

ESPANEX[®]

L Series

Technical data sheet

This sheet will be changed without any information in advance. The data on this sheet are solely for your reference and are not to be constructed as constituting a warranty.

Nippon Steel Chemical Co., Ltd. Head Office

7-21-11 Nishigotanda Shinagawa Tokyo, 141-0031, Japan

TEL +81-3-5759-2738

FAX +81-3-5759-2791

Electronic Materials R&D Laboratories

1-Tsukiji Kisarazu Chiba, 292-0835, Japan

TEL +81-438-30-7107

FAX +81-438-30-7129

1. Features

Liquid Crystal Polymer -Copper Clad Laminate (LCP-CCL) ESPANEX[®] L Series

ESPANEX[®] L Series is new flexible CCL using only LCP (liquid crystal polymer) film *Vecstar*[®] for the dielectric layer.

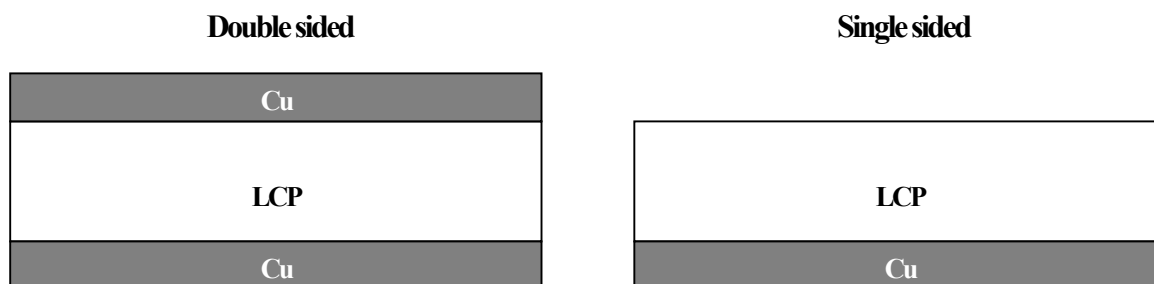
* *Vecstar*[®] ; Kuraray make.

- The excellent characteristic in LCP is maintained as it is for **an adhesiveless type**.
- Since **moisture absorption is very low**, the stable electrical, mechanical and dimensional properties are maintained.
- The electrical properties at **high frequency** are excellent (**low dielectric constant, low dielectric loss tangent**).
- In all grades, **Low Profile ED Copper foil (Rz=2.0μm)** is used for conductor layer.
- **The heat resistance is over 270 °C (P type 240 °C)**, and there is no resistant drop by moisture absorption.
- **High thermal conductivity** and excellent heat dissipation characteristic.
- **Halogen-free** flame resistance (UL94 VTM-0).
- It excels in **chemical resistance**.

ESPANEX[®] L Series is useful for various types of flexible circuits.

- LCD, PDP driver
- IC Package; t-BGA (tape-Ball Grid Array)
- High frequency and high speed applications; Wireless LAN, ITS (ETC antennas, millimeter wave for Automatic Safety Vehicle)
- Telecommunication network equipment
- High speed data links
- Chip on Film (COF)
- Multilayer Circuits

2. Products



Copper foil; In all grades, **Low Profile ED Copper foil (Rz=2.0 μm)** is used.

	Grade	Total Thickness (μm)	Thickness (Cu/LCP/Cu) (μm)	Note
Double Sided	LB18-25-18NE	61	18/25/18	Standard Type HDT=275 °C
	LB18-25-18NEP	61	18/25/18	P Type HDT=240 °C
	LB18-50-18NE	86	18/50/18	Standard Type HDT=275 °C
	LB18-50-18NEP	86	18/50/18	P Type HDT=240 °C
	LB18-100-18NE	136	18/100/18	Standard Type HDT=275 °C
	LB18-100-18NEP	136	18/100/18	P Type HDT=240 °C
Single Sided	LC18-25-00NE	43	18/25/00	Standard Type HDT=275 °C
	LC18-25-00NEP	43	18/25/00	P Type HDT=240 °C
	LC18-50-00NE	68	18/50/00	Standard Type HDT=275 °C
	LC18-50-00NEP	68	18/50/00	P Type HDT=240 °C

