Henkel

A Brand like a Friend

Data Package of ATB-100U Series (Rev.2)

Updated on June, 2014

Film Team

DDAF Adhesives

Henkel
A Brand like a Friend

Base Die (Curable)

ATB-100 (15,20,25,30um)

ATB-100U (10,15,20,25 & 30um)

- Low warpage
- L2/260C,
- Excellent flow ability on substrate

FOW and FOD

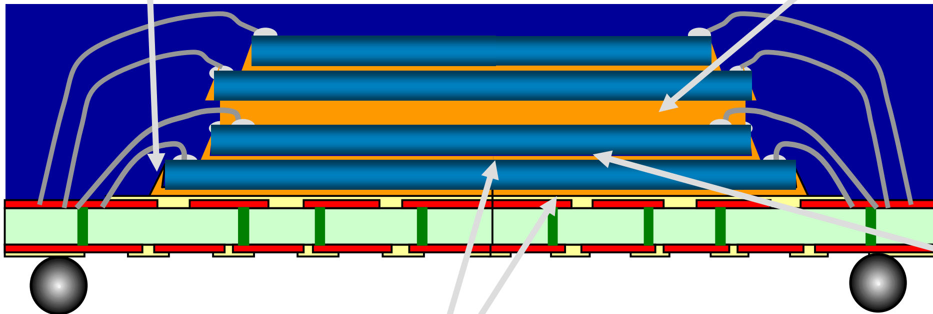
ATB-F100E (50, 60, 75 for FOW or 90, 100, & 120 for FOD)

- L2/260C
- Low CTE
- Good wire penetration
- Excellent thin die pickup

DAF for Small Die Size

ATB-F125E

- High modulus
- Excellent workability for below 3x3 mm sq
- Good wire bonding performance



Die to Die (Curable)

ATB-100 (15 & 20um)

ATB-100U (5,10,15 & 20um)

ATB-100A (5,10,15 & 20um)

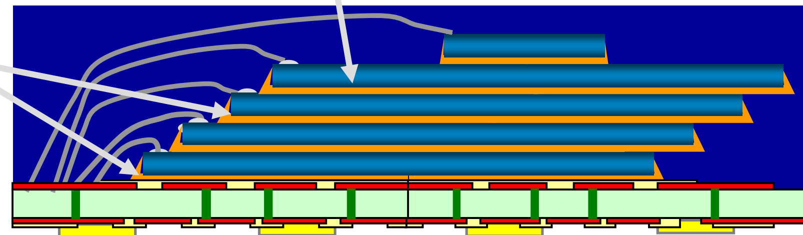
- L2/260C
- Good workability

Base Die + Die to Die (Skip Cure)

ATB-100US (5,10,15,20,25 & 30um)

ATB 100HA (5,10,15,20,25 & 30um)

- Excellent thin die pickup
- L2/260C or L1/260C
- Thermal budget up to 4 or 1-1.5 hrs @175C
- Small die pick up (2x2mm)
- 5um thickness capable



Design concept of ATB-100U Series

- Introduction
  - Single layer die attach film
  - Thin die attach film thickness(5, 10, 15, 20, 25 & 30um)
  - Chemical composition : Epoxy chemistry / Silica filler
- Application
  - Die to Die & Die to Substrate (substrate dependent)
- Advantage
  - Thin BLT & low package thickness
  - Bundled with PSA (non-UV) dicing tape (No UV process)
  - Excellent workability : Burr-free & no double die pick up
  - Low die & package warpage
  - Co-cure is possible for die-to-die & die-to-substrate applications
  - Excellent moisture resistivity

Properties of ATB-100U Series

Comparison between ATB-100 & ATB-100U

Properties of DAF		ATB-100	ATB-100U
Glass Transition Temperature		90'C	75'C
Weight loss in N_2 :		0.95%(@300C)	0.97%(@250C)
Dynamic Tensile Modulus	@25'C	1170MPa	875MPa
	@150'C	12.5MPa	2.7MPa
	@200'C	7.3MPa	1.2MPa
	@250'C	8.6MPa	1.6MPa
CTE	below Tg	46ppm/'C	63ppm/'C
	above Tg	139ppm/'C	238ppm/'C
Die Shear Strength	with 2.5x2.5mm Si	15Kg @ 25'C / 2Kg @ 260'C	15Kg @ 25'C/ 2.5Kg @ 260'C
Water Absorption	@85'C/85%RH	1.50%	1.50%
Properties of Dicing tape		ATB-100	ATB-100U
Dicing tape thickness		85um	
Base film		80um Polyolefin	
Adhesive film		5um PSA (acrylic)	

Note: Above properties are typical and should not be used for any specification purpose.

Material properties

Modulus by DMA

Storage Modulus (MPa)
Tan Delta
Loss Modulus (MPa)
Temperature (°C)

-65.37°C
2330MPa

2.15°C

25.45°C
874.8MPa

13.76°C

102.19°C

100.49°C
36.97MPa

150.95°C
2.660MPa

200.14°C
1.214MPa

250.59°C
1.557MPa

300.41°C
3.693MPa

Temp	Modulus
-65'C	2330MPa
25'C	874.80MPa
100'C	36.97MPa
150'C	2.66MPa
200'C	1.21MPa
250'C	1.56MPa

Material properties

CTE & Tg by TMA

ATB-100U

Expansion Coefficient = 237.7271 e-06 /°C

Expansion Coefficient = 62.7058 e-06 /°C

Onset Y = 1.5590 mm
Onset X = 74.94 °C

Probe Position (mm)

1.626
1.62
1.61
1.60
1.59
1.58
1.57
1.56
1.55
1.541

-84.49 -50 0 50 100 150 200 249.8

Temperature (°C)

