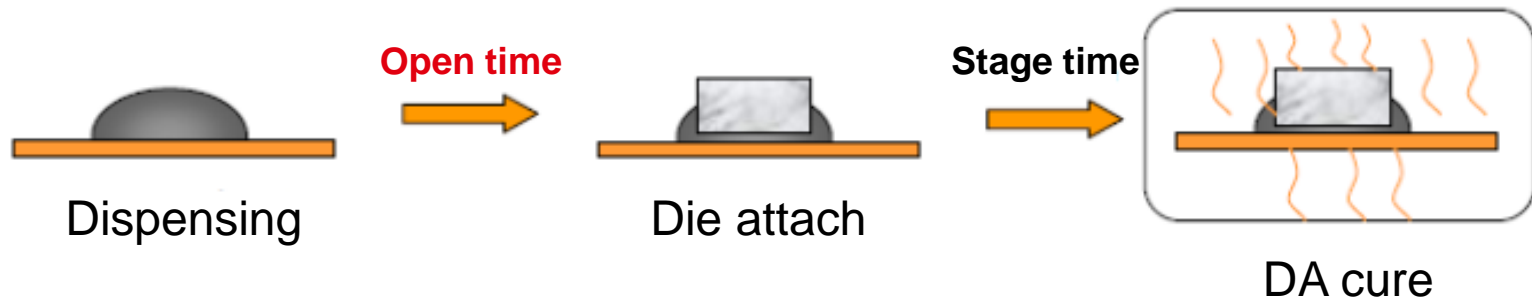
- ABP 8064T has excellent adhesion performance on PPF leadframe, especially for medium and large die.

Open Time and Stage Time Study

Open Time and Stage Time Study

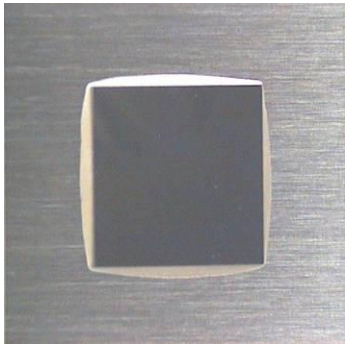
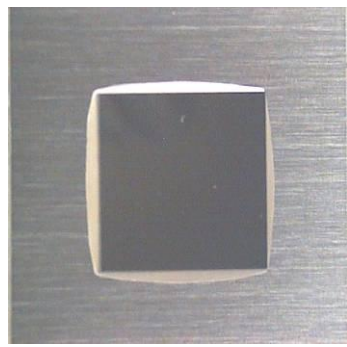
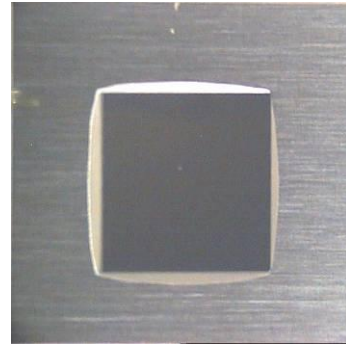
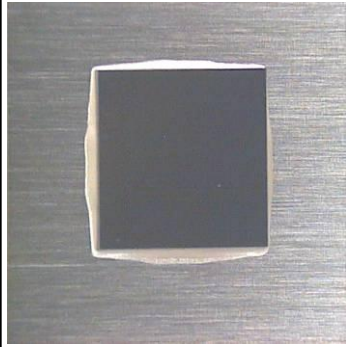
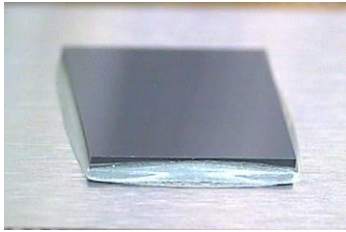
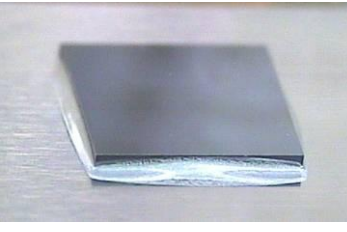
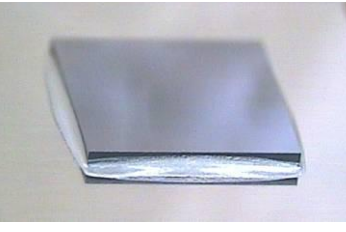
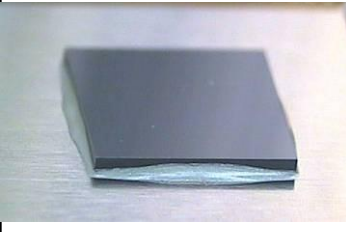
-- Open Time

