Technical datasheet

AZ® MiR™ 701 Series

Positive Tone Photoresist

APPLICATION

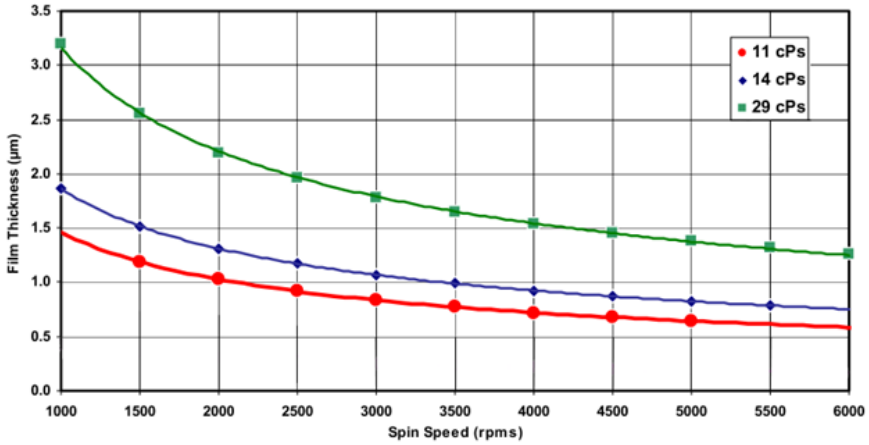
General purpose high resolution photoresist for 0.5µm and 0.35µm technology nodes. Excellent process latitude for both line/space and contact hole applications.

- TARC and BARC compatible
- TMAH developer compatible
- Safe solvent
- Spin coated thickness from 0.6 to 2.5µm
- Dyed and un-dyed versions available

TYPICAL PROCESS

- Soft Bake: 90°C/60-90s
- Expose: 365nm sensitive
- Post Expose Bake: 110°C/60-90s
- Develop: 60s Puddle or immersion Developer type: MIF
- Substrate: Si, SiO2, SiN, BARC

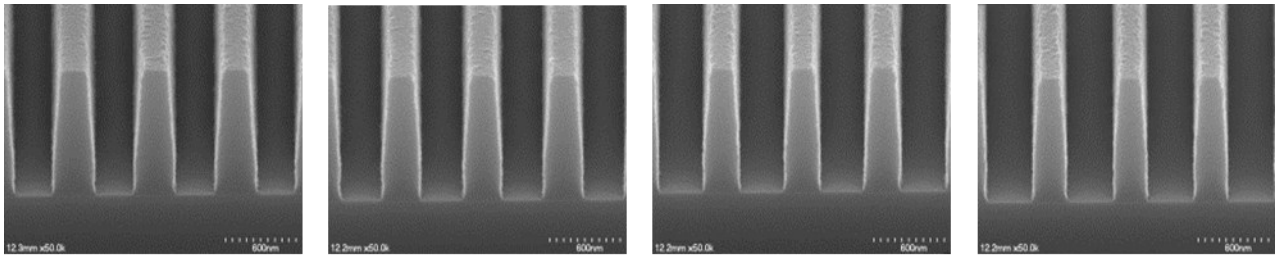
SPIN CURVES (150mm Wafers)



EXAMPLE PROCESS (0.35µm Lines/Space Pattern)

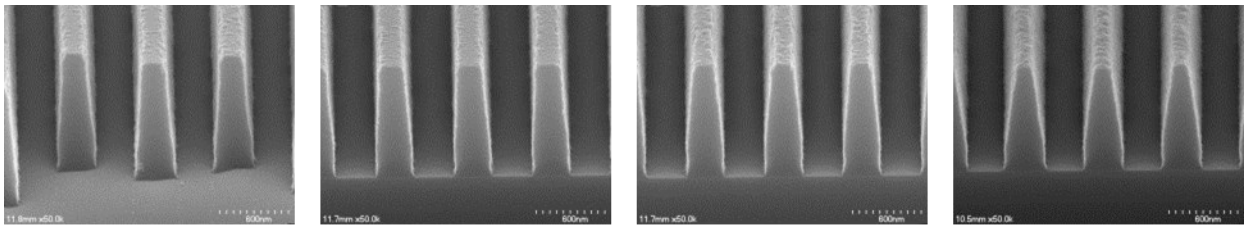
Process Step	Parameters
Coat	AZ® MiR™ 701 14cps, 1.08µm thick film on Si
Soft Bake	90°C, 90 seconds, direct contact hotplate
Expose	ASML /250 i-line stepper @ 220mJ/cm^2 nominal, 0.56NA, 0.75σ
Post Expose Bake	110°C, 90 seconds
Develop	AZ 300MIF, 60 second single puddle

