

Printed Circuit Materials

ASAHI KASEI EMD DFR SUNFORT™
AQ-209A

(FULLY AQUEOUS PROCESSIBLE DRY FILM PHOTO RESIST)

BASIC PROPERTIES AND PROCESS RECOMMENDATION

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1. INTRODUCTION

ASAHI KASEI EMD DFR SUNFORT™ is a dry film photo resist developed by our company with a combination of heretofore-developed technologies in photosensitive materials and plastics, for use in the manufacture of printed circuit boards.

AQ series is a fully aqueous type. The carrier film should be peeled off before developing.

SUNFORT™ **AQ-209A** is negative working and an aqueous processability dry film photo resist which is designed to develop completely in a mild alkaline solution such as sodium carbonate (Na_2CO_3) and strip in a dilute alkaline such as sodium hydroxide (NaOH).

SUNFORT™ **AQ-209A** is high performance photo resist in tenting/etching application and available in resist thickness of $20\mu\text{m}$ sandwiched between layers of polyester and polyethylene film.

2. STRUCTURE

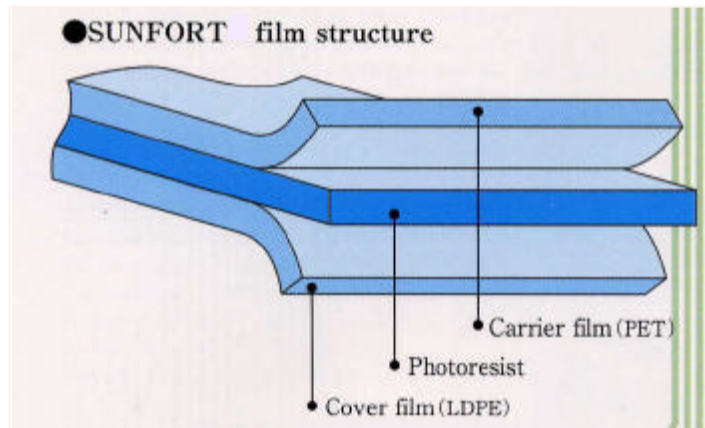
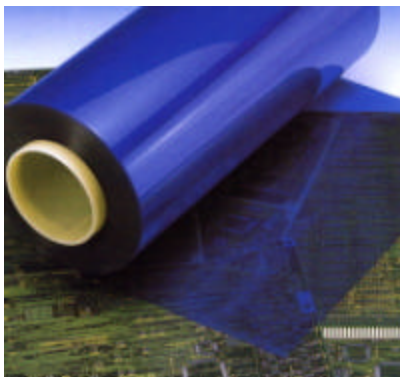


Figure1. Structure of SUNFORT™ **AQ-209A**

Film width: Customer size is available in widths ranging from 195 to 600mm in increments of 3mm.

Film length: 210m

3. FEATURES OF SUNFORT™ AQ-209A

- (1) Supper high resolution and excellent reproductivity of photo mask after developing.
- (2) Wider latitude of exposing and developing conditions.
- (3) Good imaging contrast
 - Unexposed color: Green
 - Exposed color: Dark blue
- (4) Polymerized resist is tough and has good etching resistance to etchants such as:
 - Ferric chloride (FeCl_3)
 - Cupric chloride (CuCl_2)
- (5) During stripping, polymerized resist breaks up into small particles and is not soluble in a stripping solution.
- (6) Excellent tenting capability of 20um DFR thickness