HDT: Heat Distortion Temperature

Products size (Max); 250mm * 50m / roll

3. Base Film Properties

3-1 Mechanical Properties

Properties	Unit	LCP	Polyimide	Test Conditions
Tensile Strength	MPa	200	274	IPC-TM-650 2.4.19
Tensile Elongation	%	40	57	IPC-TM-650 2.4.19
Tensile Modulus	MPa	3100	4606	IPC-TM-650 2.4.19

3-2 Thermal Properties

Properties	Unit	LCP	Polyimide	Test Conditions
HDT (Heat Distortion Temp.)	°C	275 (P Type 240)	>300	TMA Method
CTE (Coefficient of Thermal Expansion)	ppm/°C	17	20	TMA(100~190 °C)
Thermal Conductivity	W/m°C	0.5	0.2	
Flammability		VTM-0	V-0	UL-94

3-3 Hygroscopic Properties

Properties	Unit	LCP	Polyimide	Test Conditions
Water Absorption	%	0.04	3.2	In the water, 24hr
Moisture Absorption	%	<0.04	1.5	25°C,50%RH,24hr
CHE (Coefficient of Hygroscopic Expansion)	ppm/%RH	1	28	

3-4 Electrical Properties

Properties		LCP	Polyimide	Test Conditions
Dielectric Constant (Dk)	1GHz	2.86	3.5	Resonance method
	5GHz	2.86	-	
	25GHz	2.86	-	
Dielectric Loss Tangent z (Df)	1GHz	0.0025	0.007	Resonance method
	5GHz	0.0025	-	
	25GHz	0.0022	-	

3-5 Chemical Resistance

Properties(25°C, 24Hr)	Tensile Strength ratio %	
	LCP	Polyimide
MEK	100	100
Methylene Chloride	100	100
1,1,1-Trichloroethane	100	100
H ₂ SO ₄ (10%)	100	100
NaOH (10%) 25°C, 20 min	95	90

4. CCL Properties

4-1 CCL Properties

	Unit	Double Sided	Single Sided	Test Conditions
Peel Strength (after etching)	kN/m	1.2 (P type 1.6)	1.0 (P type 1.5)	JIS C-6471
Peel Strength (after reflow)	kN/m	1.2	1.0	260°C, 3 times
Dimensional Stability (after etching)	%	0.03 ~ -0.03	0.05 ~ -0.05	IPC-TM-650 2.2.4
Dimensional Stability (after heating)	%	0.05 ~ -0.05	0.07 ~ -0.07	250°C, 30min
Insulation Resistance	Ω	1*10 ¹³	1*10 ¹³	IPC-TM-650 2.6.3
Volume Resistance	Ω cm	3*10 ¹⁶	3*10 ¹⁶	IPC-TM-650 2.5.17
Dielectric Breakdown Strength	kV/mm	130	130	ASTM-D149
THB (Thermal Humidity Bias Test)	Ω	>1*10 ⁹	>1*10 ⁹	L/S=150/150μm 85°C 85%RH50V,1000hr with Coverlay Film
Solder Float Resistance Standard Type		270°C, 60sec, OK 280°C, 5sec, OK 280°C, 10sec, NG	270°C, 60sec, OK 280°C, 5sec, OK 280°C, 10sec, NG	JIS C-6471
Solder Float Resistance P Type		270°C, 60sec, OK 280°C, 5sec, NG	270°C, 60sec, OK 280°C, 5sec, NG	JIS C-6471

4-2 Dimensional Stability for Relative Humidity

[Features]

Unlike Polyimide, LCP has **the very low water absorption**.

Therefore, LCP demonstrates **excellent dimensional stability** to problems, such as a position gap by the environmental humidity at the time of high-density mounting.

