2007.3.10

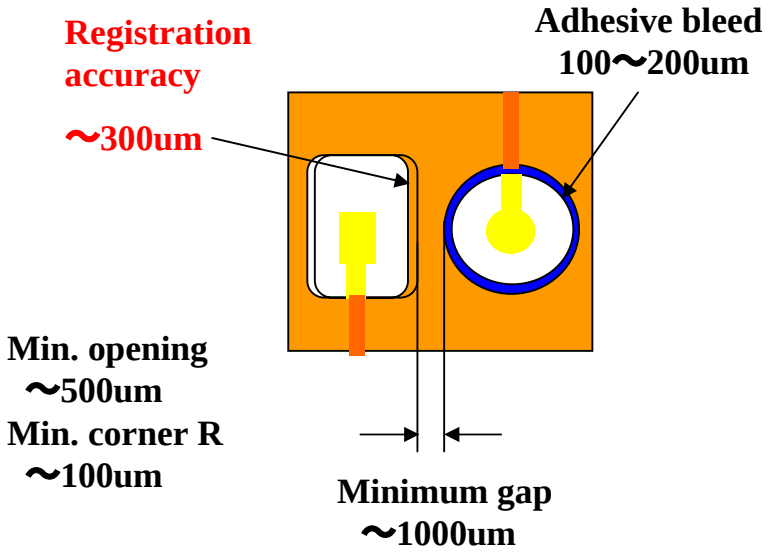
LPI Solder Mask
for
FPC/ COF / Rigid-flex / ThinPCB

PSR-9000 FLX501

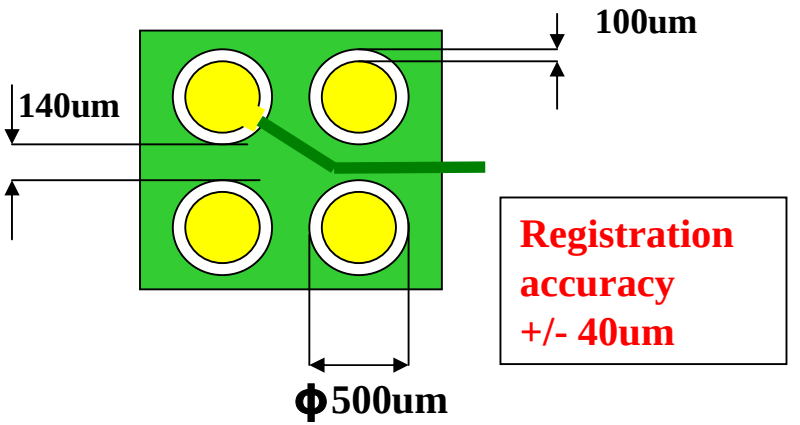
(UL: under application)

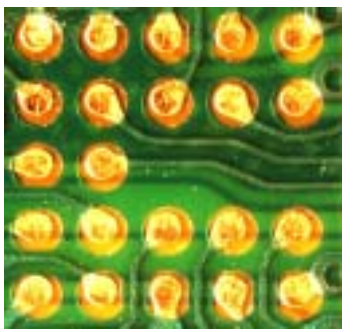
High Density Design Rule

Cover-layer limitation



Solder mask (mass production)





For high-density FPC, LPI solder mask is the most cost-effective solution!

Material Comparison

Cover-layer film:

- Dimension change
- Alignment inaccuracy
- Adhesive bleeding

- Difficult for high-density
- Hot press time & trouble
- Punching cost
- Mold cost & management

LPI Solder mask:

- High accuracy
- High yield
  No adhesive bleeding
- High density suitable
- No mold
  - Cost-saving
  - For small-size production
  - Quick turn
  - No mold management

