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AsahiKASEI
ASAHI KASEI E-MATERIALS

Printed Circuit
ASAHI KASEI E-MATERIALS DFR™

ADV-306(Paragon9000)

(FULLY AQUEOUS PROCESSIBLE DRY FILM PHOTO RESIST)

ASAHI KASEI E-MATERIALS CORPORATION
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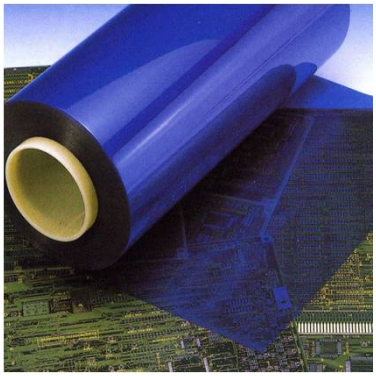
1. INTRODUCTION

ASAHI KASEI E-MATERIALS DFR™ SUNFORT™ is 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.

SUNFORT™ ADV-306 is negative working and aqueous processable dry film photo resist which is designed to be developed completely in a mild alkaline solution such as sodium carbonate (Na2CO3) and stripped in a dilute alkaline such as sodium hydroxide (NaOH).

SUNFORT™ ADV-306 is high performance photo resist in tenting/etching application and available in resist thickness of 30um sandwiched between layers of polyester and polyethylene film.

2. STRUCTURE



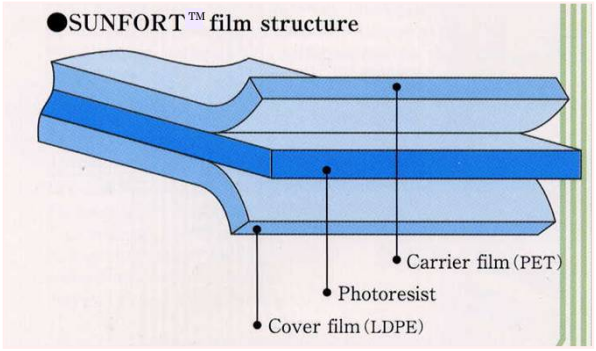


Figure1. Structure of SUNFORT™ ADV-306

3. FEATURES OF ADV-306(Paragon9000)

(1) Super high sensitivity for LDI exposure

(2) Processable by both h-line and i-line exposure

(3) High resolution and excellent producibility of photo mask after developing

(4) Good etching resistance to etchants such as Ferric chloride (FeCl3) and Cupric chloride (CuCl2) after exposure

(5) Excellent tenting capability

4. EVALUATION CONDITIONS (Table 1.) ADV-306(Paragon9000)

Table-1 Evaluation condition of imaging properties

Process	Evaluation conditions
Surface preparation	Base materials 0.4mmt copper clad laminate copper thickness 35um Jet pumice treatmen Abrasive compound : SAKURUNDUM A#400 conc. 20% pressure 0.20MPa
Lamination	Hot roll laminator AL-700 (Asahi Kasei Co.) Pre-heated panel temp 50degC Lamination-roll temp. 105degC Roll pressure 0.34MPa Lamination speed 2.0m/min
Holding time	15min.
Exposure	Exposure machine Direct imaging exposure machine Paragon9000 (Orbotech Co.) 8W Exposure energy 14-22mJ/cm2
Holding time	15min.
Development	Conveyorized spray developing machine Developing solution Anhydrous sodium carbonate（Na2CO3） Concentration 1% Developing temp. 30degC Spray pressure 0.22MPa Developing time 42sec. (B.P. = 21sec.)
Stripping	Conveyorized spray stripping machine Stripping solution Sodium hydroxide solution（NaOH） Concentration 3% Stripping temp. 50degC Spray pressure 0.20MPa Stripping time 62sec. (L.P. = 31sec.)

＊ Technical data in this article is experimental data in our laboratory and not guaranteed value.

Table 2 and 3 show representative processing conditions for SUNFORT™ ADV-306.

Table 2 and 3 show representative processing conditions for SUNFORT™ ADV-306.
Refer them to select optimum conditions, which will vary by customer's equipment.