- Open time: The time after dispensing and before die attach, at that time, the paste is open to the environment



Open Time and Stage Time Study

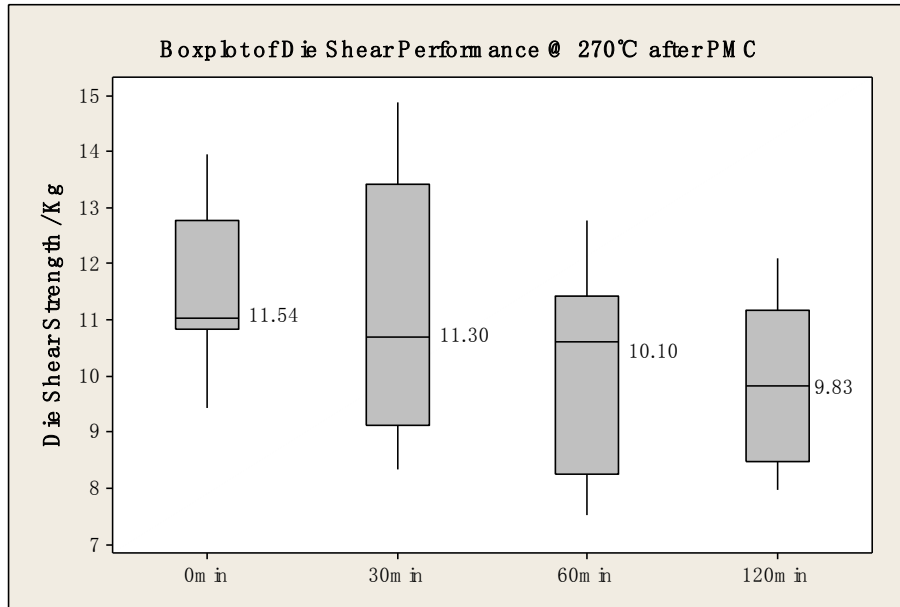
-- Open Time

Open Time	0min	30min	60min	120min
Top View				
Side View				

- After 2 hours open time, the fillet will become a little small but still have good coverage

Open Time and Stage Time Study

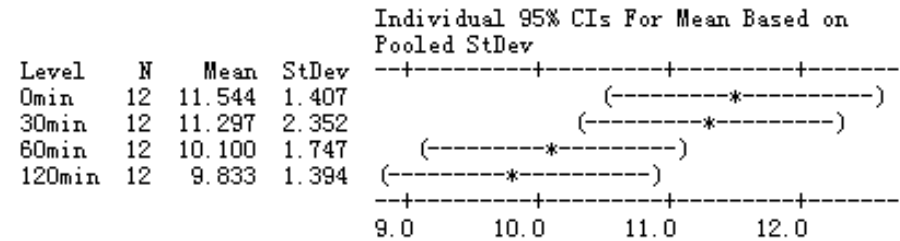
-- Open Time



One-way ANOVA: 0min, 30min, 60min, 120min

Source	DF	SS	MS	F	P
Factor	3	26.16	8.72	2.79	0.052
Error	44	137.57	3.13		
Total	47	163.73			

