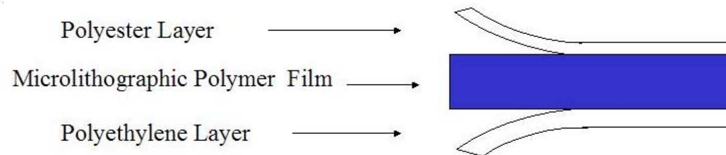
DuPont™ MX5000™ Series

DATA SHEET & PROCESSING INFORMATION

High Performance Multi-Purpose Polymer Film for MEMS Applications

Product Features/ Applications

- Negative working, aqueous processable dry film photoresist.
- Three layer package



- Suitable for application with acid and alkaline etchant solutions.
- Compatible with acid copper, tin, tin/lead, nickel sulfamate, and acid gold electrolytic plating baths.
- Strong Print-Out (Phototropic) Image after exposure.
  MX5000 series is compatible with the following typical surfaces:

  Silicon
  Silicon Nitride
  Sputtered copper
  Sputtered gold

- MX5000 series exhibits good adhesion to:

  Glass
  Polymers
  Other metals and oxides

Resist Thickness:	15, 20, 30, 40, 50µm
Unexposed Color in Yellow Light:	Light Green
Exposed Color in Yellow light:	Dark Blue

MX5000 is capable of tenting (bridging) over features already etched on the surface. This property is highly dependant on feature size, polymer thickness, and lamination conditions.

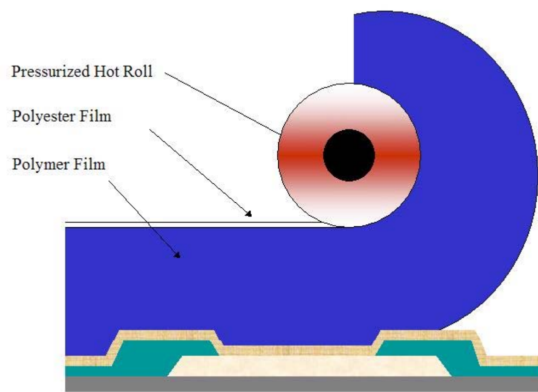
The miracles of science™

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

Automatic Dry Photoresist Laminator (Taper)

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 photoresist wrinkles 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

All photoresists experience some change in photospeed and line widths held over time following lamination. Results differ depending on resist type, duration of hold time, and the relative humidity (RH) under which the panels are stored prior to exposure. Low to moderate RH (e.g. 20-50%) has less effect than very high RH (e.g.80-98%).

Do not exceed hold time of 5 days.

PART 4: Post-lamination bake (optional)

The optional process step can be used to assure full resist 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.

Hot Plate Bake:

Temperature: 90 - 110°C (194-230°F); 100°C preferred.
Dwell Time: 20 - 80 sec; 45 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**: MPF MX5000 has peak absorption at 365nm, i-line exposure lamps are highly recommended*

***Note**: 20 mW/cm2 or higher intensity is recommended for high resolution*

Recommended Exposure

	MX5000	MX5015	MX5020	MX5030	MX5040	MX5050
	mJ/cm2	20 – 65	35 –105	40 – 115	45 – 125	50 - 140

***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)

The optional process step, post exposure bake (PEB), is recommended to enhance photoresist resolution and development latitude leading to clean surface after development and a very straight photoresist sidewall.

Oven Bake:

Temperature: 70-90°C (158°F); 85°C preferred
Dwell Time: 2 0-30 min; 25 min preferred

Hot Plate Bake:

Temperature: 90-110°C (194-230°F); 100°C preferred
Dwell Time: 20-80 sec; 45 preferred

PART 7: Development

Development Conditions: (based on ACS200 spray tool)

- Spray Pressure: 1.4-2.4 bar (20-35 psig).
- Chemistry: D4000 IC concentrate developer: 0.7-0.9 wt%; 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.

Rinsing Recommendations

***Note**: 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

***Note**: Drying should follow immediately after rinsing*

- Rotation Speed: 2500-3500 rpm; 3000 rpm preferred
- Arm Height: 80 mm
- Drying N2 Spray: 40 normal m2/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 to straighter film sidewalls and higher resistance to aggressive chemistries.

	MX5015	MX5020	MX5030	MX5040	MX5050
Time to clean (TTC)	10 – 20 secs	18 – 28 secs	27 - 37 secs	36 - 46 secs	45 - 55 secs
Total development time	24 – 33 secs	34 - 44 secs	50 - 60 secs	68 - 78 secs	85 - 95 secs

***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.*

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 - 80 sec; 45 preferred

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

PART 9: Descum (Ashing)

Plasma etching is recommended to ensure the surface is free of any organic contamination and to improve surface wetability for both photo stencil and electroplating applications.
Please consult equipment manual and manufacturer for details.

PART 10: Etching

MX5000 series photoresists are fully compatible with most acid etchants, such as cupric and ferric chloride, as well as alkaline etchants (pH=7.8 - 8.8).

PART 11: Pattern Plating

MX5000 can be used for pattern plating with acid copper, tin/lead, tin, nickel sulfamate and most acid gold baths. MX5000 has very strong resistance to lifting/underplating and organic leaching.

PART 12: Removal

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

The following removal products have been successfully used:

EKC Technology- EKC 108
Dynaloy Dynastrip 7000, 7200, 7500, Flip Strip

Proprietary chemistries are used for higher removal speeds, higher resist loading, and smaller particle size. They also minimize chemical attack on tin or tin/lead and reduce copper oxidation. Operating temperatures are between 50°C and 85°C (125°F and 185°F).

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™ MX Series DryFilm 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 more information on DuPont™ MX5000™ Series, please contact your local representative.

DuPont Electronic Technologies
14 T. W. Alexander Drive
Research Triangle Park, NC 27709 USA

www.apl.dupont.com

This information corresponds to DuPont's current knowledge on the subject. It is offered solely to provide possible suggestions for your own experiments and is not intended to substitute for any testing you may need to conduct to determine the suitability of DuPont's products for your particular purposes. This information may be subject to revision as new knowledge and experience becomes available.

Since DuPont cannot anticipate all variations in actual end-use conditions, it makes no warranties and assumes no liability in connection with any use of this information. Nothing in this publication is to be considered as a license to operate under or a recommendation to infringe any patent right
Caution : Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see "DuPont Medical Caution Statement", H-51459.

The miracles of science™

DS04-109 (0706)