Item	Property
CTE below Tg	62ppm/’C
CTE above Tg	238ppm/’C
Tg by TMA	75’C

Material properties

Weight loss by TGA

ATB-100U

Delta Y = 0.129 %

Delta Y = 0.155 %

Delta Y = 0.184 %

Delta Y = 0.247 %

Delta Y = 0.365 %

Weight % (%)

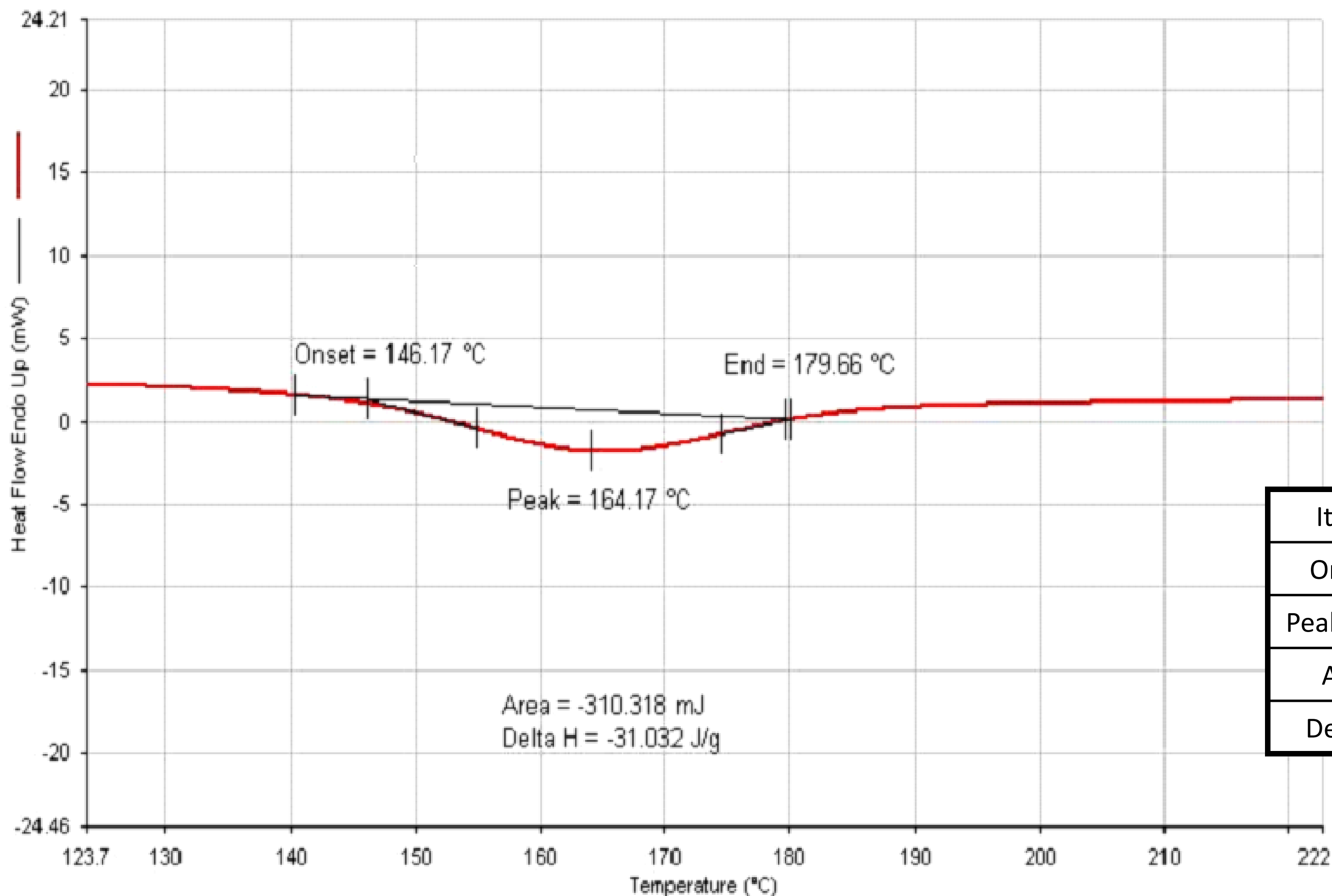
Temperature (°C)

Temp	Weight loss
100’C	0.129%
150’C	0.155%
200’C	0.184%
250’C	0.247%
300’C	0.365%

Material properties

Reaction rate by DSC

Henkel
A Brand like a Friend



Items	Data
On-set	146.17'C
Peak temp	164.17'C
Area	-310.318mJ
Delta H	-31.032J/g

Material properties

Melt viscosity

Tuesday, February 05, 2008

8* = 7931.2 [P]
Temp = 100.36 [°C]

8* = 4756.9 [P]
Temp = 110.19 [°C]

8* = 3559.9 [P]
Temp = 123.58 [°C]

8* = 3643.1 [P]
Temp = 119.44 [°C]

8000.0
7000.0
6000.0
5000.0
4000.0
3000.0

8* [P]

95.0 100.0 105.0 110.0 115.0 120.0 125.0 130.0

Temp [°C]