Table 2. Processing recommendation from board preparation to exposure

Item	Condition	Remarks
1. Board preparation 1-1 Pre cleaning Washing 1-2 Preparation (①-③) 1-3 Drying by air-blower	Conventional cleaners or dilute sulfuric acid (5-10%) ①Buff roll treatment Scotch-Brite HD#600 (3M Co.) Rotation : 1800rpm Oscillation : 300rpm Line speed : 1-3m/min ②Jet scrubbing treatment Sacrundum#220 (Japan Carlit Co.) Concentration of : ③Buff roll treatment → Chemical treatment (Sulfuric acid & Hydrogen peroxide) CB-5002 (Mec Co.) Concentration : 50vol% Temperature : 30degC Spray pressure : 0.1MPa Spray time : 10sec Air blowing : 4.0-9.0 m3/min Temp. of surface : 40-50℃	The copper surface should be completely free from moisture, oil, heavy oxidation and contaminations. The roughness after preparation should be kept 0.2-0.6um measured by laser microscope (VK-9500, KEYENCE Co.). Water in through hole should be removed.
2. Lamination 2-1 Preheating 2-2 Roll temp. 2-3 Roll pressure 2-4 Lamination speed	Temp. of copper surface should be 50+/-10C just before lamination. 110±10℃ 0.3±0.1MPa (as air cylinder gauge) 1.0-3.0m/min	Preheating is better process to increase the adhesion and the conformity of dry film to the board.
3. Holding time after lamination 3-1 Holding time	Usual : More than 15min. Forced cooling : More than 1min. Maximum : 1 days	Cool to room temp.
4. Exposure 4-1 Exposure energy 4-2 Exposure temp.	 18-22mJ/cm² 23±2℃	Step tablet 7-8st/ST.21, 10-13st/Asahi27
5. Holding time after exposure 5-1 Holding time	More than 15min. Less than one day	Development should be done within Less than one day after exposure.

Table-3. Processing recommendation from development to stripping

Item	Condition	Remarks
6. Development		
6-1 Developing solution	Anhydrous sodium carbonate	Developing time should be adjusted by Break Point = 50-65%.
6-2 Solution concentration	1.0+/-0.2%	
6-3 Solution temp.	30+/-2℃	
6-4 Spray pressure	0.15-0.20MPa	Adding AQ defoamer-501 is recommended. (AQ defoamer-501 : 0.05-0.20vol%)
6-5 Developing time	32-42sec. (B.P.: 50-65%)	Supply and change of developing solution shall be adjusted by the dissolved resist content 0.33m^2/L in case of 1.0wt% solution.
7. Water rinse after development		
7-1 Rinse water temp.	Below 25degC	Rinsing time should be settled to be over developing time.
7-2 Rinsing time	Same as developing time (at least one half)	
7-3 Spray pressure	0.15-0.20MPa	
8. Stripping		
8-1 Stripping solution	Solution of sodium hydroxide, potassium hydroxide or solvents of mono-ethanol amine series.	Stripping time should be adjusted by Lifting point = 50-65%.
8-2 Solution concentration	Sodium hydroxide : 2-3% Potassium hydroxide : 2-4% Mono-ethanol amine series : recommended concentration	Adding antifoam is recommended. (AQ deformer -101:0.05-0.1vol%) Supply and change of stripping solution should be adjusted by the stripped resist quantity 1.0m^2/L in case of the 3.0wt% solution.
8-3 Solution temp.	50 +/- 5degC	
8-4 Spray pressure	More than 0.20MPa (Thick board)	
8-5 Stripping time	48-62sec. (L.P.: 50-65%)	Resist chips should be removed by the equipment such as rotary type, or basket type.
9 Water rinse after stripping		
9-1 Rinsing time	Same as the stripping time (at least one half) More than 0.2MPa	
9-2 Spray pressure		

Break point (B.P.) : The minimum time when the surface of board is bared completely after the unexposed dry film was developed.

Lifting point (L.P.) : The minimum time when the surface of board is bared completely after the exposed dry film was stripped.

