Technical datasheet

AZ® 12XT-20PL Series

Chemically Amplified Positive Tone Photoresists

APPLICATIONS

Thick chemically amplified photoresists featuring aspect ratios and photospeed not possible with conventional DNQ type materials. These photoresists expose and develop very quickly for improved equipment productivity and reduced chemical usage.

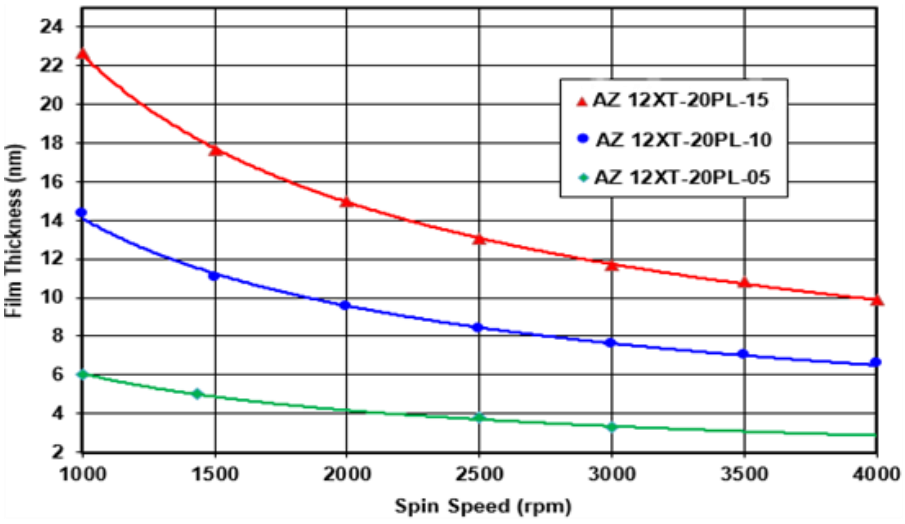
- Excellent environmental stability
- No post bake rehydration delays required
- Single coat thicknesses from 3.0 to >20µm
- Excellent for Through Silicon Via (TSV), plating, and RIE etch applications.

TYPICAL PROCESS

- Soft Bake: 110ºC/120s
- Rehydration Hold: None
- Expose: 365nm sensitive
- Post Expose Bake: 90ºC/60s
- Develop: Puddle, spray or immersion
- Developer Type: MIF

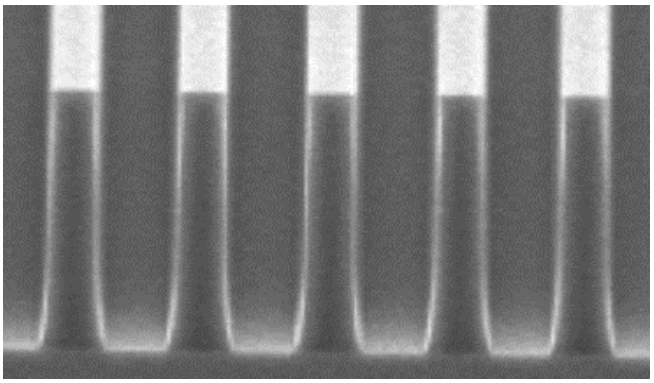
* PEB is required for proper imaging

SPIN CURVES (150MM SILICON)



OPTICAL CONSTANTS*

Cauchy A	1.535
Cauchy B (μm^2)	0.019251
Cauchy C (μm^4)	-0.00112
n @ 633nm	1.5762
k @ 633nm	0.00



2.4µm lines in 10µm thick AZ 12XT
110mJ/cm2 Exposure
AZ 300 MIF Develop (120s)

