

# LOCTITE ABLESTIK ABP 2035SCR

## Data Package

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Excellence is our Passion

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# Product description & key material properties

# Product description & key material properties

## -- Product Description

- ABP 2035SCR is a non-conductive die attach paste designed for smart card. It is an modification version of Ablebond 2035SC, mainly optimized the compatibility with UV encapsulant. It can provide below benefits:
  - Better compatibility with UV encapsulant than Ablebond 2035SC
  - As good adhesion performance as Ablebond 2035SC
  - Low temperature & quick snap cure
  - Excellent dispensing performance for high throughput application



Pictures are from internet

# Product description & key material properties

## -- key Material Properties

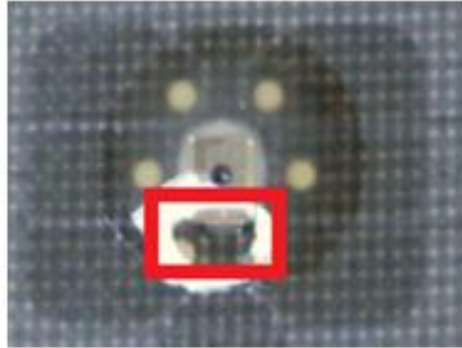
Product Name	ABP 2035SCR	Product Name	ABP 2035SCR
Base Resin	Hybrid	CTE Below T <sub>g</sub> ( ppm/ °C)	50
Filler	non-conductive	CTE Above T <sub>g</sub> ( ppm/ °C)	135
Viscosity @ 25 °C(cps)	9830	Dynamic Tensile Modulus (Mpa )	
Thixotropic Index	4.0	@ 25 °C	1500
Working Life @ 25 °C(hours)	24	@ 150 °C	80
DSC onset point (°C)	87	@ 250 °C	70
DSC peak (°C)	93		
DSC Delta H (J/g)	160		
Ionic Chloride(ppm)	<10		
Sodium (ppm)	<10		
Potassium (ppm)	<10		
T <sub>g</sub> (°C)	118		

- Typical lab data, not spec

# Compatibility with UV Encapsulant

# Compatibility with UV Encapsulant

## -- Problem Description



Uncompleted filling

- Some UV encapsulant may have poor flowability when touches 2035SC fillet, it just stops and leads to uncompleted filling issue
- The flowability is high related with wetting or surface energy. High contact angle means poor flowability, just as water on lotus leaf



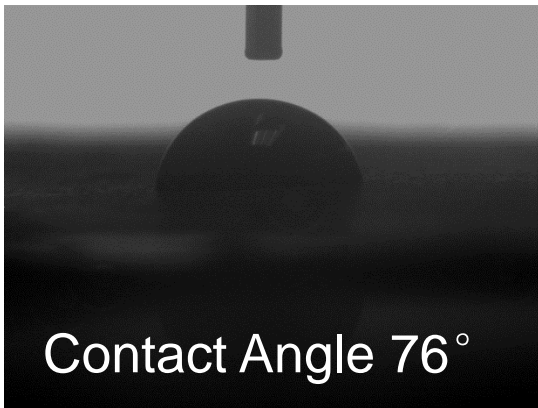
Water on Lotus Leaf



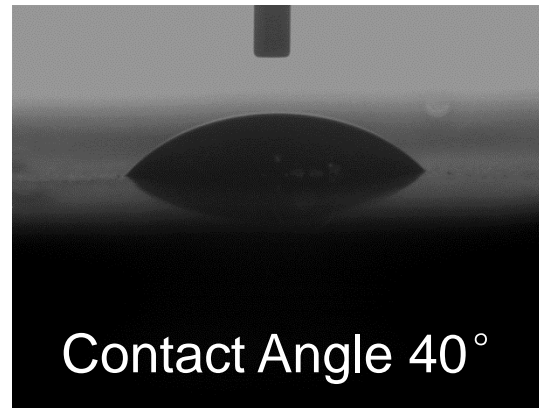
Water on Glass

# Compatibility with UV Encapsulant

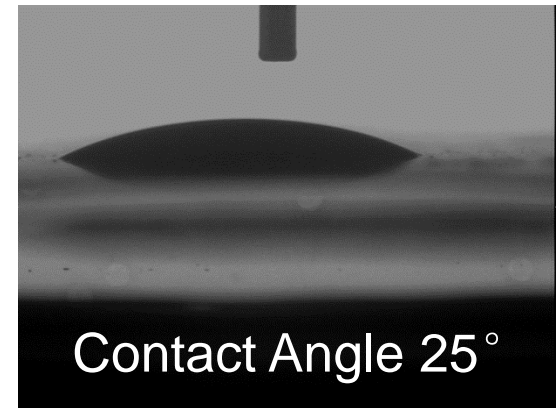
## -- Improvement



UV encapsulant  
on cured 2035SC



UV encapsulant  
on cured 2035SCR



UV encapsulant  
on FR4

- UV encapsulant: a popular UV encapsulant for smart card
- 2035SCR increases the surface energy, the contact angle of UV encapsulant will decrease from 76° to 40° . This change can optimize the encapsulant flowability well and avoid uncompleted filling issue

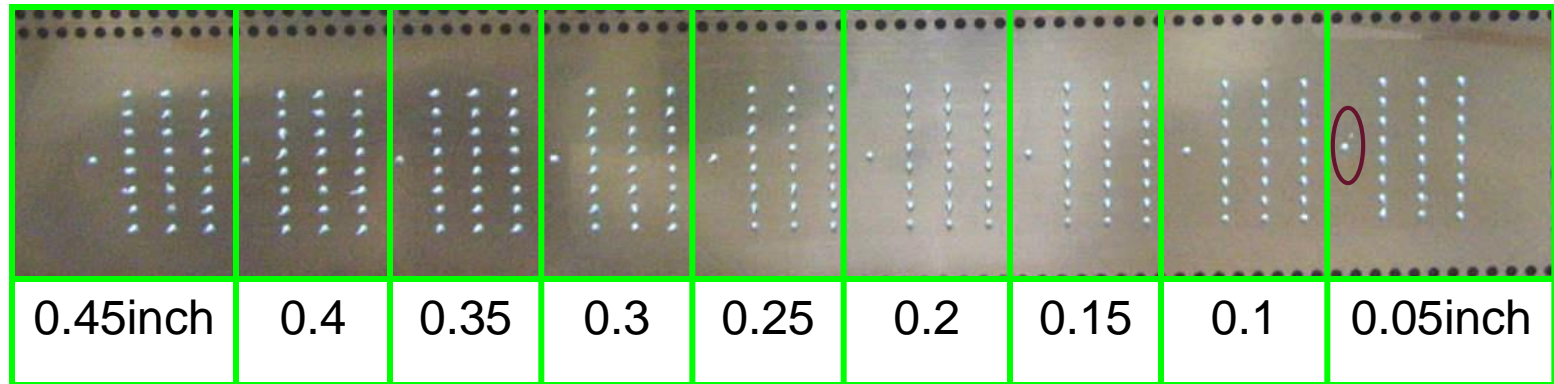


# Dispensing

# Dispensing

## -- Dot Dispensing Test Methodology

- Henkel has standard dot dispensing method: totally dispense 9 group with the same parameters except different retract distance. This testing simulates different UPH from low to high, output is total defective dot quantity.



