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Photo Imageable Cover layer Film

FLEXFINER-35SA

Technical Data Sheet

FPC Materials Dept.

 **TAIYO INK MFG. CO., LTD.**

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1. SPECIAL FEATURES

FLEXFINER-35SA is a photo imageable cover layer film to make fine patterns possible with photolithography process.

FLEXFINER-35SA offers excellent heat resistance and bendability because it consists of two layers with top cover layer and bottom adhesion layer. At the same time, FLEXFINER-35SA is photo imageable so that fine patterning is possible in the same way as with photo imageable solder mask. Compared to conventional thermal curable cover layer film, FLEXFINER-35SA does not require punching process with expensive metal mold.

Moreover, higher productivity and lower process cost can be achieved because of the simpler manufacturing process with FLEXFINER-35SA, while conventional FPC manufacturing process requires 2-step process, first punching and lamination process and second solder mask formation process.

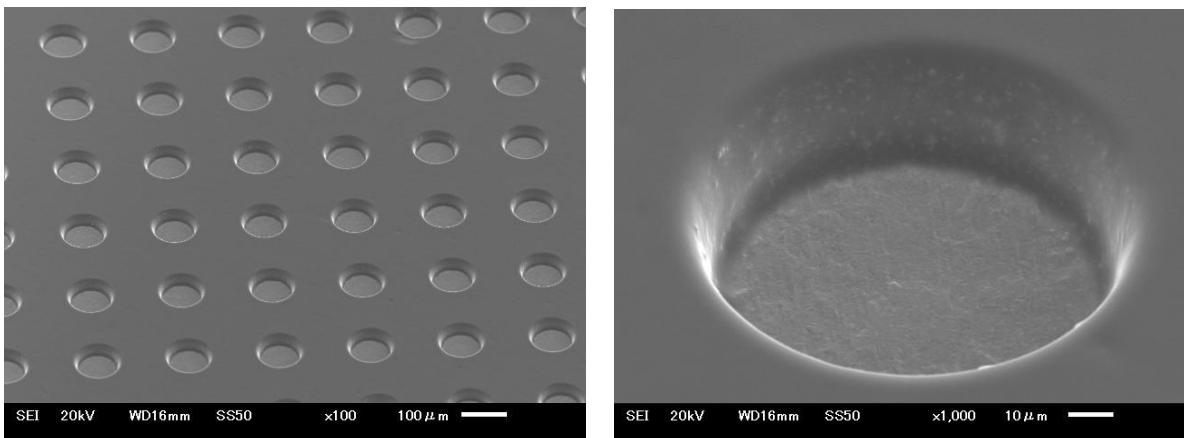
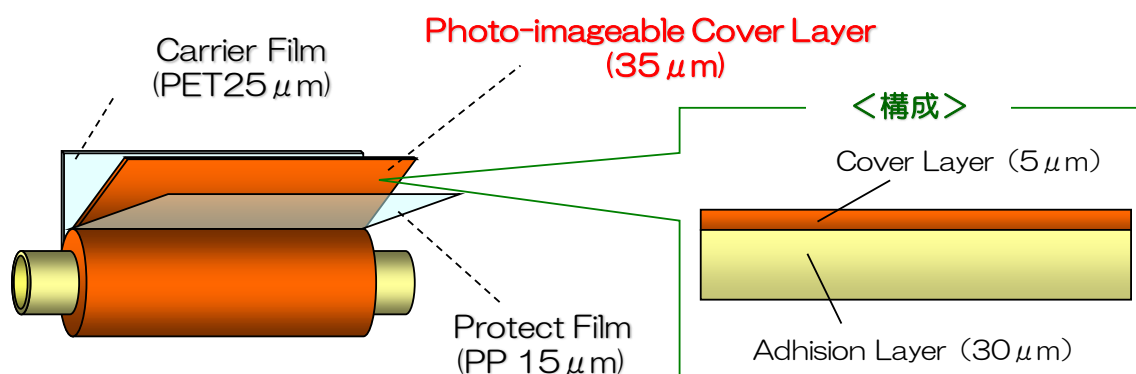


