

PHOTEC H-6840M

INTRODUCTION

PHOTEC H-6840M is aqueous processable photosensitive film used for high-density printed circuit board. H-6840M can be applied to both tenting process and plating process in addition to high photosensitivity.

FEATURES

- Excellent tenting performance.
- Good plating resistance
- High photosensitivity properties.
- Excellent resist profile suitable for applying to the high-density printed circuit board.
- High adhesion and resolution characteristics

GRADES AND DIMENSIONS

Type	Photo resist layer thickness [μm]	Film width [mm]	Film length [m]
Photec H-6840M	40	200~600 (All sizes in between are available)	150~300 mtr.

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GENERAL PROPERTIES

Table 1 shows characteristics of H-6840M.

Photosensitive Film		H-6840M
Applications		Tenting Etching Plating
Exposure	Recommended ST (X/41)	23.0± 3.0
	Sensitivity (ST=23/41) ^{*1} (mJ/cm ²)	45
Imaging Property ^{*2}		12
Peeling Strength of Base Film (N/m)		6.0
Development	Recommended Na ₂ CO ₃ Concentration (wt%)	1.0 +0.3 0.1
	Temperature (°C)	30± 2
	Minimum Development Time (MD) (sec)	28
	Foam Height of Developer ^{*3} (mm)	40
	Scum Occurrence ^{*3} (X/4)	4
Easiness of Sludge Removal ^{*3} (X/4)		4
Adhesion (L/S=n/400 : μm) ^{*4}		ST=17/41 42 ST=23/41 35 ST=29/41 25
Resolution (L/S=n/n : μm) ^{*4}		ST=17/41 42 ST=23/41 45 ST=29/41 70
Resolution (L/S=400/n : μm) ^{*4}		ST=17/41 40 ST=23/41 50 ST=29/41 80
Tent Breakage (Round Hole) ^{*5}		MD× 6 (%) 0 MD× 8 (%) 0
Plating Resistance ^{*6} (Underplating)		Standard (μm) 0 Severe (μm) 2
Cross-cut Test ^{*7} (X/10)		8
Bend Test ^{*8} (mm)		6
Conformance (μm)		9
Strip Ability	Recommended NaOH Concentration (wt%)	2.5± 0.5
	Temperature (°C)	50± 5
	Minimum Stripping Time ^{*9} 2.0wt% (sec)	65
	3.0wt% (sec)	43
	Size of Stripped Flakes ^{*9} 2.0wt% (mm)	15
3.0wt% (mm)	40	