* Unexposed photoresist film

COMPANION PRODUCTS

THINNING/EDGE BEAD REMOVAL
AZ® EBR Solvent or AZ EBR 70/30

MIF DEVELOPERS
AZ 300MIF

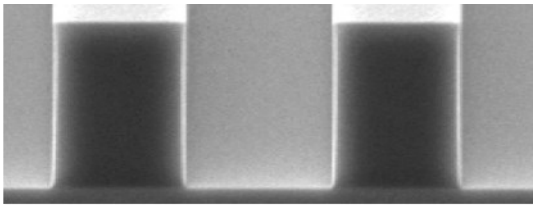
REMOVERS
AZ 300T, AZ 400T

EXAMPLE PROCESS (5µM FILM THICKNESS ON SI)

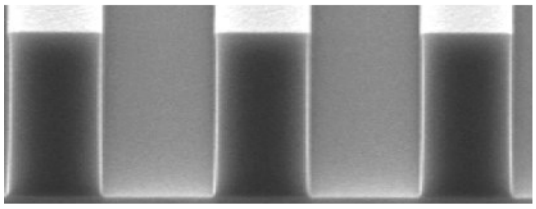
Process Step	Parameters
Prime	HMDS 140°C/60s (vapor)
Coat	5µm thick film on bare Si
Soft Bake	110°C, 120 seconds, direct contact hotplate
Post Bake Delay	None*
Expose	i-line @ 100mJ/cm^2 nominal (0.48NA)
Post Expose Bake	90°C, 60 seconds, direct contact hotplate
Develop	AZ 300MIF, 2 x 30 second puddles

* Thinner films of AZ 12XT may be affected by airborne amines if delays between soft bake and expose are excessive. Coats thinner than 6µm should be exposed and developed within 30-45 minutes after soft bake.