[Test Method]

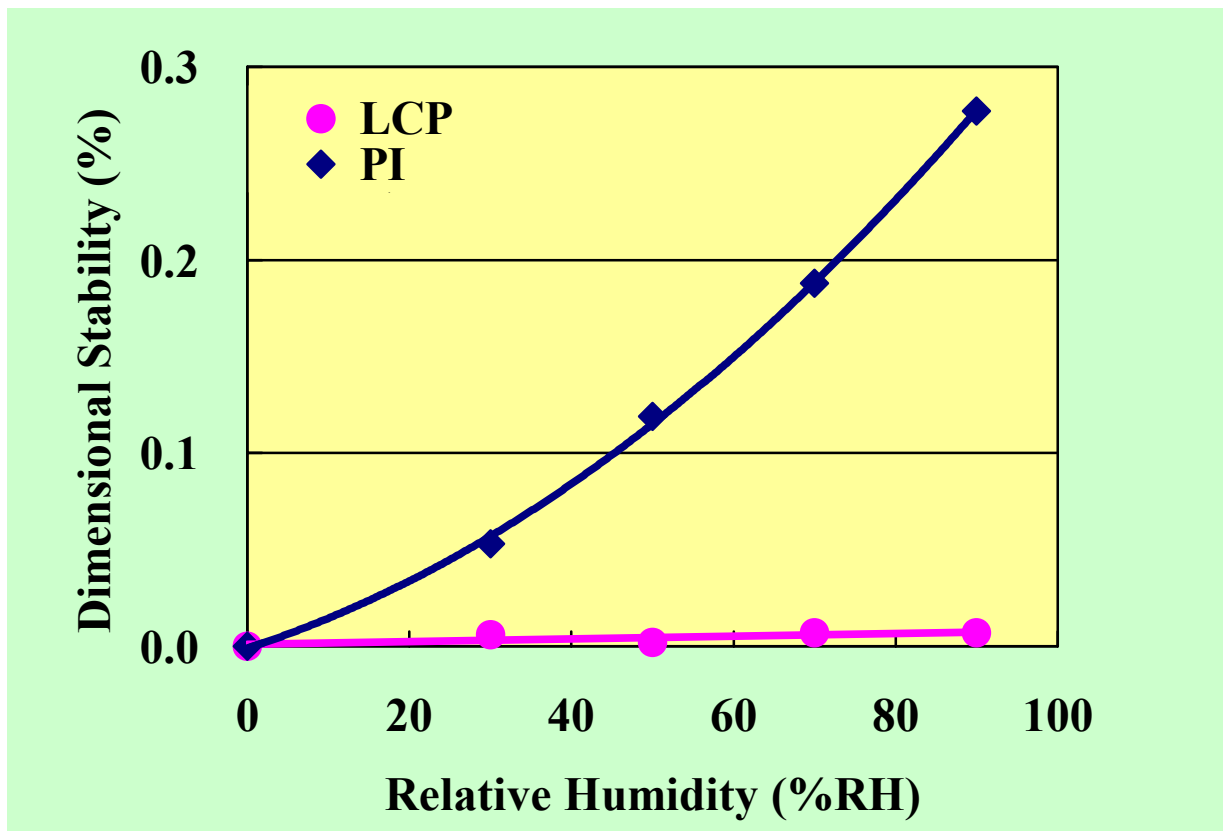
LCP (L series)

PI (adhesiveless type)

It is a value after 24hr under humidification environment about a complete etching film.

[Result]

Dimensional Stability for Relative Humidity



4-3 High reliability for various environmental conditions

[Features]

L series has **the high reliability under various environments** as a circuit board material.

[Test Method]

LCP (L series)

PI (adhesiveless type)

(After thermal exposure at 150°C)

The piece of an examination is left in the hot wind oven under 150°C atmosphere.

The peel strength by the direction of 180° is measured in normal temperature. (JIS C-6471)