# Dispensing

## -- Dot Dispensing Result

Paste	Strip#	Defective dot map									Total
		0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05inch	
2035SCR	I	0	0	0	0	0	0	0	0	24	91
	II	0	0	0	0	0	0	0	0	24	
	III	0	0	0	0	0	0	0	20	23	
2035SC	I	0	0	0	0	0	0	0	21	21	134
	II	0	0	0	0	0	0	4	21	21	
	III	0	0	0	0	0	0	4	21	21	

### Test and CI for Two Proportions

```

Sample   X    N  Sample p
2035SCR  91  675  0.134815
2035SC   134  675  0.198519
  
```

```

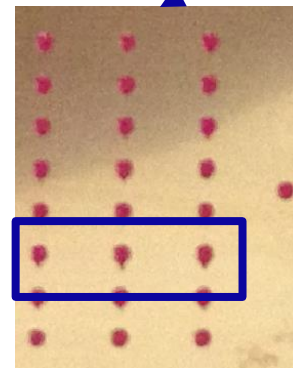
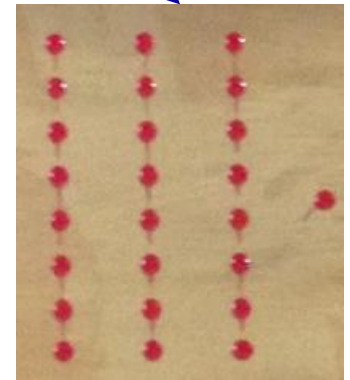
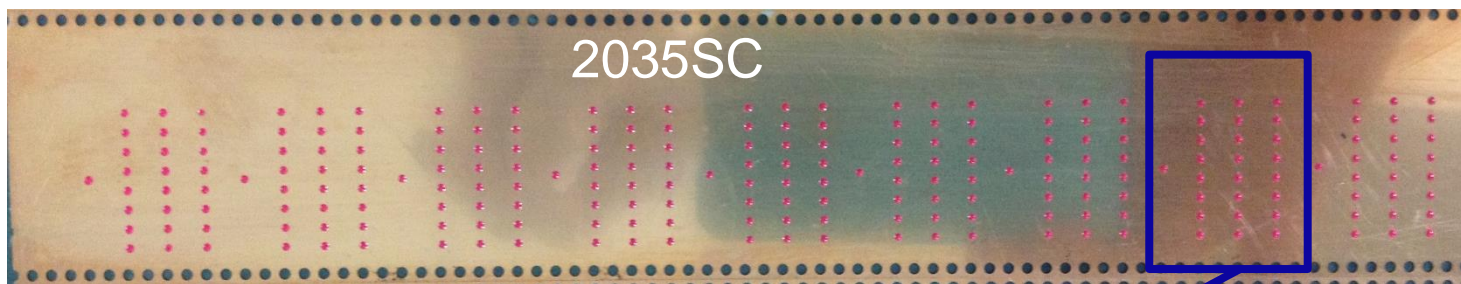
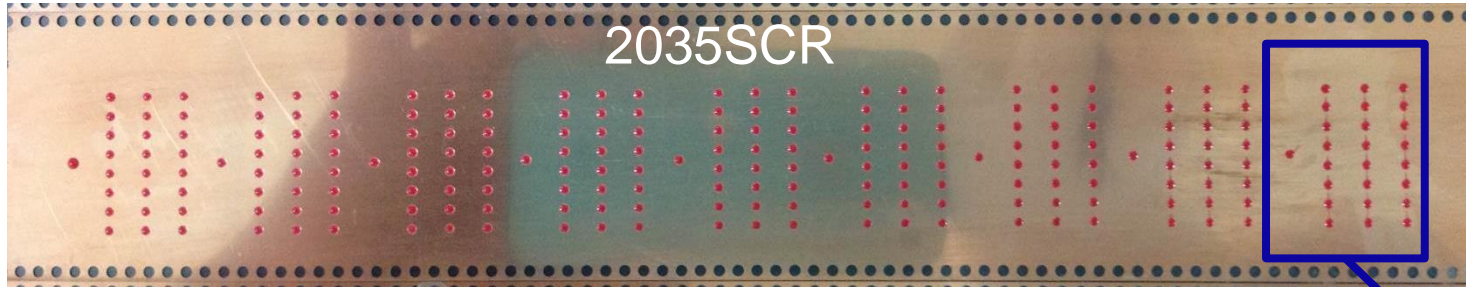
Difference = p (1) - p (2)
Estimate for difference:  -0.0637037
95% CI for difference:  (-0.103318, -0.0240893)
Test for difference = 0 (vs not = 0):  Z = -3.15
P-Value = 0.002
  
```

- Test Condition:
  - Machine: CAMALOT FX-D
  - Nozzle: EFD #22
  - Pressure: 25psi