EXPOSURE LATITUDE

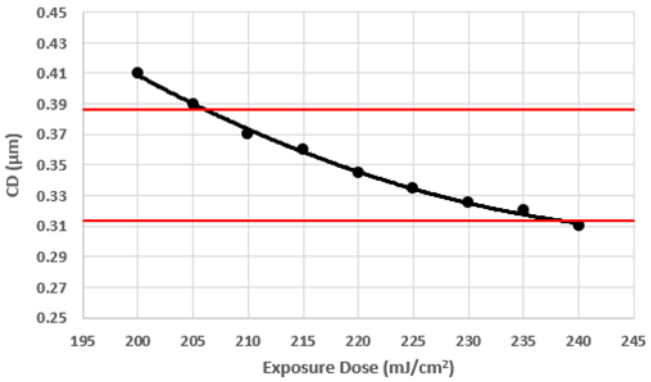


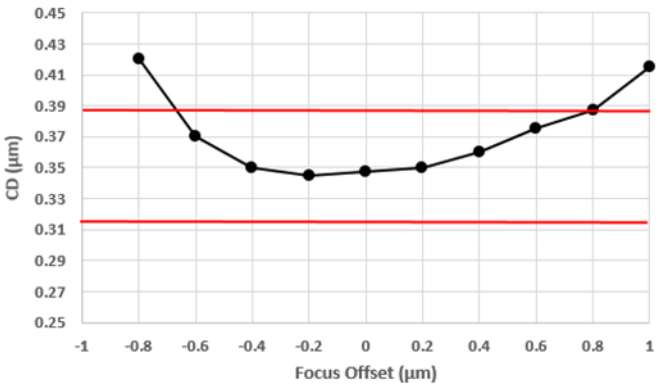
205mJ/cm^2 215mJ/cm^2 225mJ/cm^2 235mJ/cm^2

FOCUS LATITUDE (@ 220mJ/cm^2)



-0.8µm -0.4 µm +0.4µm +0.8µm

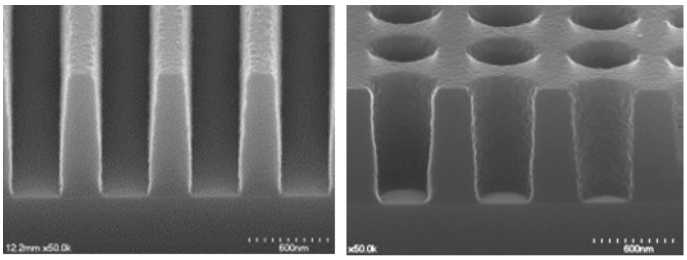




OPTICAL/MODELLING CONSTANTS*

Cauchy A	1.6104
Cauchy B (μm^2)	0.00505
Cauchy C (μm^4)	0.00171
n @ 633nm	1.63365
k @ 633nm	0
Dill A (μm^{-1})	0.7090
Dill B (μm^{-1})	0.0342
Dill C (cm^2/mJ)	0.0220

* Unexposed photoresist film



AZ® MiR 701 Photoresist
0.35µm lines and 0.40µm contact holes in 1.08µm film
AZ Aquatar TARC
AZ® 300 MIF Develop (60s)

COMPANION PRODUCTS

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

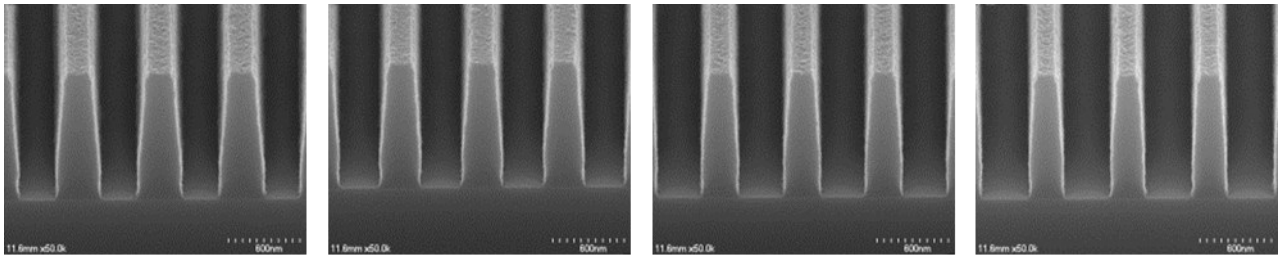
DEVELOPERS
AZ 300MIF, 726MIF, AZ 917MIF

ANTIREFLECTIVE COATINGS
AZ Aquatar™ Coating, AZ BARLi II™

EXAMPLE PROCESS (0.35µm Lines/Space Pattern with AZ Aquatar™ Coating)

