

TECHNICAL DATA

High Temperature Epoxy/Glass Laminated Sheet
for PCB Wave Soldering Pallet

リ コ セ ル
“ RICOCEL® ”

Model : ES-3521 (Standard Type)

Model : ES-3261A (Anti-Static Type)

(July 1, 2009 · Revised 6)



SINCE 1921

利昌工業株式会社

RISHO KOGYO CO., LTD.

【Features Table】

Item	Point	ES-3521	ES-3261A	Other Company's Type
Anti-Static Property	To protect Electronic Parts	×	◎	◎/○/×
Heat Resistance	Durability	◎	◎	△/×
Mechanical Strength	Fine Process Workability	◎	◎	△/×
Processing	Cost of Finishing Process	◎	◎	△
Expansion & Shrinkage	Synchronous with PCB	◎	◎	△
Chemical Resistance	Residual of Washing Flux	◎	◎	×

- ①” RICOCEL” has line up of two types, ES-3521 (Standard Type) and ES-3261A (Anti-Static Type) , and their Features are almost same expect Electric.
- ②” RICOCEL” has less decline of quality by heat, which shows excellent in Durability.
- ③” RICOCEL” has excellent property in mechanical Strength which enable Fine Process.
- ④” RICOCEL” has excellent property in Processing, which can expect Processing Cost.

【Comparison Data with Other Company' s Type】

Symbol	A Company's (From EU)		B Company's (From Japan)	C Company's (From USA)		D Company's (From Japan)	E Company's (From EU)		F Company's (From Japan)
	a Type	b Type	—	a Type	b Type	—	a Type	b Type	—
Color	Blue	Black	Black	Blue	Red	Black	Black	Gray	Black
Basement	Glass Mat		Glass Mat	Glass Mat		Glass Mat	Glass Mat		Glass Cloth/Unwoven Glass Cloth

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Note) Values in this technical data reflect typical performance of the materials and are not guaranteed-values.

Standard Specification

1. Sheet size and the tolerance

Model	Nominal Size (mm)	Original Size (mm)	Guarantee Size (mm)	Standard Thickness (mm)
ES-3521 (Standard Type)	1000 × 1000	1010 × 1010	1000 × 1000	3.0~10.0
	1200 × 1000	1210 × 1010	1200 × 1000	
	2040 × 1200	2050 × 1210	2040 × 1200	
ES-3261A (Anti-Static Type)	1000 × 1000	1010 × 1010	1000 × 1000	3.0~10.0
	1200 × 1000	1210 × 1010	1200 × 1000	
	2040 × 1200	2050 × 1200	2040 × 1200	

※1) Warp thread direction of glass cloth is in length direction of material.

The above-table indicates the size in length x width order.

※2) Please ask for non-standard size (working size).

2. Thickness and the relative tolerance

Model	Thickness (mm)	Relative Tolerance (mm)	
		Non Surface Grinding	Surface Grinding
ES-3521 ES-3261A	3.0	3.00 ± 0.35	3.00 ± 0.10(0.05)
	4.0	4.00 ± 0.40	4.00 ± 0.10(0.05)
	5.0	5.00 ± 0.55	5.00 ± 0.10(0.05)
	6.0	6.00 ± 0.60	6.00 ± 0.10(0.05)
	8.0	8.00 ± 0.70	8.00 ± 0.10(0.05)
	10.0	10.00 ± 0.80	10.00 ± 0.10(0.05)

※2) Please ask for non-standard size (working size).

Anti-Static Properties (Surface Resistance & ESD Emission)

1. Specimen

Ground material with thickness of 4.0 ± 0.1 mm.

2. Test Procedure

1) Surface Resistance

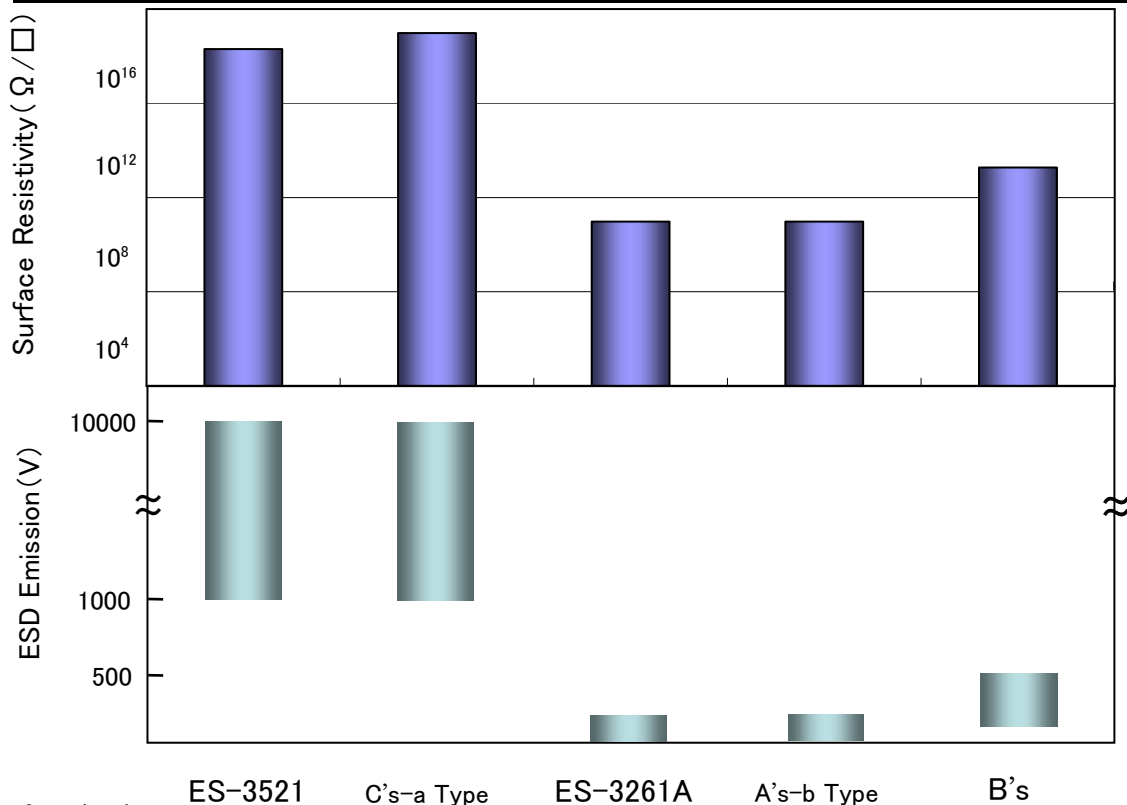
Measuring Equipment: HIRESTA-UP, MITSUBISHI CHEMICAL CORP. (JIS K6911)

2) ESD Emission (Electro Static Discharge)

Potential Difference which occurs when peeling specimen and polyimide film was measured on earthed metal sheet. Equipment: KASUGA ELECTRIC WORKS LTD. KSD-0103

3. Test Results

	Standard		Anti-Static		
	ES-3521	C's	ES-3261A	A's-b Type	B's
Surface Resistivity	2×10^{14}	1×10^{15}	1×10^7	1×10^7	2×10^9
ESD Emission	1000~10000	1000~10000	0~200	0~200	100~500



4. Conclusion

ES-3521 is Insulation material but not ESD material. In case ESD was required, please consider using ES-3261A. As ES-3261A is moderate electricity, it can control static electricity in high level.

Surface Resistance after Heat Treatment

1. Specimen

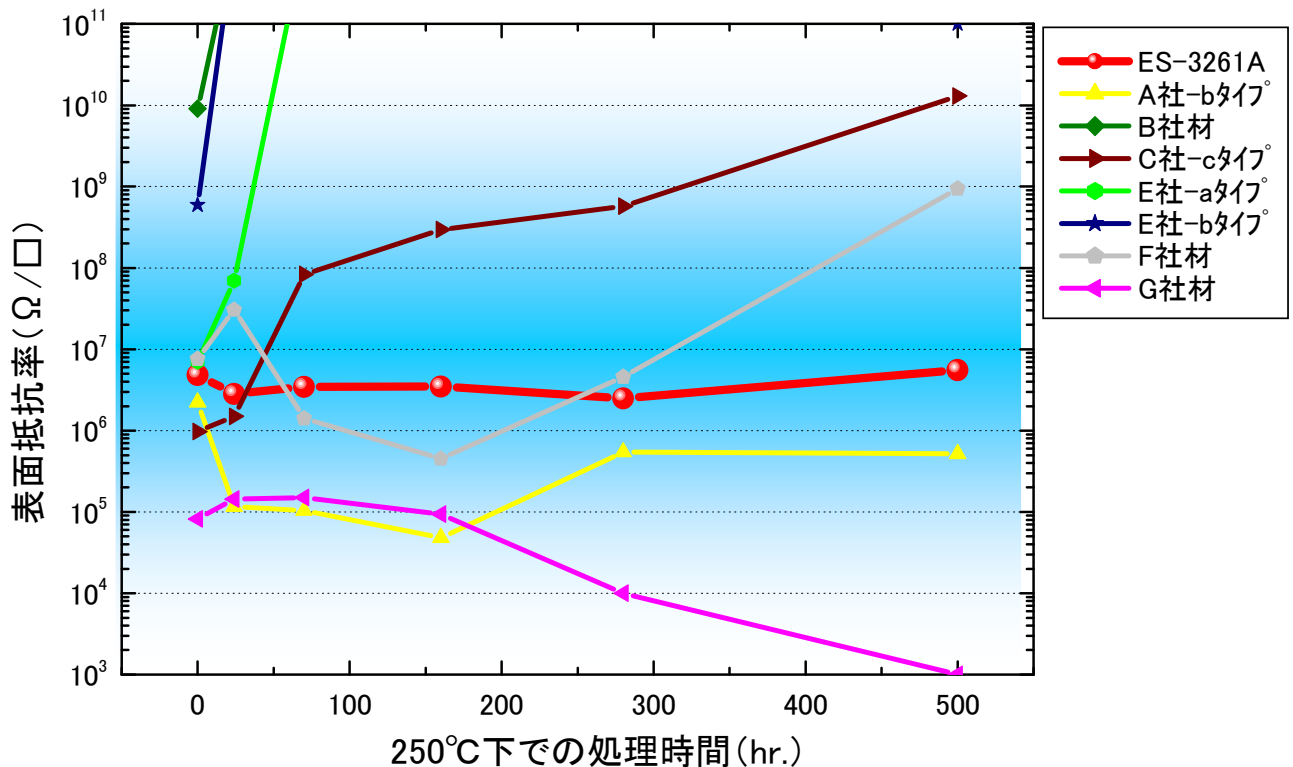
Ground material with thickness of $5.0 \pm 0.1\text{mm}$ and size of $100 \times 100\text{mm}$.