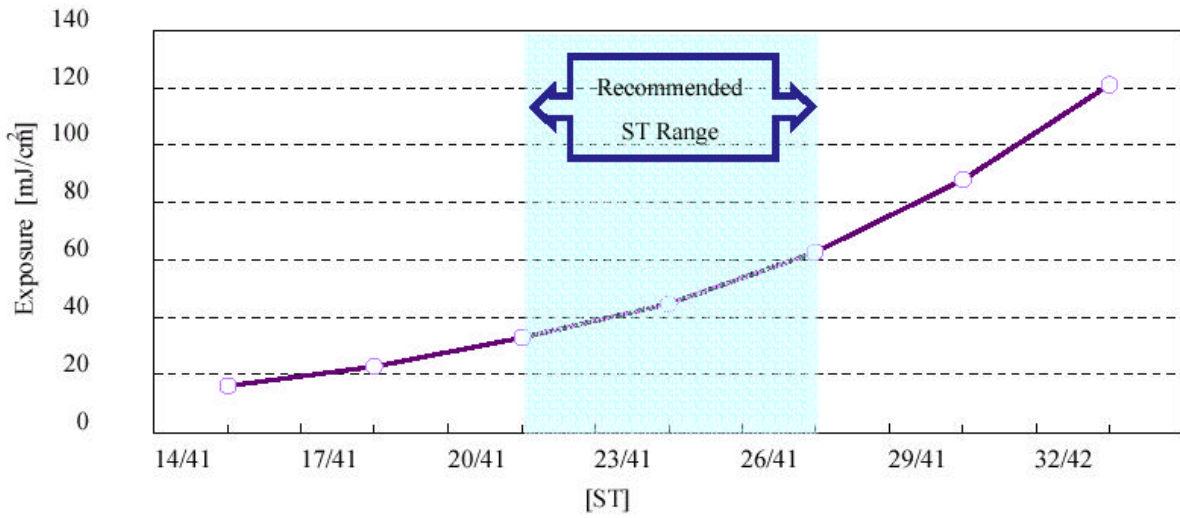


Figure2 Sensitivity

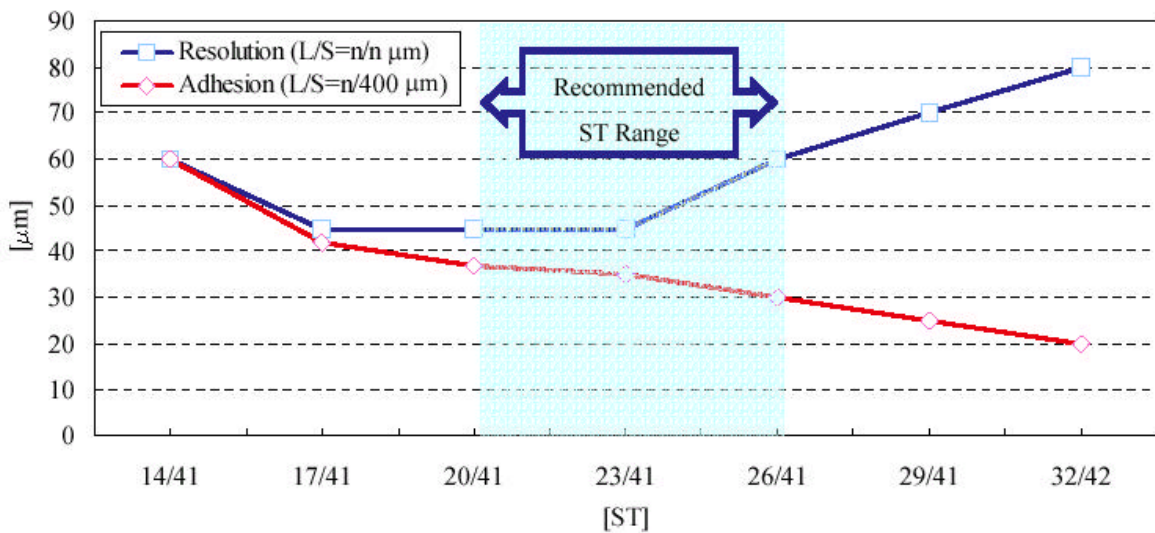


Figure3 Adhesion and Resolution

DETAILS

*1 Sensitivity: Exposure energy for recommended ST. The value is measured by UV -350(SN TYPE).



Figure 4 Photo tool: 41-step tablet

*2 Imaging Property: The numerical value shows contrast between a part exposed in ST=23/41 and an unexposed part after 1 minute. The higher value the higher contrast.

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*3 Foam Height of Developer, Scum Occurrence, Easiness of Sludge Removal: 0.3 m² of dry film is dissolved in 1 L of 1.0wt% Na₂CO₃ aqueous solution. The Na₂CO₃ aqueous solution is circulated in a pilot scale development machine for 90 minutes at 30°. Then the foam height is measured. The amount of scum occurrence is evaluated in the following (the larger figure shows less contamination to development machine):

Level 4	No scum is observed.
Level 3	Little scum is observed.
Level 2	Some scum is observed.
Level 1	Lots of scum is observed.

After the evaluation of scum property, that solution is put into a polyethylene bottle and left it for 7 days. After the bottle is shaken about 10 times, the precipitate (sludge) of the bottom of the bottle is observed. And the easiness of sludge removal is evaluated: (the larger figure shows less contamination to development machine.):

Level 4	All sludge is removed.
Level 3	Almost all sludge is removed.
Level 2	Part of sludge is removed.
Level 1	No sludge is removed.