a. Step tablet sensitivity （Stouffer21st and Asahi 27st）

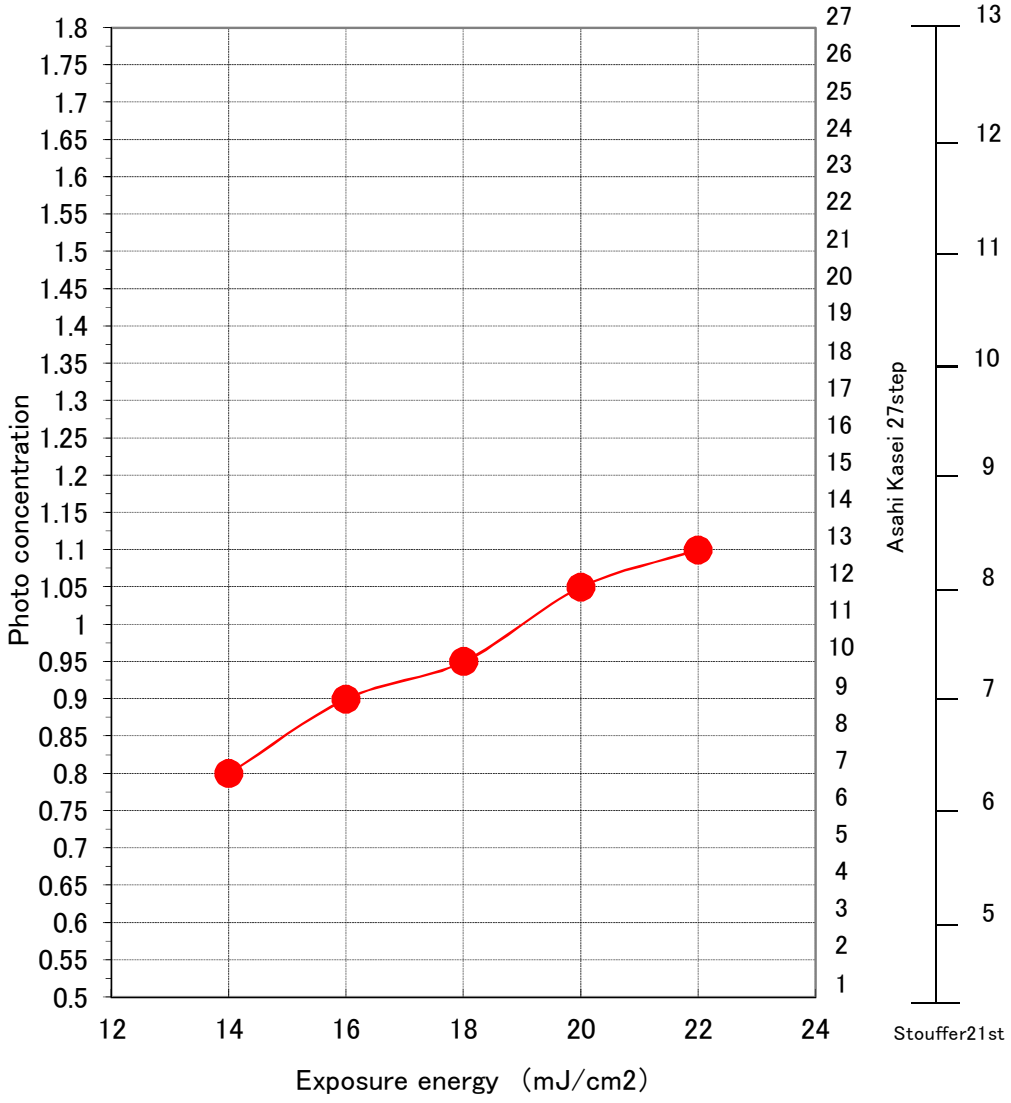


Figure a. : Step tablet : STOUFFER 21st
ASAHI 27st

Judgement of step tablet : Minimun step number which is completely covered with dull luster.