S = 1.768 R-Sq = 15.98% R-Sq(adj) = 10.25%



Pooled StDev = 1.768

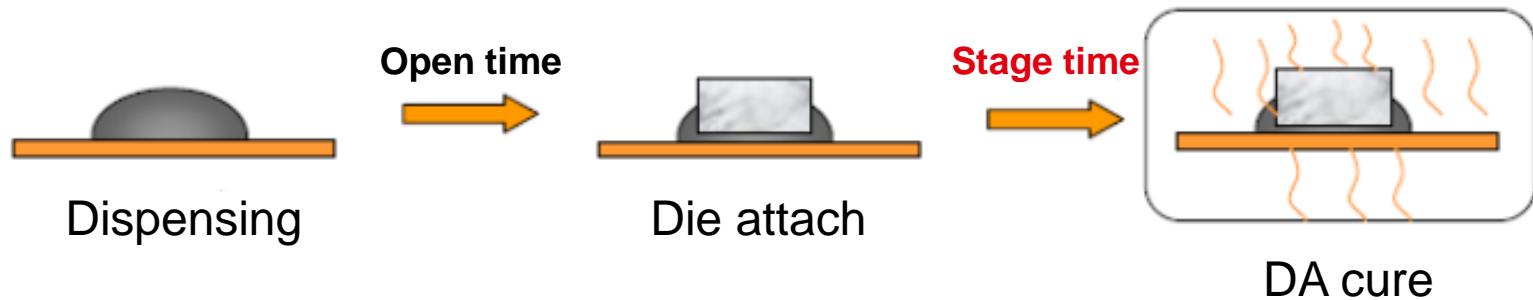
- Die size: 5x5mm die

- There's a trend that the hot die shear strength will drop as time grows, and after 2 hours open time, the influence will become significant

Open Time and Stage Time Study

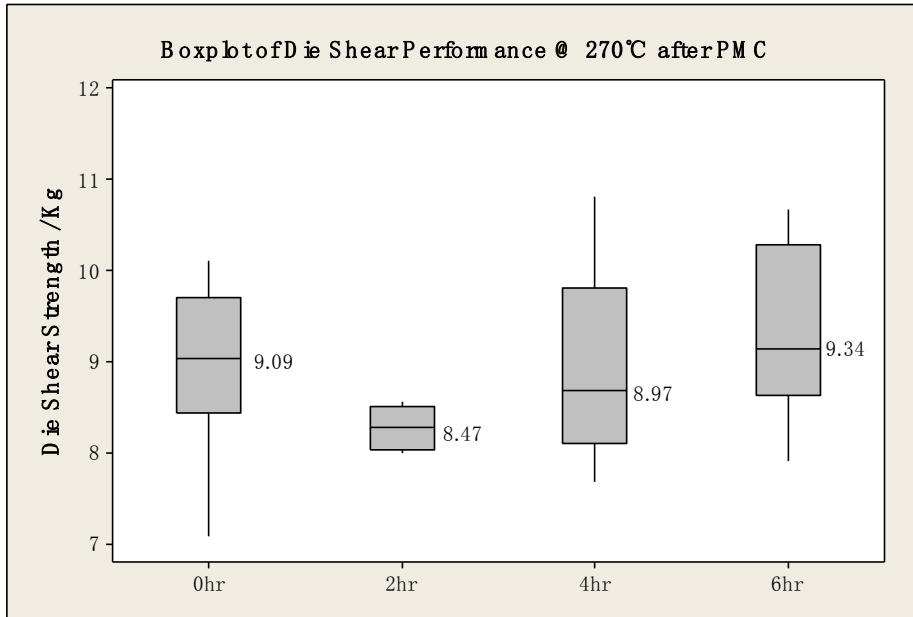
-- Stage Time

- Stage time: After die attach, it will take some time to put the packages into oven, and the time is called stage time



Open Time and Stage Time Study

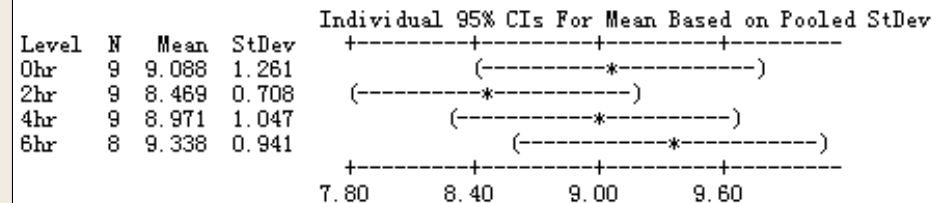
-- Stage Time



One-way ANOVA: 0hr, 2hr, 4hr, 6hr

Source	DF	SS	MS	F	P
Factor	3	3.46	1.15	1.13	0.353
Error	31	31.69	1.02		
Total	34	35.15			

S = 1.011 R-Sq = 9.84% R-Sq(adj) = 1.12%



Pooled StDev = 1.011

- Die size: 5x5mm die

- There's no significant hot die shear strength drop even after 6 hours stage time