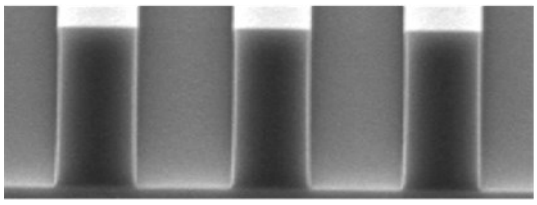
LINEARITY @ 100MJ/CM^2



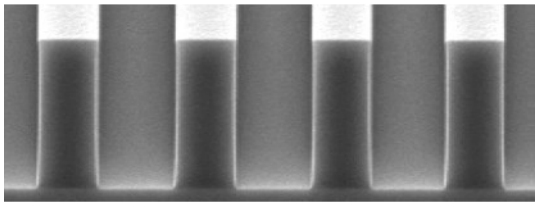
4.0µm



3.0µm

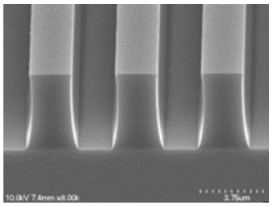


2.0µm

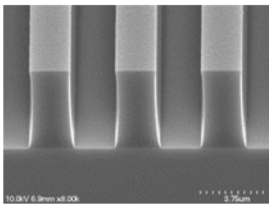


2.2µm

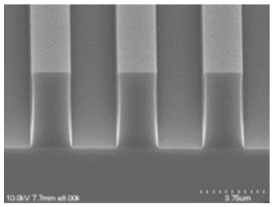
2.6µM LINES THROUGH DOSE



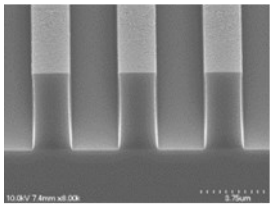
80mJ/cm^2



90mJ/cm^2

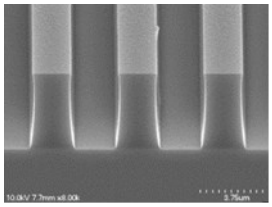


100mJ/cm^2

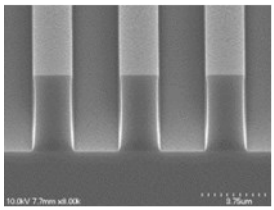


110mJ/cm^2

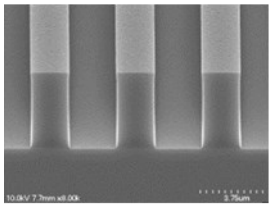
2.6µM LINES DOF @ 100MJ/CM^2



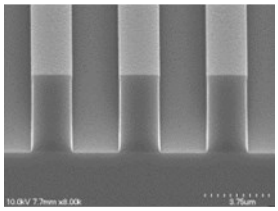
0.0µm



1.0µm



2.0µm



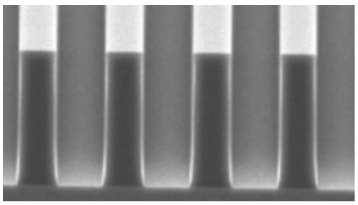
3.0µm

EXAMPLE PROCESS (10µM FILM THICKNESS ON SI)

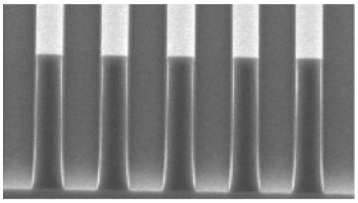
Process Step	Parameters
Prime	HMDS 140°C/60s (vapor)
Coat	10µm thick film on bare Si
Soft Bake	110°C, 180s, direct contact hotplate*
Post Bake Delay	None
Expose	i-line @ 110mJ/cm^2 nominal (0.48NA)
Post Expose Bake	90°C, 60 seconds, direct contact hotplate
Develop	AZ 300MIF, 2 x 60 second puddles

* Thicker films may require a ramped soft bake process to avoid bubble for mation due to rapid outgassing of solvents. Contact your AZ product representative for ultra-thick coat and bake processing guidelines.

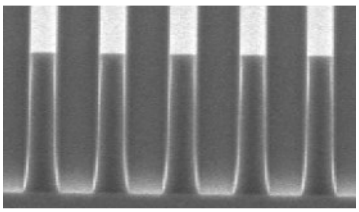
LINEARITY @ 110MJ/CM^2



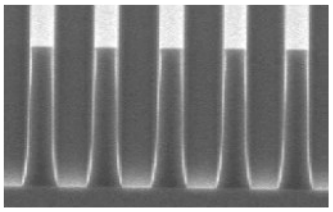
4.0µm



3.0µm

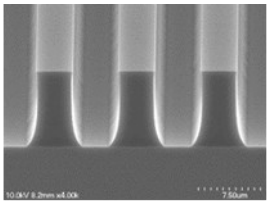


2.4µm

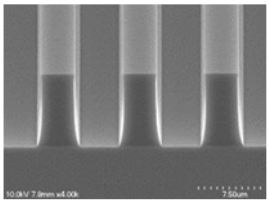


2.2µm

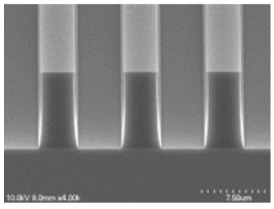
5.0µM LINES THROUGH DOSE



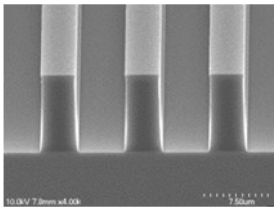
100mJ/cm^2



110mJ/cm^2

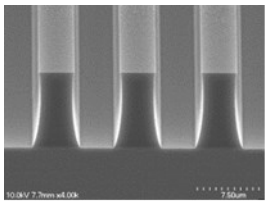


120mJ/cm^2

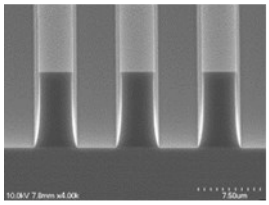


130mJ/cm^2

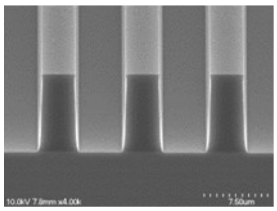
5.0µM LINES DOF @ 110MJ/CM^2



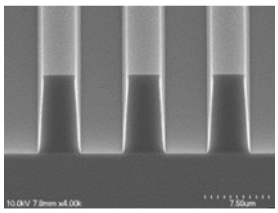
1.0µm



3.0µm



5.0µm



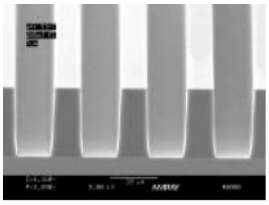
7.0µm

EXAMPLE PROCESS (15µM FILM THICKNESS ON SI)