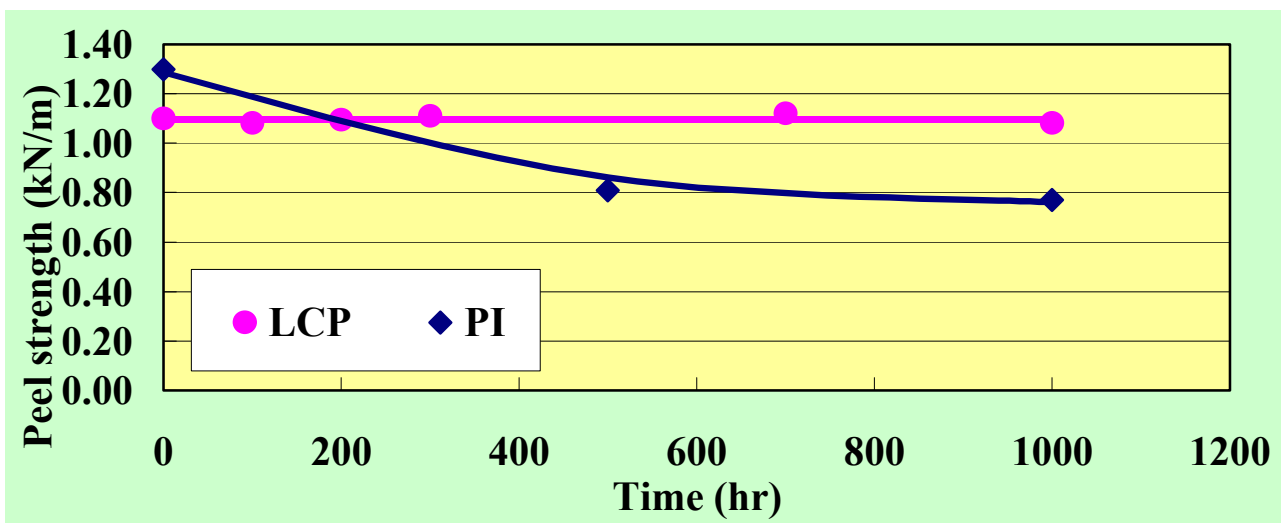
(After PCT)

The piece of an examination is left under 120°C, 2atm, 100%RH atmosphere.

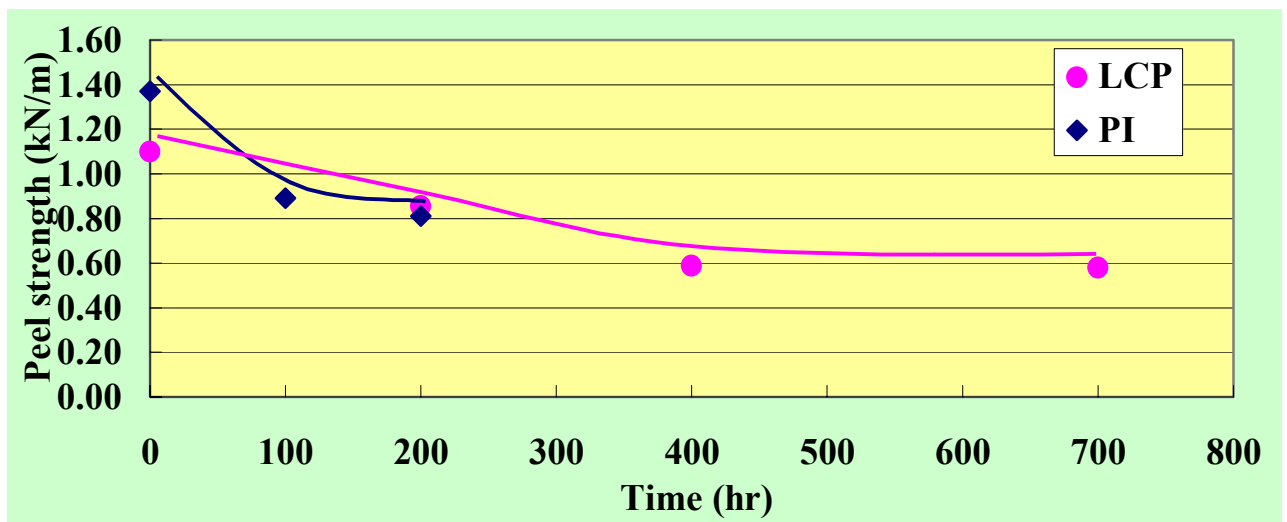
The peel strength by the direction of 180° is measured in normal temperature. (JIS C-6471)

[Result]

After thermal exposure at 150°C



After PCT (121°C, 2atm, 100%RH)



4-4 High performance at high frequency

[Features]

The electrical properties at **high frequency** are excellent (**low dielectric constant, low dielectric loss tangent**).