- 2035SCR has significantly better dot dispensing performance than 2035SC

# Dispensing

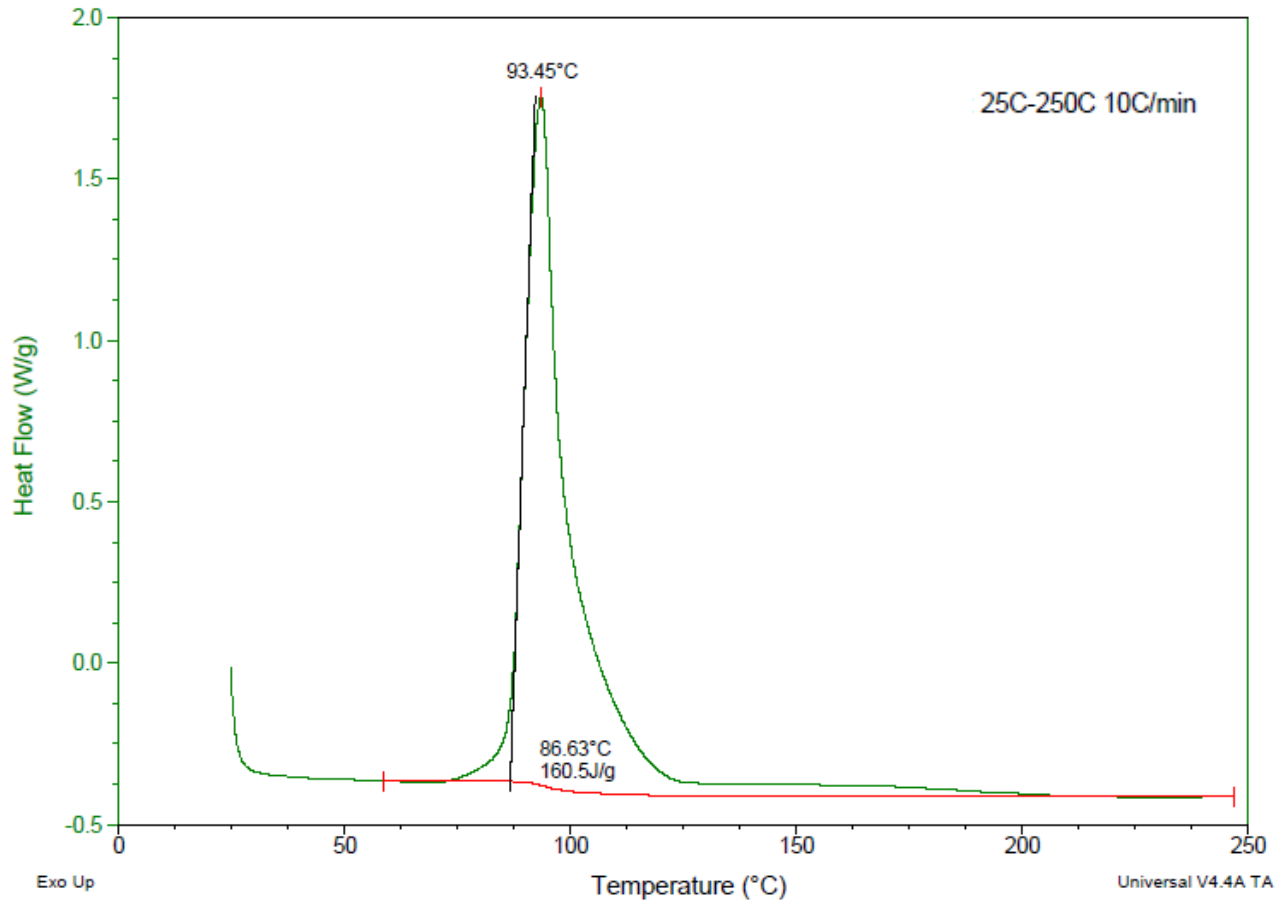
## -- Dot Dispensing Result



# Snap Cure Study

# Snap Cure Study

## -- DSC



- ABP 2035SCR on set point is about 87°C, peak is about 93°C

# Snap Cure Study

## -- DoE Plan & Result

- The purpose of this study is to find the relationship between adhesion performance and curing condition. Three factors: temperature, time & atmosphere are selected for this test
- Substrate: FR4; Die: 2x2mm, Silicon

Run Order	A: Temp (°C)	B: Time (s)	C: Atmosphere	RTDSS (Kgf)	175°C HTDSS (Kgf)
Leg 1	110	90	N2	7.3	1.6
Leg 2	130	90	N2	7.8	1.6
Leg 3	110	180	N2	7.7	1.3
Leg 4	130	180	N2	7.3	1.3
Leg 5	110	90	Air	6.7	1.5
Leg 6	130	90	Air	7.7	1.3
Leg 7	110	180	Air	6.5	1.3
Leg 8	130	180	Air	8.6	1.3

# Snap Cure Study

## -- RTDSS Analysis

Factorial Fit: RTDSS versus Temp., Time, Atmosphere

Estimated Effects and Coefficients for RTDSS (coded units)

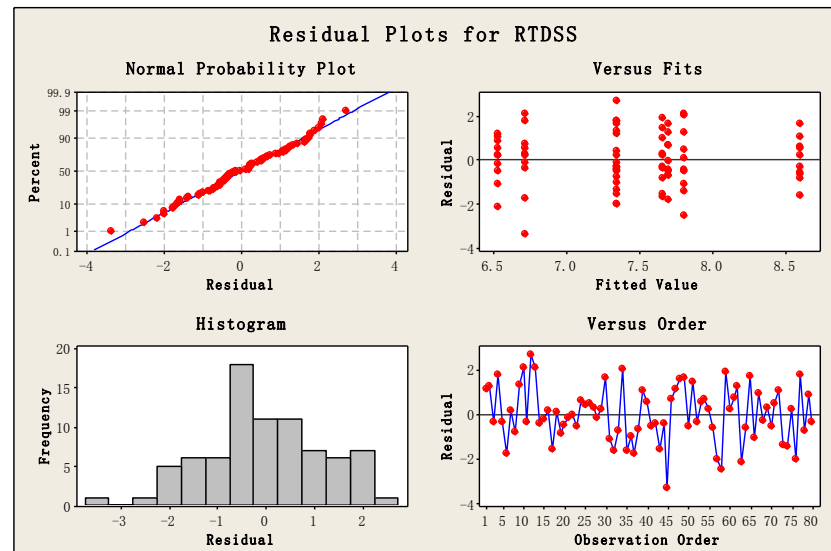
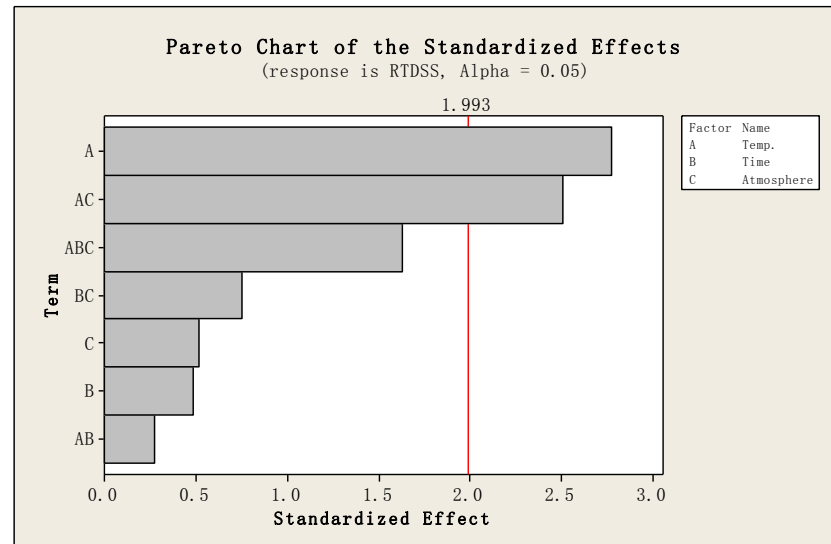
Term	Effect	Coef	SE Coef	T	P
Constant	7.46450	0.1445	51.67	0.000	
Temp.	0.80190	0.40095	0.1445	2.78	0.007
Time	0.14040	0.07020	0.1445	0.49	0.628
Atmosphere	-0.15020	-0.07510	0.1445	-0.52	0.605
Temp.*Time	0.07940	0.03970	0.1445	0.27	0.784
Temp.*Atmosphere	0.72500	0.36250	0.1445	2.51	0.014
Time*Atmosphere	0.21690	0.10845	0.1445	0.75	0.455
Temp.*Time*Atmosphere	0.47040	0.23520	0.1445	1.63	0.108

