

technical datasheet

AZ[®] nLOF[™] 2000 Series

Negative Tone Photoresists for Single Layer Lift-Off

APPLICATION

AZ[®] nLOF[™] 2000 Series i-line photoresists are engineered to simplify the historically complex image reversal and multi-layer lift-off lithography processes. Ideal lift-off pattern profiles are achieved using a standard expose/post expose bake/develop process flow. These photoresists are very fast and printed features are thermally stable to >200°C.

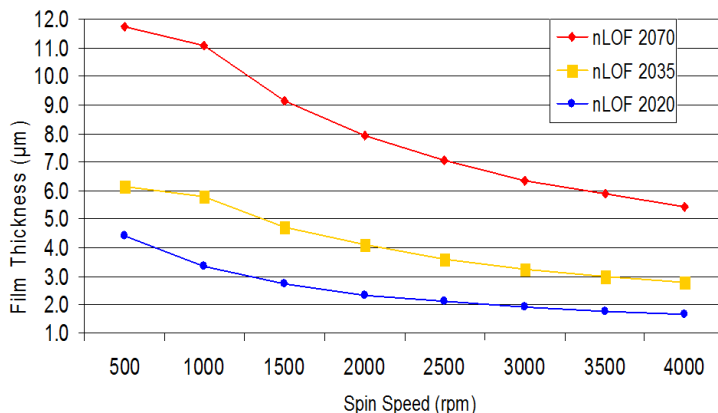
- TMAH developer compatible
- Single coat thicknesses from 2.0 to >10µm
- May be processed with vertical sidewalls for RIE etching

TYPICAL PROCESS

Soft Bake: 110°C/60-90s
 Rehydration Hold: None
 Expose: 365nm sensitive
 Post Expose Bake: 110°C/60s
 Develop: Puddle, spray or immersion
 Developer Type: MIF

* PEB is required for proper imaging

SPIN CURVES (150MM Silicon)



OPTICAL CONSTANTS*

Cauchy A	1.5946
Cauchy B (µm ²)	0.01188
Cauchy C (µm ⁴)	0.00028
n @ 633nm	1.626
k @ 633nm	0

* Unexposed photoresist film

COMPANION PRODUCTS

Thinning/Edge Bead Removal

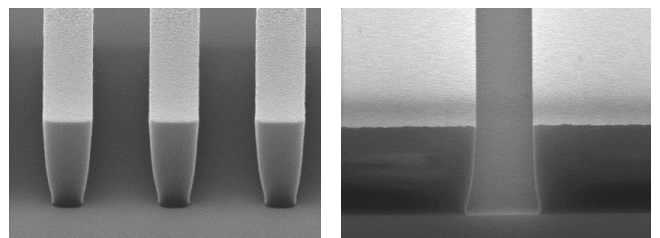
AZ[®] EBR Solvent or AZ[®] EBR 70/30MIF

Developers

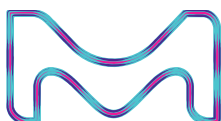
AZ[®] 300MIF, AZ[®] 726MIF, AZ[®] 917MIF

Removers

AZ[®] Kwik Strip, AZ[®] 400T, AZ[®] Remover 880



2.0µm lines and 2.0µm iso trench
 3.5µm thick AZ nLOF 2035
 72mJ/cm² i-line Exposure
 AZ 300 MIF Develop (120s)



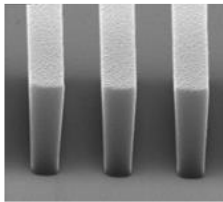
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REFERENCE PROCESS (2.0µm Film Thickness on Si)

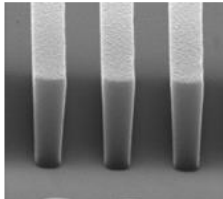
Process Step	Parameters
Prime	HMDS 140°C/60s (vapor)
Coat	2.0µm thick film AZ nLOF 2020 (33cPs) on bare Si
Soft Bake	110C, 60 seconds, direct contact hotplate
Exposure	i-line @ 66mJ/cm ² nominal (0.54NA) Nikon Stepper*
Post Expose Bake	110C*, 60 seconds, direct contact hotplate
Develop	AZ 300MIF, 60s single puddle

* Pattern profiles can be modified by varying exposure dose and PEB temperature. See profile optimization matrix for additional information.