4. BASIC PROPERTIES OF AQ-209A

IMAGING RESOLUTION PROPERTIES		(TEST CONDITION)
Base materials	1.6mm thickness, Grass-epoxy copper-clad laminate (35μm)	
Copper surface preparation	chemical etching	CB-801 (MEC 50% 30°C)
Lamination	Hot roll laminator (ASAHI AL-70)	
	Pre-heated panel temp.	50°C
	Laminating roll temp.	105°C
	Roll pressure	0.35MPa (as air cylinder gauge)
	Lamination speed	2.0m/min
Holding time	30min (more than 15min) after lamination	
Exposure	4.5kw super high pressure mercury vapor short arc lamp HMW-801 (ORC Mfg. Co. Ltd.) 50 - 90mJ/cm ²	
Holding time	30min (more than 15min) after exposing	
Development	Conveyorized spray developing machine	
solution	Developing solution	Anhydrous sodium carbonate (1.0wt%)
	Developing temp.	30°C
	Spray pressure	0.2MPa
	Developing time	32sec. (B.P.=16sec.)
Etching	Conveyorized spray developing machine	
	Etchant	Cupric chloride
	Etchant temp.	50°C
	Spray pressure	0.2MPa
	Etching time	65sec. (Copper: 35um)
Stripping	Conveyorized spray stripping machine	
	Stripping solution	Sodium hydroxide solution (3.0wt%)
	Stripping temp.	50°C
	Spray pressure	0.20MPa
	Stripping time	36sec. (L.P.=18sec.)

(Step tablet)

Our step tablet: Optical density from 0.50 to 1.80, $D=0.05$

(Our photo mask and step tablet for evaluating resolution)

Our photo mask for evaluating resolution (See figure 2)