2. Test Procedure

Specimen were heated in Dryer at temperature of 250°C . Then measured the surface resistance after treatment for a certain period.

Surface Resistance Measure : Mitsubishi Chemical High reseter UP (JIS K6911)

3. Test Results



※Blue range in above graph is $10^5 \sim 10^9 \Omega/\square$ as $10^7 \Omega/\square$ is middle. Generally, that is the range that No ESD will occur and extinguish the electrification even if the electrify object might contacted.

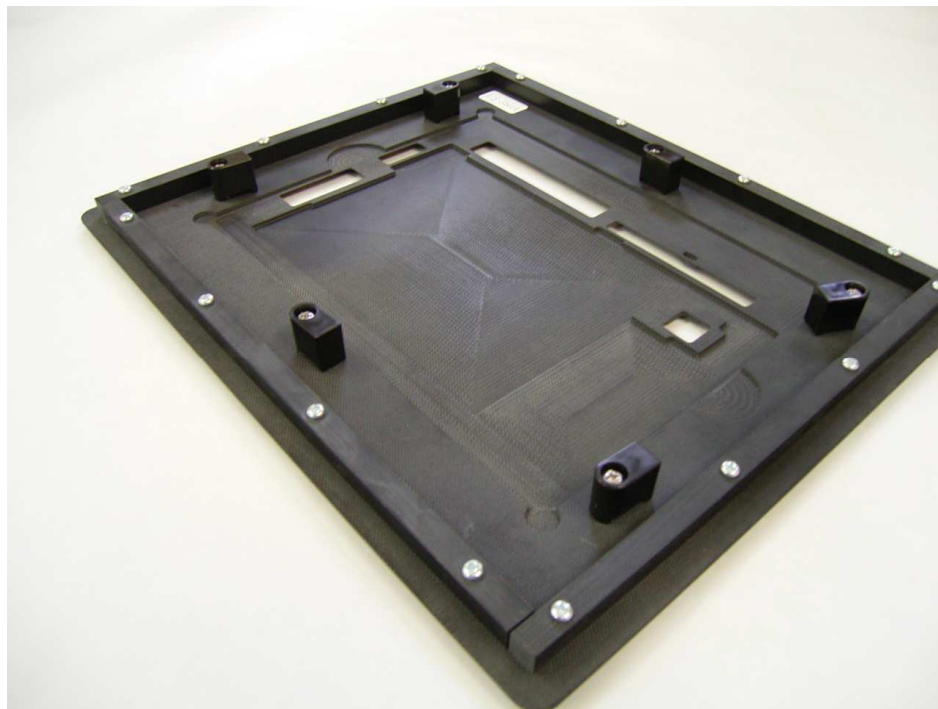
4. Conclusion

Soldering Pallet is exposed repeatedly to high temperature, around 260°C on mounting process. This test is evaluating the endurance of Anti-static characteristics in case this material was used repeatedly as soldering pallet. It shows surface resistance of ES-3261A is very small and stable in anti-static under heat resistance.

Warp in Wave-Soldering Process

1. Specimen

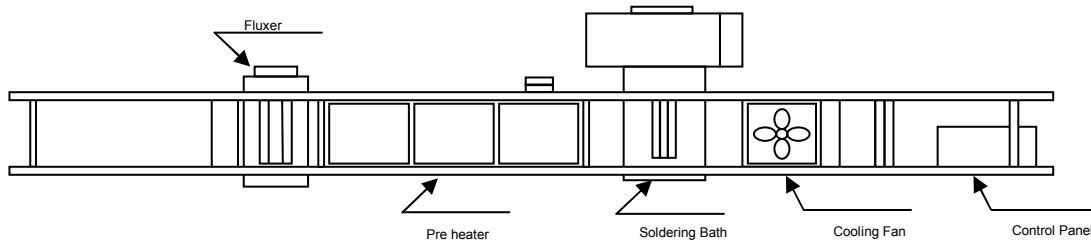
With 6.0 ± 0.1 mm thick ground material, we made the specimen of soldering pallet shows below and used for measuring the warp during the soldering process. The size of pallet is 235mm x 280mm. This specimen has frames made of glass epoxy laminates on its upper surface.



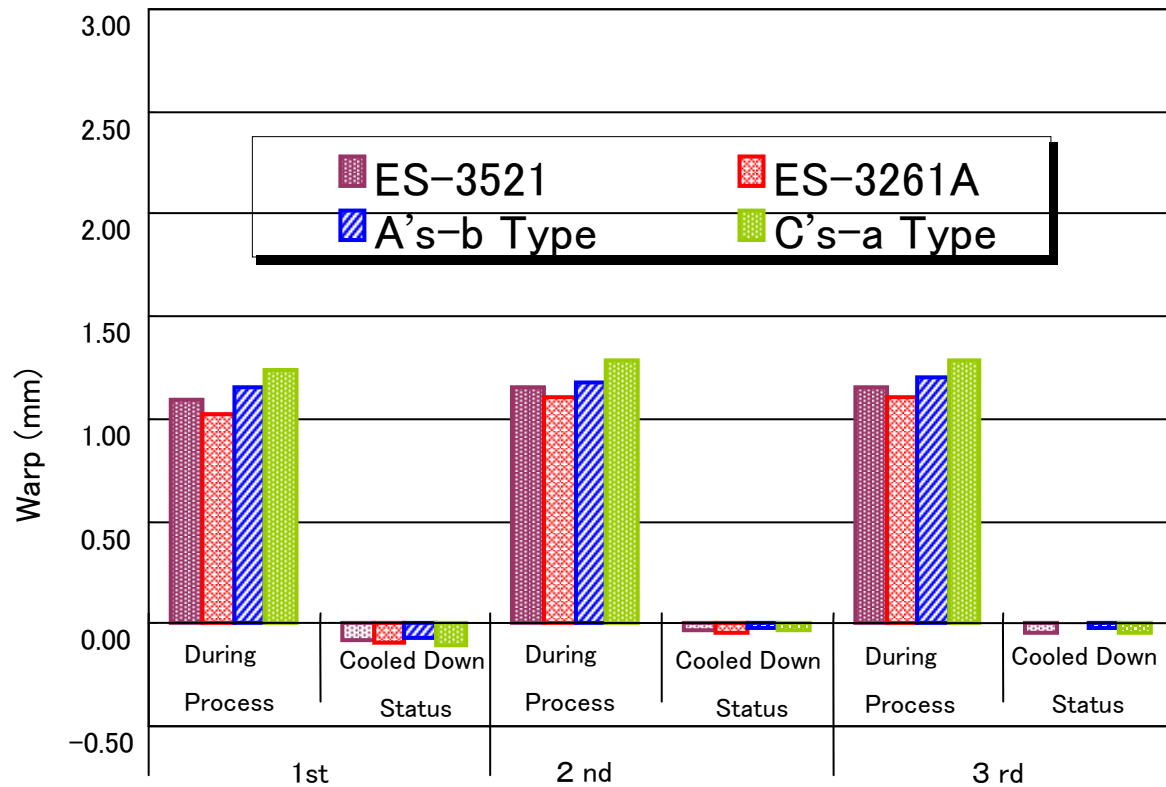
※Picture shows the soldering pallet made of ES-3261A.

2. Test Procedure

The soldering pallet was set in the below-mentioned wave-soldering line. By using LVDT (Linear Variable Differential Transformer) with Temperature and duration: at 250°C for 5 seconds, without pre-heater. We measured displacement of the center point of the pallet from the initial level during the process and after cooled-down status, which we defined as the warp volume.



3. Comparison Test Results



4. Conclusion

When Soldering Pallet contact Solder, bottom side of soldering pallet will warp due to expansion by heating. In that case, if warp became big, there will have gap between PCB and pallet, which will make defective on soldering. As shown on the above, our ES-3261A has excellent property of warp retardant.