Fig. Formed pattern ($\Phi 100\mu\text{m}$)

2. SPECIFICATIONS

Item	Remarks
Color	Amber
Supply form	Dry film Width: 247mm or 495mm Length: 50m
Handling time limit at RT	5 days
Storage condition	-15deg.C or below at dark place
Shelf life	2 years after production

3. FILM STRUCTURE



Composition		Thickness
Photo imageable cover layer	Polyimide derivative	5 μm
	Epoxy derivative	30 μm
Carrier film	PET	25 μm
Protect film	PP	15 μm

4. PROCESS

The process of making the cover layer of FLEXFINER-35SA is shown in the following Fig. In process point of view, there is a difference from conventional photo imageable solder mask process. PEB (Post Exposure Bake) process after exposure is needed for excellent heat resistance and stable opening shape.

The recommended process conditions are shown below. Regarding PEB process, please refer to Appendix "PEB process" for further details.

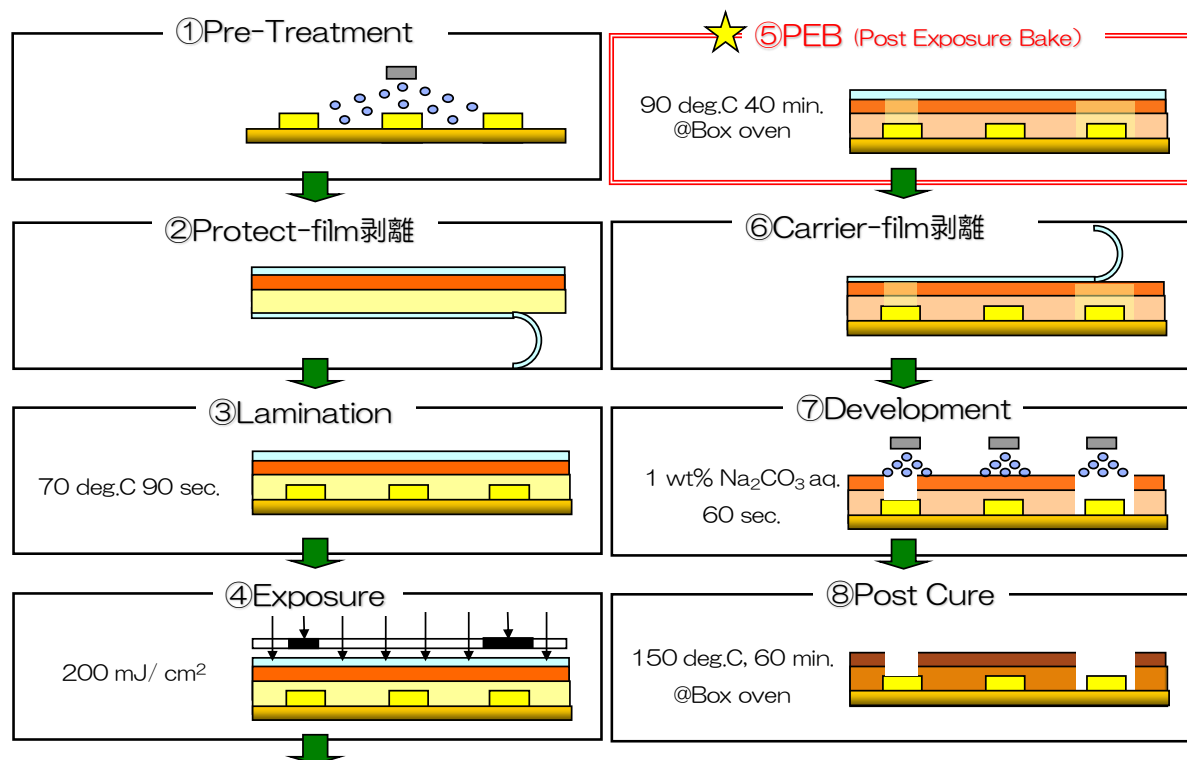


Fig. Forming process of photo imageable coverlay

Process	Recommended conditions	Remarks
Film thawing	>4 hours at 20~25deg.C	- Thaw films at the temperature controlled between 20~25deg.C - Take films out from box and thaw film without removing light-shield black film. - After thawing, the films must be used within 5 days. The use of the film after 5 days might cause residues and/or development failure.
Pre-treatment	Acid cleaning	- Remove waxes and oxidized surface - Remove moisture completely after cleaning - Chemical agent: MECBRITE CB-801Y (MEC COMPANY LTD.)