[Test Method]

LCP (L series)

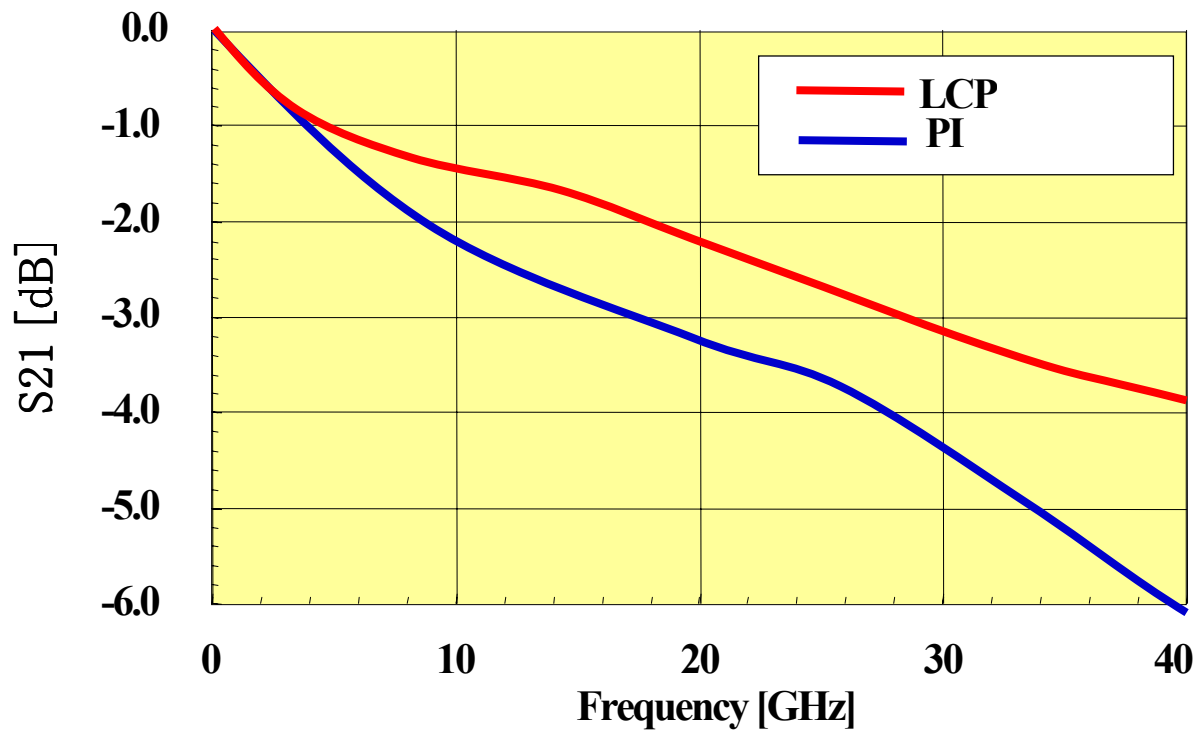
PI (adhesiveless type)

Scattering parameter (S21) is measured using a network analyzer.

($Z_0=50\Omega$, Coplanar waveguide of GSG structure, $L=50\text{mm}$)

[Result]

Low transmission loss (S21)



Offered from Nippon Mektron Co., Ltd

4-5 Bendability

[Features]

L series has **bendability equivalent to polyimide (adhesiveless)** as a flexible circuit board.

[Test Method]

LCP (L series)

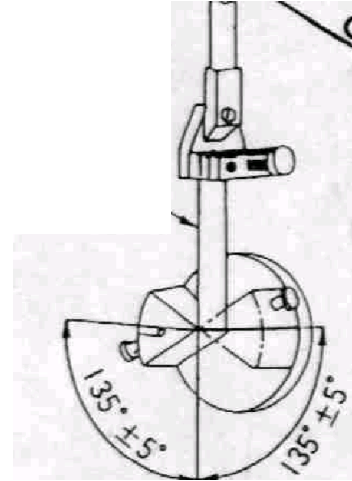
PI (adhesiveless type)

