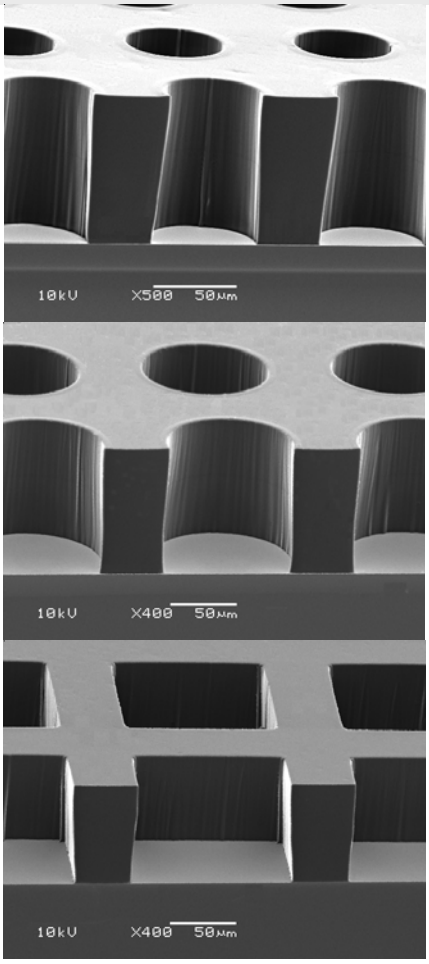
DuPont™ Riston® SAF2000 Series

PRELIMINARY DATA SHEET & PROCESSING INFORMATION
MICROLITHOGRAPHIC POLYMER FILM

High Performance & High Resolution Multi-Purpose Polymer Film



MPF Product Features/ Application

- Negative working, aqueous processable polymer film
- Three layer package

- Suitable for in-via and mushroom electroplating bumping applications
- Suitable for photo stenciling applications
- Strong heat resistance
- High resolution capability Wide processing latitude
- SAF series is compatible with the following typical surfaces:
  - Silicon
  - Silicon Nitride
  - Sputtered copper
  - Sputtered gold
  - PI/BCB with UBM

- Polymer film thickness: 15, 20, 30, 50, 75, 100 and 120 microns
- Unexposed Color in Yellow Light: Light Green
- Exposed Color in Yellow light: Dark Blue

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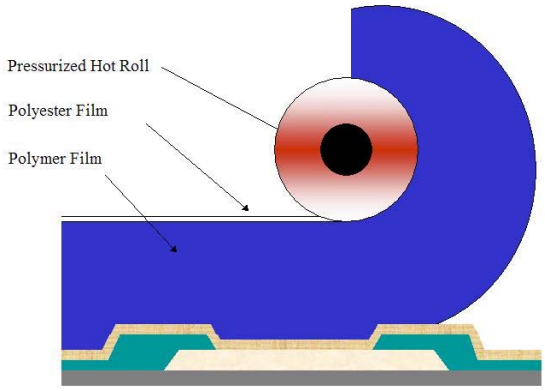
PART 1: SURFACE PREPARATION

Surface must be free of any kind of organic contamination and metal oxides from previous processes. It is recommended, whenever possible, to clean the surface with light acid solution (2-3% sulfuric acid solution) followed by D.I. water rinse and dry with nitrogen gas. Cleaning immediately prior to lamination is recommended to remove surface particles and avoid recontamination.

PART 2: LAMINATION



The main objective of the lamination step is to provide intimate contact between the polymer and the substrate, eliminating any air entrapment, ensuring the polymer flows into the substrate cavities encountered on the surface roughness, maximizing the polymer adhesion.

HRL Hot Roll Laminator Conditions

Roll Temperature:	85-110°C (185-230°F); 95°C preferred
Roll Speed:	0.6-1.5 m/min (2-5 ft/min); 1.2 m/min preferred
Pressure:	15-40 psig

See equipment manufacturer recommendations. Call a DuPont Representative for details.

***Note**: Reduced lamination roll pressure and/or temperature may be required if equipment is not correctly aligned and polymer winkles are observed.*
***Note**: Substrates must never be stacked horizontally, or random impression defects will be induced.*
***Note**: Allow substrates to cool down to room temperature prior to further processing.*

PART 3: POST-LAMINATION HOLD TIME

Always allow enough time for wafers to cool down to room temperature prior to exposure.
Do not exceed hold time of 3 day between lamination and exposure.

PART 4: POST-LAMINATION BAKE (OPTIONAL)

This optional process step can be used to promote polymer film adhesion. Post lamination bake (PLB) is recommended to enhance Film adhesion on extra smooth surfaces and/or for aggressive applications.

Oven Bake:

Temperature:	55-75°C (122-158°F); 65°C preferred.
Dwell Time:	15-20 min; 20 min preferred

***Note**: Temperature will vary according to film thickness, substrate type and process requirements.*

PART 5: EXPOSURE

***Note**: Do not remove polyester coversheet film. Coversheet has minimum light absorption and provides protection against mask contamination.*
***Note**: SAF has peak absorption at 365nm, i-line exposure lamps are highly recommended.*

Resolution:
To maximize resolution we recommend the use of hard contact and high intensity light source.

Exposure Intensity

- 10 mW/cm2 or higher intensity is recommended for low resolution
- 20 mW/cm2 or higher intensity is recommended for high resolution.

Recommended Exposure Range

	SAF	SAF15	SAF20	SAF30	SAF50	SAF75	SAF100	SAF120
mJ/cm2	100-150	100-150	100-150	100-150	220-460	240-480	250-500	260-520

Note: The high end of the recommended exposure range should be used for aggressive applications.