b. Resolution （Negative photo mask）

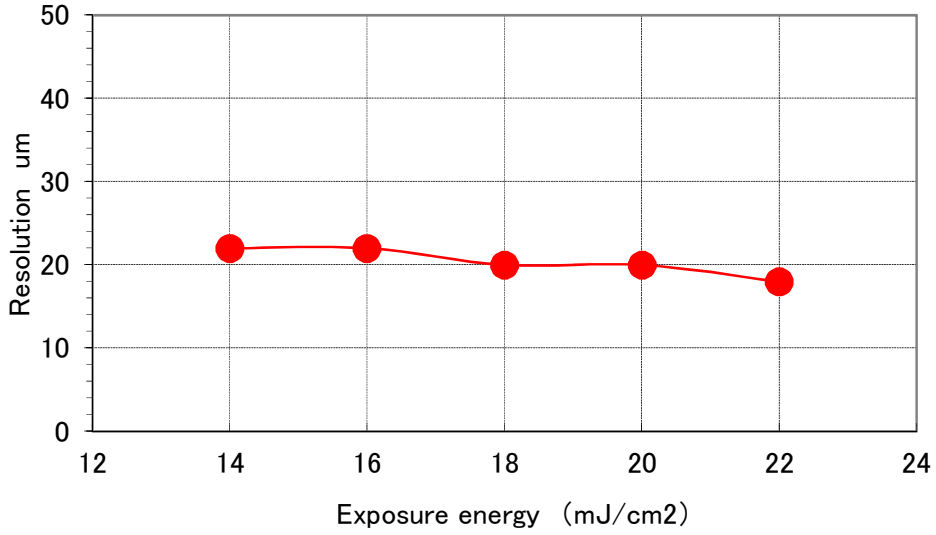


Figure b. Exposure energy vs. resolution (line width)

[Judgement of resolution]

The mimnimum size of developed line or space, which is not flowed and is not buried by using our photo mask for evaluating resolution.

And the minimum resist pattern size is less than +/−20% narrow or wide at the highest resolution line.

c. Line width100um

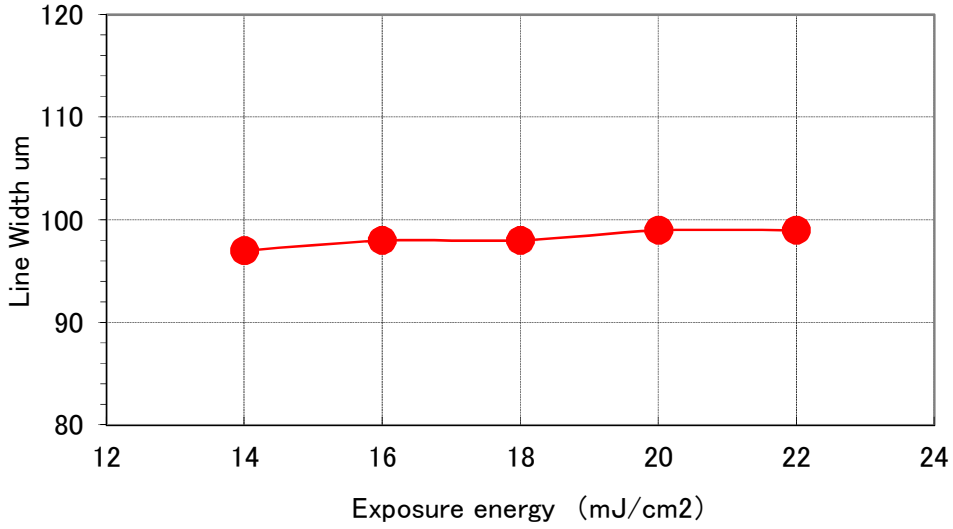


Figure c. Exposure energy vs. reproducibility of developed line width

[Method of measurement]

Line width (100um) is measured by optical microscope.

d. Resolution （Positive photo mask）

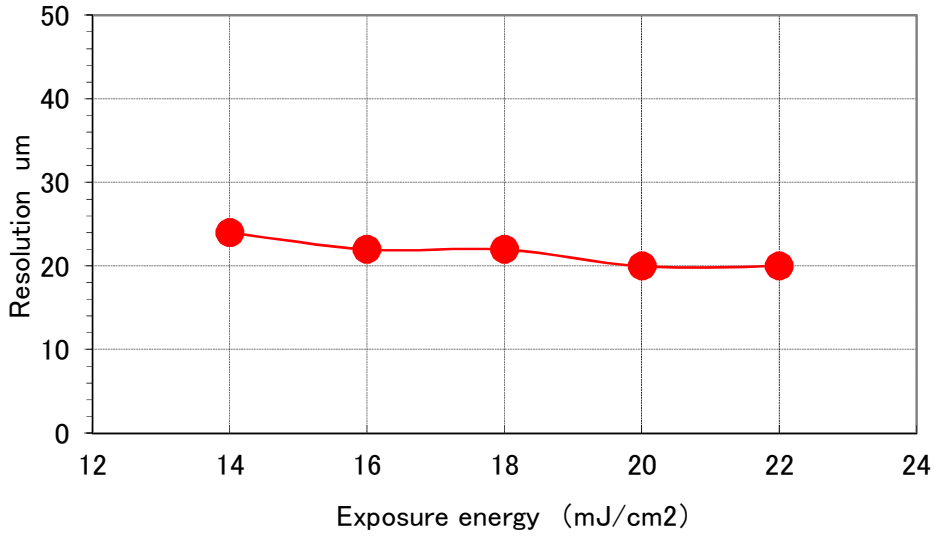


Figure d. Exposure energy vs. resolution (Space width)

[Judgement of resolution]

The mimnimum size of developed line or space, which is not flowed and is not buried by using our photo mask for evaluating resolution.

