

Fleuron™ PR-USF

DESCRIPTION

FLEURON™ PR-USF is a fluorinated soft negative photoresist. Due to its dielectric features, it is primarily used to encapsulate microelectrodes. However, due to its unique material properties, such as chemical inertness, solvent compatibility and resistivity against most etchants it serves as a versatile resist for many applications.

FLEURON™ PR-USF photoresist is compatible with standard (i-line) 365 nm lithography tool sets with access to an inert N₂ environment during UV exposure. It exhibits good adhesion to traditional semiconductor materials such as, Si, SiO₂ and various metals, including Au, Pt, Al, and Ni. It can withstand most wet etch processes, solvents, and high vacuum. FLEURON™ PR-USF photoresist produces thin films using conventional spin coating methods. It produces a soft, elastic, and resilient photo pattern that can be used in for a wide variety of applications, such as MEMS, microfluidics, stretchable / wearable electronics, and biomedical devices (Figure 1). **Note: For inert UV curing environment, we offer a Diffuser that attaches to MA toolkits.**

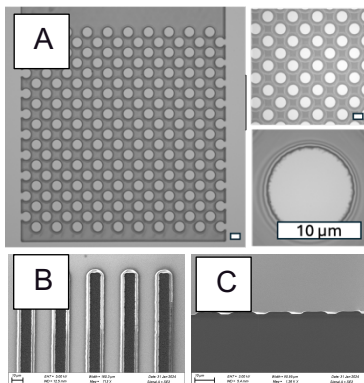


Figure 1. (A) Optical Microscope image of circular array pattern of FLEURON™ PR-USF. Bottom Row; **(B-C) SEM images** of 10 µm dense pattern, **(B)** top down **(C)** and cross-section.

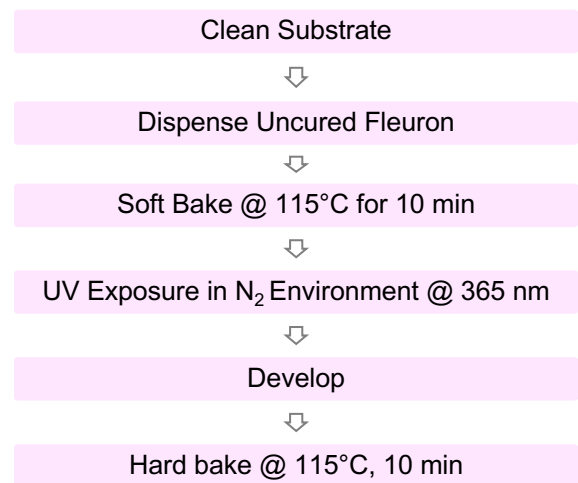
FEATURES

- Soft Elastomer-based negative photoresist, low **Young's modulus (~5 MPa)**, and high tensile strength (~8 MPa).
- Low-k dielectric.
- Low refractive index.
- Low moisture and ionic absorption.
- Adheres to metal and supports multi-layer lithography.
- Does not swell in most cleanroom solvents and resists most etchants.
- Low post-cure film stress.
- Room temperature crosslinking in an inert environment.
- Excellent chemical & thermal stability @ 240°C.

PROCESSING

Figure 2 displays the simple lithographic processing method. Optimizations may be necessary to achieve the desired results based on tool used. For additional assistance or you would like to purchase our Diffuser, please contact Axoft's technical support team at materials@axoft.us. We are happy to help troubleshoot any problems you may have.

Figure 2. Work flow lithography process



PATTERN PROTOCOL

To ensure good adhesion to the substrate, ensure a clean substrate via oxygen plasma or other methods to ensure no organic contamination.

Example:

1. Dispense 0.5-1 mL of photoresist per inch diameter wafer i.e. 1.5- 3 mL for 3" wafer.
2. To evenly spread photoresist, first spin wafer at 500 rpm for 5 seconds.
3. Then ramp to desired rpm from fig 3, using an acceleration of 1000 rpm/second for 45 seconds.

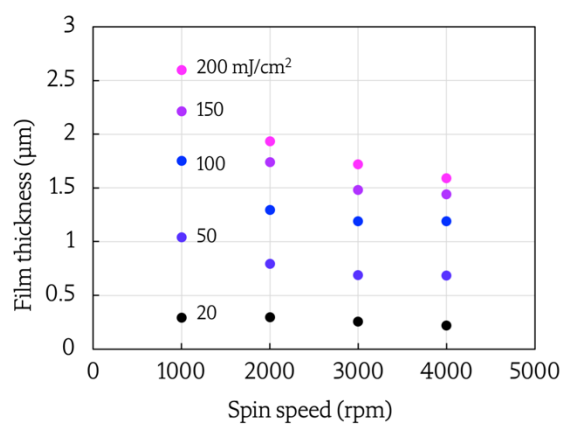


Figure 3. Film thickness as a function of spin speed and UV dosage.