Lamination	- Vacuum laminator (Carrier system type) Temp. 70deg.C (50~80deg.C) Vacuum Time: 20sec Press Time: 90sec Pressure: 0.4MPa - Vacuum laminator (Batch-type) Temp. 70deg.C (50~80deg.C) Time: 60sec Pressure: 0.4MPa	- Lamination temperature higher than 90deg.C may cause thinner thickness on copper and non-uniform color. - Optimum lamination conditions depend on equipment, FPC size, and etc. - Vacuum laminator (Carrier system type): MEIKI CO., LTD. MVLP-500 - Vacuum laminator (Batch-type): Nichigo-Morton Co., Ltd. VACUUMEX 724
Exposure	Contact exposure unit (high pressure Hg short arc) Energy: 200 mJ/cm² (150~250 mJ/cm²)	- Confirm the sensitivity with step tablet (Kodak No.2 21steps) at the exposure process. Recommendable sensitivity: Gloss sensitivity: Step 5+/-2 Residual sensitivity: Step 11+/-2 - Exposure on top of the base film - Higher exposure energy could cause poor resolution. Lower energy could cause deterioration of cover layer properties, lift-off of fine pattern, and/or under-cut. - Contact exposure unit: ORC MANUFACTURING CO., LTD. EXP-2960
PEB (Post Exposure Bake)	(Box oven) Temperature: 90deg.C (85~95deg.) Time: 20~70min	- PEB process is necessary for excellent heat resistance, excellent gold plating resistance. please refer to Appendix "PEB process" for more details. - PEB time longer than 70 min could degrade developability. PEB time shorter than 20 min could cause deterioration of cover layer properties, delamination, and/or under-cut. - PEB temperature higher than 95deg.C could degrade developability. PEB temperature lower than 85deg.C could cause deterioration of cover layer properties, delamination, and/or under-cut. - PEB process condition should be within the window shown in the following Fig. on the next page
Removal of Carrier film	After storage at 20~25deg.C, before development (0.5~24h)	Peel carrier-film after storage at room temperature to cool substrate off after PEB process. Appearance defect would be caused by peeling without cooling-off.