Temp	Melt Viscosity [P]
100’C	7931.2
110’C	4756.9
120’C	3643.1
124’C	3559.9

General process flow for ATB-100U

Silicon Wafer

Laminate
Back grind (BG) Tape

Backside Grinding

Laminate
at 65~70'C

Peel off
Back grind Tape

Dicing

Die Pick-up

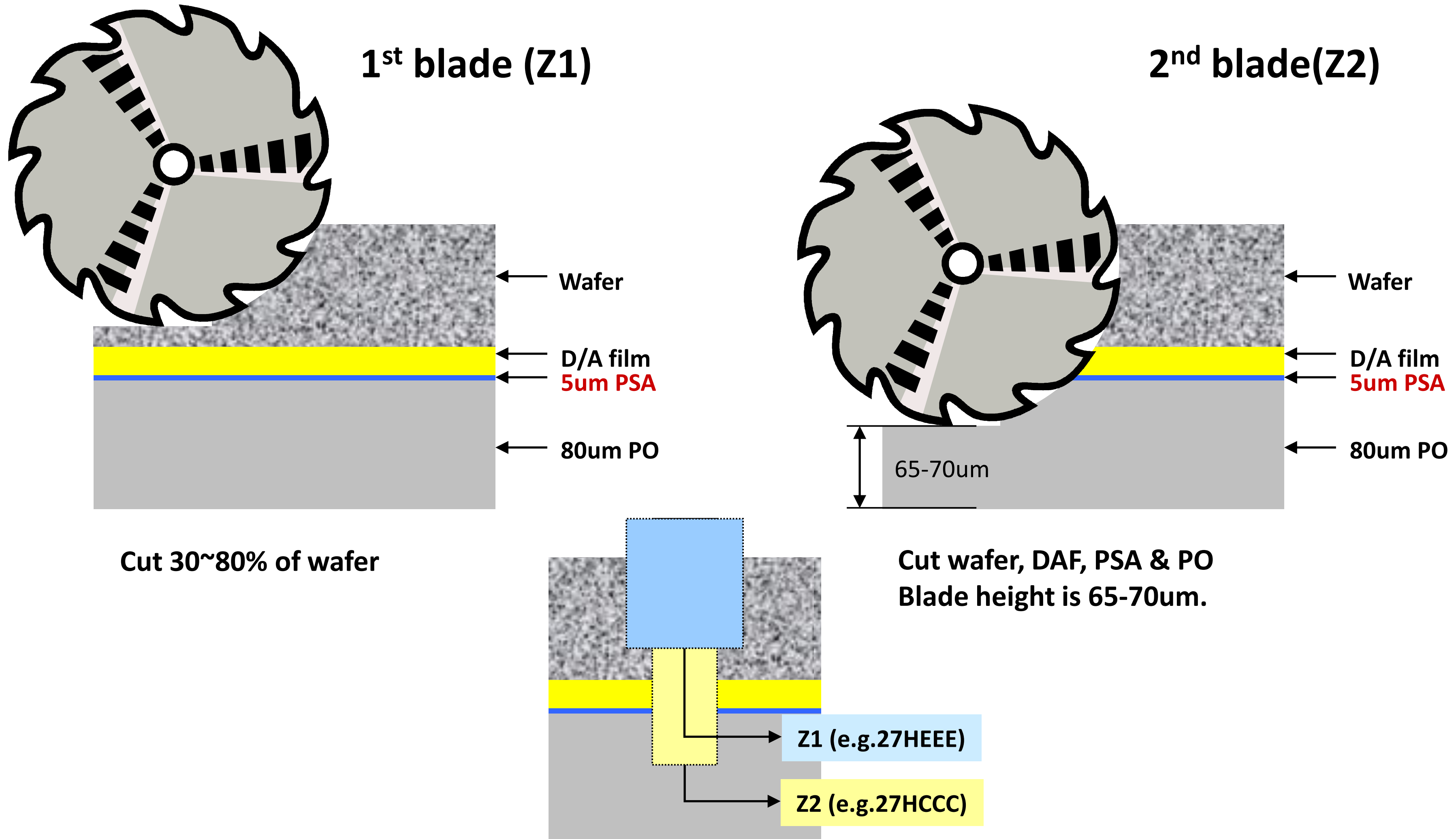
Lamination process

Typical Recommendations

- Equipment
  - Auto or Semi-auto laminator
  - TSK RM system, DISCO DFM system or any equivalent
- Process condition
  - Temperature: 65~70’C
  - Speed: 20-40mm/sec
  - Pressure: 0.2-0.5 MPa

Dicing process

Recommendation of process condition



Dicing process

Recommendation of process condition

Typical Recommendations

- Equipment
  - Disco, TSK, any equivalent
- Process condition
  - 1st Blade : No big impact on dicing performance
  - 1st Blade height : cut 30-80% into wafer
  - 2nd Blade : 27HCBC, 27HCCC or 27HABB,.. etc.
  - 2nd Blade height : 65-70um
  - SPD speed : 35,000-45,000 RPM
  - Cut speed : 25-50mm/sec

Dicing process - Burr

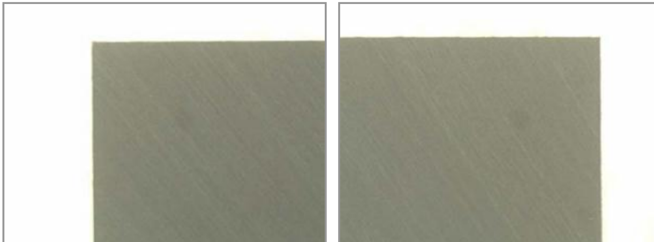
Test Vehicle
ATB-120U: 20 µm thick adhesive
Device: 100 µm Si wafer, 8.18 x 10.59mm
Step cut :
Blade: HCDD(Z1), HABB(Z2)
Blade height: 150 µm(Z1), 65 µm(Z2)
Cutting speed: 50mm/sec
SPD speed: 40,000 RPM