Adhesion Performance

-- Summary

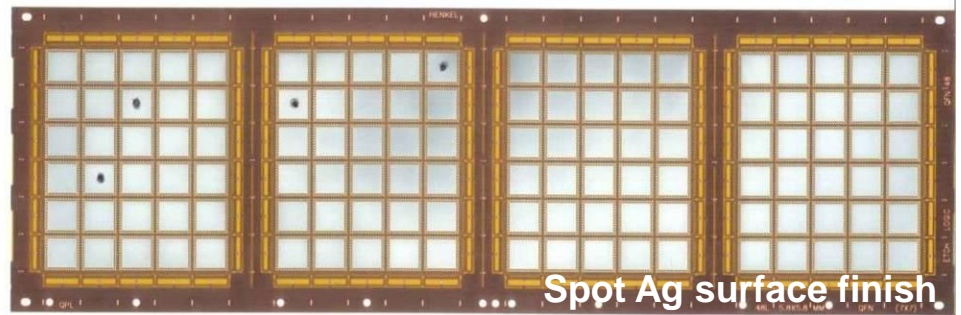
- Open Time: After 2 hours open time, the fillet will become a little small but still have good coverage. HDSS will drop as time grows, and after 2 hours open time, the influence will become significant
- Stage Time: There's no significant hot die shear strength drop even after 6 hours stage time

In package thermal Resistance

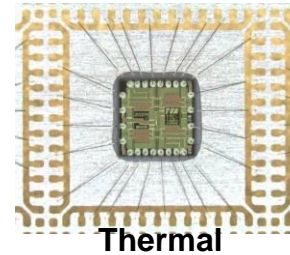
In Package Thermal Resistance

-- Test Vehicle

- 48 lead 7x7mm QFN
 - 5.8x5.8 mm Die Pad
 - NiPdAu (PPF)