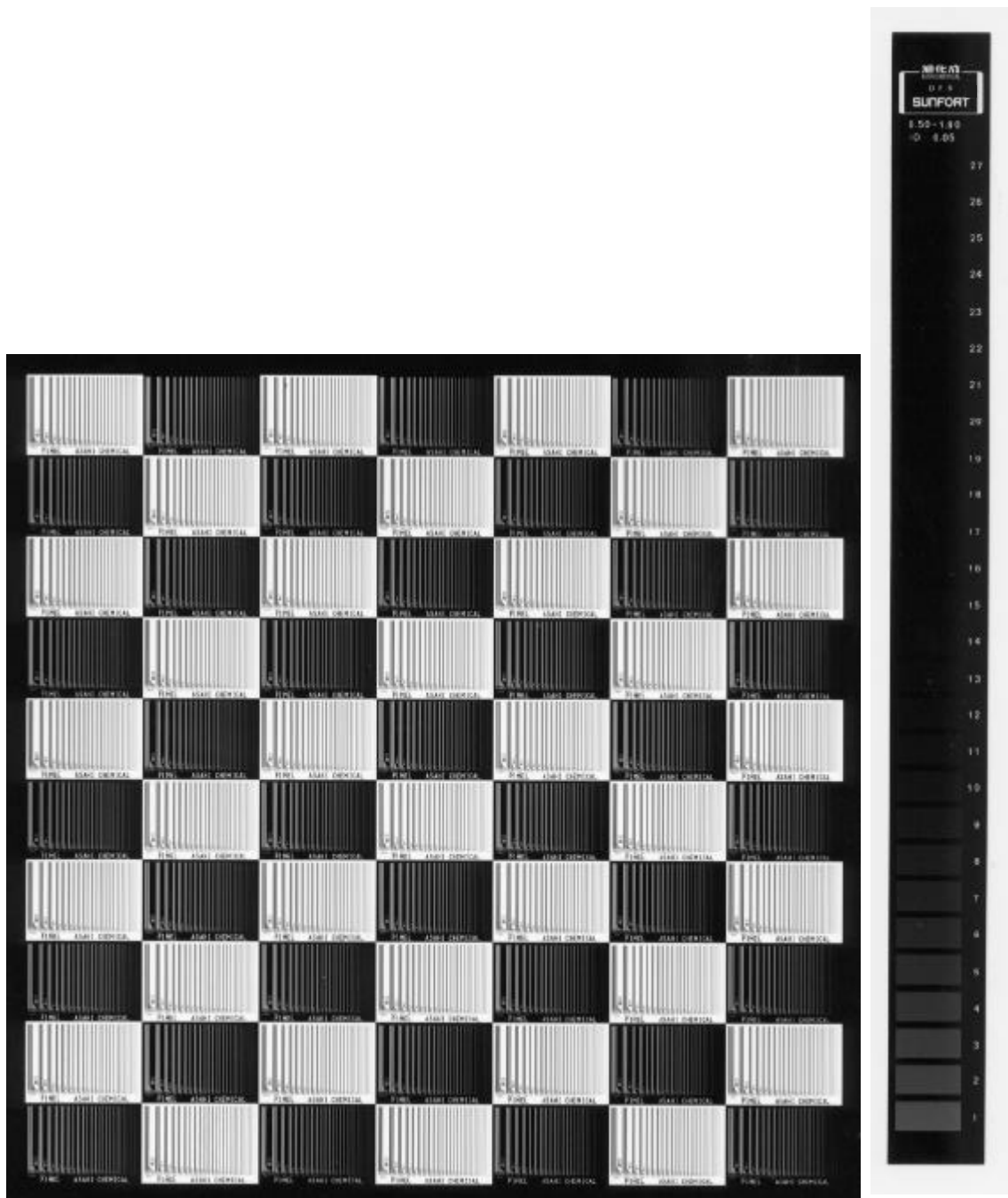


Figure 2. Our photo mask and step tablet

<Result 1> Relation of exposure energy to step tablet

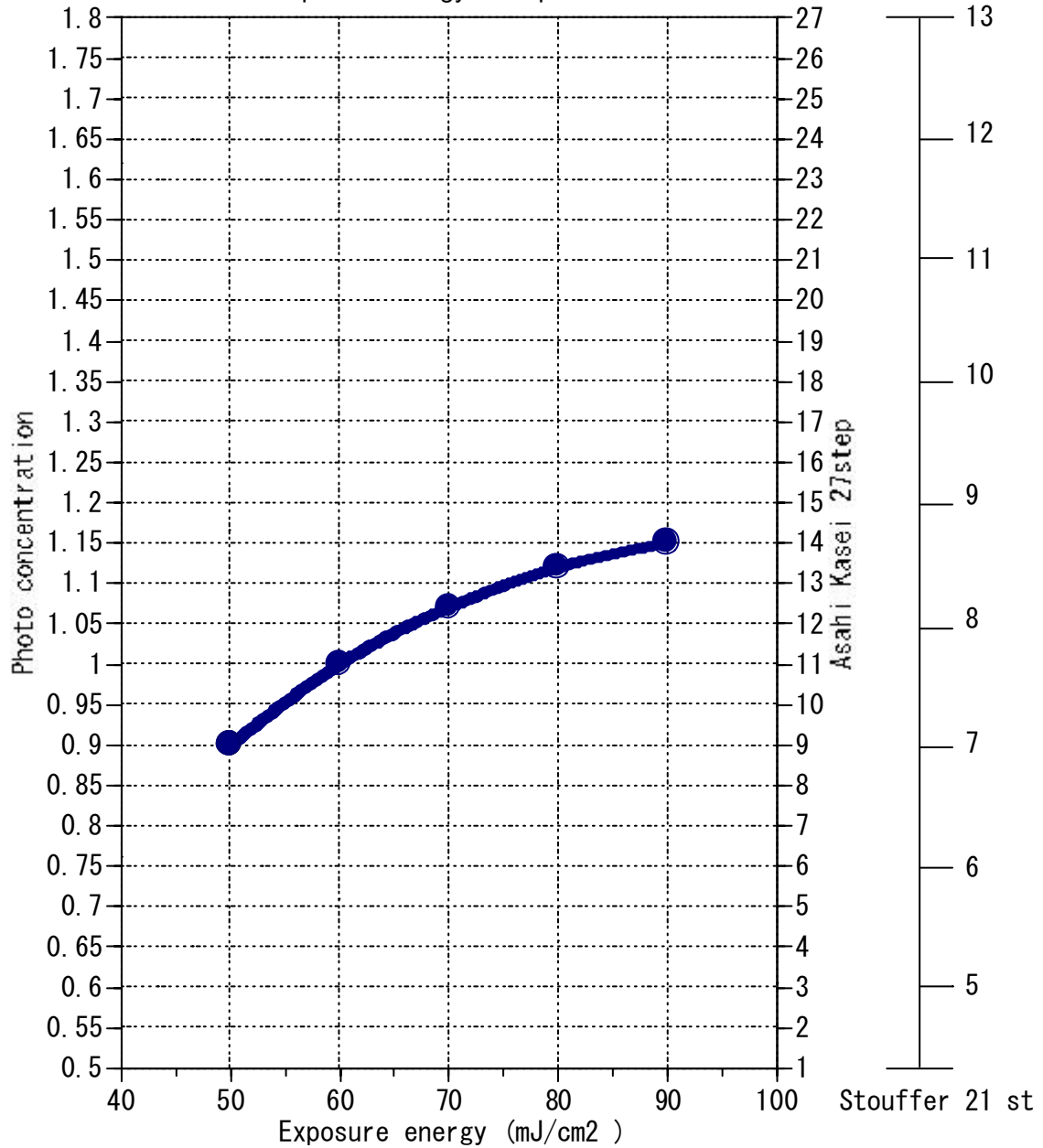


Figure 3. Relation of exposure energy to step tablet of SUNFORT™ AQ-209A.

(Judgement of step tablet)

Step number is completing covered with dull luster. Judged by STOUFFER 21 step tablet.

(Note)