Water Absorption

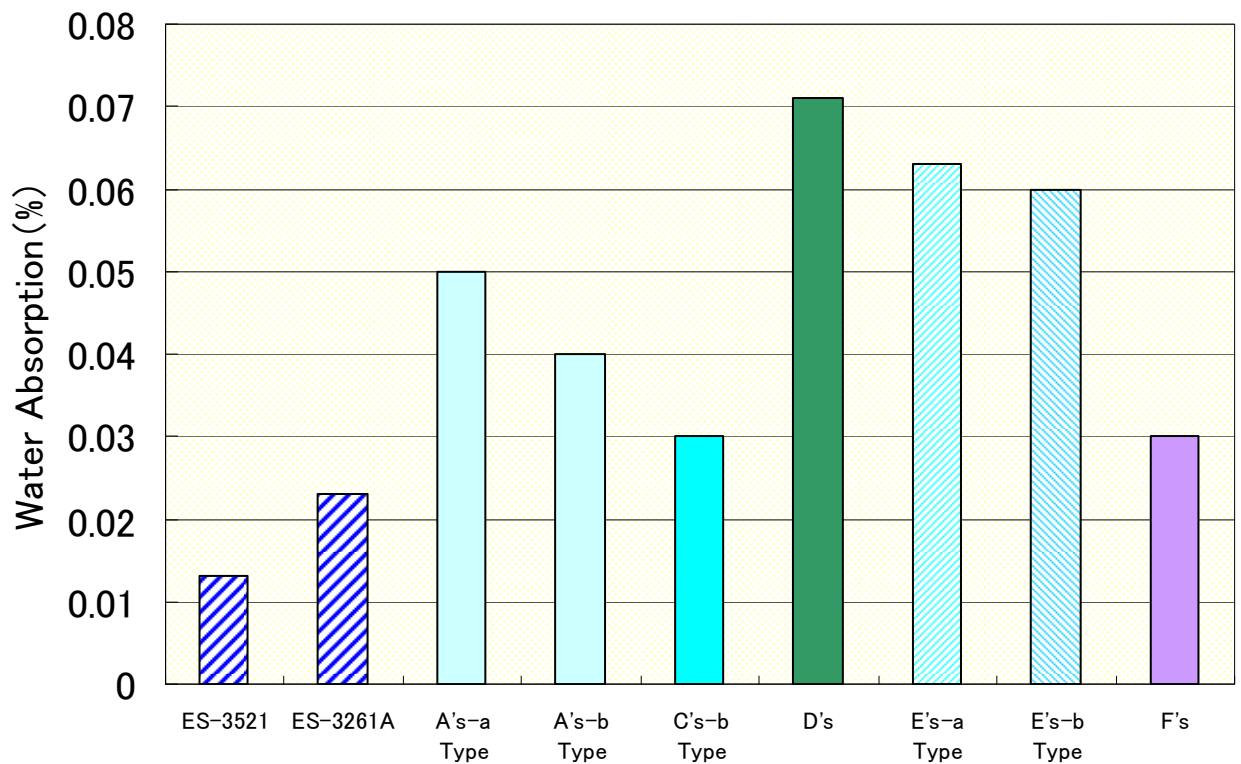
1. Specimen

Ground material with thickness of 4.0 ± 0.1 mm and size of 50×50 mm.

2. Test Procedure

Accordance with JIS K 6911

3. Comparison Test Results



4. Conclusion

According to the above result, Water absorption of ES-3521 · ES-3261A are less than our competitor's material and hard to get influence of water absorption on storage. Moreover, as our material has little water absorption, the gas (steam) occurred from the material also very little when mounting processing. Our material can avoid a certain influence of water absorption.

Weight Change rate (IPA immersed)

1. Specimen

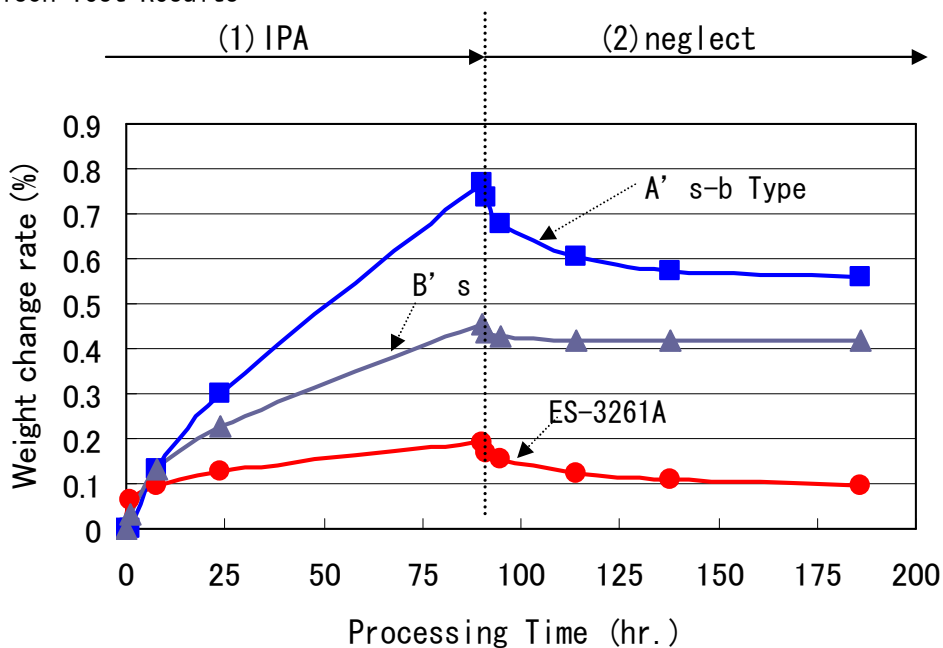
Ground material with thickness of 6.0 ± 0.1 mm and size of 50×50 mm.

2. Test Procedure

(1) Specimen was treated on heat ($300^\circ\text{C} \times 5\text{hr.}$) and then immersed into IPA for a certain time (90hr.) and measured the weight change rate.

(2) After immersed into IPA for 90hr., specimen was neglect under normal condition, and then measured the weight change rate.

3. Comparison Test Results



Note

IPA MSDS Data sheet (Petrochemical Industry association 2000.5.31)

Chemical name · form : Isopropyl Alcohol · $(\text{CH}_3)_2\text{CHOH}$ (Molecular Weight 60.1)

Classification : Inflammability liquid, acute poisonous substance

Hazardous : In case of inhale high density steam, poisoning might occur.

Environment Impact : Ecology poison is not strong.

4. Conclusion

Soldering Pallet might clean with IPA or etc, after repetition use. Above data shows that our ES-3261A has less immersing and remaining of IPA than our competitor's material. Therefore, our material can decrease the influence of IPA which occurred due to heat of Soldering.

Chemical Resistance (IPA)

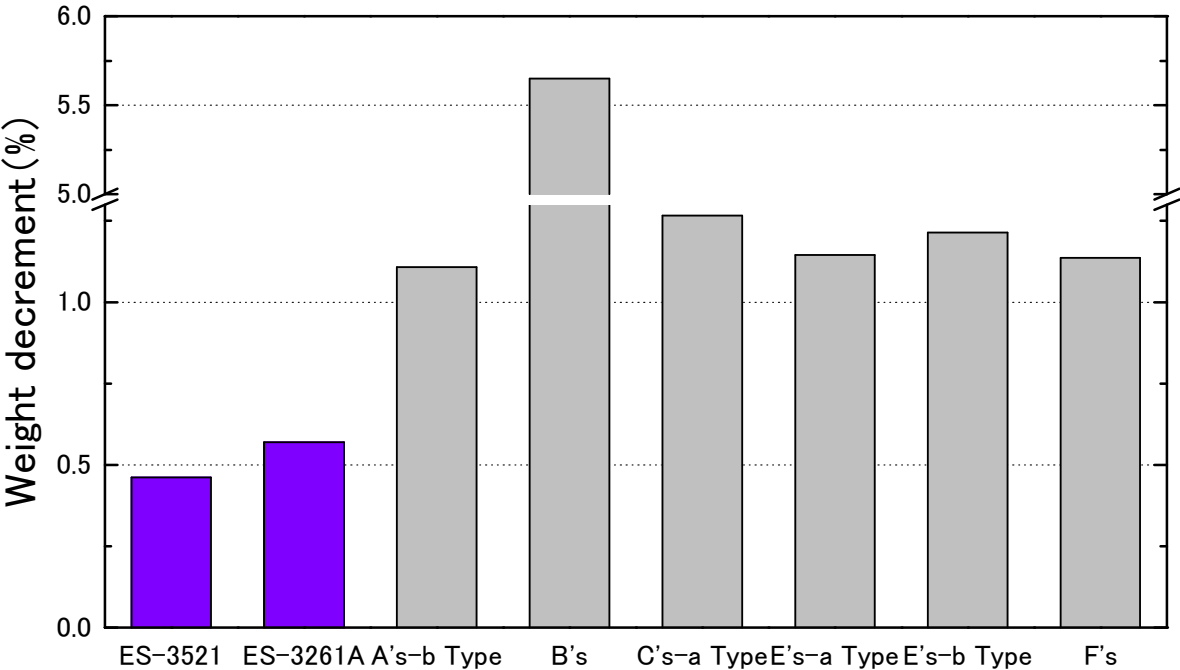
1. Specimen

Ground material with thickness of 5.0 ± 0.1 mm and size of 50×50 mm.

2. Test Procedure

Specimen was treated under flow back of IPA for 120 hours. Then, measured weight loss rate against the original after treated at 250°C for 24 hours.

3. Comparison test Results



4. Conclusion

ES-3521 · ES-3261A has property of less aging influenced by IPA. It means our material has excellent property of endurance in repetition use under mounting process and washing process.