Pick-up results for large die

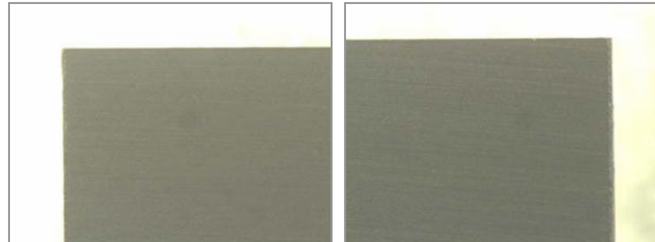
- No pick-up issue (0/10die)
- No delamination between DAF & Si (0/10die)

Die backside view after pick-up

25um thick adhesive



10um thick adhesive

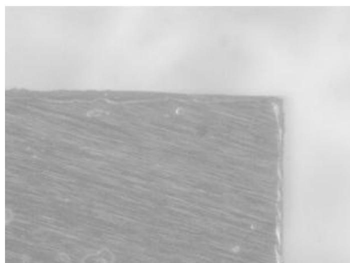


clear dicing line (burr free), no tearing or peeling-off

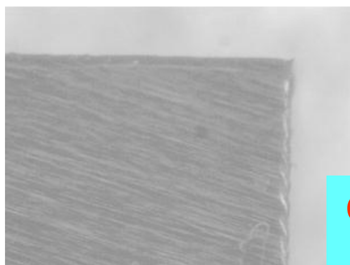
Dicing process – Small Die Capability (ATB-110U)

DAF -->	RP-882-1A1	RP-882-1A1	RP-882-1A1
DAF thickness -->	10umt	10umt	10umt
Dicing tape -->	ERX-6107	ERX-6107	ERX-6107
cut method -->	step	step	single
die size -->	1.5 x 1.5mm	2 x 2mm	70 x 150mil
Die Fly during dicing	No die fly	No die fly	No die fly
Die pick-up fail	0NG/25	0NG/25	0NG/25
Die Crack	0NG/25	0NG/25	0NG/25
Re-attach	0NG/25	0NG/25	0NG/25

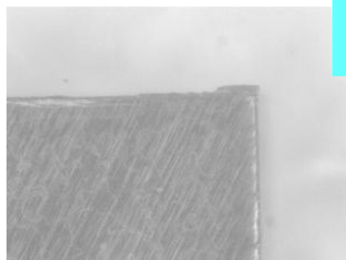
1.5x1.5mm



2x2mm



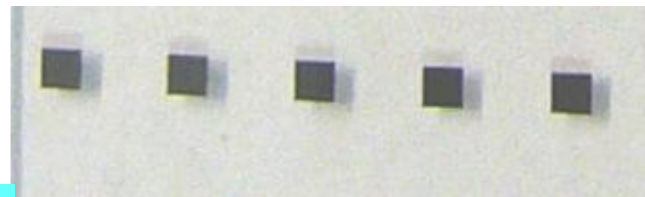
70x150mil

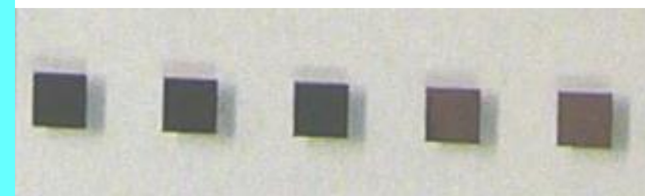


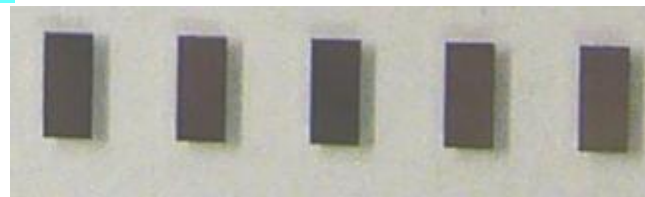
Clear Dicing Line

No Die Flying

No Reattach







Die attach process

Recommendation of process condition

Typical Recommendations

- Die to BT
  - Substrate temp: 100-130’C
  - Bonding force: 0.5-3.0kg / 10mmsq die
  - Bonding time: 0.5-3.0sec
  - Controlled stroke further improves wet-ability

- Die to Die
  - Substrate temp: 100-130’C
  - Bonding force: 0.5-1.5kg / 10mmsq die
  - Bonding time: 0.5-1.5sec

Die attach process

Wettability with Die attach condition

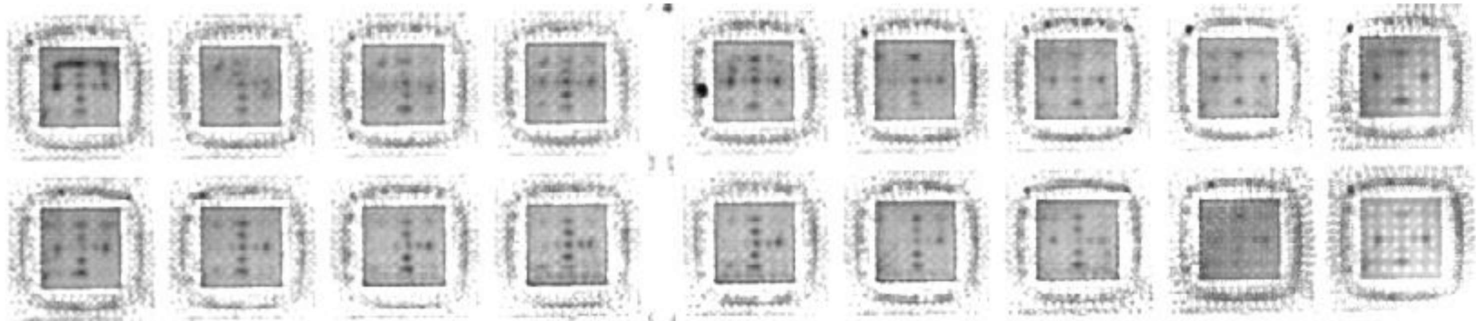
Test Vehicle

- **ATB-125U: 25 µm thick adhesive**
- **Device: 75 µm Si wafer, 7.5 x 7.5mm, PI passivation**
- **Flat type collet**
- **Die attach condition: 120’C(Heater block) / 0.5~1.5kg / 0.5~1.5sec**