And the minimum resist pattern size is less than +/-20% narrow or wide at the highest resolution line.

e. Independent line adhesion

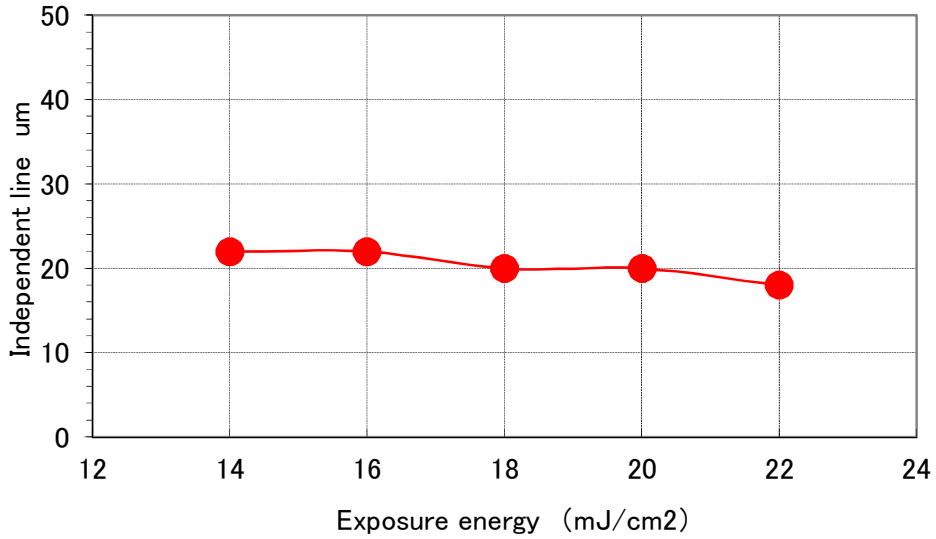


Figure e. Independent line adhesion after developing

[Judgement of line adhesion]
The minimum developed line which is not flowed and not chipped off.

f. Independent space digging

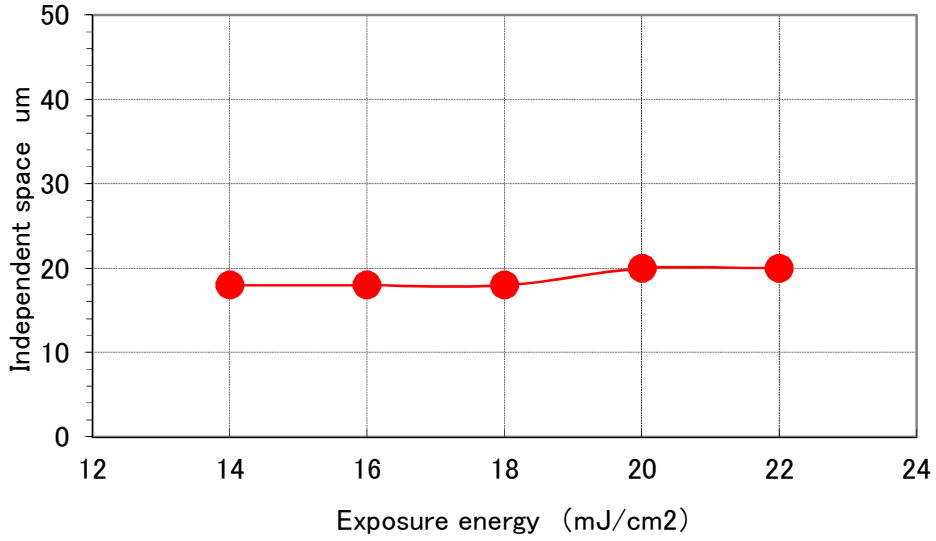


Figure f. Independent space digging after developing

[Judgement of space digging]
The minimum developed space which is not buried.

