SU-8 TF 6000

High Resolution Thin Epoxy Negative Photoresist (0.5 –10 µm Film Thickness)

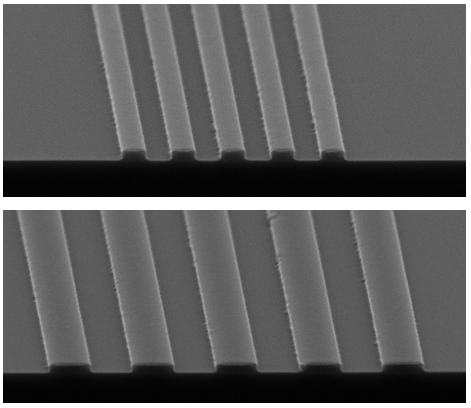
Description

SU-8 TF 6000 is a high-contrast, chemically amplified, negative tone epoxy based resist that is sensitive to broadband UV radiations (i-, h- and g-Line) and is recommended wherever high resolution, photoimageable, thin, permanent structures are required. SU-8 TF 6000 is available in five standard viscosities to achieve low defect coatings with film thicknesses ranging from ~ 0.4 to 16 µm in a single coat process.

Features

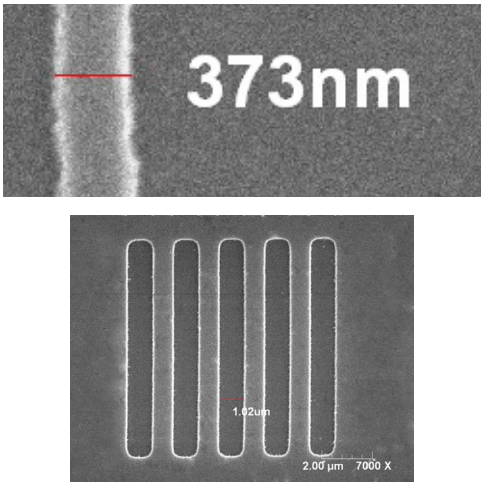
- Photoimageable thin films with high resolution i-Line patterning capability (sub-0.5 µm lines/spaces at 0.5 µm film thickness on silicon with an i-Line stepper; and 1 µm lines/spaces at 0.5 µm film thickness on silicon with a broadband contact aligner)
- Broadband, i-Line, g-Line and h-Line sensitivity
- Low temperature cure (< 150°C)
- Highly uniform coatings and good adhesion to rigid and flexible substrates
- Outstanding thermal and chemical resistance

Contact Aligner Exposure
120 mJ/cm^2, 90°C/2 min PEB



1 µm (top) and 2 µm (bottom) L/S
in 0.5 µm thick SU-8 TF 6000 coating

i-Line Stepper Exposure
350 mJ/cm^2, 110°C/2 min PEB



373 nm isolated line (top) and 1 µm trenches
(bottom) in 0.5 µm thick SU-8 TF 6000 coating

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PROCESSING GUIDELINES

The following conditions represent Kayaku Advanced Materials' recommendation for a baseline process. It is expected that a certain amount of optimization will be required for customer-specific systems, facilities and application. For guidance on optimizing the process for a specific application, please contact your local Kayaku Advanced Materials Technical Sales Representative or Technical Support.

Substrate Preparation

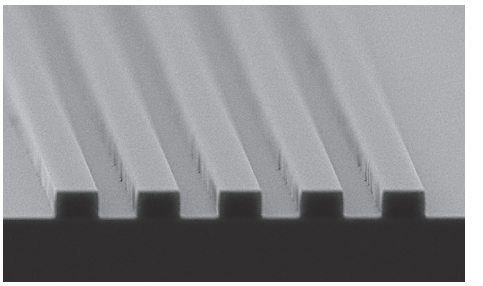
To obtain maximum process reliability, substrates should be clean and dry prior to applying SU-8 TF 6000 resist. For best results, substrates should be cleaned with a piranha wet etch (using H_2SO_4 & H_2O_2) followed by a de-ionized water rinse. Substrates may also be cleaned using reactive-ion etching (RIE) or any barrel asher supplied with oxygen.

Coat

SU-8 TF 6000 resists are available in five standard viscosities, as shown in Table 1. The film thickness vs. spin speed curves are displayed in Figure 1a and 1b. The curves were generated using a Brewer Science®, Model # Cee® 200 coater, static dispense on 6 inch (150 mm) silicon wafers and a soft bake of 110°C (times listed in Table 2) on a level hot plate. Please note that the exact thickness obtained may be slightly offset from Figure 1 due to equipment type, coat program and environmental conditions.