MIT method (JIS C-6471)

Weight; 0.5 kgf

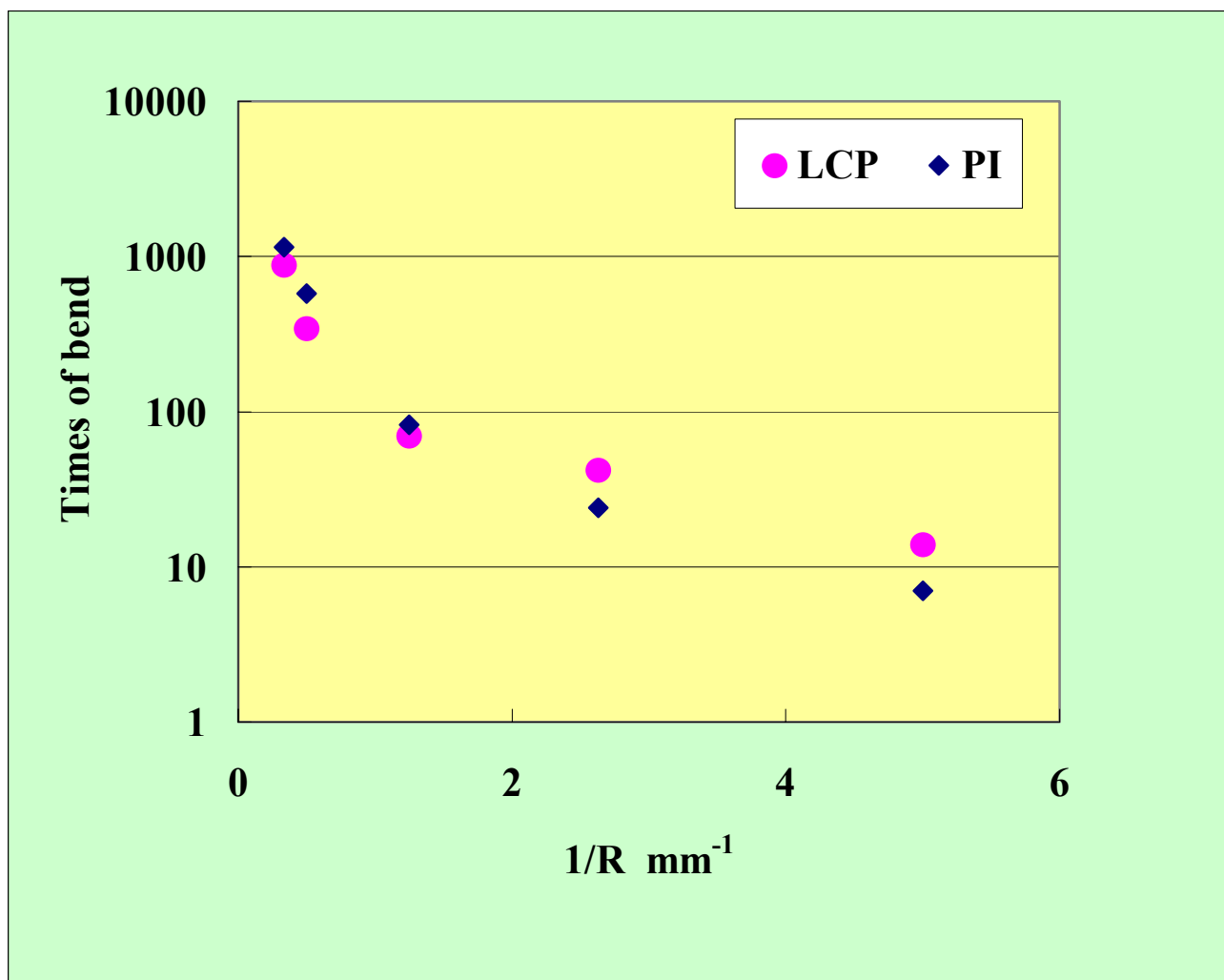
Pattern ; L/S=150 μ m/250 μ m (Single Sided)

Without coverlay film



[Result]

Bendability



4-6 Processability (Laser, Desmear, Plating)