After the above evaluation, throw sample panels into the developer to see if there are any resist chips on the panel because incomplete polymerized resists sometimes stick to the conveyor roll.

<Result 2> Relation of exposure energy to resolution and reproductivity of developed line width. Figure 4 and 5 show the relation of exposure energy to resolution and reproductivity of developed line width.

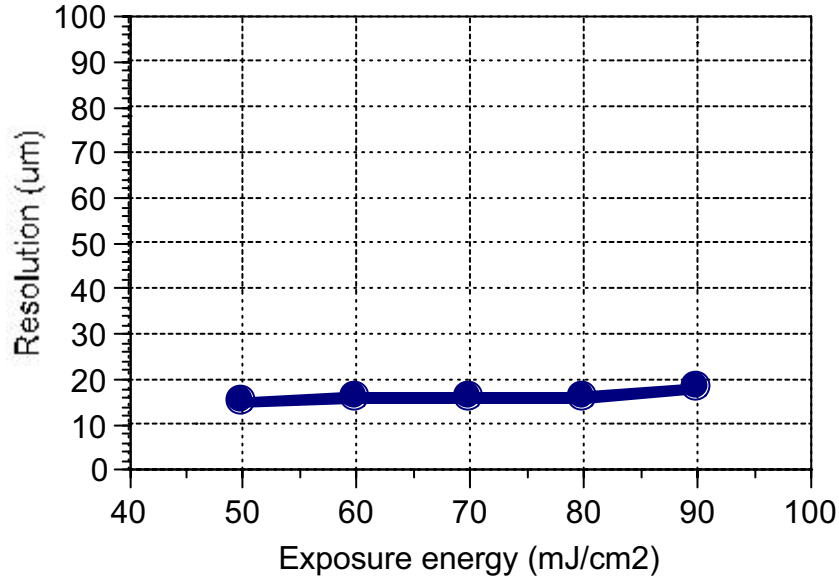


Figure 4. Exposure energy vs. resolution (line width)