SU-8 TF 6000	Viscosity (cSt)	Density (g/mL)
6000.5	2.5	0.999
6001	6	1.026
6002	15	1.050
6005	75	1.083
6010	425	1.109

Table 1. SU-8 TF 6000 Viscosity



Contact Aligner Exposure
5 µm L/S in 3 µm thick SU-8 TF 6000 coating

Recommended Program

(1) Dispense 1 ml of resist for each inch (25 mm) of substrate diameter.
(2) Spin at 500 rpm for 5-10 seconds with accelera tion of 500 rpm/second.
(3) Spin at 2000-3000 rpm for 30 seconds with acceleration of 500 rpm/second.

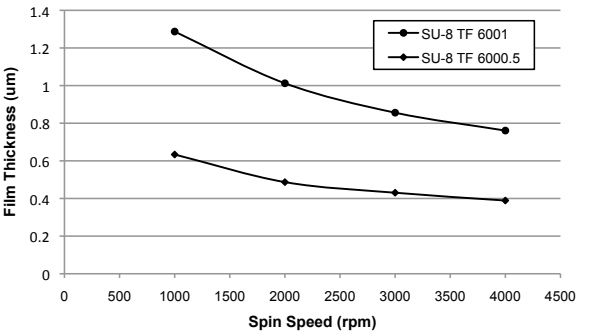


Figure 1a. SU-8 TF 6000.5 and 6001 Thickness vs. Spin Speed

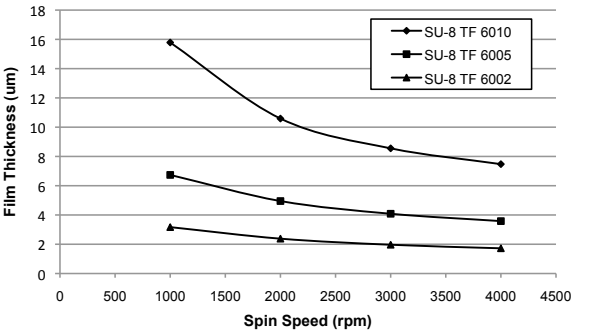


Figure 1b. SU-8 TF 6002, 6005 and 6010 Thickness vs. Spin Speed

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An edge bead may form on the outer edge of the wafer during the spin-coating process. When exposing using a mask aligner, the edge bead prevents close contact of the photomask with the wafers resulting in poor aspect ratio and resolution. In order to achieve the best lithographic results, this edge bead should be removed. This can be accomplished by using a small stream of Kayaku Advanced Materials' EBR PG at the edge of the wafer at the top and from the bottom. For edge bead removal using EBG PG, please refer to the EBR PG technical data sheet.

Soft Bake

A level hot plate with good thermal control and uniformity was used for the Soft Bake step of the process. Convection ovens may also be used. Table 2 shows the recommended Soft Bake temperatures and times for the various SU-8 TF 6000 products at selected film thicknesses.

THICKNESS microns	**SOFT BAKE TIMES** minutes @ 110˚C
0.5	1
1	2
2	3
5	5
10	10

Table 2. Soft Bake Times (hot plate)

Optical Parameters

The dispersion curve and Cauchy coefficients are shown in Figure 2. This information is useful for film thickness measurements based on ellipsometry and other optical measurements.