PEB process margin

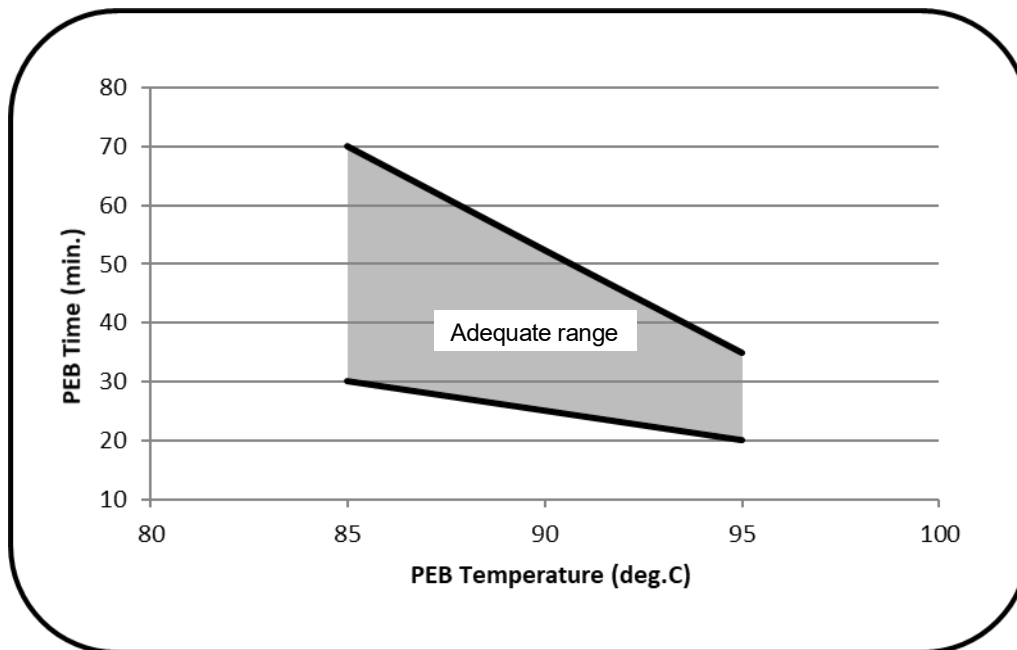
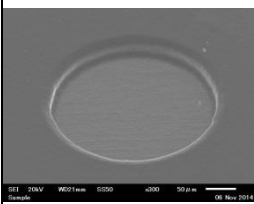
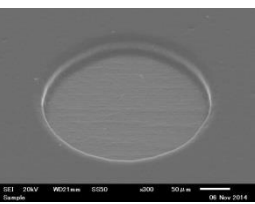
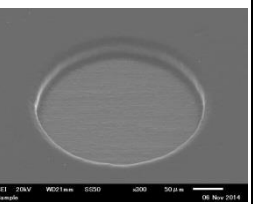
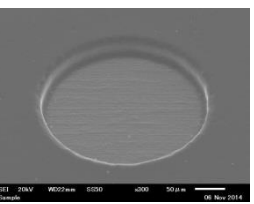
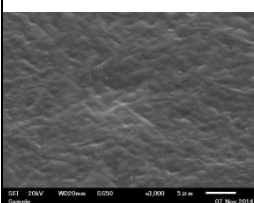
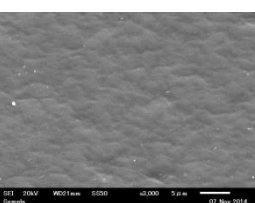
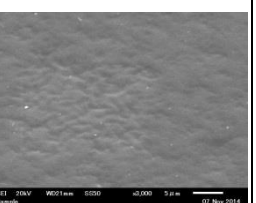
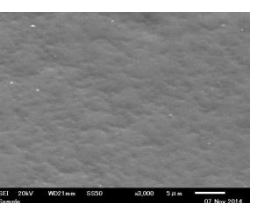


Fig. Relation between temperature and time in PEB process

Process	Recommend condition	Remarks
Development	● <u>Developing</u> Solution: 1wt%Na₂CO₃ Temperature: 30deg.C Pressure: 0.2Mpa Time: 60sec (40 ~ 80sec) ● <u>Water rinse</u> Temperature: 15~30deg.C Time: 0.5~1.5 times as developing time	● When the developing time is less than 40sec., it may cause poor resolution and/or residue. ● When the developing time is more than 80sec., it may cause poor physical properties, poor ENIG resistance, under cut and /or delamination.
Post cure	<u>Box oven</u> 150deg. C / 60min	● Optimum curing process window should be considered together with legend ink curing time. Excess or short curing time may cause deterioration of final properties.

APPENDIX "PEB PROCESS"

FLEXFINER-35SA consists of top cover layer and bottom adhesion layer. Composition of top cover layer is polyimide basis. Only with UV exposure, polyimide network is not sufficiently formed. PEB (Post exposure bake) is required after exposure process to make polyimide cured sufficiently.