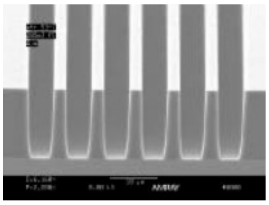
Process Step	Parameters
Prime	HMDS 140°C/60s (vapor)
Coat	15µm thick film on bare Si
Soft Bake	110°C, 240s, direct contact hotplate*
Post Bake Delay	None
Expose	i-line @ 185mJ/cm^2 nominal (0.48NA)
Post Expose Bake	90°C, 60 seconds, direct contact hotplate
Develop	AZ 300MIF, 2 x 60 second puddles

* Thicker films may require a ramped soft bake process to avoid bubble for mation due to rapid outgassing of solvents. Contact your AZ product representative for ultra-thick coat and bake processing guidelines.

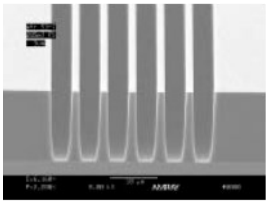
LINEARITY @ 185MJ/CM^2



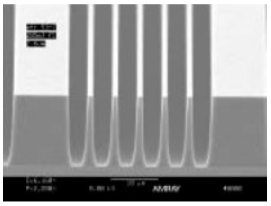
7.0µm



4.0µm

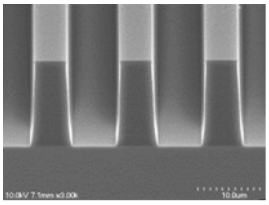


3.0µm

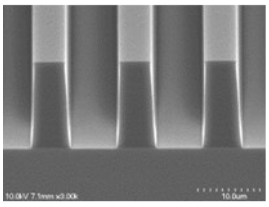