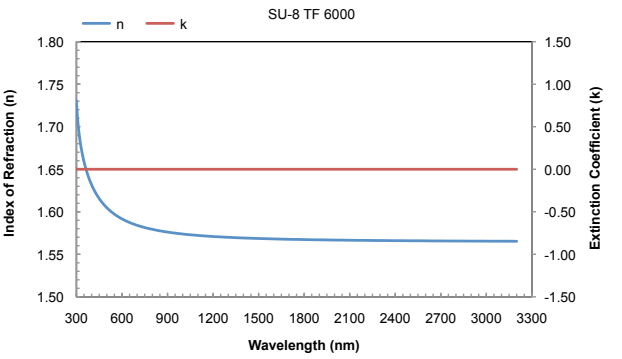

Figure 2. Cauchy Coefficients

Exposure

SU-8 TF 6000 resist series is compatible with i-, g- and h-Line or broadband exposure tools. Table 3 gives the recommended baseline exposure dose to produce 10 µm lines and spaces on silicon, glass (soda lime) and copper at various resist thicknesses obtained in contact mode using an EVG 620 mask aligner with a 500 watt mercury short arc lamp and PL-360LP long pass filter (www.omegafilters.com). The exposure dose is dependent on the spectral output and measured wavelength, and should be adjusted accordingly.The use of a long pass filter to obtain vertical sidewalls in 0.5-10 µm thick films during broad band exposure is not mandatory, as T-topping is not observed for developed resist profiles in that thickness range. Without a long pass filter, the optimal exposure dose is expected to be lower than listed in Table 3.

THICKNESS microns	**EXPOSURE ENERGY** on Si mJ/cm^2	**EXPOSURE ENERGY** on Glass and Cu Relative to Si
0.5	40-80	1-1.5X
1	40-80	1-1.5X
2	80-100	1-1.5X
5	80-100	1-1.5X
10	80-100	1-1.5X

Table 3. Exposure Dose

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Post Exposure Bake (PEB)

A post exposure bake (PEB) is required to complete the curing reaction and should take place directly after exposure.

THICKNESS microns	PEB TIMES minutes @ 110ºC
0.5–10	2

Table 4. PEB Times

Development

SU-8 TF 6000 series resists have been optimized for development in solvent-based SU-8 Developer. They can be developed in a variety of develop modes including immersion, spray, puddle or spray/puddle.

THICKNESS microns	DEVELOPMENT TIME minutes
0.5–10	3

Table 5. Development Times for SU-8 Developer

Rinse and Dry

When using SU-8 Developer, spray rinse the developed image with fresh developer for the approximate times listed in Table 6. Dry with filtered, pressurized air or nitrogen.

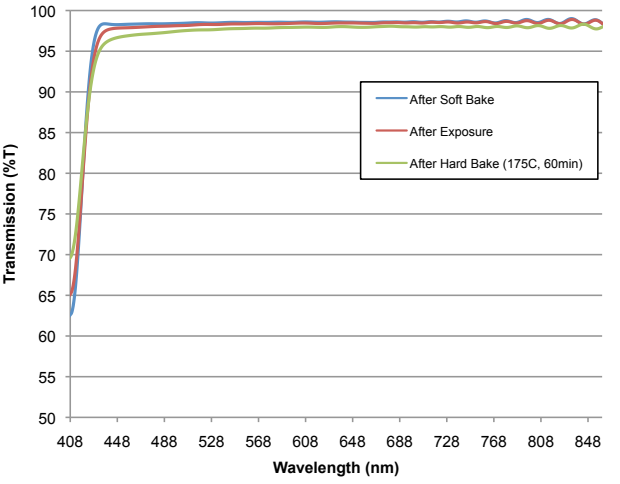
THICKNESS microns	RINSE TIME seconds
0.5–10	10-30

Table 6. Rinse Times with SU-8 Developer

Hard Bake

SU-8 TF 6000 has good mechanical properties. However, for applications where the imaged resist is to be a permanent part of the final device, the resist may be ramp/step hard baked between 150˚C–200˚C on a hot plate or in a convection oven to further cross-link the material. Bake times vary based on the type of bake process and the resist thickness.

OPTICAL PROPERTIES



Process conditions (10 µm film):
Soft Bake: 10 minutes at 110˚C
Exposure: 60 mJ/cm^2
Hard Bake: 60 minutes at 175˚C

Figure 3. Optical Transmission

PHYSICAL PROPERTIES

(Typical values)

Shear Adhesion on Si/Copper/Glass (Soda lime) (MPa) 10 µm thick films, 150˚C/60 minutes Hard Bake	58/25/48

Other film mechanical properties will be similar to SU-8 2000 film properties. Please refer to the SU-8 2000 processing guidelines for details.

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Storage

Store SU-8 TF 6000 resists upright and in tightly closed containers in a cool, dry environment, away from direct sunlight at a temperature of 40-70˚F (4-21˚C). Store away from light, acids, heat and sources of ignition. Shelf life is twelve months from date of manufacture.

Handling

Consult Safety Data Sheet (SDS) for details on the handling procedures and product hazards prior to use. If you have any questions regarding handling precautions or product hazards, please email *productsafety@kayakuAM.com.*

Disposal

The material and its container must be disposed in accordance with all local, state, federal and/or international regulations.

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