S = 1.29207 PRESS = 148.395

R-Sq = 19.82% R-Sq(pred) = 1.01% R-Sq(adj) = 12.02%

Analysis of Variance for RTDSS (coded units)

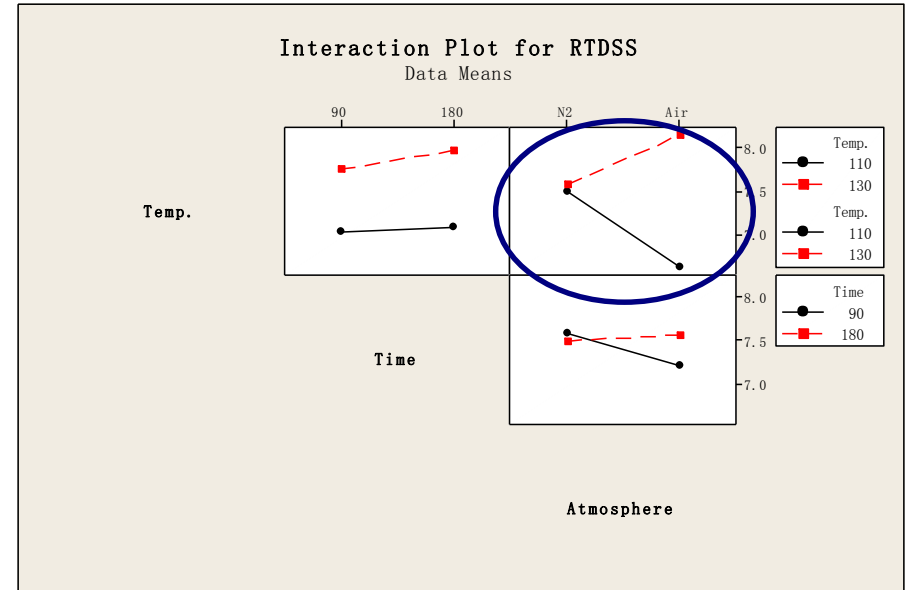
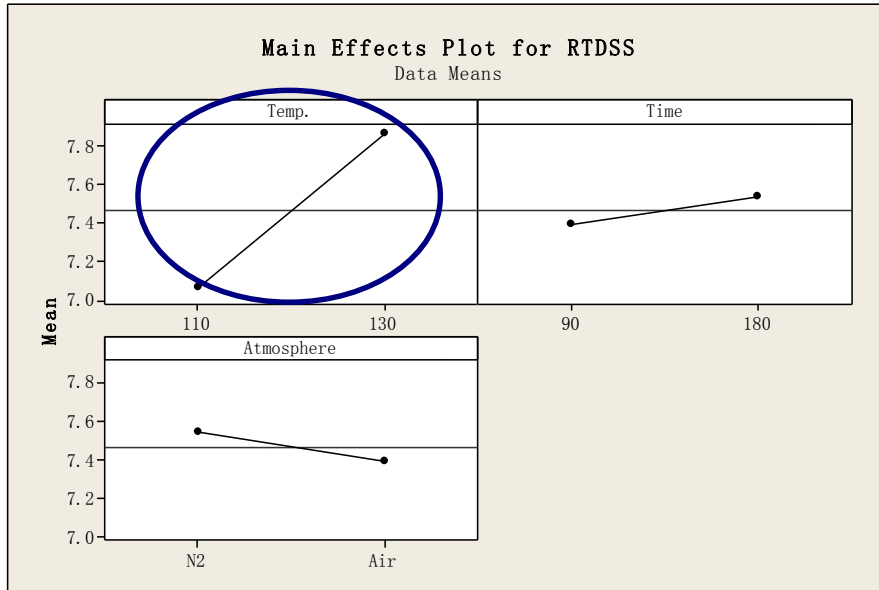
Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	3	13.706	13.706	4.5688	2.74	0.050
Temp.	1	12.861	12.861	12.8609	7.70	0.007
Time	1	0.394	0.394	0.3942	0.24	0.628
Atmosphere	1	0.451	0.451	0.4512	0.27	0.605
2-Way Interactions	3	11.579	11.579	3.8598	2.31	0.083
Temp.*Time	1	0.126	0.126	0.1261	0.08	0.784
Temp.*Atmosphere	1	10.512	10.512	10.5125	6.30	0.014
Time*Atmosphere	1	0.941	0.941	0.9409	0.56	0.455
3-Way Interactions	1	4.426	4.426	4.4255	2.65	0.108
Temp.*Time*Atmosphere	1	4.426	4.426	4.4255	2.65	0.108
Residual Error	72	120.200	120.200	1.6694		
Pure Error	72	120.200	120.200	1.6694		
Total	79	149.911				