*4 Adhesion, Resolution: Photo tool: Hitachi test pattern No.G-2 and No.3
 Development time: 2.0 times of MD

*5 Tent Breakage: After being laminated a dry film and exposure in ST=23/41, the evaluation board (ø 6mm, ø 5.5 mm, ø 5 mm, ø 4.5 mm, ø 4 mm, ø 3.5 mm, ø 3 mm (24 holes in each diameter)) is developed for several development times. Breakage ratio is shown on the Table 1.

*6 Plating Resistance (Underplating): The process of plating test is given in the following.

Table 2 The procedures of plating process (Standard Conditions tertid.)

Step	Process	The details of the process		
		Condition	Temp.	Time
1	Cleaner	10vol% PC-455 Conc. (Enthone.)	30°C	2 min
2	Water Rinsing	2 cascade	r.t.	2 min
3	Micro Etching	Na ₂ S ₂ O ₈ 200g/L	r.t.	1 min
4	Water Rinsing	2 cascade	r.t.	2 min
5	Acid Dip	10vol% H ₂ SO ₄	r.t.	1 min
6	Copper-Sulfate Plating process	CuSO ₄ .5H ₂ O 60 g/L 98% H ₂ SO ₄ 98 mL/L NaCl 100 mg/L Leveler 20 mL/L Brightener 0.6 mL/L Current Density 2.5 A/dm ²	r.t.	40 min
7	Water Rinsing	2 cascade	r.t.	2 min
8	Acidic Dipping	10vol% H ₂ SO ₄	r.t.	1 min
9	Tin-Sulfate Plating process	Organic SnSO ₄ 40 mL/L 98% H ₂ SO ₄ 30 g/L 105 mL/L Current Density 1.2 A/dm ²	r.t.	10 min
10	Water Rinsing	2 cascade	r.t.	3 min

*Severe Condition: Skipping Step 6~Step 8

*7 Cross-cut Test: JIS K 5600 (Japanese Industry Standard) Cross-cut Test is evaluated in the following:

Level 10	No resist is peeled
Level 8	The area of peeled resist is ? 5%.
Level 6	The area of peeled resist is 6~15%.
Level 4	The area of peeled resist is 16~35%.
Level 2	The area of peeled resist is 36~65%.
Level 0	The area of peeled resist is ? 66%.

*8 Bend Test: JIS K 5600 (Japanese Industry Standard). It is shown on the Table 1 that the minimum diameter with no cracks is observed.

*9 Minimum Stripping Time, Size of Stripped Flakes: ST=23/41, dipping in NaOH aqueous solution at 50°C. Keeping stirring for 30 seconds after resist stripped off. Then, the size of stripped flakes is observed.

APPLICATION METHOD

Process		Condition (ex.)	Remarks
Substrate pretreatment	Mechanical surface treatment	Buffing polish : Scotch-Brite ® VF~UF (#320~#800) Polish width at a still time : 9~12 mm Grain polish : 10~30 vol% Super polish-P	* Polish the substrate surface evenly to remove burrs, dust on the substrate surface, oil and oxidized films thoroughly. * Moisture adhered on the substrate surface and inside the holes by treatment will cause rust, dirt (stains) and so forth. Remove it promptly and completely.
	Water rinsing	Spray temperature: Room temperature Spray time: 10~30 sec Spray pressure: 0.15~0.25 MPa	* Stacking or holding substrates after pretreatment will cause scratches, oxidation of copper and dust on the surface.
	Hot air shower	Temperature : 100~150°C Time : 20~40 sec	* Combination of buffing polish and grain polish is preferable.
Lamination		Roll temperature: 110± 10°C Roll pressure: 0.3~0.5MPa Roll speed: 1~3 m/min	* The temperature of substrate before lamination should be within the 20~60°C and 40~60°C is preferable.