***Note**: All intensity and energy measurements were made at the polymer film surface with an International Light IL-1400A radiometer and an SSD001A Super Slim UV detector probe (275-400 nm sensitivity).*

PART 6: POST-EXPOSURE BAKE (OPTIONAL)

This optional process step, post exposure bake (PEB), is recommended to enhance polymer film resolution and development latitude leading to more complete development and a straighter film sidewall.

Oven Bake:

Temperature: 70-90°C (158°F); 85°C preferred
Dwell Time: 20-30 min; 25 min preferred

Hot Plate Bake:

Temperature: 90-110°C (194-230°F); 100°C preferred
Dwell Time: 20-30 min; 25 min preferred

***Note**: Temperature will vary according to film thickness, substrate type and process requirements.*

PART 7: DEVELOPMENT

***Note**: Remove polyester coversheet film to allow proper development.*

Development Conditions: Recommended for developers with non-stationary spray nozzles

- Spray Pressure: 1.4-2.4 bar (20-35 psig).
- Chemistry: D4000 IC concentrate developer - 0.6-0.9wt%; 0.75 wt% preferred.
- Temperature: 27-32°C (80-90°F); 28°C preferred
- Flow: 180-220 ml/min; 200ml/min preferred
- N_2 Spray: 40 normal m^2/min
- Rotation Speed: 800 – 1200 rpm; 1000 rpm preferred
- Arm Speed: 200 cycle/min
- Arm Height: 50 mm

Total Development Time:

Total Development Time @ 28°C (86°F), 2 bar (29 psig) spray pressure, 50% breakpoint @ 0.75% conc.

***Note**: For 200mm and higher wafer diameter development should be set up for 30% of total developing time on the edges of the wafer only and 70% for the hole wafer surface area.*
***Note**: Total developing time will vary slightly with process conditions (exposure dose, baking cycle and hold times). Development should be adjusted by adding 50% to 60% over developing from the clean photoresist breakpoint time.*

Rinsing Recommendations

Rinsing should follow immediately after development.

- Rinse water hardness: 150-300 ppm CaCO3 equivalent. Softer water can be hardened by the addition of magnesium sulfate (Epsom salts).
- Rinse temperature: 21-25°C (70-80°F)
- Rinse spray pressure: 1.4-2.4 bar (20-35 psig).
- Rotation Speed: 800 – 1200 rpm; 1000 rpm preferred
- Arm Speed: 200 cycle/min
- Arm Height: 50 mm
- Develop-to-Rinse Dwell time Ratio: 2:1 minimum.

Drying Recommendations

Drying should follow immediately after rinsing.

- Rotation Speed: 2500-3500 rpm; 3000 rpm preferred
- Arm Height: 80 mm
- Drying N_2 Spray: 40 normal m^2/min
- Dwell time: 20-40 sec; 30 seconds preferred

***Note**: Minimize white light exposure during post development hold.*

PART 8: POST-DEVELOPMENT BAKE (OPTIONAL)

This optional process step, post development bake (PDB), is recommended to enhance polymer film resolution and processing latitude leading straighter film sidewall and higher resistance to aggressive chemistries.

	SAF15	SAF20	SAF30	SAF50	SAF75	SAF100	SAF120
Time to Clean (TTC)	44-54s	55-65s	78-88s	131-141s	208-218s	291-301s	359-409s
Total Development Time	81-98s	100-120s	138-166s	227-272s	355-426s	493-592s	605-762s

Oven Bake:

Temperature: 70-90°C (158°F); 85°C preferred
Dwell Time: 20-30 min; 25 min preferred.

Hot Plate Bake:

Temperature: 90-110°C (194-230°F);100°C preferred
Dwell Time: 20-30 min; 25 min preferred

***Note**: Temperature will vary according to film thickness, substrate type and process requirements.*

PART 9: DESCUM (ASHING)

Plasma etching is recommended to ensure surface is free of any organic contamination and improve surface wet ability for electroplating applications. Please consult equipment manual and manufacturer for details.

The following parameters are for reference only.
Flow: 250 SCLL O_2
Power: 250 Watts
Vacuum: 500 mTorr
Dwell: 30 Sec

PART 10: PLATING

SAF can be used for plating with acid copper, tin/lead, tin. SAF has very strong resistance to lifting/underplating and organic leaching.
SAF2000 is compatible with acid copper, tin, tin/lead, nickel sulfamate, most lead free electrolyte, and acid gold baths plating under controlled conditions, please contact a DuPont technical representative for further details.

PART 11: REMOVAL

***Note**: Total removal time will vary with process conditions (exposure dose, baking cycle, hold times,etc).*

The following removal products have being successfully used:

EKC Technology –EKC 108
Dynaloy - Dynastrip 7000, 7200, 7500
General Chemicals - GenSolv 475

Proprietary chemistries are used for higher removal speeds and higher polymer loading. They also minimize chemical attack on surface metallurgy. Operating temperatures are between 50°C and 85°C (125°F and 185°F).

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Storage

Temperature: 5-21°C (40-70°F)
Relative Humidity: 40-60%

Safe Handling

Note safety and industrial hygiene precautions. Consult the Material Safety Data Sheet (MSDS) of any chemical used. MSDS's for DuPont™ SAF Series Micrographic Film are available from your DuPont Representative.

Safe Lighting

Protect photoresist through lamination and development steps from UV radiation and visible light up to 450 nm by use of gold fluorescent "safe lights".
High intensity (> 75 foot-candles) yellow "safe light" can cause a change in photospeed over time) and should be avoided.

Waste Disposal

For questions concerning disposal of photoresist waste refer to the latest DuPont literature and Federal, State, and Local Regulations.

For further information on DuPont™ SAF Series, please contact your local representative.

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