LPI Solder Mask Concerns

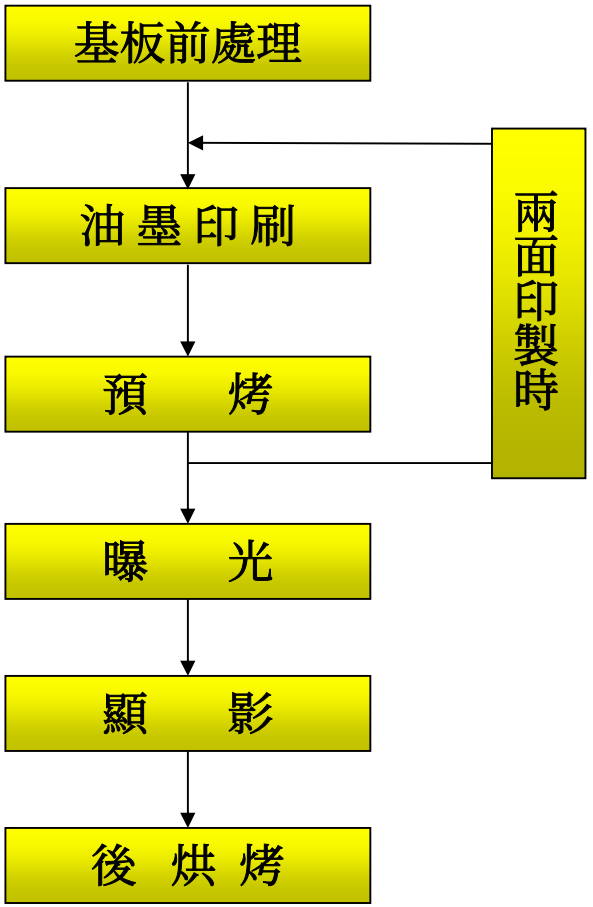
1. LPI solder mask process flow

2. Handling crack in PCB process

3. Surface finishing (ENIG) resistance

4. Visual/color difference
   after PCB post-process & assembly

1. Process Flow (TR61719)



酸處理･化学刷磨
Chemical-etching, Soft-etching,
Jet-scrub, acid cleaning

網印SCREEN

預烤 (箱型爐･Jack-type tunnel oven)
80°C / 20~30min (Max. 50min)

曝光 (紫外線照射)
400~600mJ/cm^2

顯影 (1wt% Na_2CO_3 30°C)
90~120sec

後烘烤 (箱型爐･隧道式爐)
150°C / 60min

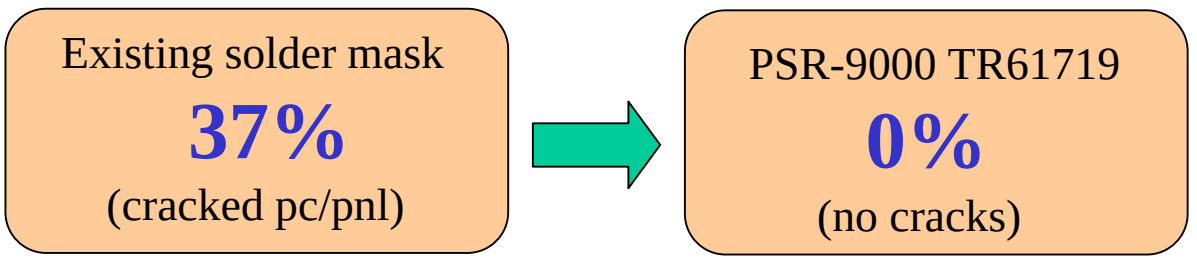
2. Handling Crack

What causes handling crack;

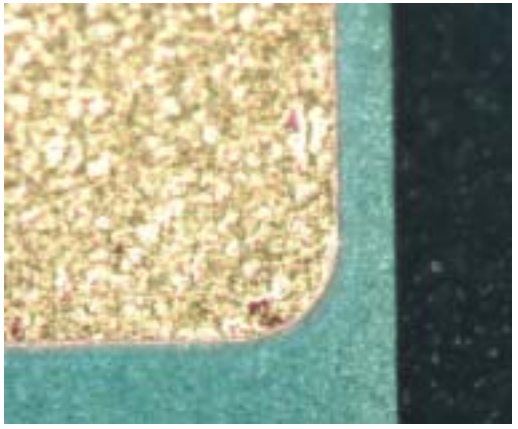
- Operator: Rough handling
- Process: Line-jamming, roll pressure, spray
- Solder mask: due to tackiness & brittleness

TR61710 solved both problems.

※Customer-A result



3. ENIG resistance



Solder mask thickness:

18um (on Cu)

Ni/Au thickness:

Ni 5um/Au 0.03um

- ***No Ni/Au intrusion***
- ***No peel-off***

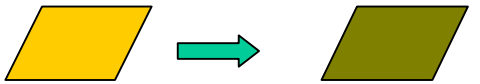
(※Customer-B Test coupon)

4. Cu Discoloration

In atmosphere, copper becomes discolored due to oxidation resulted from temp. and humidity.

$4Cu+O2 \rightarrow 2Cu2O$

$2Cu+O2 \rightarrow 2CuO$



After soldermask process, few steps of thermal history exist such as stiffener attachment, Ag/Al paste over-coating, etc…

Such process, respectively, requires baking at above 160-degree for more than 1 hour in general. Through the processes, Cu will be decolorized.

Thus Cu below soldermask will be also oxidized as air penetrates soldermask when such thermal process is implemented.