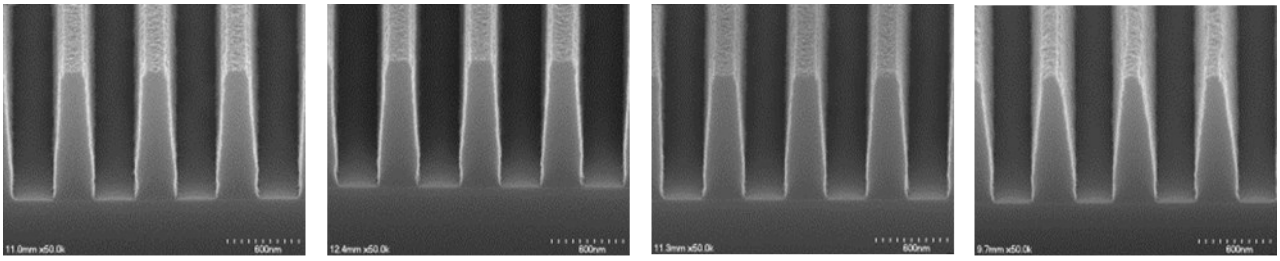
Process Step	Parameters
Coat	AZ MiR™ 701 14cps, 1.08µm thick film on Si
Soft Bake	90°C, 90 seconds, direct contact hotplate
Coat	65nm AZ Aquatar Coating
Expose	ASML /250 i-line stepper @ 180mJ/cm^2 nominal, 0.56NA, 0.75σ
Post Expose Bake	110°C, 90 seconds
Develop	AZ 300MIF, 60 second single puddle

EXPOSURE LATITUDE

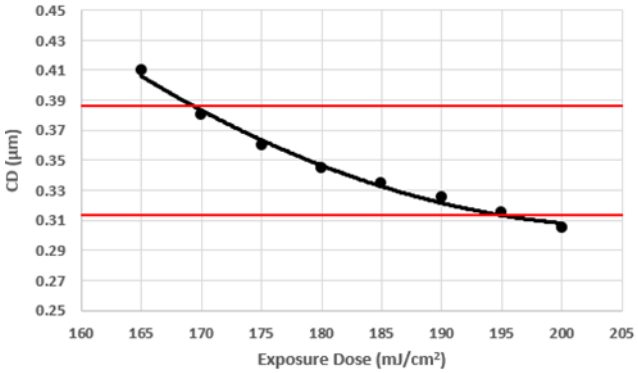


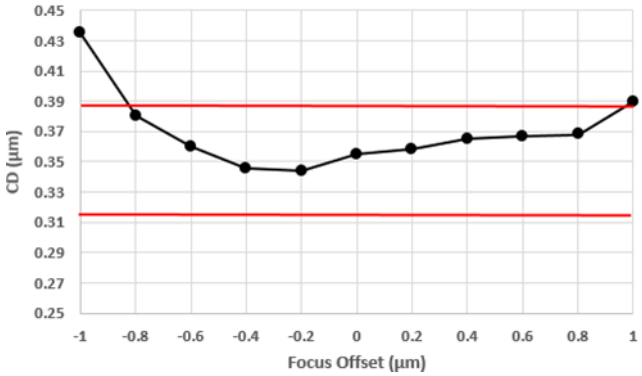
165mJ/cm^2 175mJ/cm^2 185mJ/cm^2 195mJ/cm^2