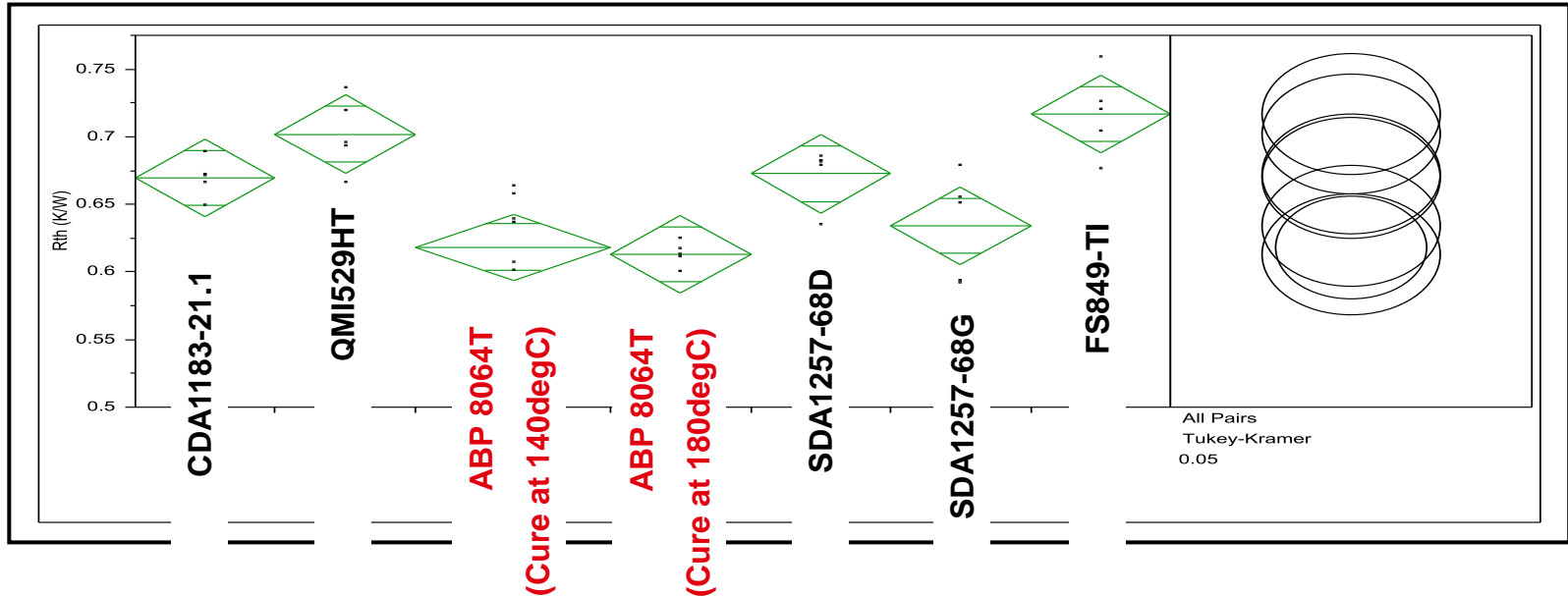


- Thermal Characterization:
 - Thermal Die (2.54x2.54x0.330mm)



In Package Thermal Resistance

-- Test Result



- ABP 8064T has outstanding thermal resistance performance, it is significantly better than QMI519HT and FS849-TI