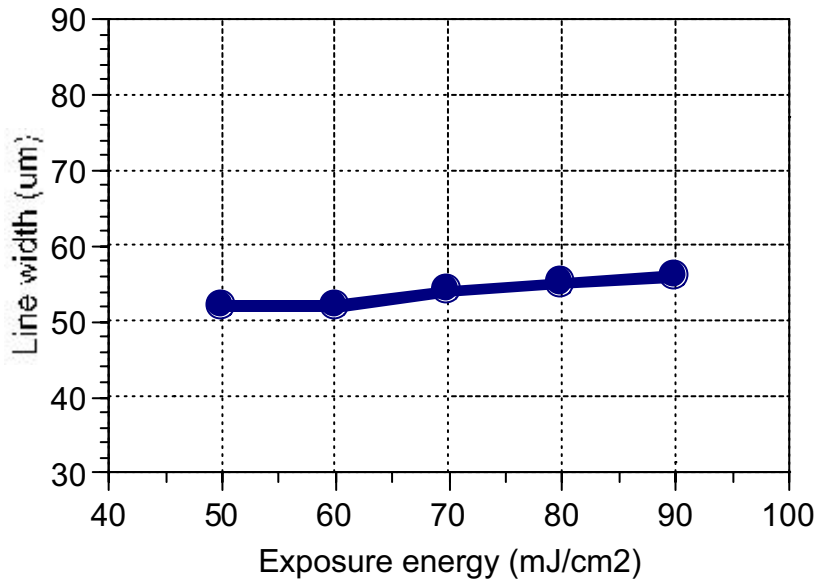


Figure 5. Exposure energy vs. reproductivity of developed line width (50um line=2mil)

(Judgement of resolution)

The minimum size of developed line or space, which should not flow and be buried by using our photo mask for evaluating resolution. And the minimum resist pattern size is less than $\pm 20\%$ narrow or wide at the highest resolution line.

<Result 3> Relation of exposure energy to independent fine pillar's adhesion and independent fine pillar's space clearance after developing on Figure 6 and 7.

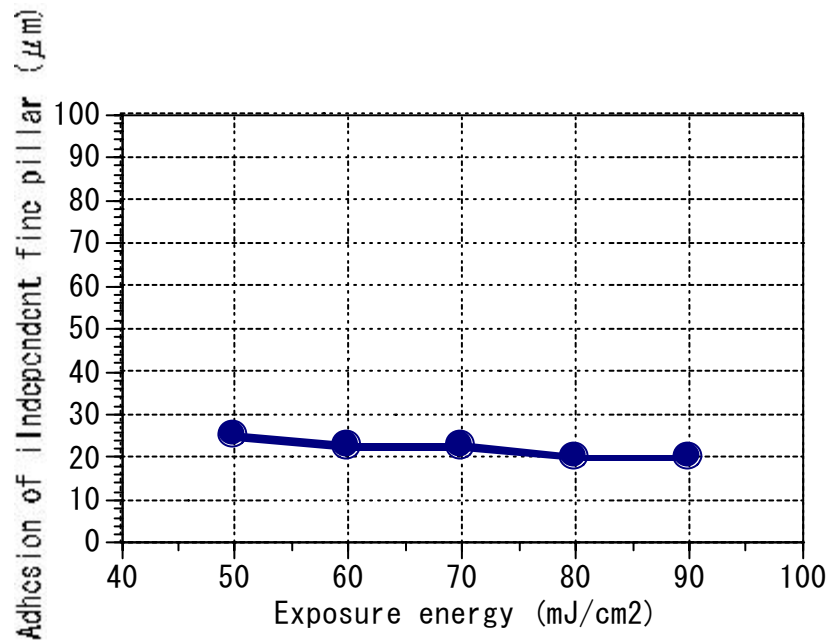


Figure 6. Adhesion of independent fine pillar after developing

(Judgement of independent fine pillar's adhesion)

The developed independent fine pillar should not flow out and chip off.

The minimum pillar's diameter is 5μm.