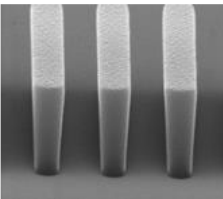
Resolution @ 66mJ/cm²



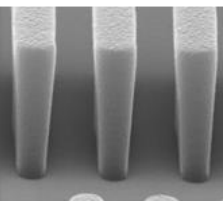
0.95µm



0.85µm

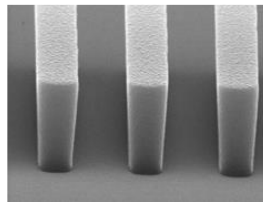


0.80µm

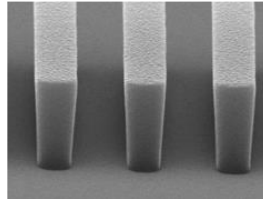


0.70µm

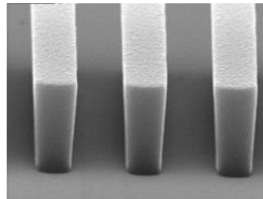
1.0µm Lines Through Dose



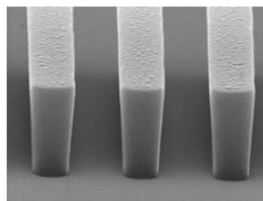
62mJ/cm²



66mJ/cm²

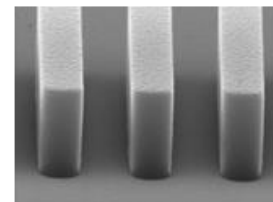


70mJ/cm²

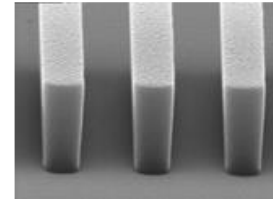


74mJ/cm²

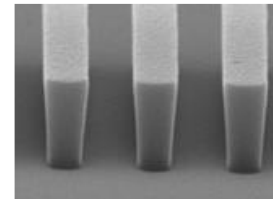
1.0µm Lines DoF @ 66mJ/cm²



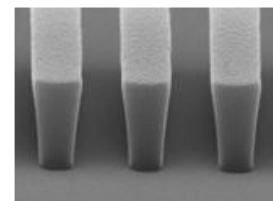
-0.2µm



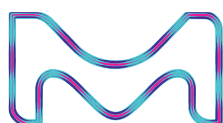
0.2µm



0.6µm



1.0µm



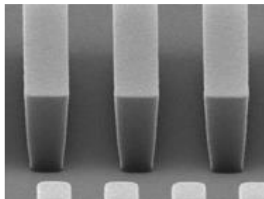
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REFERENCE PROCESS (3.5µm Film Thickness on Si)

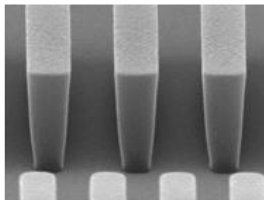
Process Step	Parameters
Prime	HMDS 140°C/60s (vapor)
Coat	3.5µm thick film AZ nLOF 2035 (79cPs) on bare Si
Soft Bake	110C, 60s, direct contact hotplate
Post Bake Delay	None
Expose	i-line @ 80mJ/cm ² nominal (0.548NA) Nikon Stepper*
Post Expose Bake	110C*, 60 seconds, direct contact hotplate
Develop	AZ 300MIF, 120s single puddle

* Pattern profiles can be modified by varying exposure dose and PEB temperature. See profile optimization matrix for additional information.