4. Minimize Cu Oxidation

1. Soldermask thickness
   - 15-20um on Cu

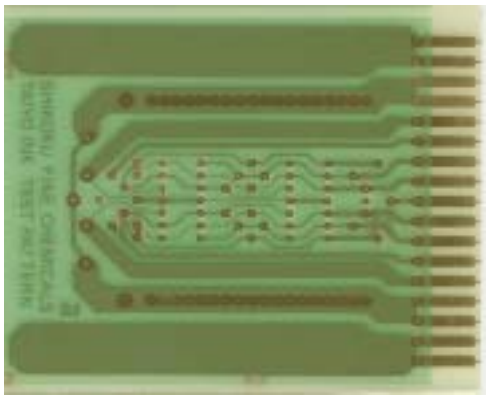
2. Soldermask pre-treatment
   - Anti-tarnish step

3. N2-purge
   - during baking/reflow process

4. Cu color change

Initial

(after Post-cure)

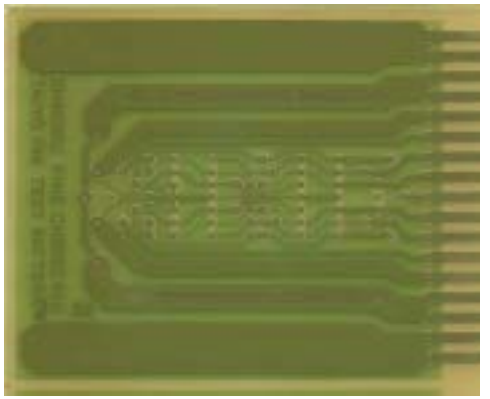


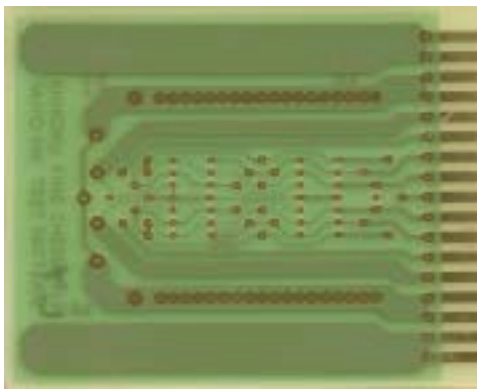
Lead-free Reflow:

260C*10sec

9-time

In Atmosphere





In N2-purge

LPI Solder Mask Comparison

Status @2006/11

Item	I-series	9000A02	FLX101	FLX501
Handling crack	△	△	△	◎
Tackiness, film-mark	XX	◎	○	○
Pre-cure Window	○	◎	○	○
Warpage	△	△	○	○
ENIG, chemical resistance	△	△	○	◎
Heat resistance	○	△	○	◎
Bendability	△	△	△	○
Electrical property	X	△	○	○
Halogen-Free	Y/N	N	YES	YES

Solder Mask Property-1

		PSR-9000 A02	PSR-4000 FLX101	PSR-9000 FLX501
Adhesion	Cross hatch peeling	PASS	PASS	PASS
Pencil Hardness	No scratch on copper	5H	5H	5H
Solder Heat Resistance	Rosin flux Floating 260C 10sec x 1time	PASS	PASS	PASS
Acid Resistance	10vol% H_2SO_4 20degC/ 30min	PASS	PASS	PASS
Alkaline Resistance	10wt% NaOH 20degC/ 30min	PASS	PASS	PASS
Solvent Resistance	PGM-AC	PASS	PASS	PASS
Electro'less Ni/Au Plating	Ni 3um, Au 0.03um	PASS	PASS	PASS

Solder Mask Property-2

		PSR-9000 A02	PSR-4000 FLX101	PSR-9000 FLX501
Insulation Resistance	IPC comb type (B pattern) 25- 65degC cycle, 0%RH DC 100V for 7 Days. Measure @ DC 500V for 1min value at room temp.	Initial $5.0\times10^{13}\Omega$ Conditioned $2.0\times10^{11}\Omega$	Initial $8.3\times10^{12}\Omega$ Conditioned $4.5\times10^{11}\Omega$	Initial $3.9\times10^{13}\Omega$ Conditioned $5.3\times10^{11}\Omega$
Dk	@ 1MHz	3.1	3.3	Checking
Df		0.03	0.02	Checking
Tg (CTE)	TMA (a1/a2 ppm)	77C (85/172)	68C (75/171)	Checking
Young's Modulus	Tensile method	2700MPa	2500MPa	2500MPa
Elongation	Tensile method	57MPa	56MPa	47MPa
Tensile Strength	Tensile method	5.1%	4.4%	5.1%