# Snap Cure Study

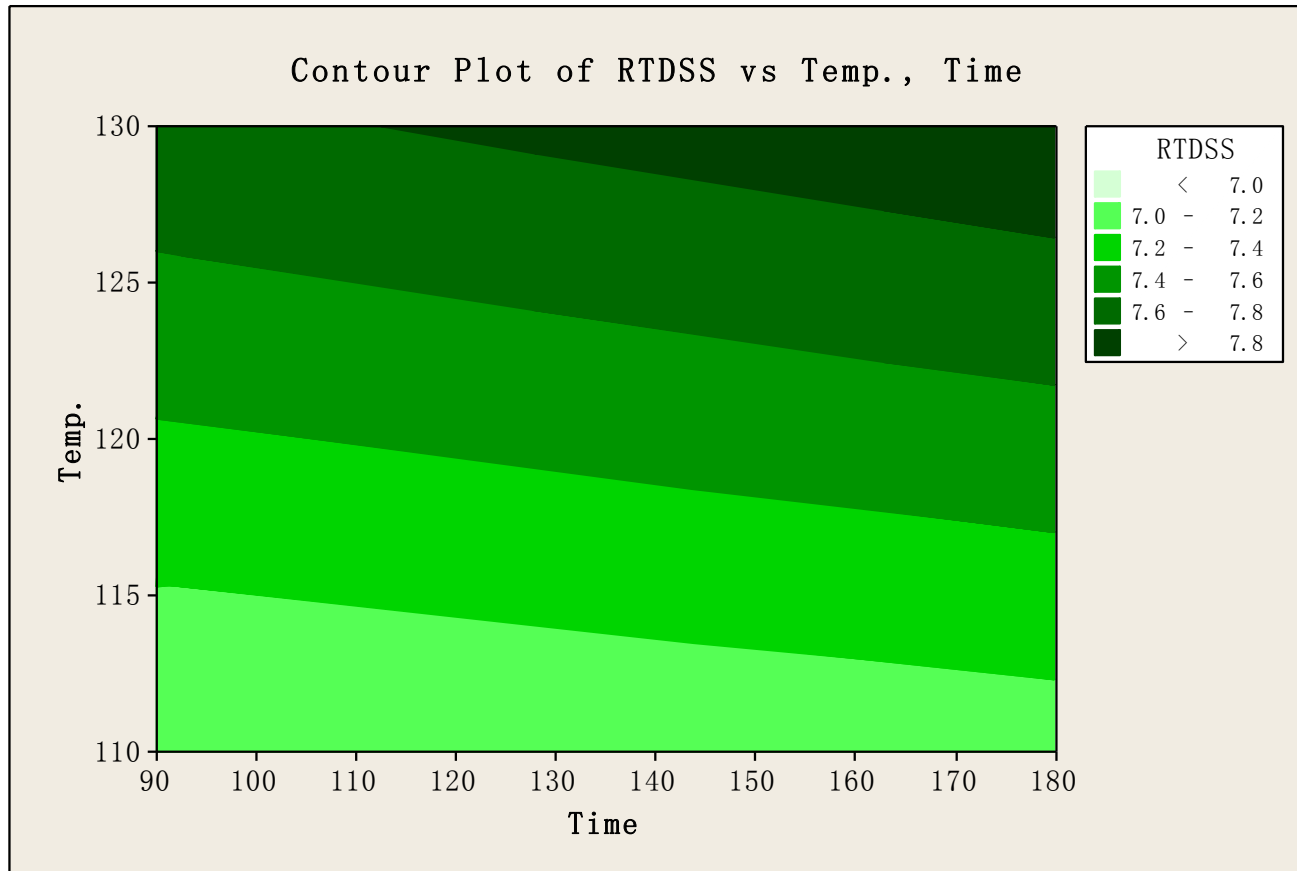
## -- RTDSS Analysis



- Curing temperature will significantly affect RTDSS
- Temperature & curing atmosphere have significant interaction. Temperature won't affect RTDSS under N2 condition but will influence a lot with air, higher is better

# Snap Cure Study

## -- RTDSS Analysis



- RTDSS will increase with high temperature

# Snap Cure Study

## -- HTDSS Analysis

### Factorial Fit: HTDSS versus Temp., Time, Atmosphere

Estimated Effects and Coefficients for HTDSS (coded units)

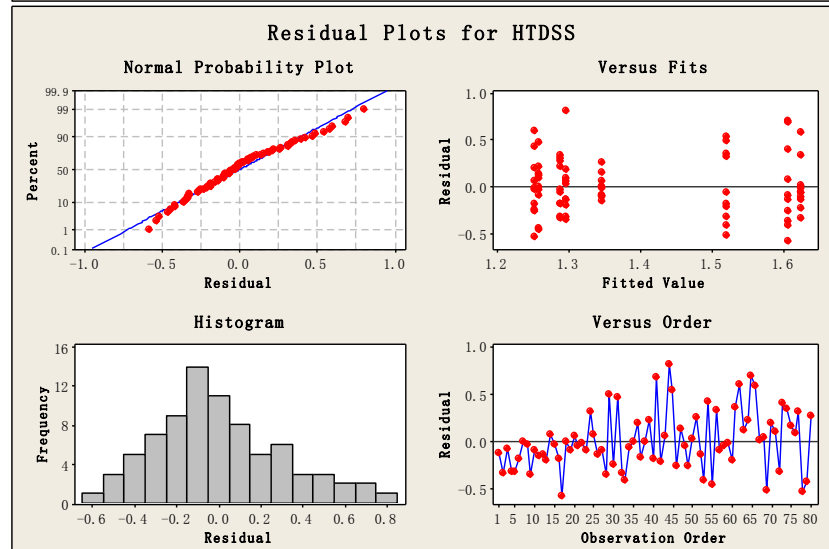
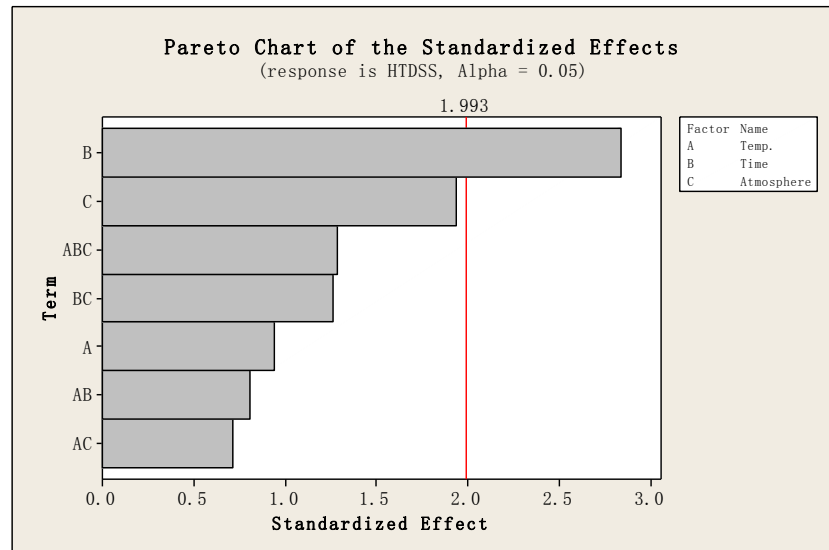
Term	Effect	Coef	SE Coef	T	P
Constant	1.3985	0.03603	38.81	0.000	
Temp.	-0.0679	-0.0339	0.03603	-0.94	0.350
Time	-0.2045	-0.1022	0.03603	-2.84	0.006
Atmosphere	-0.1393	-0.0696	0.03603	-1.93	0.057
Temp.*Time	0.0582	0.0291	0.03603	0.81	0.422
Temp.*Atmosphere	-0.0514	-0.0257	0.03603	-0.71	0.478
Time*Atmosphere	0.0908	0.0454	0.03603	1.26	0.212
Temp.*Time*Atmosphere	0.0926	0.0463	0.03603	1.28	0.203