Thermal Expansion Rate (50–250°C)

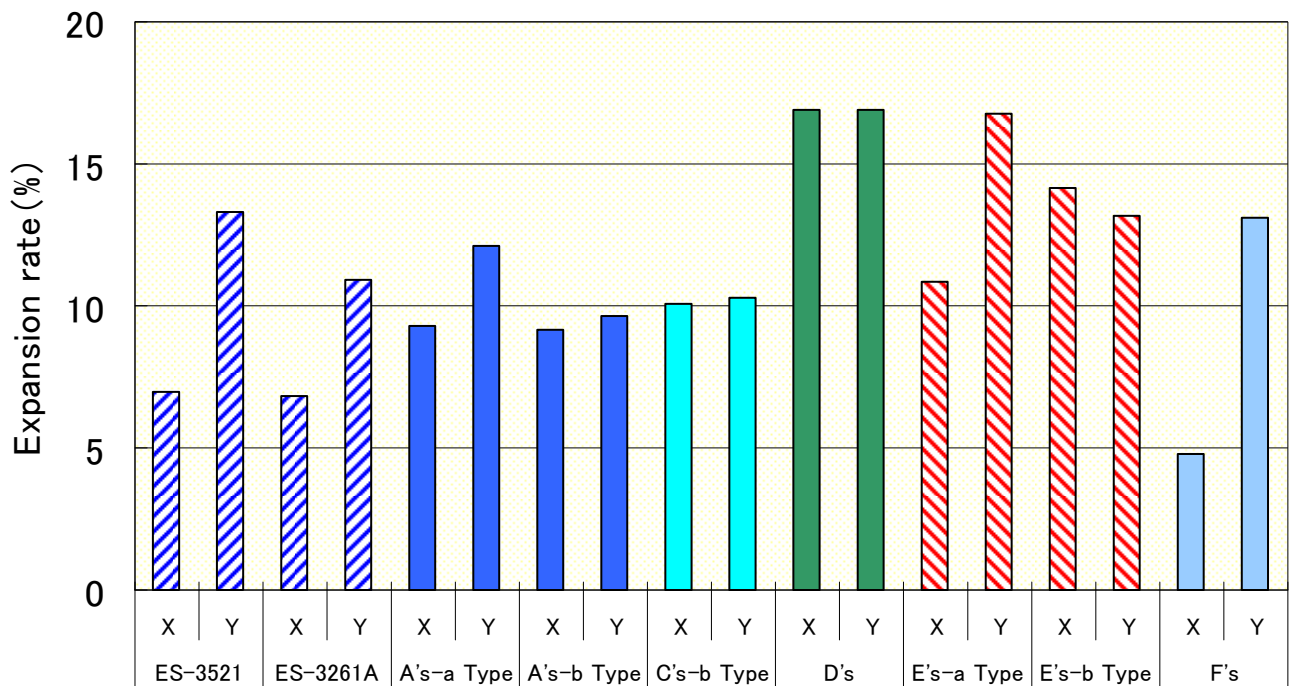
1. Specimen

Ground material with thickness of 4.0 ± 0.1 mm and size of 4×10 mm.

2. Test Procedure

Thermal expansion rate was calculated by measured volume of the expansion in the direction of X-Y at 50~250°C.

3. Comparison Test Results



4. Conclusion

Base material of ES-3521 and ES-3261A is glass cloth (Our competitor use glass mat) and has same direction as PWB. Therefore, our material enables to register the transformation at high accuracy size by unifying the direction of pallet and PWB when designing high accuracy pallet.

Loss on Heat (250°C)

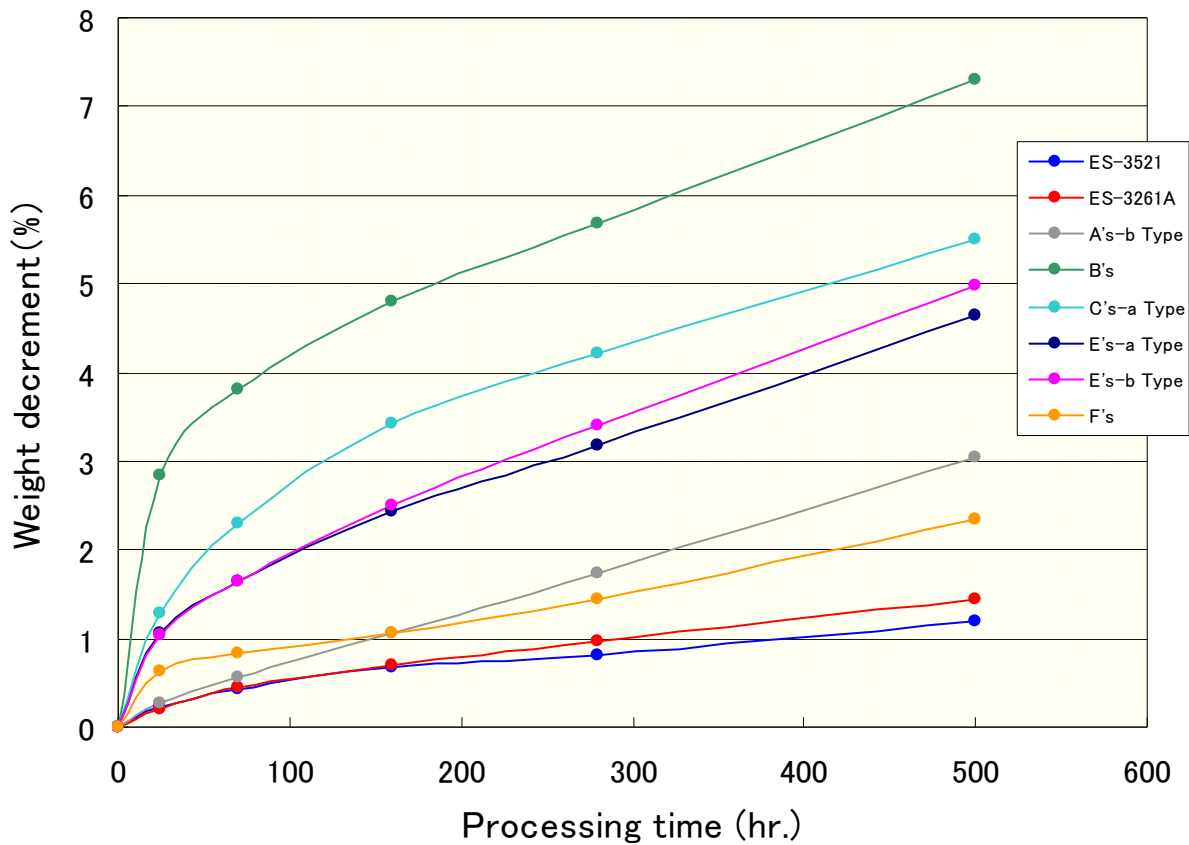
1. Specimen

Ground material with thickness of 6.0 ± 0.1 mm and size of 50×50 mm.

2. Specimen

Specimen was treated with 250°C heated convection oven for a certain time. Then measured the weight and calculate the weight loss rate against original weight.

3. Comparison Test Results



4. Conclusion

Pallet may be exposed to high heat during soldering process. On that process, Glass cloth does not age but resin does. Aging of resin can verify by weight loss. ES-3521 - ES-3261A has property of less reduction in weight than our competitor's model. From view of this point, our material has excellent property of endurance.

Loss on Heat (300°C)

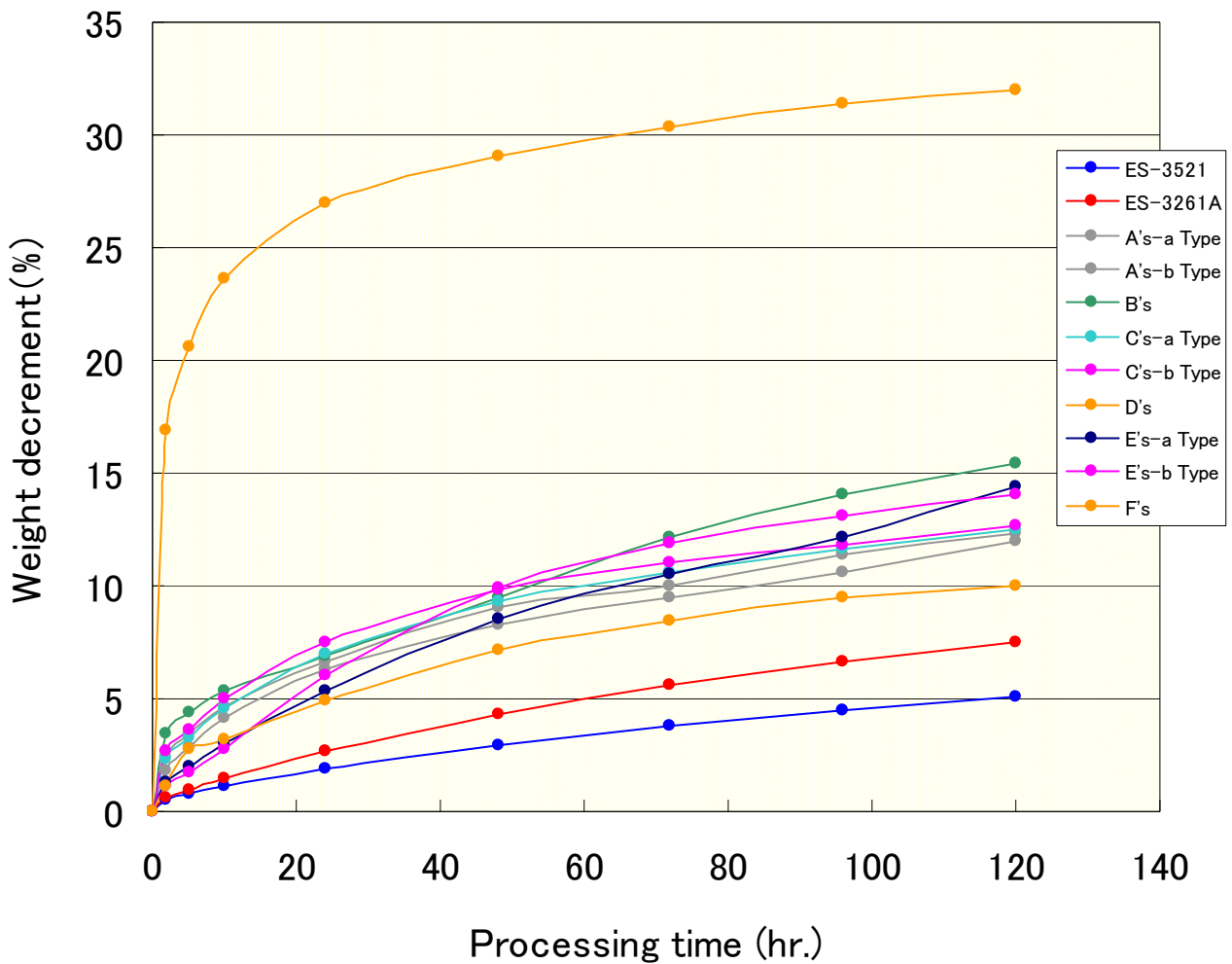
1. Specimen

Ground material with thickness of 4.0 ± 0.1 mm and size of 50×50 mm.