	Without PEB process	PEB process 85deg.C / 35min	PEB process 90deg.C / 35min	PEB process 95deg.C / 35min
Cross section view (image)	 Dissolved cover layer by development	 Formed cover layer	 Formed cover layer	 Formed cover layer
Top view of formed pattern (Design value φ300um)				
Surface of FLEXFINER				
Solder heat resistance 288deg.C /10sec	Blister	Pass	Pass	Pass

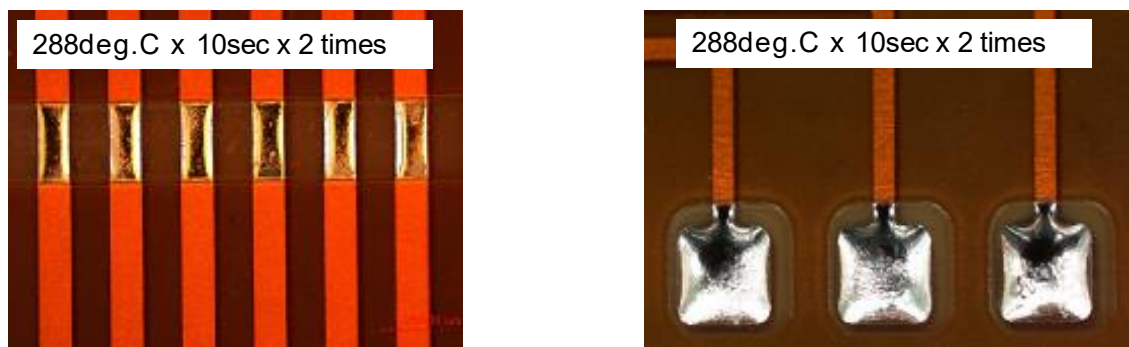
As shown above, formed pattern shape without PEB process is similar to its with PEB, but there is a tendency of surface changing to matte when PEB process is skipped. This is because top cover layer is dissolved during developing process. In such case, solder heat resistance is also affected. Blister could be observed on the substrate after soldering test without PEB process.

To prevent this phenomenon, PEB process is required after exposure process. PEB process makes top cover layer of imide resin sufficiently reacted and formed. The cured film shows excellent heat resistance.

5. FINAL PROPERTIES

Item	Test method	Result
Adhesion	TAIYO Internal Test Method Cross hatch/Tape peeling	100/100
Pencil hardness	TAIYO Internal Test Method No scratch on copper surface	3H
Solder heat resistance	288deg.C 10sec × 2 times	Pass
MIT test	L/S=200/200um, R: 0.38um, Load: 4.9N, Number of samples: 5	Measuring
Bandability	TAIYO Internal Test Method 180deg. Bending	No crack
Flame retardance	UL-94 Kapton100H, Double-sided	VTM-0

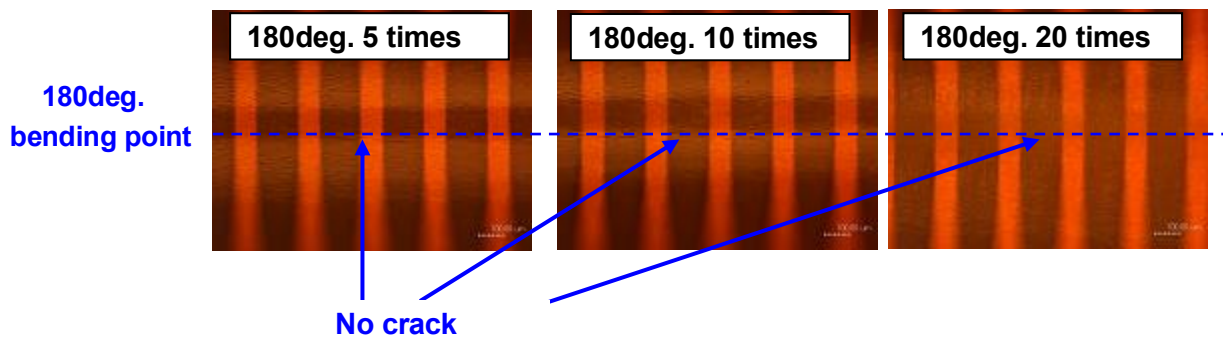
【Solder heat resistance】



Base material: FELIOS R-F775 (PI:25um, Cu:18um, *Panasonic*)

Fig. Surface observation after solder heat resistance (288deg.C 10sec × 2 times).