SAT result after die attach (Thru Scan)

D/A condition

Time	1.5sec	1.5sec	1.5sec	1.0sec	1.0sec	1.0sec	0.5sec	0.5sec	0.5sec
Pressure	1.5kg	1.0kg	0.5kg	1.5kg	1.0kg	0.5kg	1.5kg	1.0kg	0.5kg

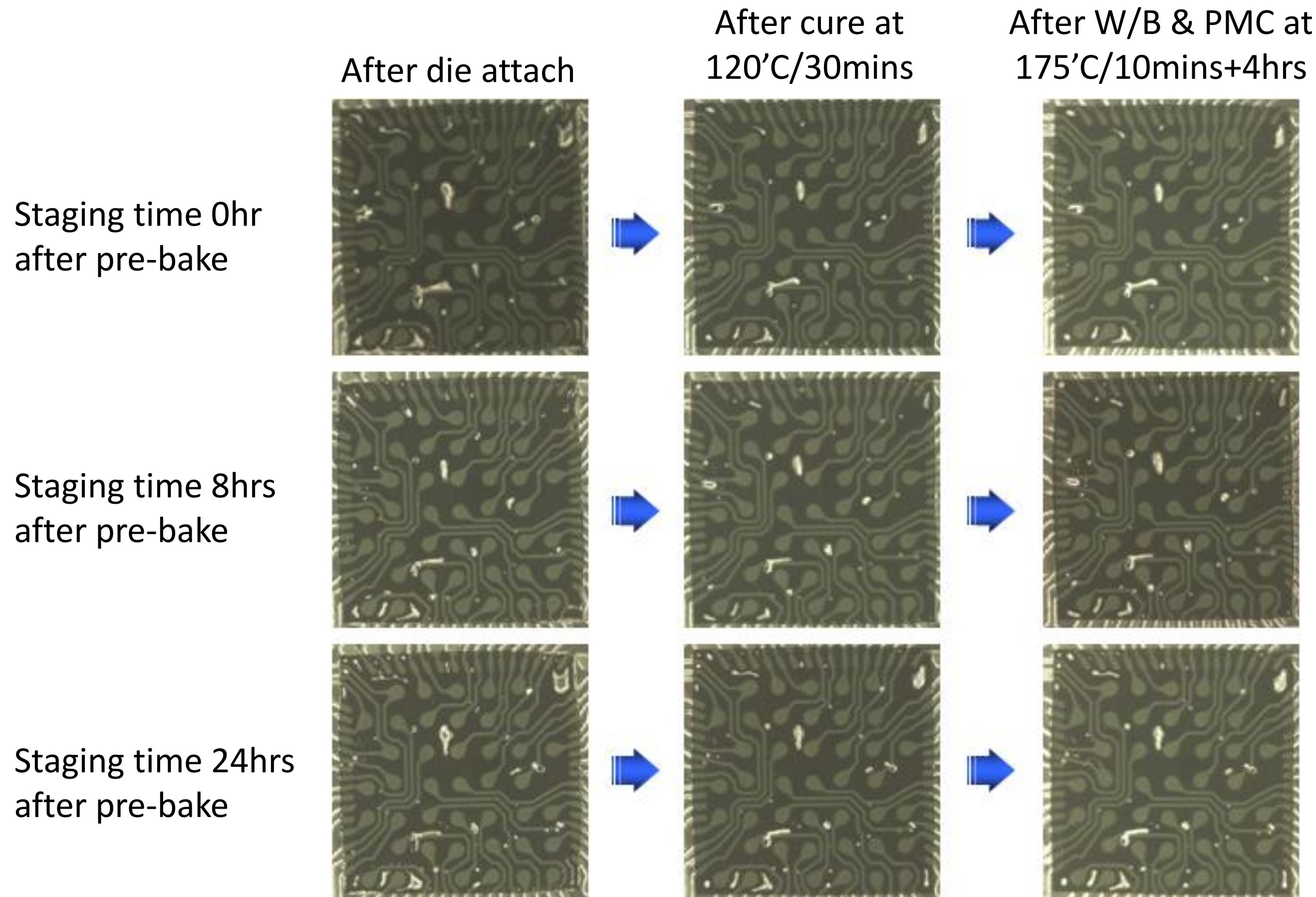


ATB-125U has good wettability, and it is not sensitive to die attach condition

Die attach cure process

Void performance on Laminate substrate with staging time

Henkel
A Brand like a Friend



* 20um thick adhesive used

ATB-100U has good moisture resistance performance, and there's no voiding issue with 24hrs after pre-baking of substrate