2. Specimen

Specimen was treated with 300°C heated convection oven for a certain time. Then measured the weight and calculate the weight loss rate against original weight.

3. Comparison Test Results



4. Conclusion

As acceleration test, we measured weight loss by heat at higher temperature than usual soldering temperature. As result, we confirmed that our ES-3521 · ES-3261A has excellent property of endurance as well as previous page.

Heat Resistance for soldering

1. Specimen

(1) Model

ES-3521・ES-3261A

Comparison material : A' s-b Type, B' s, C' s-a Type

(2) Specimen Size

6.0mm^t × 25mm × 25mm

2. Test Procedure

Tested delaminating(Swelling), Exhausting of Gas and Smelling after immersed in soldering bath for a certain time at 260°C and 350°C.

3. Comparison Test Results

Solder dipping Condition	Specimen	Swelling (Heat Resistance)	Exhausting Gas	Smelling
260°C 300sec.	ES-3521	○	◎	◎
	ES-3261A	○	◎	◎
	A's-b Type	○	◎	◎
	B's	○	◎	◎
	C's-a Type	○	◎	◎
350°C 60sec.	ES-3521	○	○	○
	ES-3261A	○	○	○
	A's-b Type	○	△	△
	B's	×	△	△
	C's-a Type	○	△	△

※Swelling

○ : None

× : found

※Exhausting Gas

◎ : a particle

○ : a little

△ : Many

※Smelling

◎ : None

○ : Weak

△ : Strong

4. Conclusion

The condition of wave soldering is about 260°C 10sec. and the pallet has been used for repeatedly. Our competitor' s model exhaust gas strongly due to decomposition of resin at 350°C for 60sec. However, our models exhaust a little gas, which can serve better working environment.

Displacement rate at 325°C (Z direction)

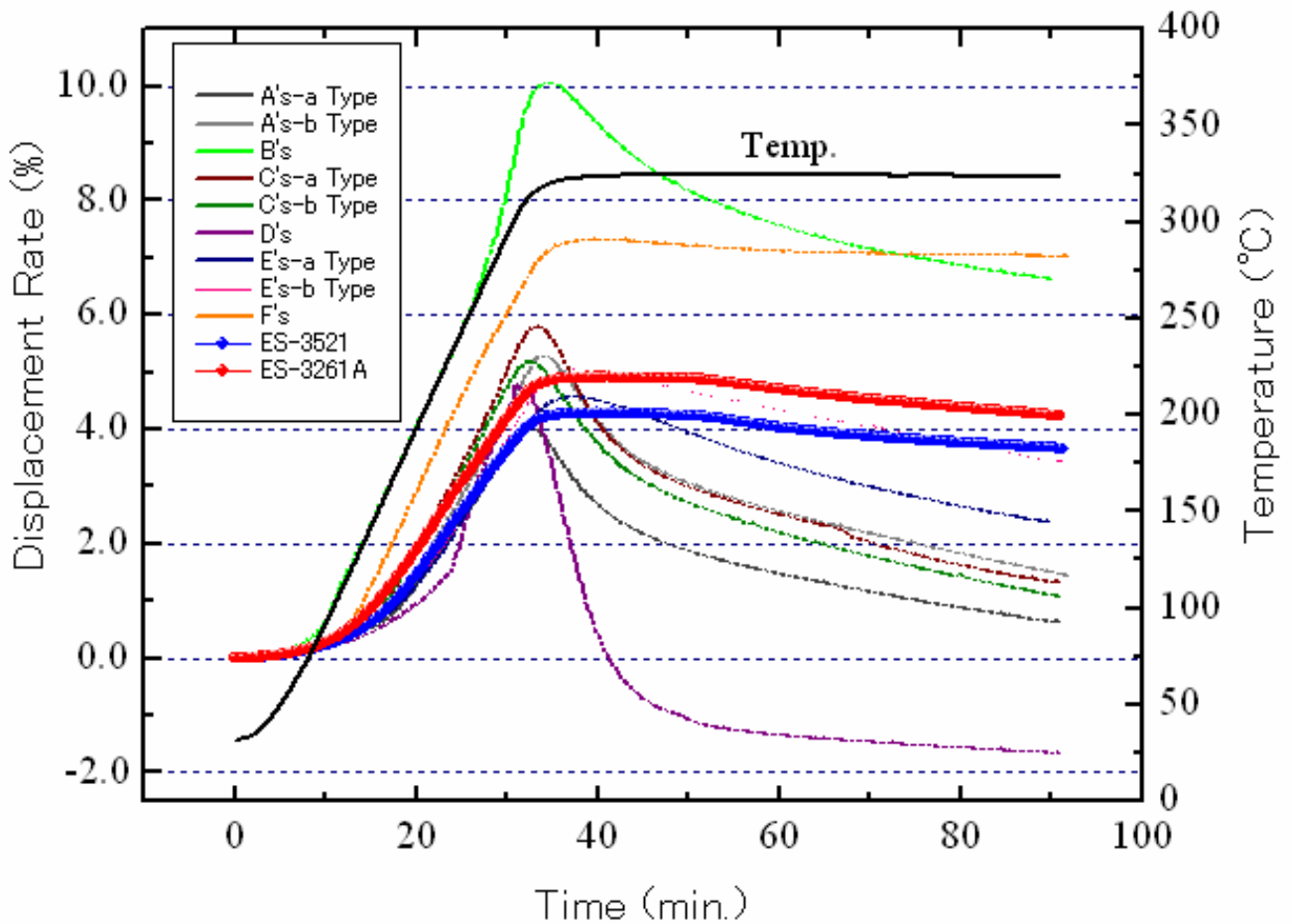
1. Specimen

Ground material with thickness of 4.0 ± 0.1 mm and size of 4×4 mm.

2. Specimen

Specimen was heated $10^\circ\text{C}/\text{min}$ gradually up to 325°C and after kept 325°C for 60sec., we measured displacement thickness. Then calculate the displacement rate.

3. Comparison Test Results



4. Conclusion

Every material expanding until 300°C . After 300°C , the material will turn to shrink due to aging by heat. Shrink of our model is smaller than the others and match to previous data of "Weight Loss on heat". This data shows our model has excellent property of Heat Resistance.

Drilling Workability① (Wearing of Drill bit)

1. Specimen

Ground material with thickness of 6.0 ± 0.1 mm and size of 150×250 mm.

2. Specimen

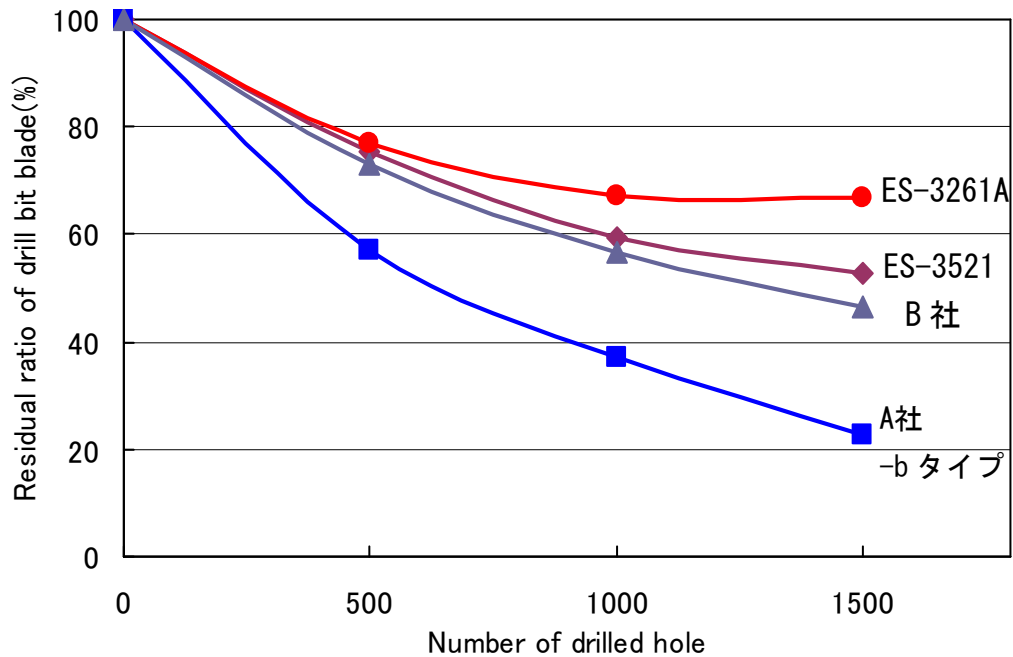
Measured wearing of Drill bit after 500 shots, 1000 shots and 1500 shots with single stack of specimen.