- Remark: The data is from Henkel US

In Package Thermal Resistance

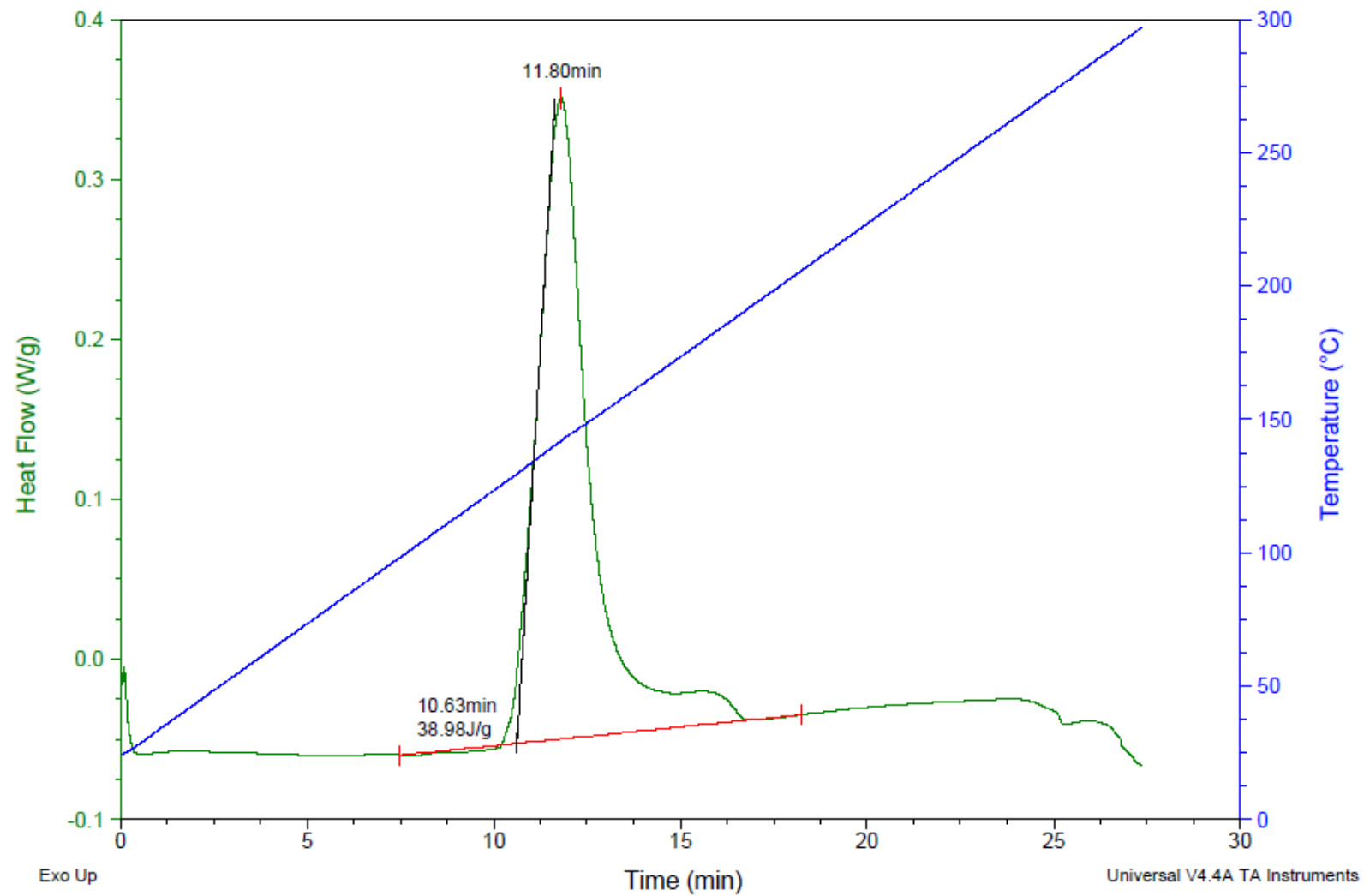
-- Summary

- ABP 8064T has outstanding thermal resistance performance, it is significantly better than QMI519HT and FS849-TI