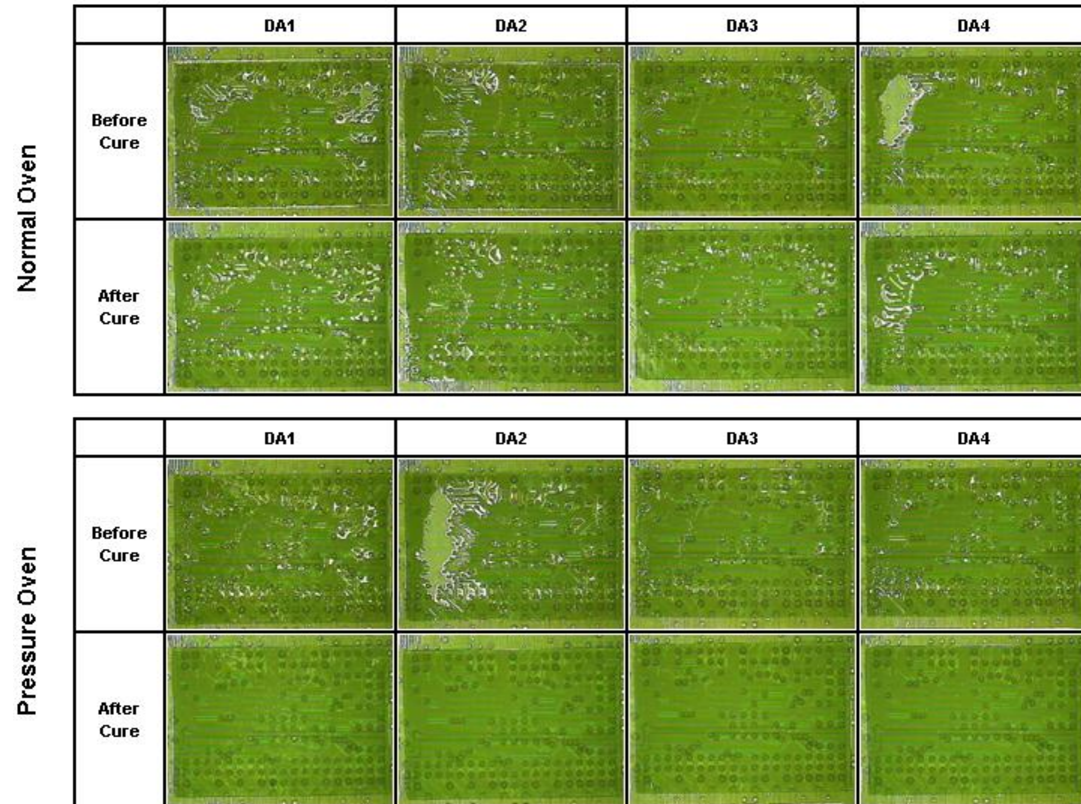
Die attach cure process

Normal Oven vs. Pressure Oven

Die size: 10x16 mm sq

	Temperature (℃)	Force (kg)	Time (sec)
DA1	130	1.0	1.0
DA2	130	1.0	0.5
DA3	130	3.0	2.0
DA4	130	3.0	1.0

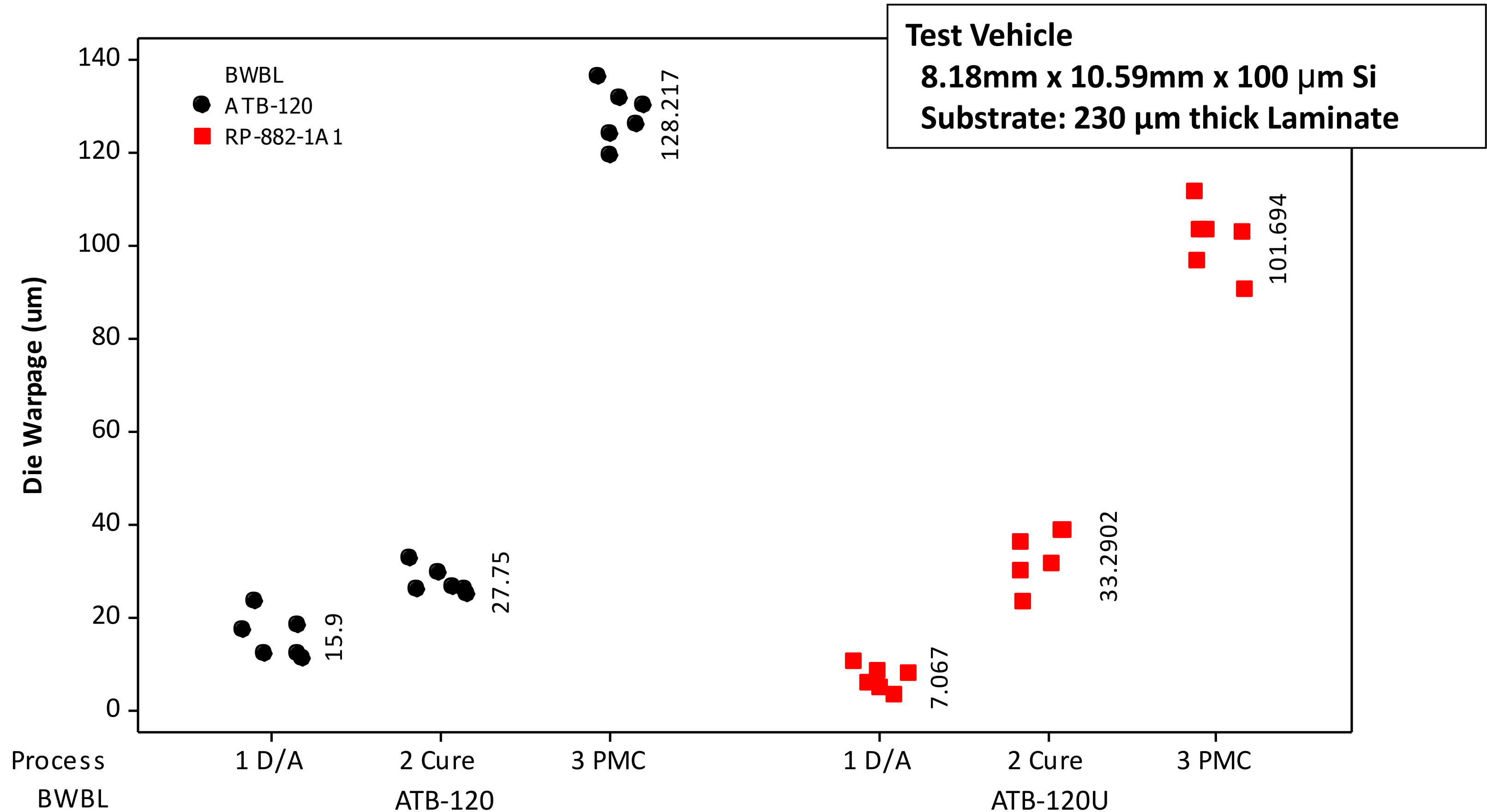
	Normal Oven	Pressure Oven
ATB-120U	30 min at 100℃/30 min at 125℃ (2 step)	60 min at 130℃ under 7 atm (1 step)