2.6µm

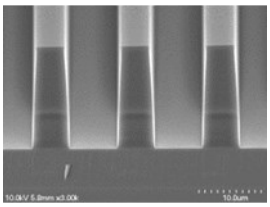
7µM LINES THROUGH DOSE



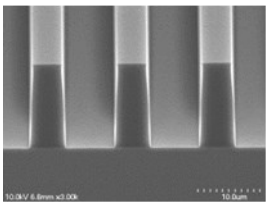
185mJ/cm^2



200mJ/cm^2

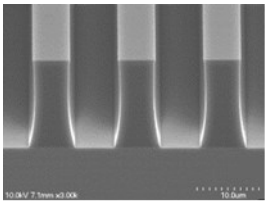


215mJ/cm^2

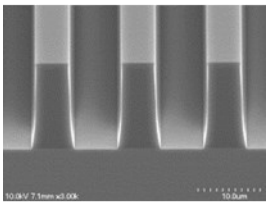


230mJ/cm^2

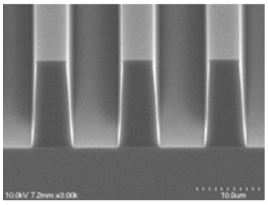
7µM LINES DOF @ 185MJ/CM^2



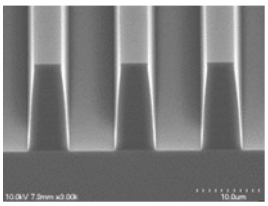
2.0µm



4.0µm

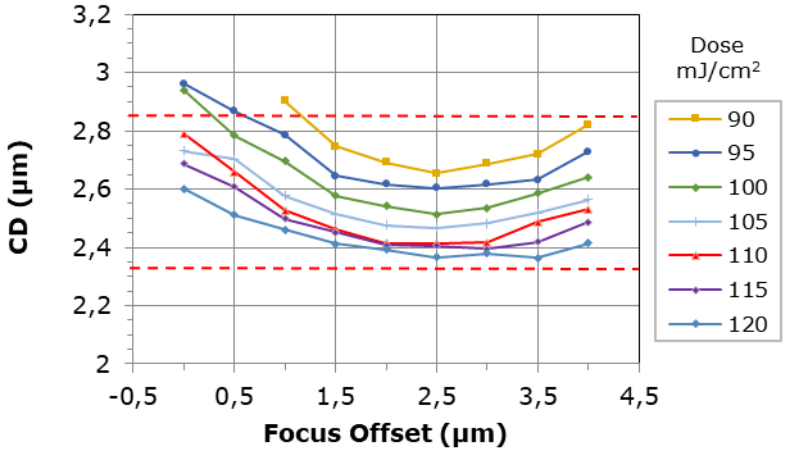


6.0µm

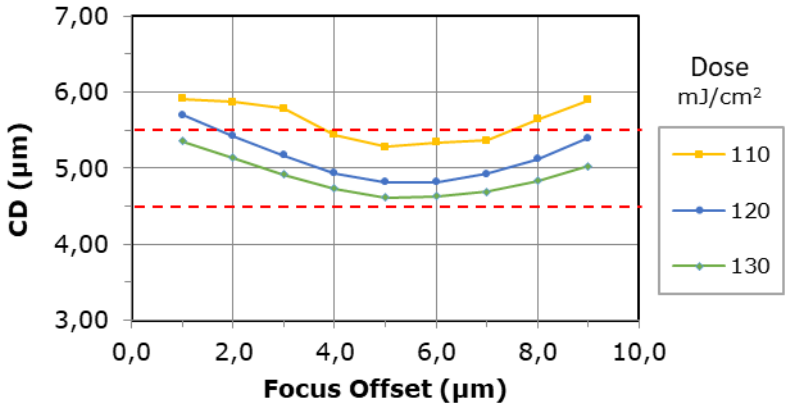


8.0µm

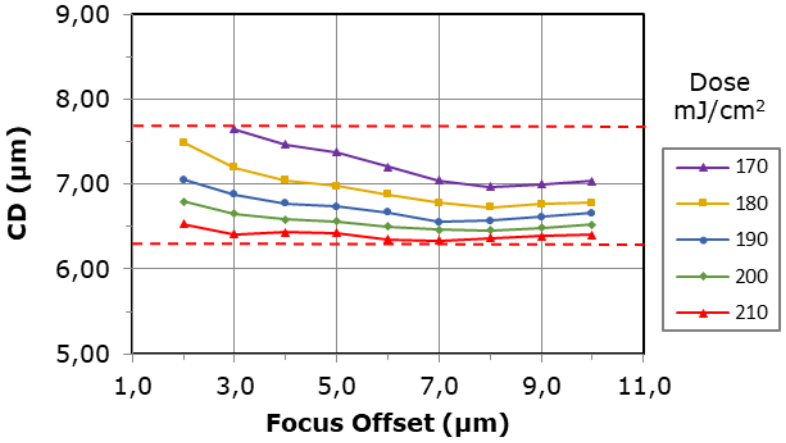
SAMPLE FOCUS/EXPOSURE CURVES ON SI



Mask CD: 2.6µm lines @ 1:1 pitch
Coated thickness: 5.0µm
Soft Bake 110°C/120s
Expose: ASML Stepper @ 0.48NA
Post Expose Bake: 90°C/60s
Develop: AZ 300MIF 2x30s puddles