Appendix

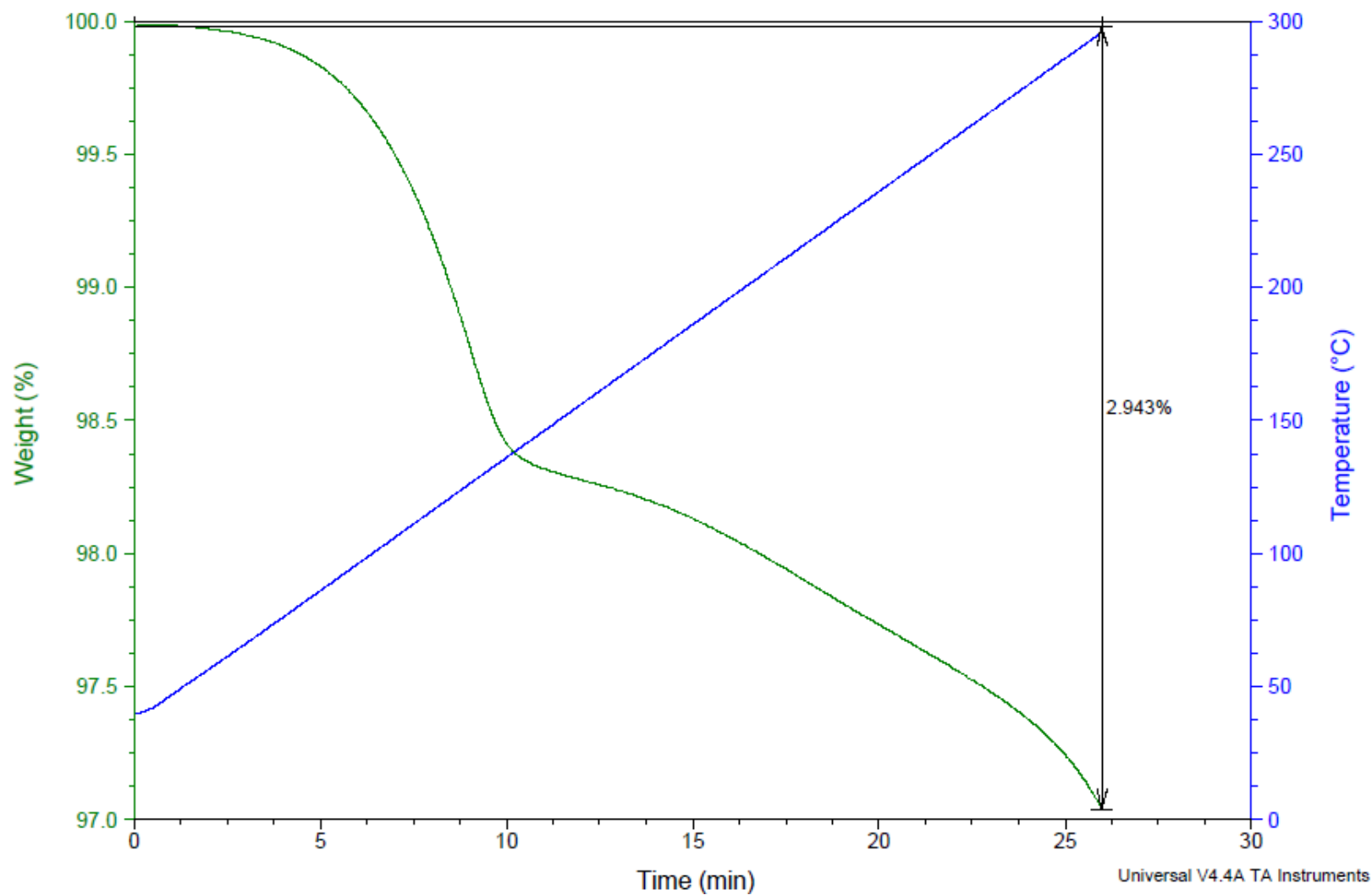
Appendix

-- DSC



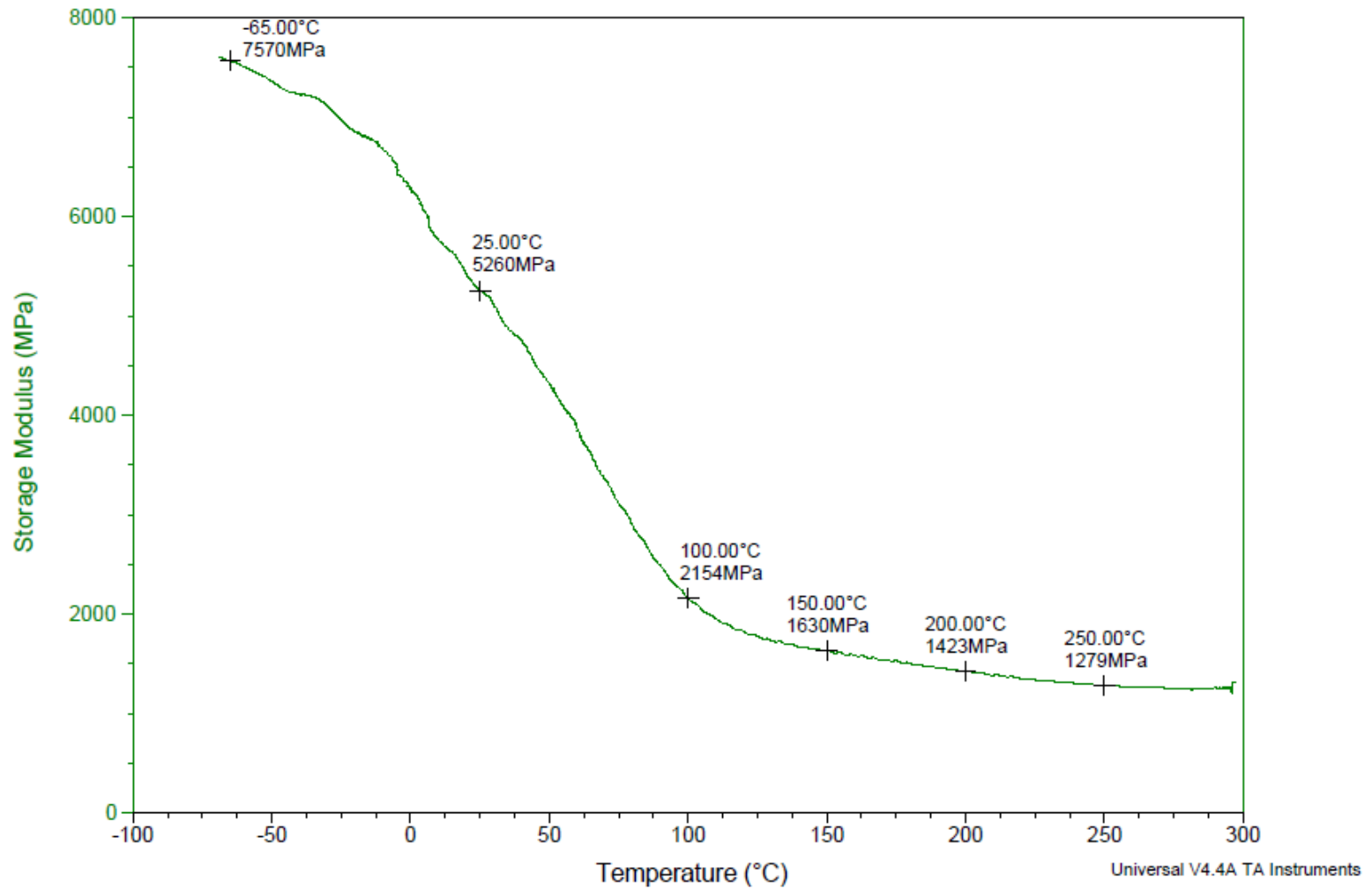
Appendix