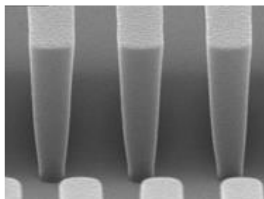
Resolution @ 80mJ/cm²



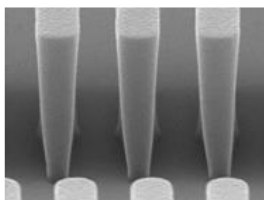
2.00µm



1.50µm

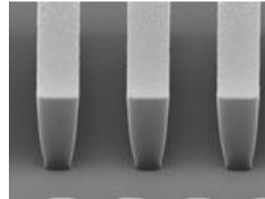


1.10µm

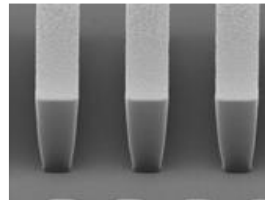


0.90µm

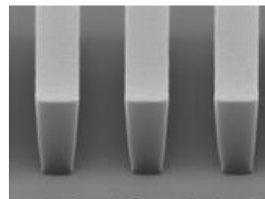
2.0µm Lines Through Dose



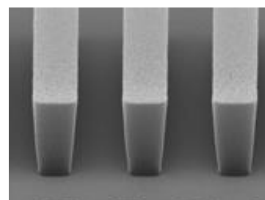
72mJ/cm²



80mJ/cm²

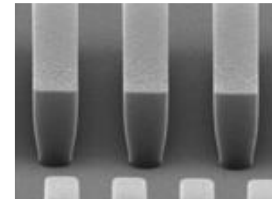


88mJ/cm²

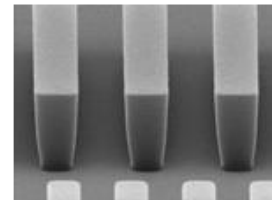


96mJ/cm²

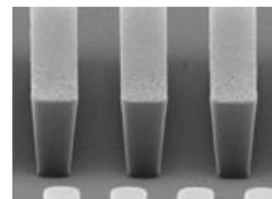
2.0µm Lines DoF @ 80mJ/cm²



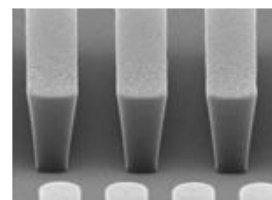
-1.0µm



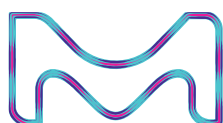
0.0µm



1.0µm



1.8µm

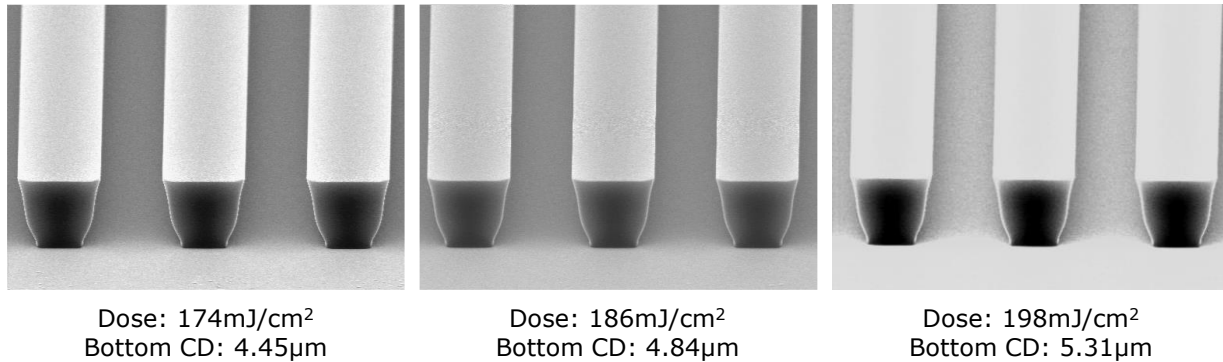