Pressure oven can have more broad window of die attach to achieve void-free after cure.

Die warpage performance

Comparison between ATB-120 & ATB-120U



ATB-120U shows lower warpage than ATB-120

HDSS with different cure temperature

Comparison between ATB-120, ATB-120A & ATB-120U

Test Vehicle
2 x 2mm Si die on 42 alloy L/F
Cure : Convection oven (air) with 30min ramp. time

HDSS (grams)

1.E+04
1.E+03
1.E+02
1.E+01

0 20 40 60 80 100 120

Holding time at cure temperature (minutes)

- ATB-120A cure at 120'C
- ATB-120 cure at 120'C
- ATB-120A cure at 130'C
- ATB-120 cure at 130'C
- RP-882-1A1 cure at 120'C
- RP-882-1A1 cure at 130'C

ATB-120U has faster curing reaction than ATB-120 or ATB-120A, and it can deliver shorter cure time: 120'C/30~60mins or 130'C/15~30mins

HDSS with different cure temperature

110'C, 120'C, 130'C & 140'C as a cure temperature

Test Vehicle
2 x 2mm Si die on 42 alloy L/F
Cure : Convection oven (air) with 30min ramp. time

HDSS (grams)
1.E+04
1.E+03
1.E+02
1.E+01
0
20
40
60
80
100
120
Holding time at cure temperature (minutes)
120
130
140
150

60mins at 120'C is enough to get fully cured material, and 30mins is enough for 130'C or above.

Die attach cure

Cure time vs. degree of cure at 120'C

Limit (min)	Area (mJ)	Percent (%)
25.755	-167.863	90.00
28.421	-177.189	95.00
31.427	-184.650	99.00

Onset = 2.844 min

Peak = 2.367 min
Area = -165.530 mJ
Delta H = -9.680 J/g

Heat FlowEndo Up (mW)

13.23
13.0
12.8
12.6
12.4
12.2
12.0
11.8
11.6
11.4
11.2
11.0
10.83

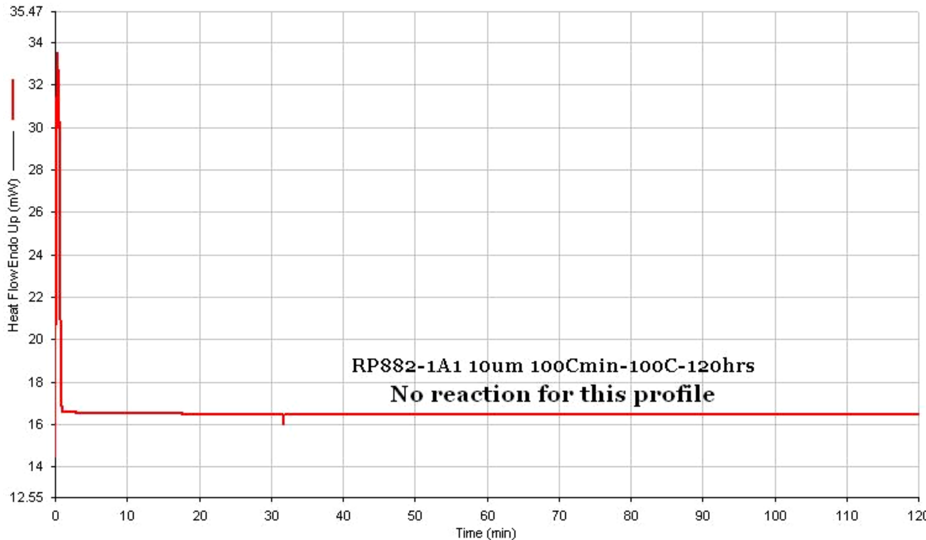
0.687 10 20 30 40 50 60 70 80 90 100 110 120

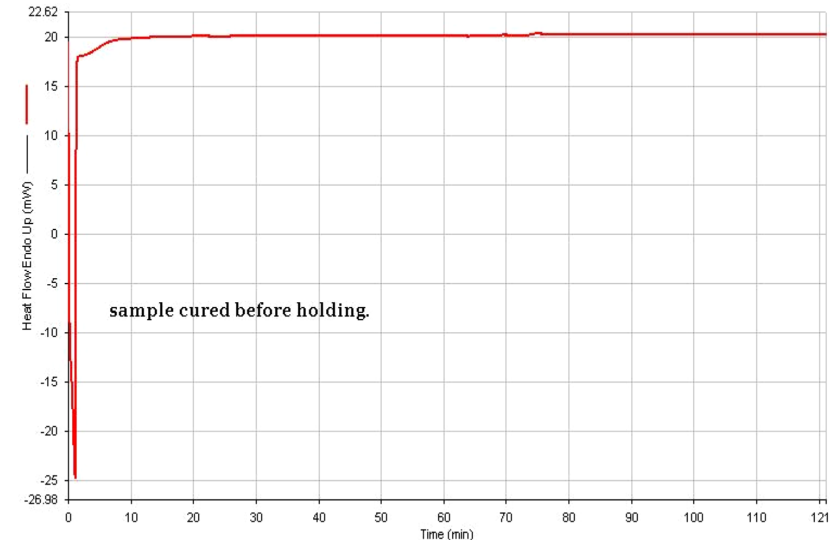
Time (min)