CAUTIONS IN APPLICATION

1. Application: Use this film only as resist for printed circuit board-related material and other pattern formations.
2. Conditions for holding: **Keep film rolls under $23 \pm 2^\circ\text{C}$ and $60 \pm 10\% \text{RH}$ for more than 2 hours after out from cooling storage (Temperature : $5 \sim 20^\circ\text{C}$). Keep film rolls horizontally.**
3. Polish: Scotch-Brite® VF~UF and other polisher (#320~#800) are suitable for buffing polish. Select polisher after checking it carefully. Organic residues, stains due to insufficient dewatering and drying on the copper surface, may cause polymerization of resist and penetration of plating or etching solution.
4. Substrate preheating: Preheating at too high temperature for a long time may cause rust. It should be done for less than 10 min at 80°C and for less than 3 min at 150°C . **And when the substrate surface temperature prior to lamination exceeds 70°C , the film thickness on a through-hole edge may become too thin and it may cause tenting breakage.**
5. Short break during lamination: Avoid holding rolls on laminator for a long time. Rolls should be stored in dark place under the recommended conditions.
6. Holding after lamination and exposure: Covering with black sheet or under a yellow lamp (2 meters or more distance required). The maximum holding time in the later case (under a yellow lamp) is 5 days. Exposure should be done within 4 days after lamination. Development should be done within 3 days after exposure. Non-ultraviolet white lamp emits some ultraviolet light, laminated boards should be covered with black sheet under such camps. Keep temperature $23 \pm 2^\circ\text{C}$ and relative humidity $60 \pm 10\%$ (20°C). Laminated substrates should be put in a rack one by one. Pilling up laminated substrates may cause the following defects:
 - (1) Resist may be polymerized by heat accumulation and it may cause some residue after development.
 - (2) The film of the photosensitive layer at a through-hole edge may be thinned and it may break the tent. When using for tenting, should be put laminated substrates in a rack.
 - (3) Sandwiched dusts and foreign particles and so forth may thin the film of the photosensitive layer and it may cause open or short circuits.
7. Development: When temperature of developer is over 35°C , it may make resist profile worse. Consult Enthone for appropriate Defoamer.
8. Stripping: Strip within one week after lamination. The following defoamer is effective to prevent overflow owing to foaming. Consult Enthone for appropriate Defoamer.
9. Dry film components in developer and stripper can be coagulated by neutralization. The coagulated components can be separated from the aqueous solution by filter press method and centrifugal method. The separated aqueous solution has some COD and BOD values, so it has to be waste-disposal treated in a proper way.

CAUTIONS ON SAFETY

Photosensitive dry film contains acrylic monomers, so it may cause skin-irritation and allergic effects. Especially it affects allergic people conspicuously. So be careful in the following.

1. Do not contact dry film directly because it may cause a rash. Flush away with soap plenty water when you contact it. When you get it in your eyes, flush it away with plenty of water and seek medical attention.
2. Install a device for exhausting gas at laminator and an indoor ventilation system not to inhale vapor from the unexposed film at lamination.
3. In the process of using dry film, polyethylene film and polyester film are discarded. These films, which have been in contact with the unexposed resist, may contain trace amounts of irritants and should not be reused.
4. Put on protect tools such as gloves and glasses when you renew developer and stripper or do maintenance check of your machines.

CAUTIONS ON STORAGE

1. **When storage is done in a dark, cool, and dry place at the temperature of 5~20°C and relative humidity of 60% (20°C) or lower.**
2. Keep film rolls horizontally by using of racks or support boards for storage. When they are laid vertically, sheets of dry film may slip one by one and roll-shape may be like a bamboo sprout (rolls are laid down horizontally in a package).
3. Take out film rolls from black sheet under a yellow lamp or the same kind of safety lamp. Do not leave them under the yellow lamp for a long time. Cover film rolls by black sheet when you store them for a long time.

HANDLING AND SAFETY INSTRUCTIONS

For detailed information consult the material safety data sheets for this product.
Please read material safety data sheets carefully before using this product.

DISCLAIMER

All recommendations and suggestions in this bulletin concerning the use of our products are based upon tests and data believed to be reliable. Since the actual use by others is beyond our control, no guarantee expressed or implied, is made by Enthone, its subsidiaries or distributors, as to the effects of such use or results to be obtained, nor is any information to be construed as a recommendation to infringe any patent.

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