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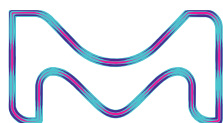
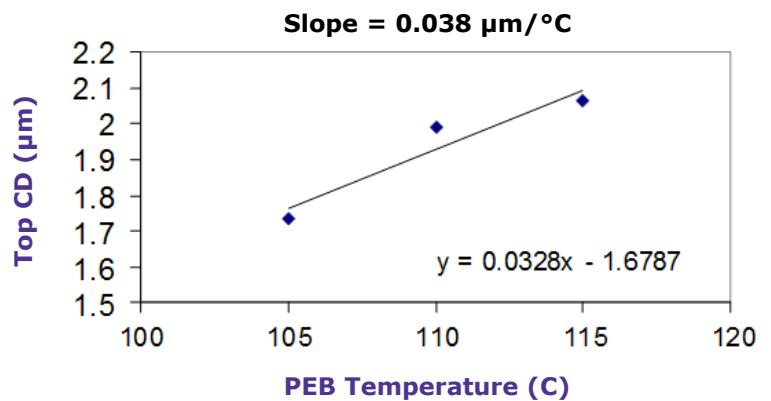
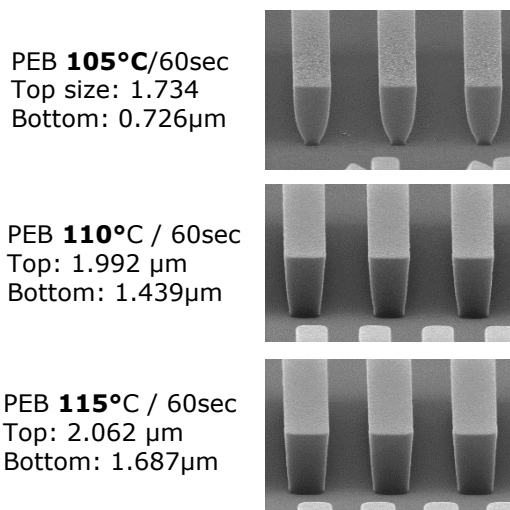
REFERENCE PROCESS (7.0µm Film Thickness on Si)

Process Step	Parameters
Prime	HMDS 140°C/60s (vapor)
Coat	7.0µm thick film AZ nLOF 2070 (330cPs) on bare Si
Soft Bake	110C, 90s, direct contact hotplate
Post Bake Delay	None
Expose	i-line @ various doses (0.54NA) Nikon Stepper
Post Expose Bake	110C, 90 seconds, direct contact hotplate
Develop	AZ 300MIF, 2 x 60 second puddles

BOTTOM CD vs. EXPOSURE DOSE (Mask CD = 7.0µm dense lines)

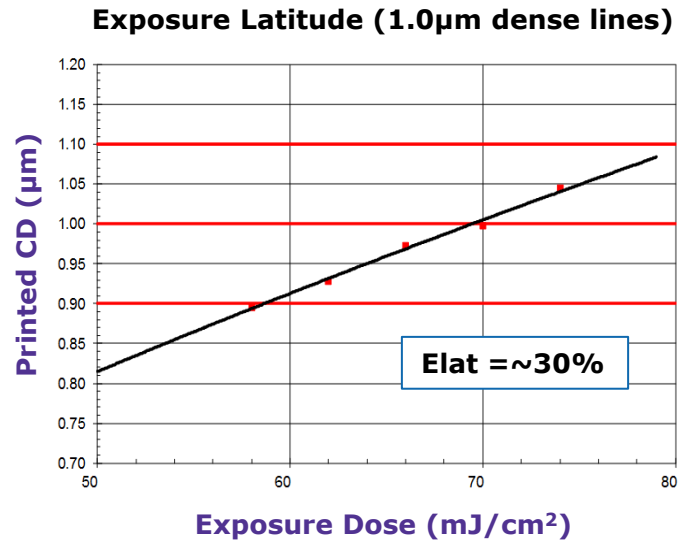
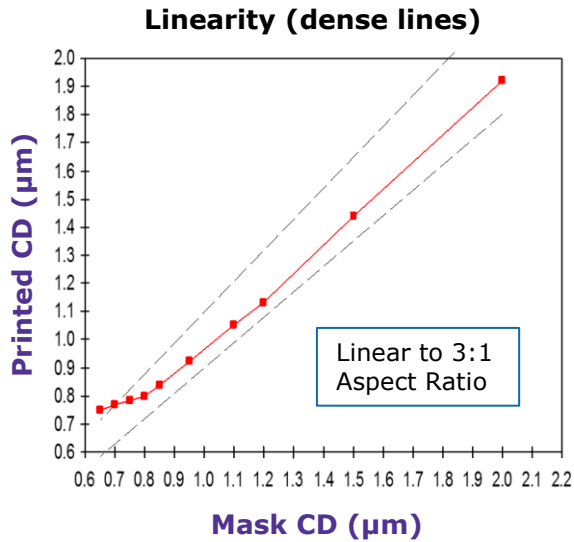