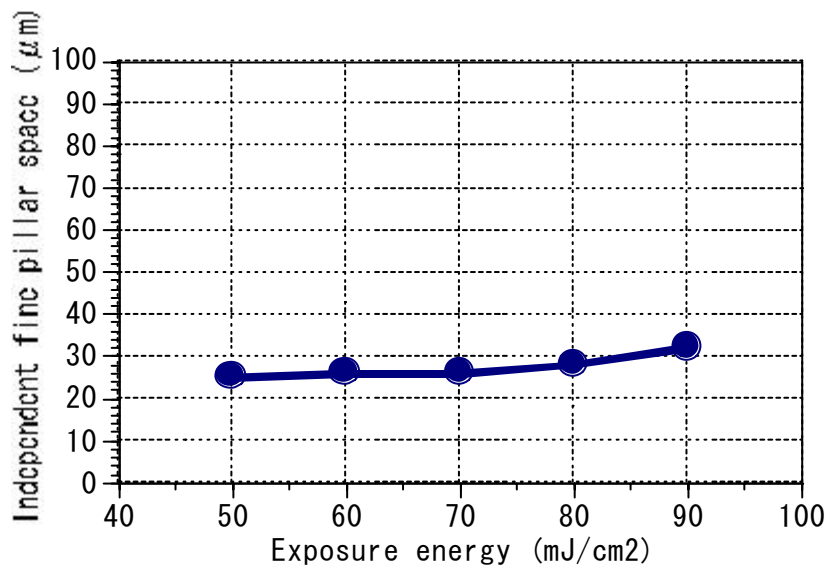


Figure 7. Clearance of independent fine pillar after developing

(Judgement of independent fine space clearance)

The developed independent fine pillar's space clearance should not be buried. The minimum clearance diameter is 5μm.

Table 2. Processing recommendation from developing to stripping

Item	Condition	Remarks
4. Development		
4-1 Developing solution	Sodium carbonate	(1) Developing time should be adjusted by BREAK POINT=50-65% (2) Adding antifoam is recommended. (3) Supply and change of developing solution should be adjusted by the dissolved resist content ($0.5\text{m}^2/\text{dm}^3$) in case of the 1.0wt% solution.
4-2 Solution concentration	1.0 ± 0.2 wt%	
4-3 Solution temp.	30°C	
4-4 Developing time	32sec.	
4-5 Spray pressure of developing zone	0.1 to 0.2 Mpa	
4-6 Rinse water temp.	Below 25°C	
4-7 Rinsing time	32sec.	
4-8 Spray pressure of rinse water zone	0.1 to 0.2 MPa	
5. Stripping		
5-1 Stripping solution	Sodium hydroxide or potassium hydroxide	(1) Stripping time should be adjusted by LIFTING POINT=50-65% (2) Adding antifoam is recommended. (3) Supply and change of stripping solution should be adjusted by the stripped resist quantity ($1.5\text{m}^2/\text{dm}^3$) in case of 3.0wt% solution.
5-2 Solution concentration	2.0 to 3.0wt%	
5-3 Solution temp.	50 ± 5 °C	
5-4 Stripping time	More than 36sec.	
5-5 Spray pressure of stripping zone	0.1 to 0.3MPa	
5-6 Rinse water temp.	20 to 30°C	
5-7 Rinsing time	36sec.	
5-8 Spray pressure of rinse water zone	0.1 to 0.3MPa	

(Note) Adjusting of break point and lifting point

1. Break point or lifting point should be set at 1/2 to 2/3 length of developing or stripping chamber.
2. Rinsing time should be more than 1/2 of developing or stripping time.

6. SAFETY AND HANDLING PRECAUTIONS

6-1. STORAGE RECOMMENDATIONS

- (1) **SUNFORT™** should be stored only in cool (5 - 20°C) and dry (less than 60% at humidity level) areas.
- (2) **SUNFORT™** should be laid horizontally.

6-2. HANDLING PRECAUTIONS

- (1) **SUNFORT™** should be taken out from a black film under yellow safe lights.
- (2) Boards should be covered with black shield-film in case of more than 24-hour hold time after lamination.

6-3. SAFETY PROCEDURES

Take care of the following items; since unpolymerized photo resists contain acrylic monomer, which may cause irritation or allergic reaction to skin.

- (1) In case of contact with skin or clothing, immediately wash with soap and running water. If unpolymerized photo resist or washout solution comes in contact with eyes, immediately flush eyes with plenty of water for at least 15 minutes and consult an oculist.
- (2) Use with adequate ventilation during lamination.
- (3) Not to use cover film (protective polyethylene) after lamination.

(Note) A developing solution (Na_2CO_3) and a stripping solution (NaOH , KOH) should be handled with much care. Wear safety glasses and impervious gloves when making these solutions, and providing maintenance for equipment.

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