[Features]

L series has **processability equivalent to polyimide.**

[Test Method]

Laser

CO₂Laser: Φ100μm, Pulse 150Hz 0.1μs

YAG Laser: Φ 50μm, 50 shoot

Condition of Desmear

Process	Chemicals	Concentration	Temp. (°C)	Time (min.)
Swelling	MacuDizer 9204	100vol%	40	1
Washing			25	
Permanganate treatment	MacuDizer 9275	50g/l	70	10
	MacuDizer 9276	5vol%		
Washing			25	
Reduction treatment	MacuDizer 9279	10vol%	43	5
	98% H ₂ SO ₄	2vol%		
Washing			25	

MacuDizer : MacDermid Japan Co.

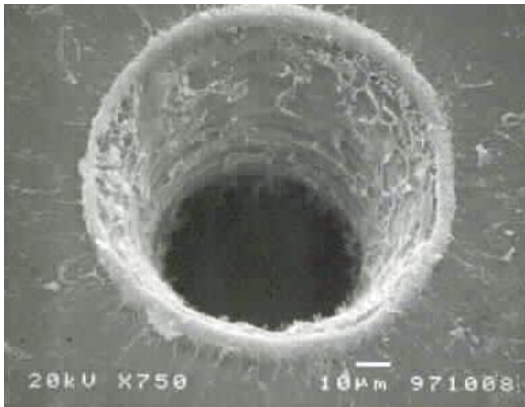
Cross section via-hole after plating

Laser BVH (Blind Via Hole), Laser TH (Through Hole), Punch TH

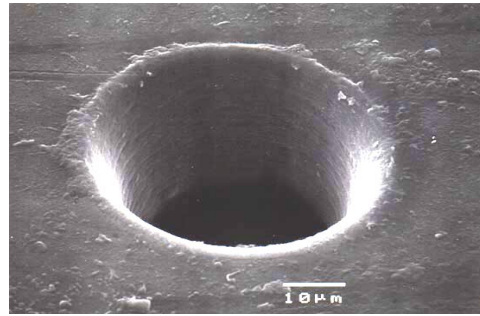
Reliability test by daisy chain coupon

Temp. Cycle, Hot Oil, Solder Dip (JIS 5016)

[Result]



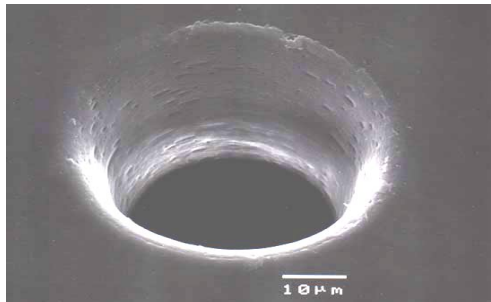
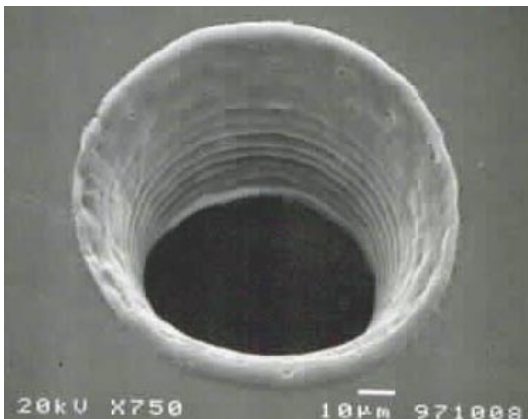
CO₂ Laser Φ100 μm



YAG Laser Φ50 μm



after Desmear



Offered from Kuraray Co., Ltd

Cross section via-hole after plating



Laser BVH(Φ50 μm)

Laser TH(Φ 50 μm)

Punched TH(Φ 150 μm)

Reliability test by daisy chain coupon

Stress test	Condition and Duration	50 μmBVH	50 μmTH	150 μmTH
Temp. Cycle	-65°C to 125°C, 1000 cyc.	○	○	○
Hot Oil	r.t. to 260°C, 100 cyc.	○	○	○
Solder Dip	260°C, 10sec	○	○	○

Offered from Nippon Mektron Co., Ltd