EXAMPLE PEB SENSITIVITY (3.5µm Film Thickness on Si)

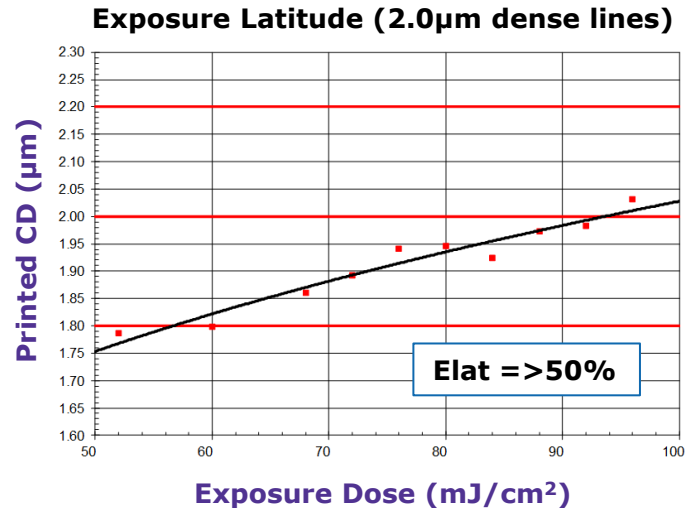
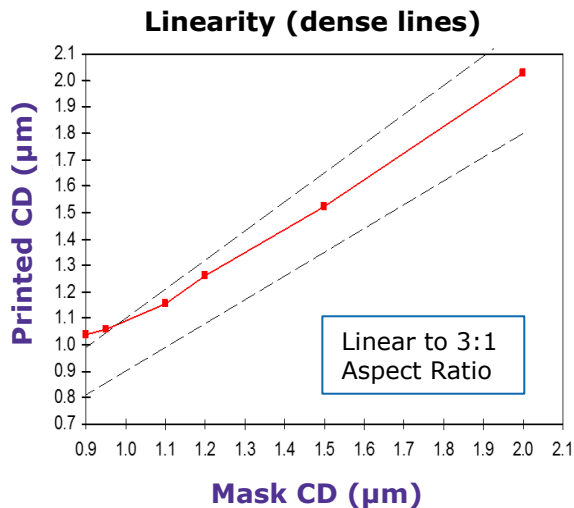


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SAMPLE PROCESS WINDOWS on Si (FT = 2.0 μ m and 3.5 μ m)



Coat: AZ nLOF 2020 @ FT=2.0 μ m
 Soft Bake: 110C/60s
 Expose: Nikon Stepper @ 0.54NA
 Post Expose Bake: 110C/60s
 Develop: AZ 300MIF 60s puddle



Coat: AZ nLOF 2020 @ FT=3.5 μ m
 Soft Bake: 110C/60s
 Expose: Nikon Stepper @ 0.54NA
 Post Expose Bake: 110C/60s
 Develop: AZ 300MIF 120s puddle