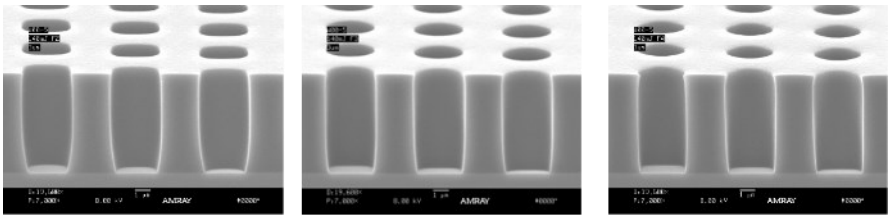
Mask CD: 5.0µm lines @ 1:1 pitch
Coated thickness: 10.0µm
Soft Bake 110°C/180s
Expose: ASML Stepper @ 0.48NA
Post Expose Bake: 90°C/60s
Develop: AZ 300MIF 2x60s puddles



Mask CD: 7.0µm lines @ 1:1 pitch
Coated thickness: 15.0µm
Soft Bake 110°C/240s
Expose: ASML Stepper @ 0.48NA
Post Expose Bake: 90°C/60s
Develop: AZ 300MIF 2x60s puddles

PATTERN PROFILES ON VARIOUS SUBSTRATES

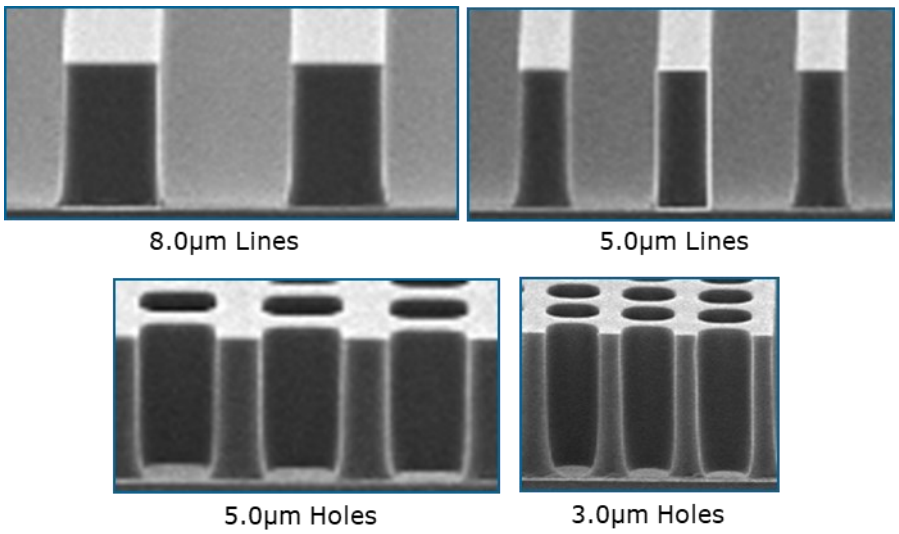
CONTACT HOLES ON SI



Focus = 2.0 | Focus = 3.0 | Focus = 4.0

Mask CD: 3.0µm holes @ 1:1 pitch
Coated thickness: 6.3µm on Si
Soft Bake 110°C/120s
Expose: ASML Stepper @ 0.50NA
Dose: 140mJ/cm2
Post Expose Bake: 90°C/60s
Develop: AZ 300MIF 2x45s puddles

LINES AND HOLES ON CU

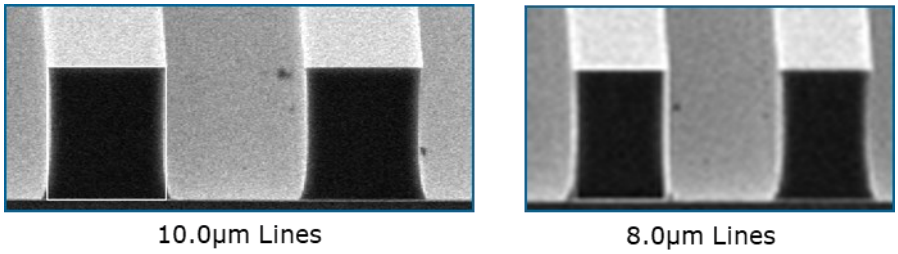


8.0µm Lines | 5.0µm Lines

5.0µm Holes | 3.0µm Holes

Mask CD: As indicated @ 1:1 pitch
Coated thickness: 10.0µm on Cu
Soft Bake 110°C/120s
Expose: ASML Stepper @ 0.50NA
Dose: 250mJ/cm2
Post Expose Bake: 90°C/60s
Develop: AZ 300MIF 2x45s puddles