S = 0.322261 PRESS = 9.23128

R-Sq = 19.17% R-Sq(pred) = 0.21% R-Sq(adj) = 11.31%

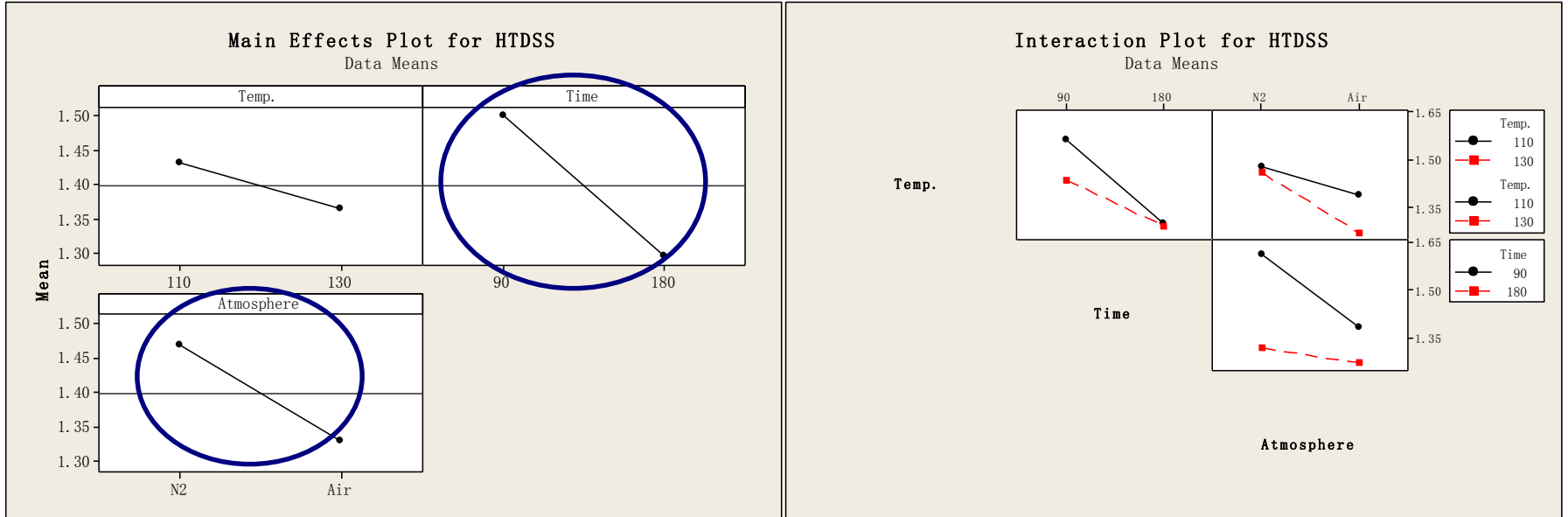
Analysis of Variance for HTDSS (coded units)

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	3	1.31657	1.31657	0.43886	4.23	0.008
Temp.	1	0.09207	0.09207	0.09207	0.89	0.350
Time	1	0.83640	0.83640	0.83640	8.05	0.006
Atmosphere	1	0.38809	0.38809	0.38809	3.74	0.057
2-Way Interactions	3	0.28530	0.28530	0.09510	0.92	0.438
Temp.*Time	1	0.06774	0.06774	0.06774	0.65	0.422
Temp.*Atmosphere	1	0.05284	0.05284	0.05284	0.51	0.478
Time*Atmosphere	1	0.16471	0.16471	0.16471	1.59	0.212
3-Way Interactions	1	0.17131	0.17131	0.17131	1.65	0.203
Temp.*Time*Atmosphere	1	0.17131	0.17131	0.17131	1.65	0.203
Residual Error	72	7.47734	7.47734	0.10385		
Pure Error	72	7.47734	7.47734	0.10385		
Total	79	9.25051				



# Snap Cure Study

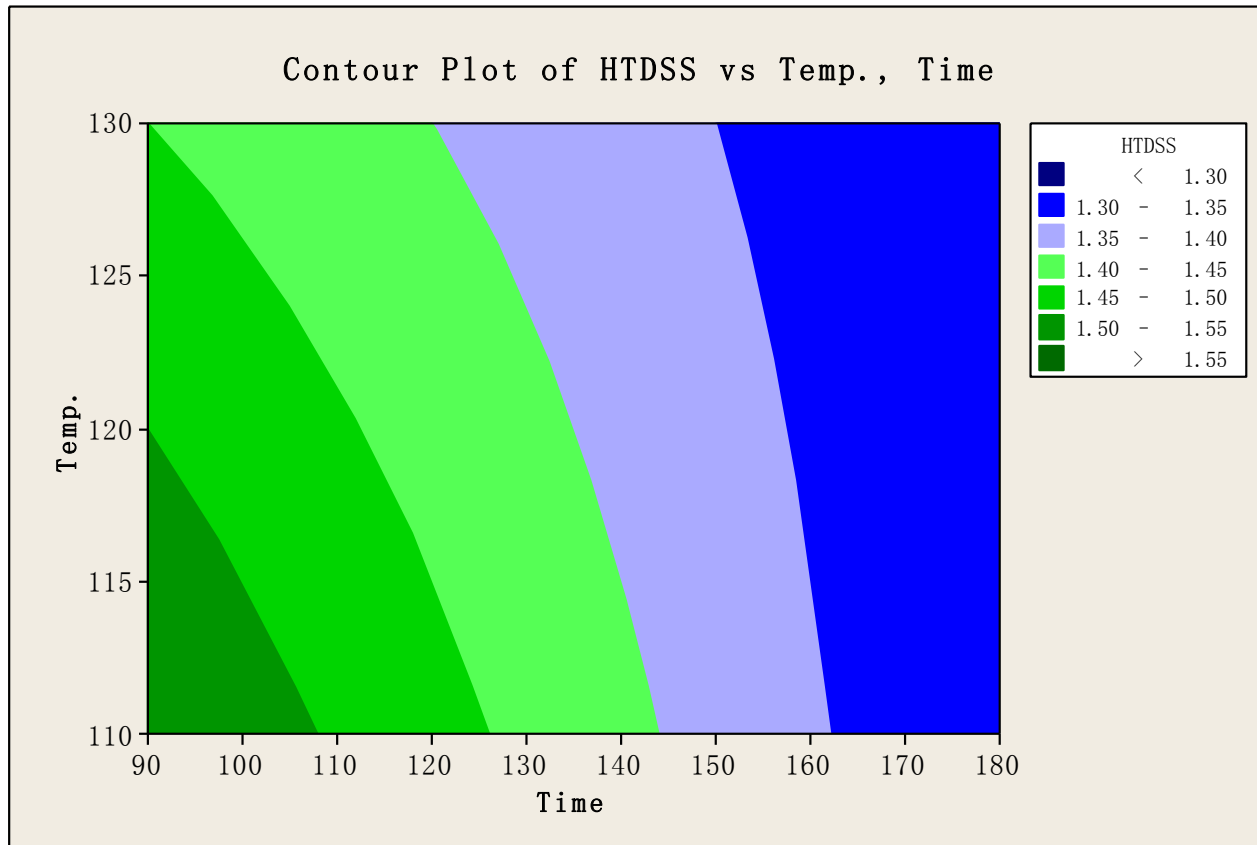
## -- HTDSS Analysis



- Curing temperature and atmosphere will affect HTDSS significantly, shorter time and N2 is better