g. Isolated fine pillar adhesion

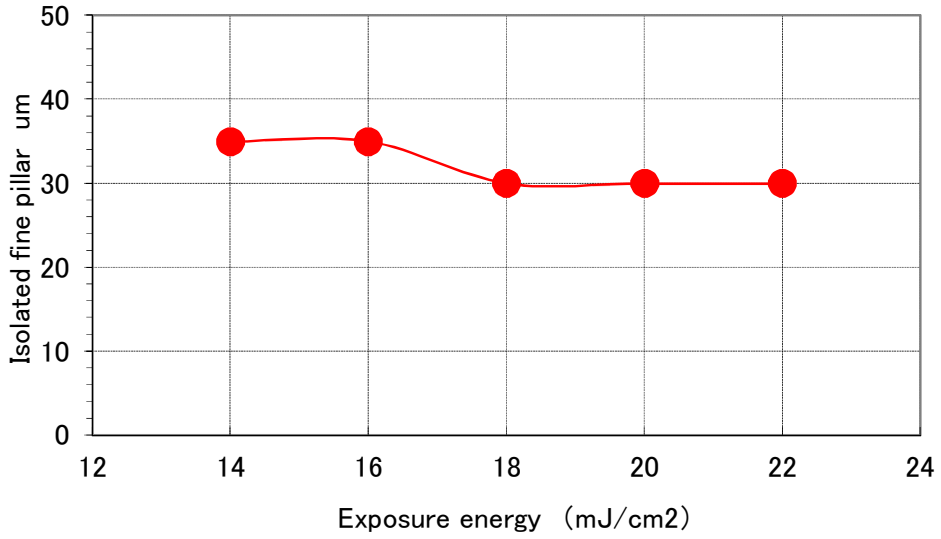


Figure g. Isolated fine pillar adhesion after developing

[Judgement of pillar adhesion]
The minimum developed pillar which is not flowed and not chipped off.

h. Isolated fine via digging

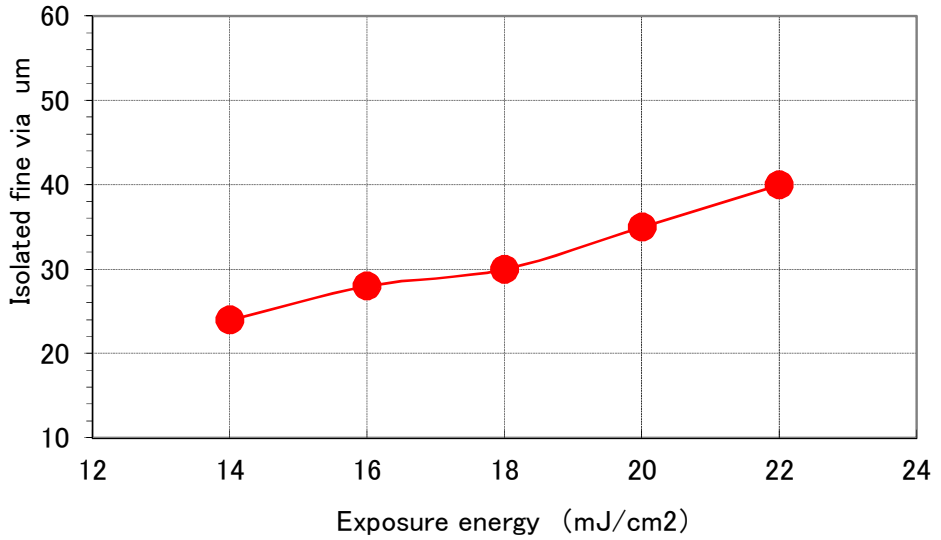


Figure h. Isolated fine via digging after development

[Judgement of space digging]
The minimum developed via which is not buried.

7-1. STORAGE RECOMMENDATIONS

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

(2) **SUNFORT™** rolls should be laid horizontally.

7-2. 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.

7-3. SAFETY PROCEDURES

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

(1) In case of contact with skin and clothing, wash immediately with soap and running water. If unpolymerized photoresist or washout solution come in contact with eyes, flush eyes immediately with plenty of water for at least 15 minutes and consult an oculist.

(2) Use with adequate ventilation during lamination.

(3) Please dispose cover film (protective polyethylene) and carrier film (PET) by incineration. These are not reusable.

(Note) A developing solution (Na2CO3) and a stripping solution (NaOH, KOH) should be handled with much care. Wear safety glasses and impervious gloves when making the solution.