Entry board : Aluminum board (0.15mm Thickness)
 Back up board : RICOLTE PS-1160G (1.5 mm Thickness)
 Drill bit : $\phi 1.0$ mm \times 8.0mm
 Revolution : 54000rpm
 Feed : $30 \mu\text{m/rev.}$

3. Comparison Data

(単位 : %)

	0ショット	500ショット	1000ショット	1500ショット
ES-3521	100	75.2	59.6	52.8
ES-3261A	100	77.0	67.1	66.9
A社-bタイプ	100	56.9	37.0	22.7
B社	100	73.0	56.6	46.3



4. Conclusion

Since wearing of Drill bit on processing of our ES-3521・ES-3261A is only a little, tooling cost can be saved and maintaining the process accuracy.

Drilling Workability② (End Mill Processing)

1. Specimen

- a) ES-3261A 6.0mm Thickness (Anti-Static Type)
- b) A' s - b Type 6.0mm Thickness (Anti-Static Type)

2. Processing machine

Machining Center

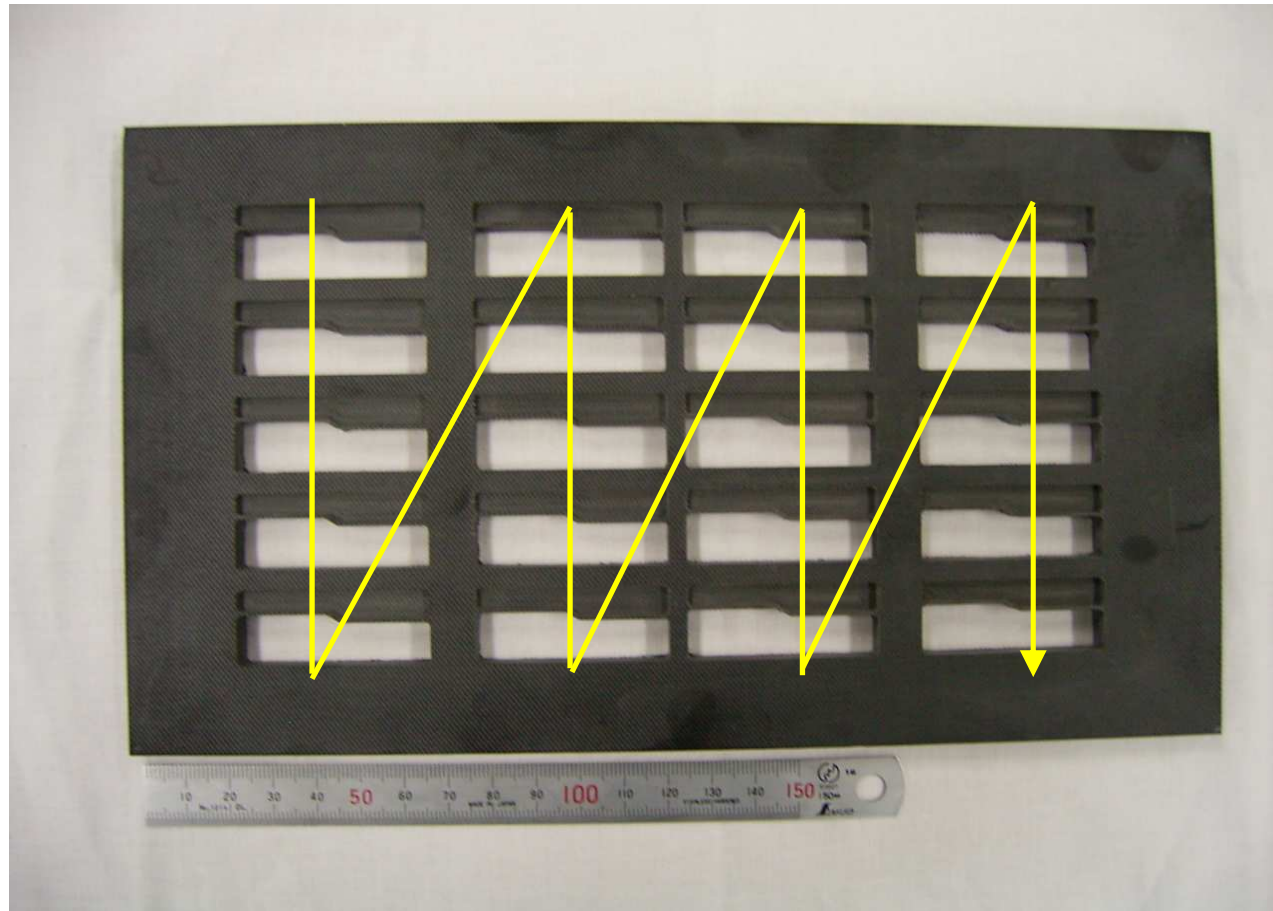
(ACE CENTER MB-56VA

Max. Revolving : 15000 r p m)

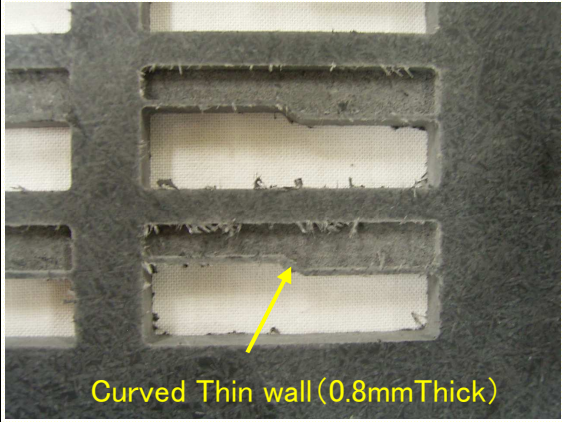
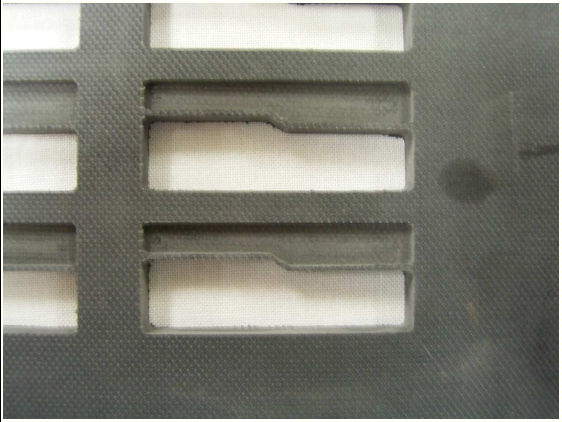
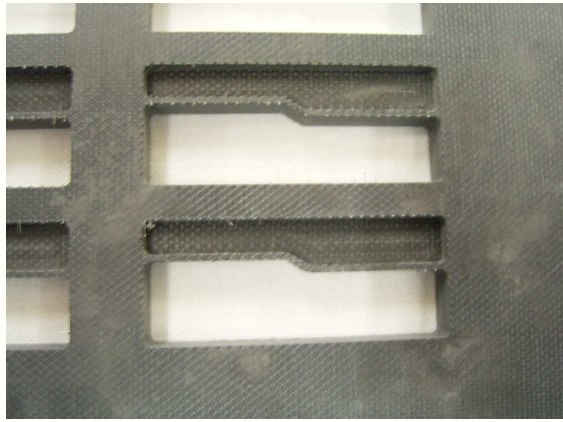
3. Processing route

As shown on picture

(processing volume 70cm³) 。



4. Comparison results

Specimen		A's-b type	Risho ES-3261A	
C o n d i t i o n	Tool	Tungaloy SED2020F ϕ 2.0	←	←
	Revolving Speed	5000rpm	←	←
	Nick (Dept × width)	1.0 × 1.5mm	←	←
	Feeding Speed (Time)	600mm/min (approx. 105min.)	600mm/min (approx. 105min.)	1200mm/min (Approx. 60min.)
Appearance after Processing				
Barr		×	○	○~△
Crack or Chip		None	None	None

5. Conclusion

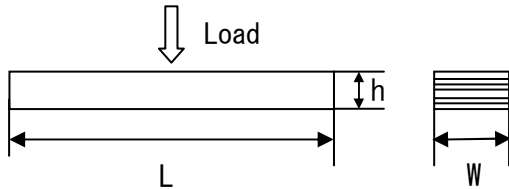
As ES-3261A has excellent property of End Mill processing, scarcely Barr was found.

Bending Strength

1. Specimen

Following specimen was made according to JIS K 6911.