# Snap Cure Study

## -- HTDSS Analysis



- Shorter curing time will get better HTDSS

# Snap Cure Study

## -- Summary

- RTDSS
  - Curing temperature will significantly affect RTDSS
  - Temperature & curing atmosphere have significant interaction. Temperature won't affect RTDSS under N2 condition but will influence a lot with air, higher is better
- 175°C HTDSS
  - Curing temperature and atmosphere will affect HTDSS significantly, shorter time and N2 is better
- Recommendation:
  - To balance RTDSS and HTDSS, 120°C 2min curing profile was recommended

# Adhesion Performance

# Adhesion Performance

## -- Test Condition

- Substrate: Selected the

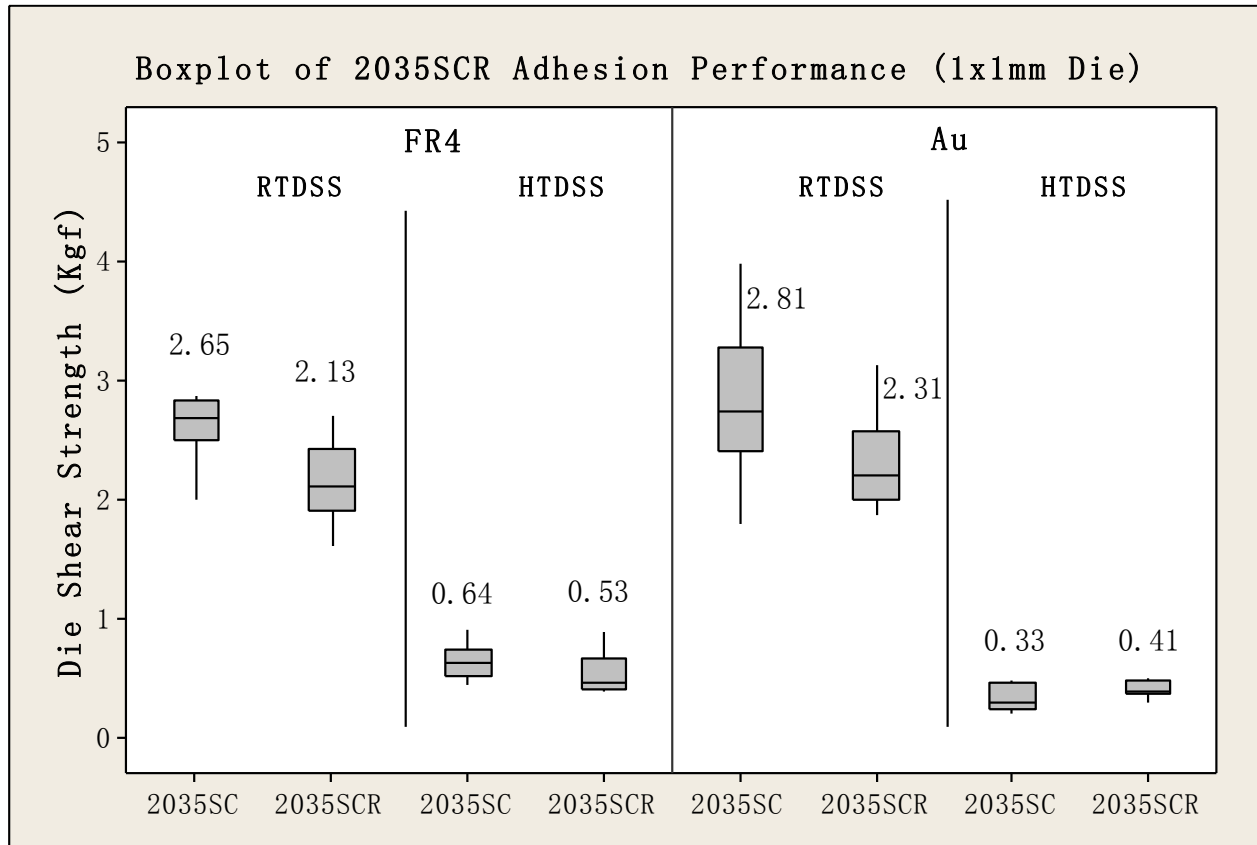


- Die: 1x1mm, 3x3mm
- Curing profile: 120°C 2min, air (most customer don't use N2)
- Die shear: RTDSS, die shear @ room temperature  
HTDSS, die shear @ 175°C, to simulate WB process



# Adhesion Performance

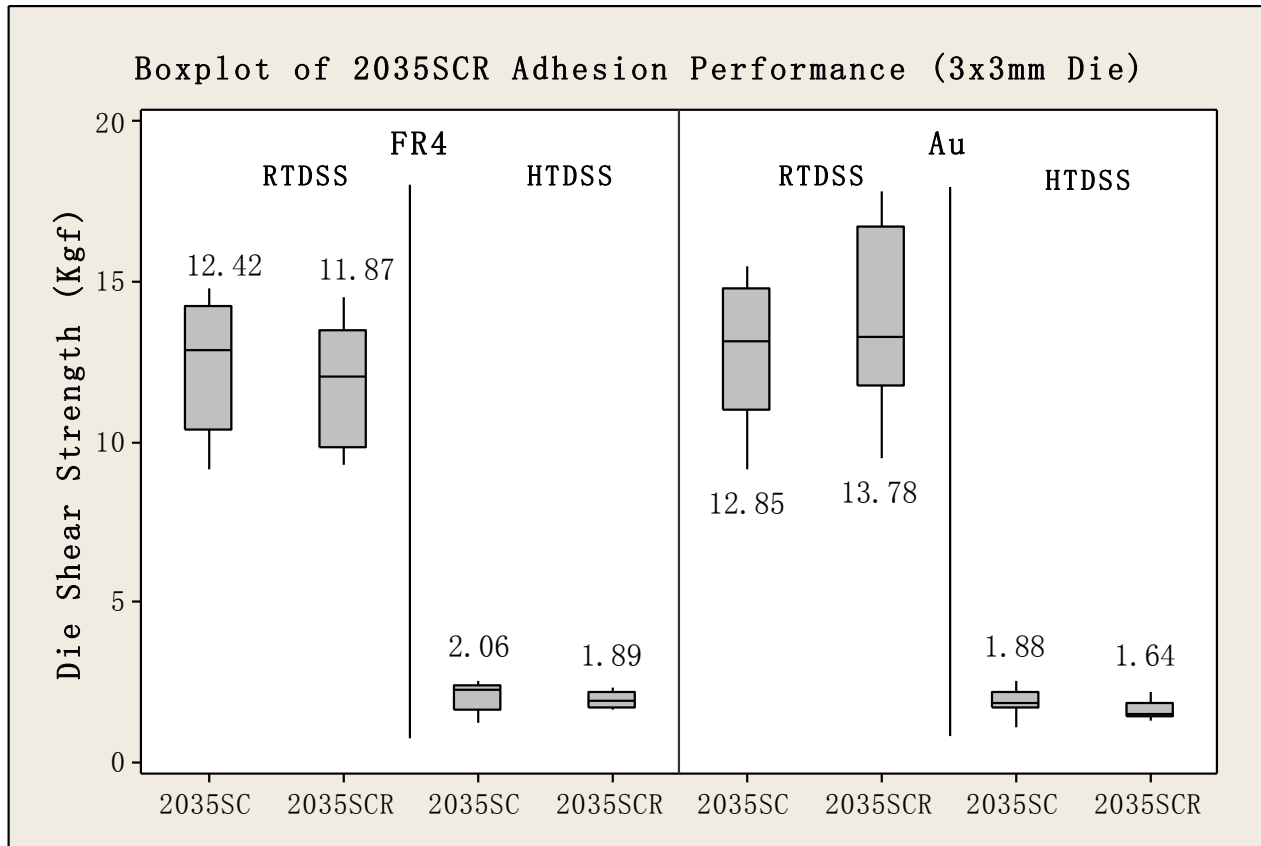
## -- Die Shear Test (1x1mm Die)