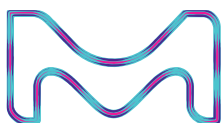
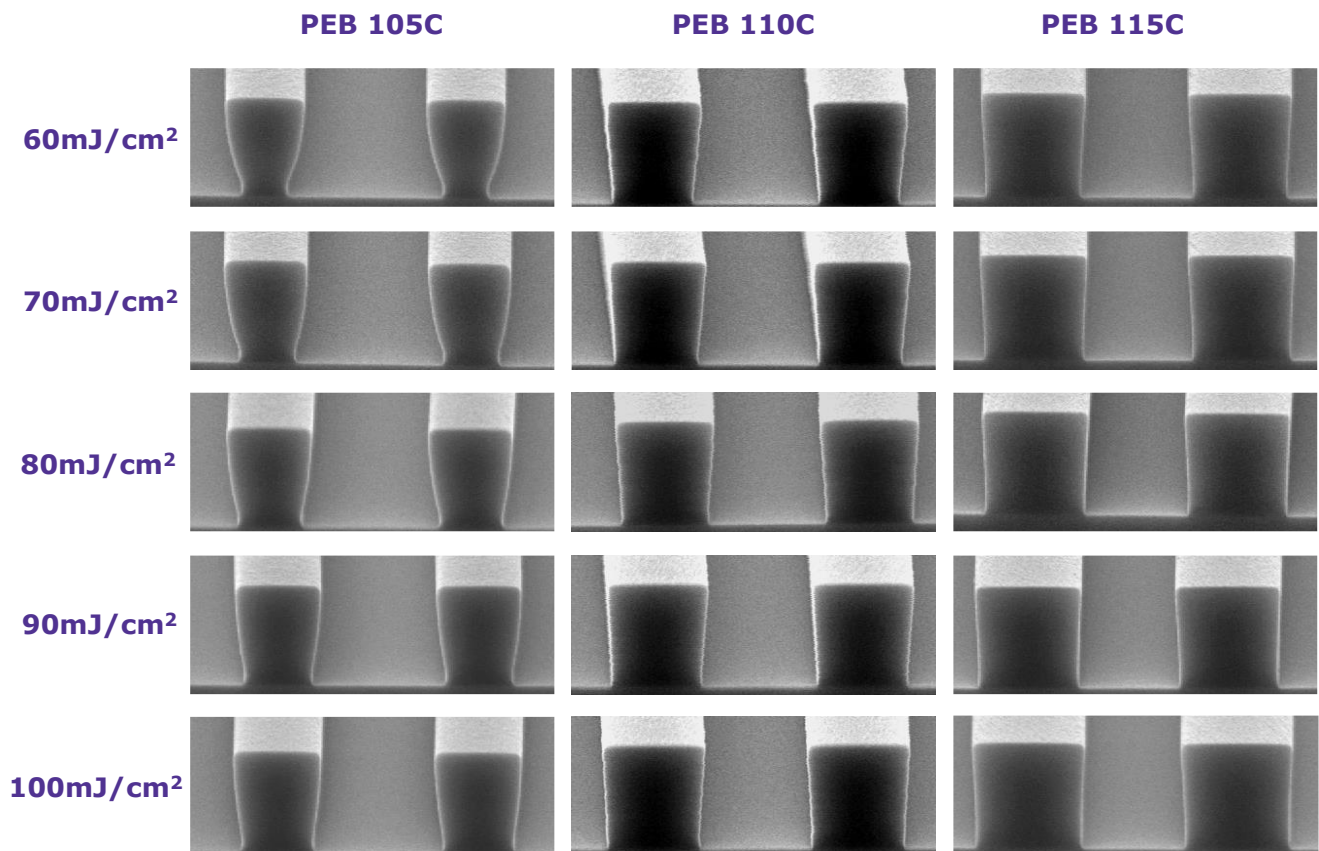


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PROFILE TUNING BY VARYING PEB AND EXPOSURE DOSE

Process Step	Parameters
Prime	HMDS 140°C/60s (vapor)
Coat	2.0µm thick film AZ nLOF 2020 (33cPs) on bare Si
Soft Bake	110C, 60 seconds, direct contact hotplate
Exposure	i-line @ varying dose (0.54NA) Nikon Stepper
Post Expose Bake	Various as indicated
Develop	AZ 300MIF, 60s single puddle

Profile Response to Varying Dose and PEB Temperature



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PROCESS CONSIDERATIONS

SUBSTRATE PREPARATION

Substrates must be clean, dry, and free of organic residues. Oxide forming substrates (Si, etc.) should be HMDS primed prior to coating AZ nLOF 2000. Contact your AZ product representative for detailed information on pre-treating with HMDS.