① Vertical to layers

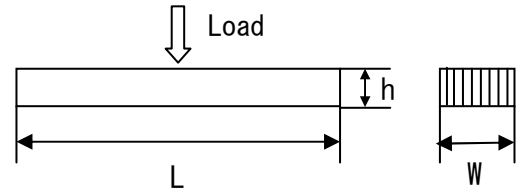


W : 6 mm

L : 50 mm

h : 0.5, 1.0, 2.0, 4.0 mm

② Parallel to layers



W : 6 mm

L : 50 mm

h : 0.5, 1.0, 2.0, 4.0 mm

2. Test Procedure

1) Treatment of Specimen

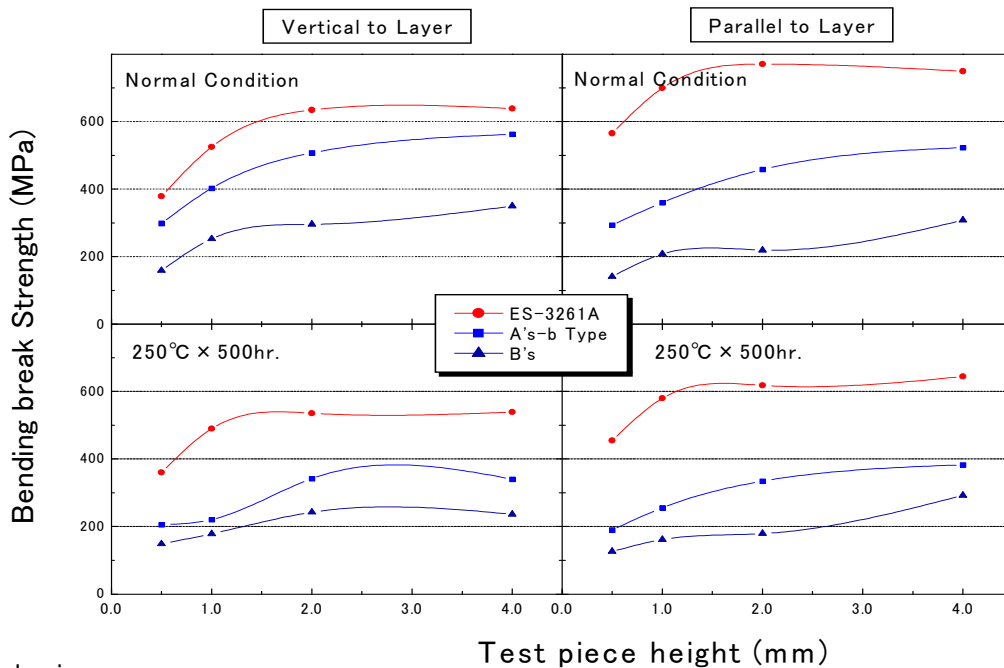
① Normal Condition

② 250°C × 500hours

2) Measuring Method

Based on JIS K 6911. Fulcrum distance: 30mm

3. Comparison Test Results



4. Conclusion

Assumed processing of thin wall of pallet, and measured the strength at normal condition and after aging by heat with 0.5~4.0mm specimen. ES-3261A has excellent property of parallel and vertical strength against layers at normal condition and after aging by heat.

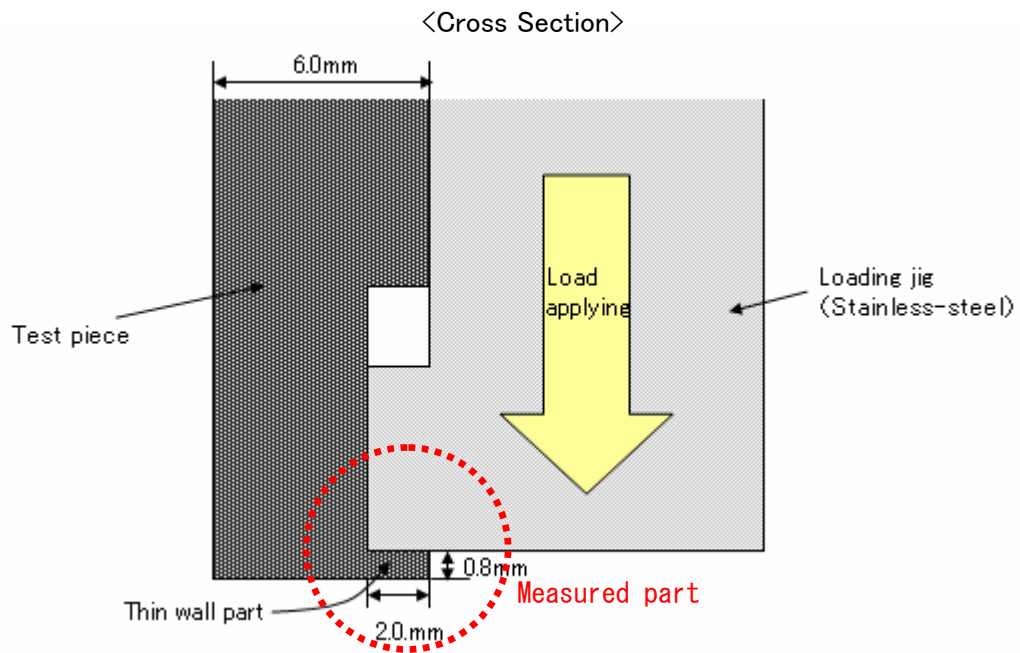
Breaking Strength (Thin wall)

1. Specimen

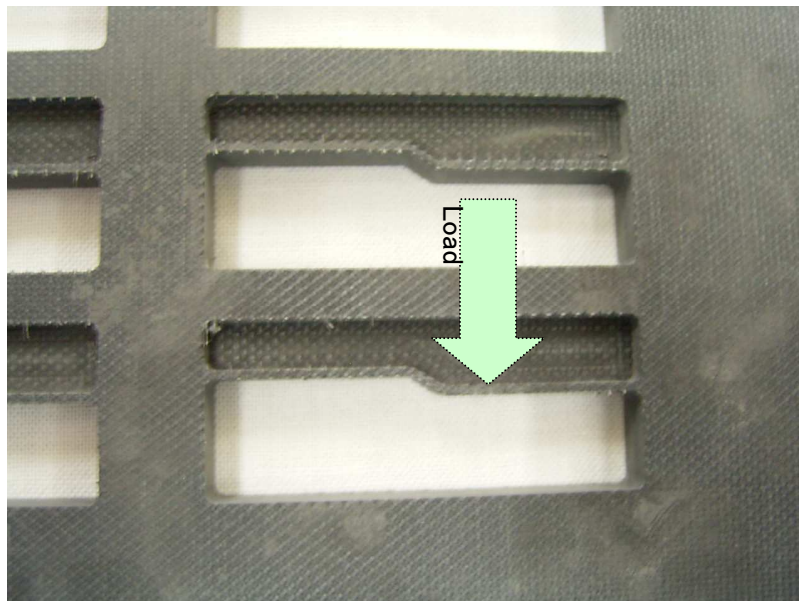
- a) ES-3261A 6.0mm Thickness (Anti-Static Type)
- b) A' s-b Type 6.0mm Thickness (Anti-Static Type)

2. Test Procedure

As shown below, maximum breaking strength of thin wall was measured.



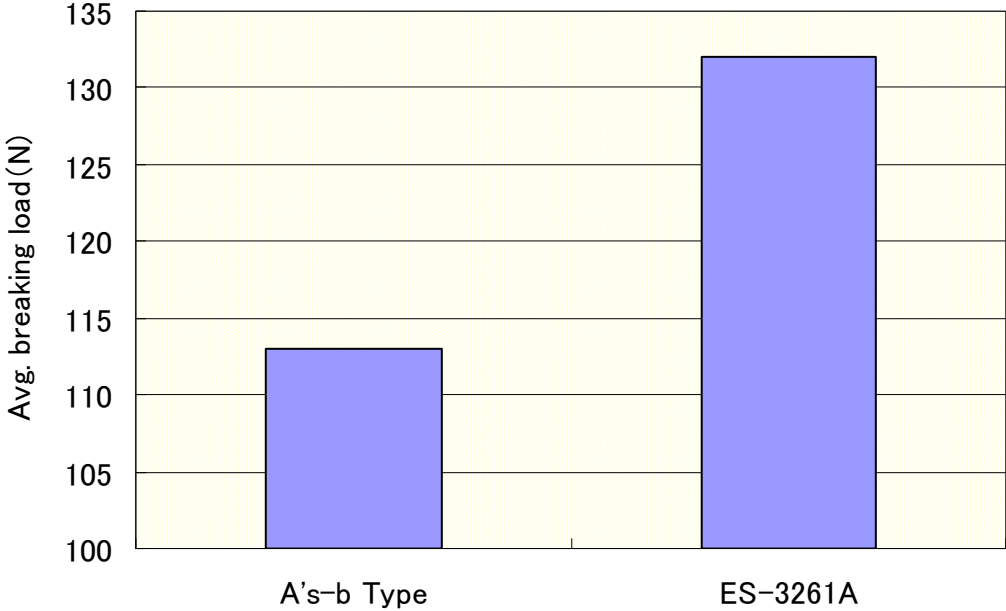
<Picture of Specimen>



3. Test Results

(Unit:N)

No.	ES-3261A	A's-b Type
1	128	90
2	150	105
3	160	123
4	91	100
5	137	105
6	112	134
7	127	113
8	142	122
9	130	139
10	142	99
Avg.	132	113
Max.	160	139
Min.	91	90



4. Conclusion

Above data shows thin wall of our ES-3261A is stronger than that of our competitor' s model.

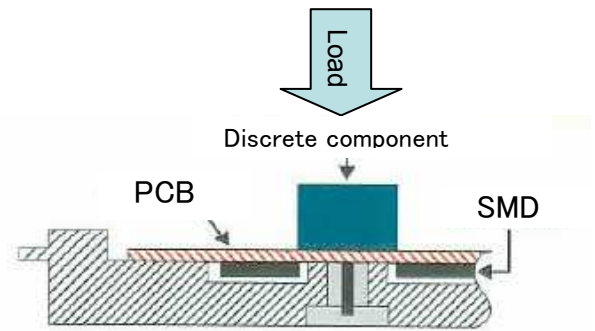
Transformation of thin Frame

1. Using Condition

■ Example of thin Frame pallet



■ Mounting Condition (Cross Section)



■ Due to transformation of the pallet, gap can be seen between pallet and PCB was occurred.