LINES ON AU



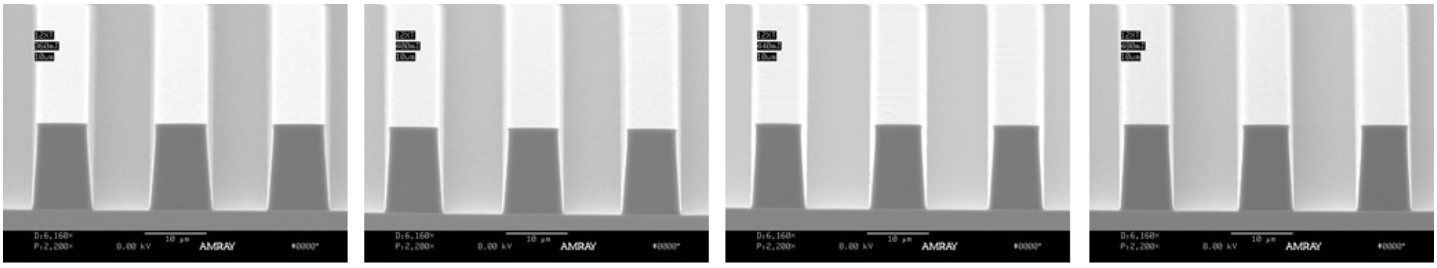
10.0µm Lines | 8.0µm Lines

Mask CD: As indicated @ 1:1 pitch
Coated thickness: 10.0µm on Gold
Soft Bake 110°C/120s
Expose: ASML Stepper @ 0.50NA
Dose: 200mJ/cm2
Post Expose Bake: 90°C/60s
Develop: AZ 300MIF 2x45s puddles

EXAMPLE PROCESS FOR SUSS MICROTEC MA-200 MASK ALIGNER

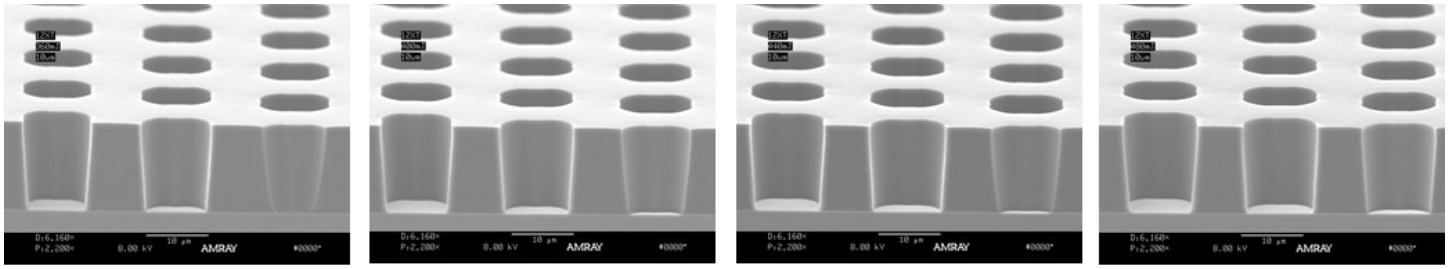
Process Step	Parameters
Prime	HMDS 140°C/60s (vapor)
Coat	10µm thick film on bare Si
Soft Bake	110°C, 180s, direct contact hotplate*
Post Bake Delay	None
Expose	i-line @ 110mJ/cm^2 nominal (0.48NA)
Post Expose Bake	90°C, 60 seconds, direct contact hotplate
Develop	AZ 300MIF, 2 x 60 second puddles