-- TGA



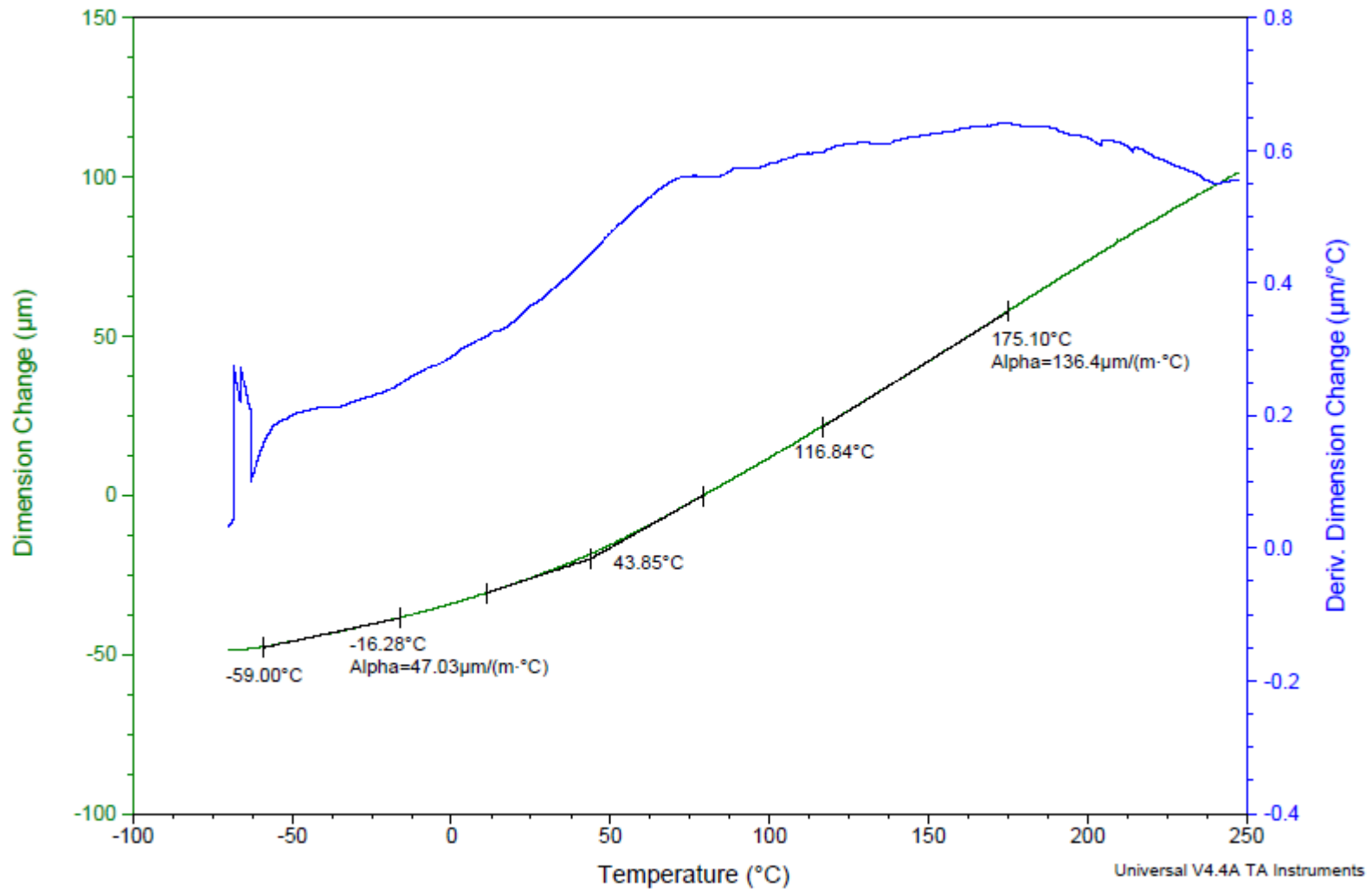
Appendix

-- DMTA



Appendix

-- TMA



Thank you!



Excellence is our Passion