SOFT BAKE

Bake for 10 minutes at 115°C on a level hotplate. Avoid direct contact with the mask.

UV EXPOSURE

- ❶ **IMPORTANT TO NOTE:** *An inert local atmosphere (e.g. N₂) around the sample or within the tool is required during UV exposure.*

To determine UV exposure, refer to Figure 3. No post exposure baking is required.

- ❶ *If flood exposing using a hard mask, add spacers to the wafer to prevent sticking to photomask.*
- ❶ *Please contact us for a Diffuser that can easily be attached to most contact aligners that provides an inert environment during UV curing.*

AXOFT'S NITROGEN DIFFUSER

Axoft's Diffuser is compatible with most masked aligner toolsets. It seamlessly fits around wafer holders and attaches to a nitrogen line found in most cleanrooms. The Diffuser delivers a uniform stream of N₂ during UV exposure, ensuring the inert conditions for curing Fleuron™ photoresists effectively.

DIFFUSER PROTOCOL

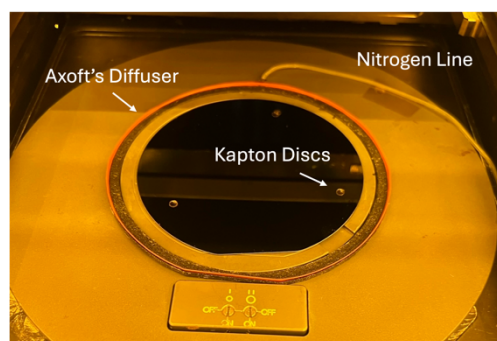


Figure 4. Axoft's Diffuser attached to 4" wafer holder using a SUSS MA6 toolset

1. Place Kapton discs (4) around the edge of the wafer (to prevent the resist from sticking to the photomask).
 2. Position Diffuser around the base of the wafer holder.
 3. Attach nitrogen line to the main nitrogen line in cleanroom. Set air flow to 60 sscm.
 4. Wafer is now ready for UV exposure (follow instructions of tool).
- **See Diffuser TDS on our website for additional info.**

DEVELOPMENT

Post UV cure - Develop the resist using Axoft Dev-10 or Dev-20 (fluorine free) solvent developer in an appropriate solvent hood.

1. Using a dispenser (i.e. a plastic pipette), fill 2-3 mL with Dev-10 or Dev-20 developer.
2. Dispense on surface of wafer.
3. Allow to sit for 10 secs.
4. Grab wafer with tweezers and remove developer using N₂ gun.
5. Repeat steps 1-4.

① ***If you notice a rainbow-like reflection on substrate, the uncured resist has not been fully removed. Repeat steps 1-4 until this is no longer present.***

OPTICAL PROPERTIES (TRANSMISSION)

The transmission curve shown in Figure 4, are based on a 5 wt.% solution of FLEURON™ PR-USF.

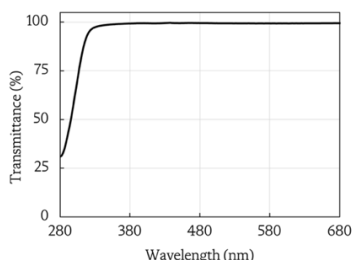


Figure 4. Transmission curve of Axoft FLEURON™ PR-USF.

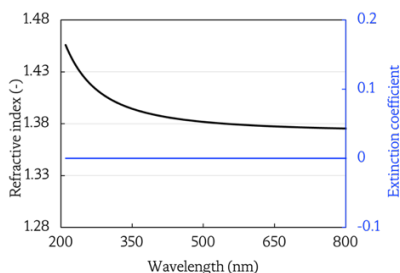


Figure 5. The index of refraction and extinction coefficient for FLEURON™ PR-USF.

HARD BAKE

Hard baking ensures full removal of solvent that may be trapped within the cured resist. To ensure removal we recommend baking for 30 minutes on a 150°C hot plate.

PHYSICAL PROPERTIES (TYPICAL VALUES)

Young's Modulus	5 MPa
Elongation	150±20 %
True Tensile strength	8±2 MPa
CTE	285 ppm/°C
TGA (N2, 5% weight loss)	265°C
Dielectric constant (1 kHz)	2.25
Swelling ratio (Q, DI water, 72 hr)	1.002

STORAGE

Store FLEURON™ PR-USF photoresist upright and in tightly closed containers in a cool, dry environment away from direct sunlight at a temperature of 10-25 °C. Store away from light, acids, and heat. Shelf life is 6 months from the shipping date.

HANDLING

Refer to Safety Data Sheet (SDS) for details on the handling procedures and product hazards prior to use.

DISPOSAL

FLEURON™ PR-USF photoresist may be included with other waste streams containing organic solvents designated for hazardous waste, in accordance with local, state, and federal regulations. It is the responsibility of the customer to ensure the proper disposal of FLEURON™ PR-USF photoresists, developer and residues in accordance with all federal, state, and local environmental regulations.

DISCLAIMER

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