SOFT BAKE

Soft bake times and temperatures may be application specific. Process optimization is recommended to ensure optimum pattern profiles and stable lithographic and adhesion performance. Soft bake temperatures for AZ nLOF 2000 should be in the 100-110C range. Delays between soft bake and exposure should be minimized for optimum performance.

EXPOSURE

AZ nLOF 2000 requires exposure energy at the 365nm wavelength.

POST EXPOSE BAKE

A PEB is required for proper imaging of AZ nLOF 2000. PEB temperatures and times may be application specific. As a general rule, PEB temperatures should be in the 100 to 115C range. As with any chemically amplified photoresist, CD's in nLOF 2000 will exhibit some dependency on PEB temperature (< 0.04 μ m/ $^{\circ}$ C is typical).

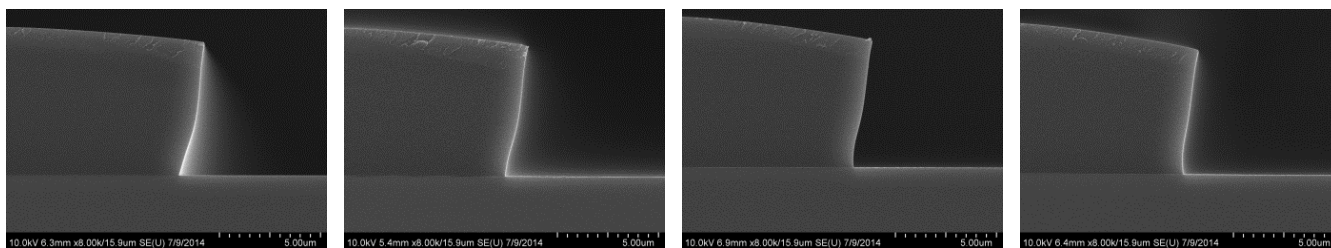
DEVELOPING

AZ nLOF 2000 series photoresists are compatible with industry standard 0.26N (2.38%) TMAH developers. AZ 300MIF is recommended.

HARD BAKE

Hard baking (post develop bake) improves adhesion in wet etch or plating applications and improves pattern stability in dry etch or deposition chambers. AZ nLOF materials are extremely thermally stable and may be hard baked at temperatures above 150C.

HARD BAKE STABILITY FOR LARGE PADS IN AZ nLOF 2070 (7.0 μ m Film Thickness)



115C Hard Bake

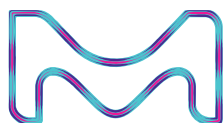
120C Hard Bake

125C Hard Bake

130C Hard Bake

STRIPPING

AZ nLOF 2000 Series resists are compatible with industry standard solvent based removers. AZ 400T or AZ Remover 770 is recommended.



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COMPATIBLE MATERIALS

AZ nLOF 2000 Series materials are compatible with all commercially available lithography processing equipment. Compatible materials of construction include glass, quartz, PTFE, PFA, stainless steel, HDPE, polypropylene, and ceramic. AZ nLOF 2000 series photoresists are not recommended for use on copper substrates.

STORAGE

AZ nLOF 2000 Series materials are combustible liquids. Store in sealed original containers in a well ventilated, dry area away from heat, light, oxidizers, reducers, and sources of ignition. Recommended storage temperature is 30°-55°F.

HANDLING/DISPOSAL

AZ nLOF 2000 Series materials contain PGMEA (1-Methoxy-2-propanol acetate). Refer to the current version of the MSDS and to local regulations for up to date information on safe handling and proper disposal. Wear solvent resistant gloves, protective clothing, and eye/face protection.

AZ nLOF 2000 is compatible with drain lines handling similar organic solvent based materials.

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www.emd-performance-materials.com

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