■ Soldering defect might occur due to over flow of Solder from the gap.



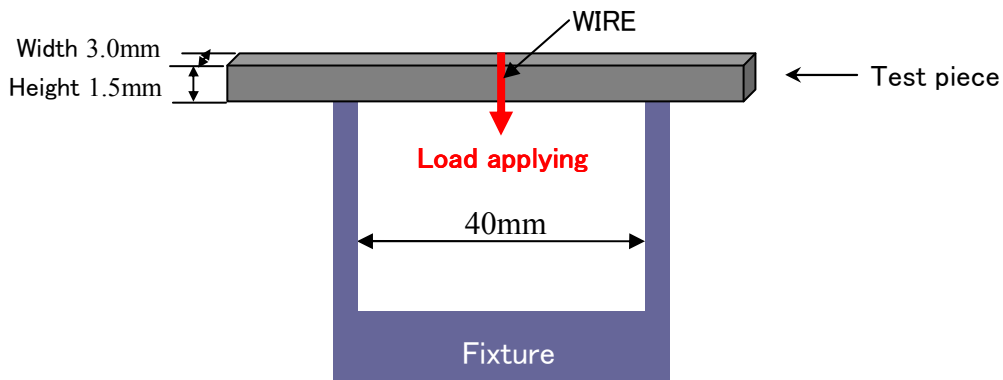
2. Transformation retardant Test

1) Specimen

- ①ES-3521 1.5 × 3.0 × 50.0mm
- ②A' s-b Type 1.5 × 3.0 × 50.0mm

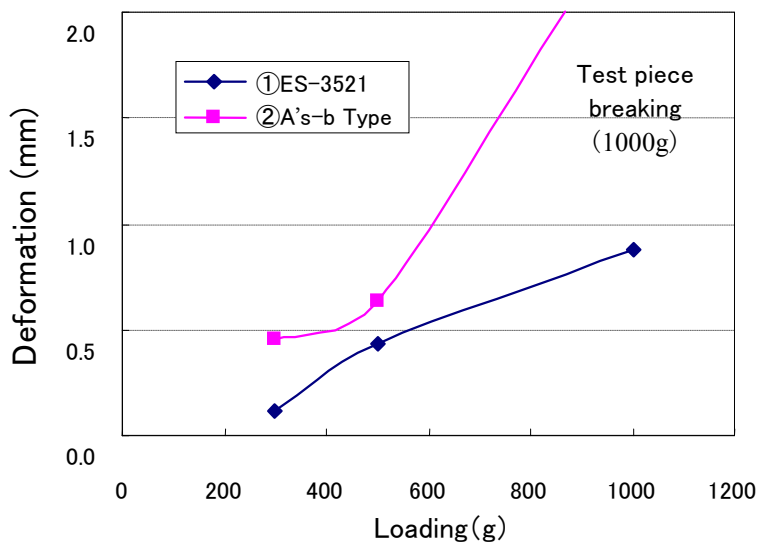
2) Test Procedure

- (i) Using tolling as shown below (fulcrum distance:40mm), we wind the wire (ϕ 0.5mm) to specimen and load a certain weight. Then, we neglect it in dryer (260°C) for 1 min.
- (ii) After take it out from Dryer, we release the load and cool down to the room temperature.
- (iii) Then we measured bending (transforming) volume by Dial Gage.



3) Comparison Test Results

Deformation		Unit:(mm)		
Test piece \ Load	300g	500g	1000g	
①ES-3521	0.12	0.43	0.88	
②A's-b Type	0.45	0.63	× (Test piece breaking)	



4) Conclusion

Above data shows our ES-3251 has much better property of Transforming retardant compare to our competitors.

Flexural Modulus (Room Temp. and High Temp.)

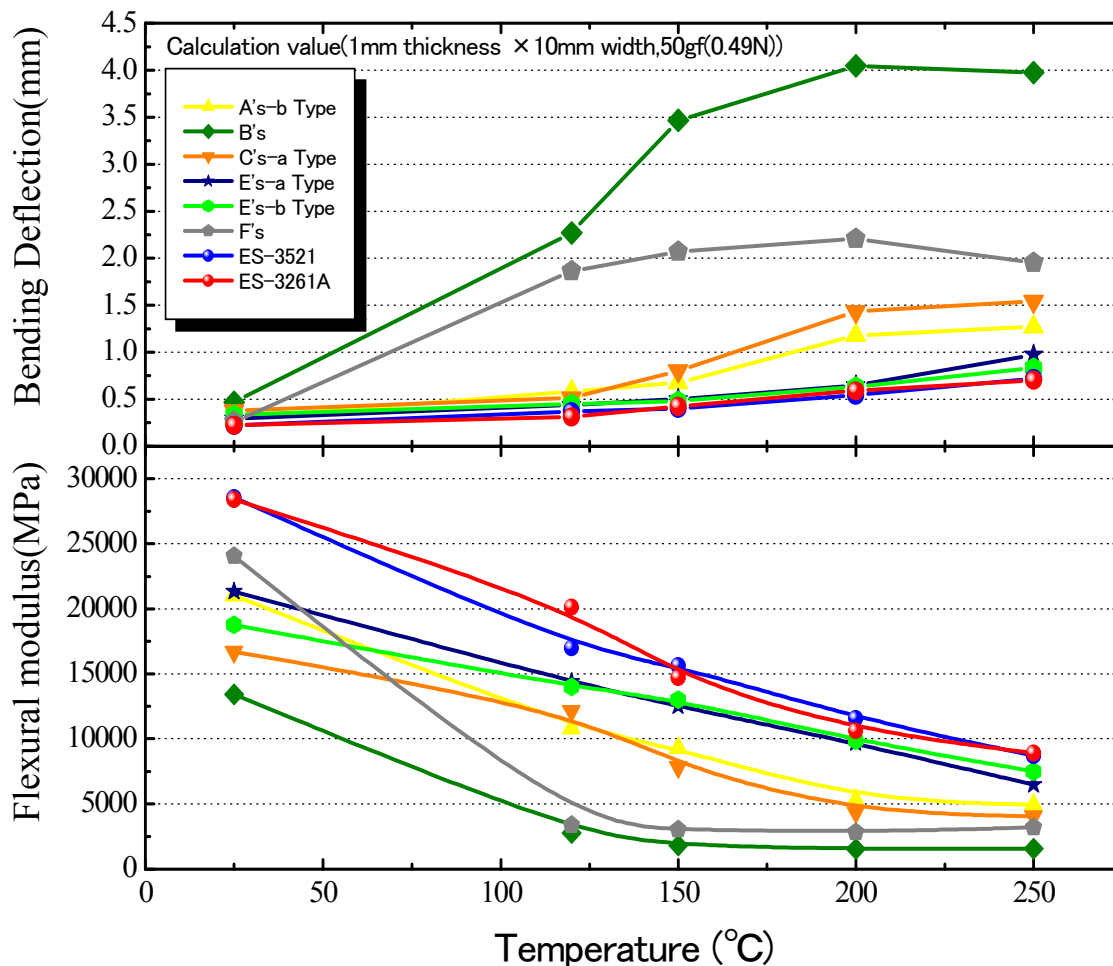
1. Specimen

Ground material with thickness of 5.0 ± 0.1 mm and size of 10×100 mm.

2. Specimen

Based on JIS K 691125~250°C, Flexural Modulus of vertical wise shall be measured. From the measured result, we calculate the Bending Deflection in case of applied 50gf (0.49N) load on bottom part of the pallet (1mm Thickness).

3. Comparison Test Results



4. Conclusion

Basement of our material is glass Cloth, opposite to this; our competitors' materials are glass mat or glass woven cloth. By applying the heat retardant resin to our basement, our material became excellent material in Flexural modulus property from room temperature to high temperature. Thereof calculated Bending Deflection is small, which shows excellent properties in transforming retardant.

General Properties

Test Item		Unit	ES-3521	ES-3261A
Surface Resistance		Ω	2×10^{14}	1×10^7
ESD Emission		V	1000~10000	0~200
Density		-	1.95	1.95
Water Absorption		%	0.013	0.023
Ignition Loss		%	31.0	30.5
Flexural Strength (Normal Temperature)	MD	MPa	555	553
	TD		473	499
Modulus In Flexure (Normal Temperature)	MD	MPa	28562	28413
	TD		25062	26466
Glass Transition Temperature (T _g)	TMA Method	°C	145	132
	DMA Method		177	165
Solder Limit (Dip)	260°C	Sec.	300<	300<
	350°C		60<	60<
Coefficient of Linear Expansion (Z direction)	$\alpha 1$ (50→100°C)	$\times 10^{-6}/K$	45	59
	$\alpha 2$ (200→250°C)		199	215
Coefficient of Linear Expansion (X, Y direction)	X (50→250°C)	$\times 10^{-6}/K$	6.96	6.82
	Y (50→250°C)		13.33	10.91
Thermal Conductivity		W/mK	0.38	0.38
Warp on wave soldering (235×280mm)	Normal Condition	mm	0.00	0.00
	Under wave soldering (260°C-5sec.)		1.10	1.02
	After 3 cycle of wave soldering		-0.04	0.00
Weight Decrement Rate	250°C - 500hr.	%	1.19	1.45
	300°C - 120hr.		5.08	7.49
Drilling Workability	500 shots	%	75.2	77.0
	1500 shots		52.8	66.9

※) Above values are examples of measurement and are not guaranteed values.