【Bending test】



Base material: FELIOS R-F775 (PI:25um, Cu:18um, *Panasonic*)
Circuit: L/S=100/200um

Fig. Surface observation after 180deg. bending test

【Chemical resistance】

Item	Test method	Result
Solvent resistance	Solvent: PGM-AC 25deg.C / 20min. Immersion, Cross hatch/Tape peeling	Pass No blister, no delamination
Acid resistance	Acid: 10vol%H ₂ SO ₄ aq. 25deg.C / 20min. Immersion, Cross hatch/Tape peeling	Pass No blister, no delamination
Alkaline resistance	Alkaline: 10wt%NaOHaq. 25deg.C / 30min. Immersion, Cross hatch/Tape peeling	Pass No blister, no delamination
ENIG resistance	ENIG Au: 0.1um, Ni: 4.0um	Pass No blister, no delamination

【ENIG test】

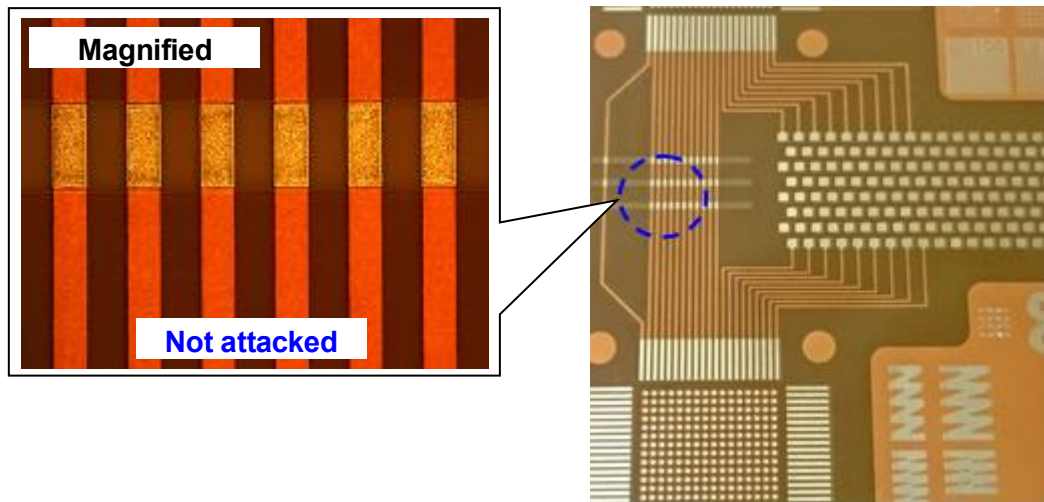


Fig. Surface observation after ENIG test

【Mechanical and physical properties】

Item	Test method	Result
Tensile test	Tensile testing machine <i>SHIMADZU</i> : AGS-G 100N	Measuring
TMA	Thermal mechanical analyzer <i>SII</i> : TMA/SS6100	Measuring
Springback	TAIYO Internal Test Method, on Kapton100H(25um), Single-sided/Double-sided	Measuring
Insulation resistance	IPC Comb type, B pattern 100V, 60sec	Measuring
	IPC Comb type, B pattern 500V, 60sec	Measuring
Breakdown voltage	JIS C 2110	Measuring
Dielectric property	Cavity resonator perturbation method (1GHz)	Measuring

*All test data in this technical data sheet are based on our laboratory test results and just for reference.
We cannot guarantee the same results on your process.

6. CAUTION

All chemicals used in this product might have unknown toxicity. Please handle with your most care referring to the SDS for use.