10µM LINES THROUGH DOSE



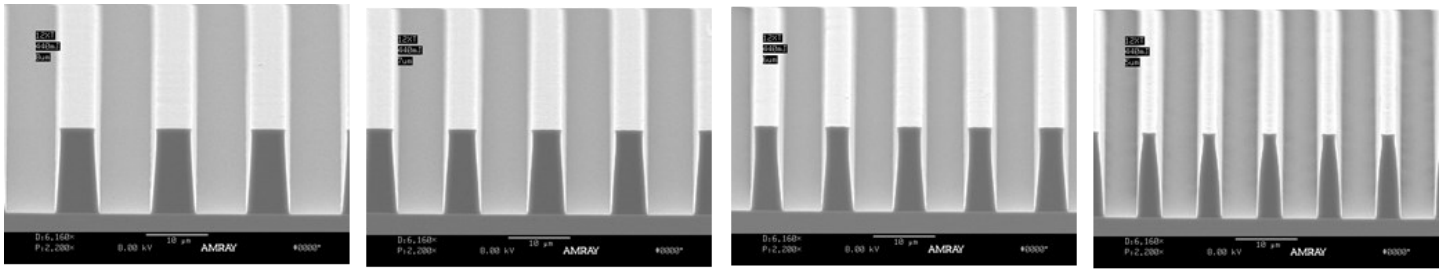
360 mJ/cm^2 400 mJ/cm^2 440 mJ/cm^2 480 mJ/cm^2

10µM HOLES THROUGH DOSE



360 mJ/cm^2 400 mJ/cm^2 440 mJ/cm^2 480 mJ/cm^2

RESOLUTION @ 440 MJ/CM^2



8.0 µm 7.0 µm 6.0 µm 5.0 µm

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 12XT. Contact your 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 12XT should be in the 95°-110°C range. Delays between soft bake and exposure should be minimized for optimum 12XT performance.

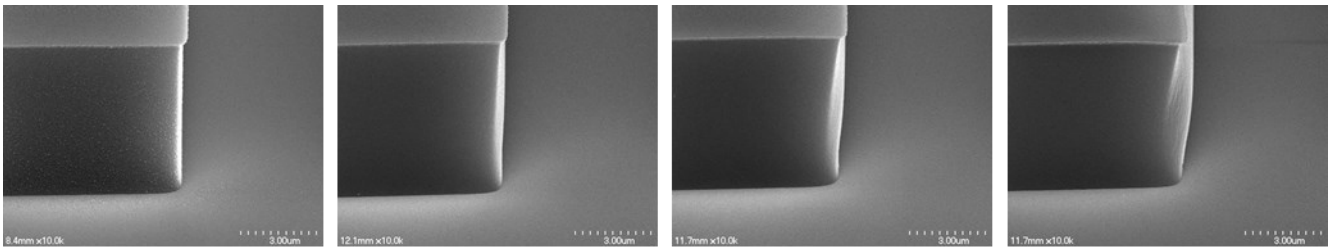
EXPOSURE
AZ 12XT requires exposure energy at the 365nm wavelength.

POST EXPOSE BAKE
A PEB is required for proper imaging of AZ 12XT. PEB temperatures and times may be application specific. As a general rule, PEB temperatures should be in the 90° to 100°C range.

DEVELOPING
AZ 12XT 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 processes. Hard bake temperatures should be in the 100° to 115°C range to ensure minimal thermal distortion of the pattern.

HARD BAKE STABILITY FOR 10µM LINES (6.5µM FILM THICKNESS)



No Hard Bake | 105°C Hard Bake | 110°C Hard Bake | 115°C Hard Bake

STRIPPING
AZ 12XT Series resists are compatible with industry standard solvent based removers. AZ Kwik Strip, AZ 300T, or AZ 400T is recommended.

COMPATIBLE MATERIALS

AZ 12XT 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.

HANDLING/DISPOSAL

AZ 12XT 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 12XT is compatible with drain lines handling similar organic solvent based materials.

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