- For 1x1mm die, 2035SCR has good adhesion on die shear performance, very close to 2035SC

# Adhesion Performance

## -- Die Shear Test (3x3mm Die)



- For 3x3mm die, 2035SCR has good adhesion on die shear performance, very close to 2035SC

# Adhesion Performance

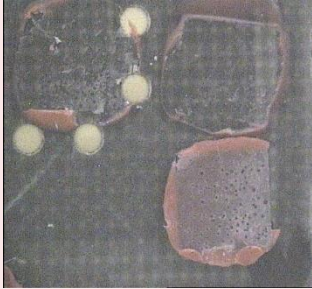
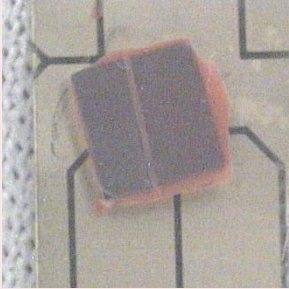

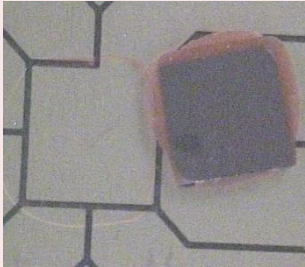
## -- Peel Test

- Sometimes customer will complain die drop issue after snap cure while rolling up the tape, especially for  $\geq 3 \times 3 \text{mm}$  dies. This phenomena is related with not good peel strength of cured DA paste.
- Because of we have no auto peel test machine, we will do this test manually and qualitatively. Peel strength will be divided into 4 levels as below
- This test only use  $3 \times 3 \text{mm}$  die

Peel Strength	Very good	Good	Normal	Bad
Score	3	2	1	0

# Adhesion Performance

## -- Peel Test

Peel Test Result				
Paste	FR4		Au	
	Score	Failure Mode	Score	Failure Mode
2035SCR	3		1	
2035SC	3		1	

- 2035SCR has equal peel strength as 2035SC, very good on FR4, normal on Au

# Adhesion Performance

## -- Summary

- ABP 2035SCR keeps the adhesion performance of Ablebond 2035SC, no big difference.

# Work Life

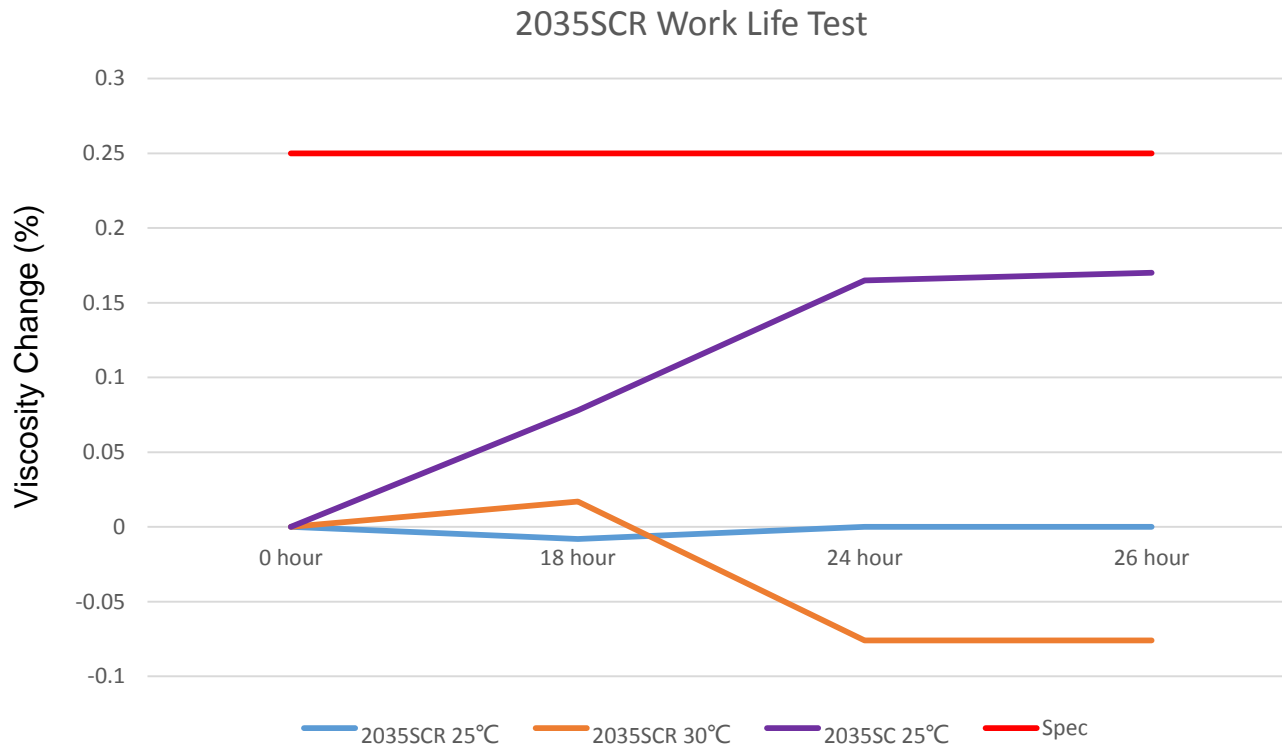
# Work Life

## -- Definition

- Henkel defined the product's work life by chemical work life
  - Chemical work life is determined under room temperature, the viscosity increasing is less than 25%

# Work Life

## -- Test Result



- 2035SCR showed much stable work life than 2035SC



Thank you!



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