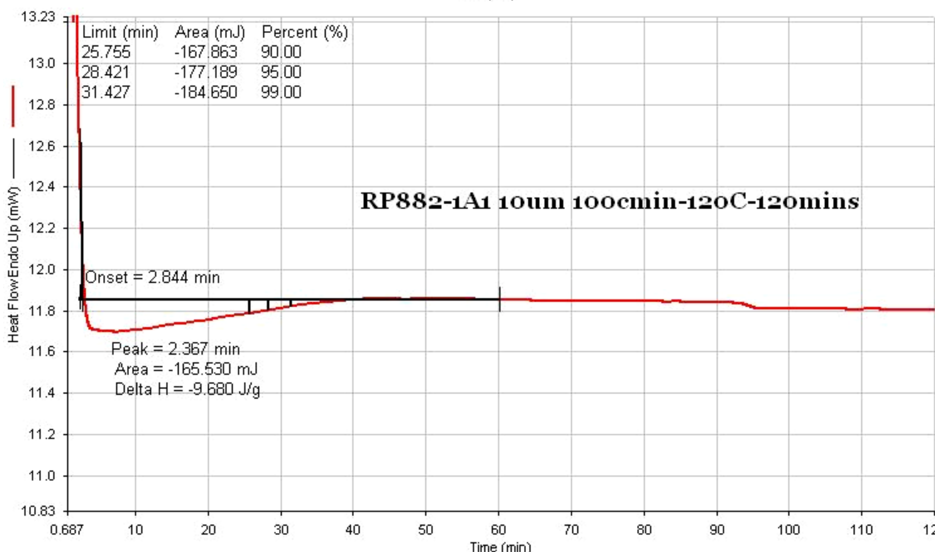
All cure reaction finished within 30 minutes at 120'C

Die attach cure

Cure time vs. degree of cure at different temperature







1) **No significant reaction at 100°C up to 2 hrs**

2) **Reaction rate at 120°C is**
   25min for 90% cure
   28min for 95% cure
   31min for 99% cure

3) **Reaction rate at 150°C is**
   <10min for 99% cure

- **Reach target cure temperature within 1 minute**

30 minutes at 120'C is required to get fully cured adhesive

Reliability performance

MRT L3@260'C & L2@260'C for mother & daughter D/A

Henkel
A Brand like a Friend

Test Vehicle

Package: 12x12mm SCSP

Die Size : 300x300x3mil for mother die / 200x200x3mil for daughter die

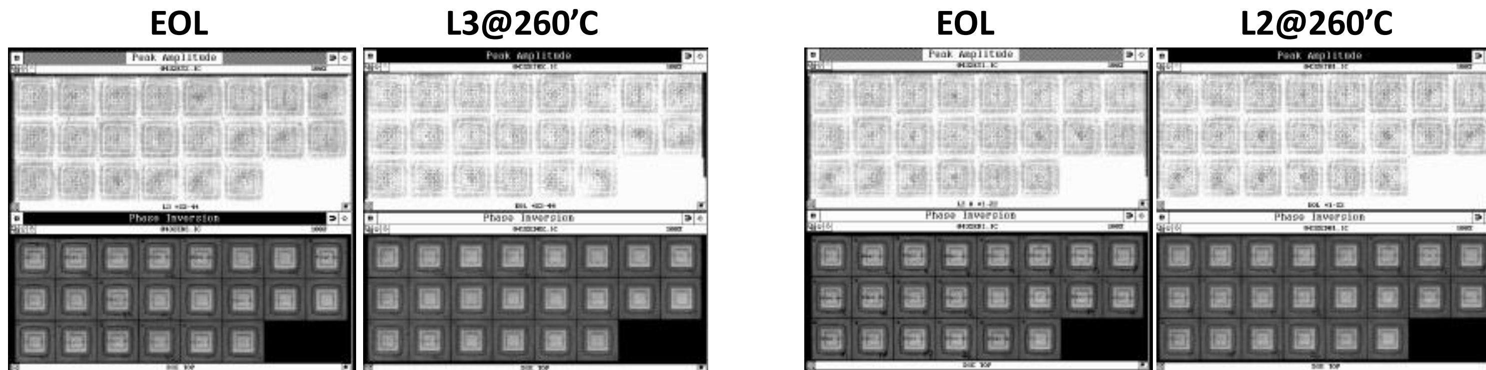
Substrate: Laminate substrate

Die attach adhesive

Mother die attach: ATB-125U

Daughter die attach: ATB-110U

Test result



ATB-100U has good MRT performance, and it passed L3@260'C & L2@260'C with mother & daughter die attach applications

Summary of ATB-100U

- Thin bond line thickness and low package thickness
  - 5, 10um, 15um, 20um, 25um, and 30um thick adhesive
- Bundled with 5um of PSA (non-UV) dicing tape (No UV process)
- Excellent workability
  - Burr free and no double die pickup
- Co-cure process is available for mother & daughter D/A application
- Excellent reliability
  - Passed L3 & L2 with 260'C reflow at mother & daughter die attach applications