FOCUS LATITUDE



-0.8µm -0.4 µm +0.4µm +0.8µm

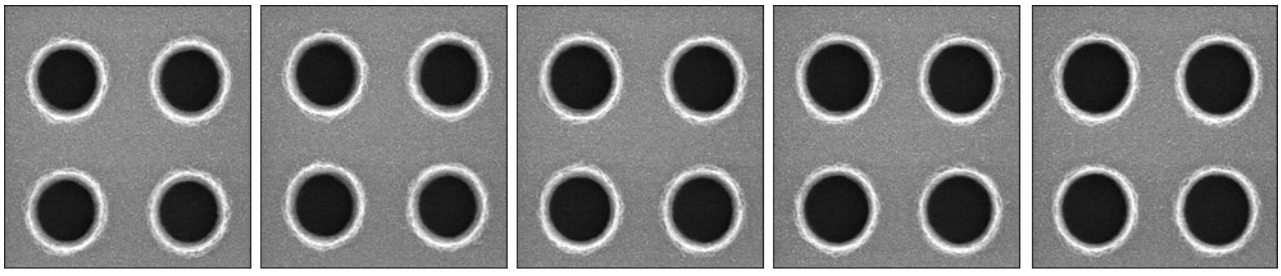




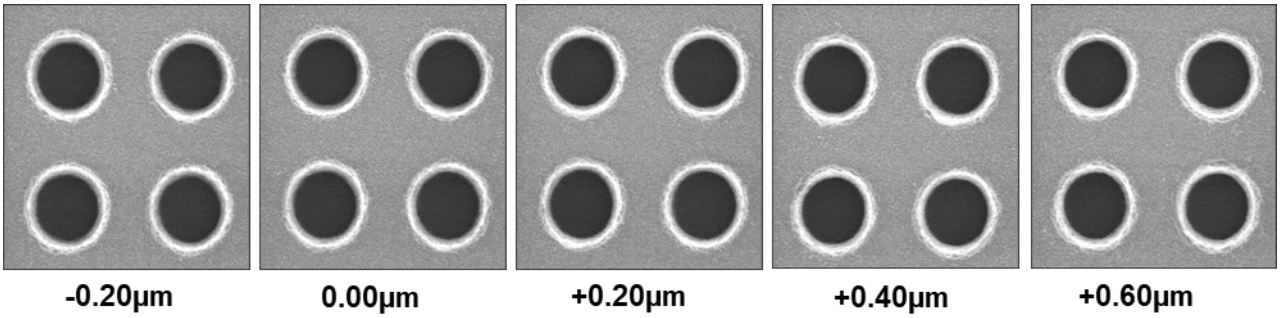
EXAMPLE PROCESS (0.50µm Contact Hole Pattern)

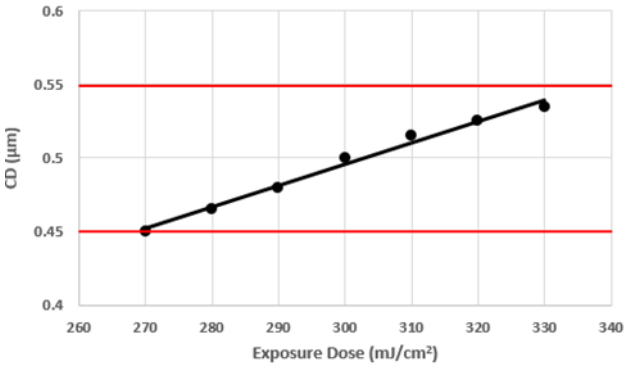
Process Step	Parameters
Coat	AZ MiR™ 701 14cps, 1.08µm thick film on Si
Soft Bake	90°C, 90 seconds, direct contact hotplate
Expose	ASML /250 i-line stepper @ 300mJ/cm^2 nominal, 0.56NA, 0.75σ
Post Expose Bake	110°C, 90 seconds
Develop	AZ 300MIF, 60 second single puddle

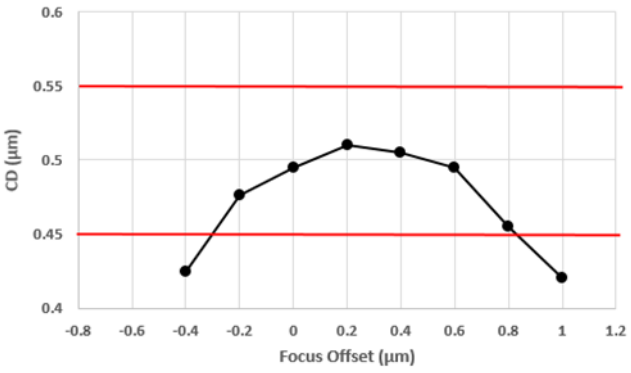
EXPOSURE LATITUDE



FOCUS LATITUDE



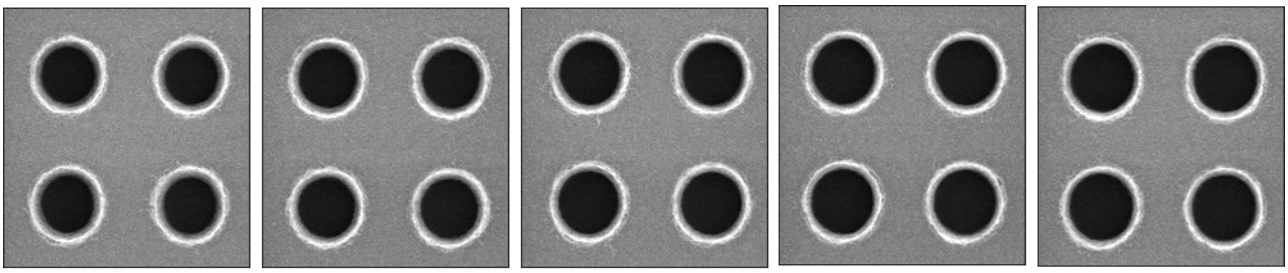




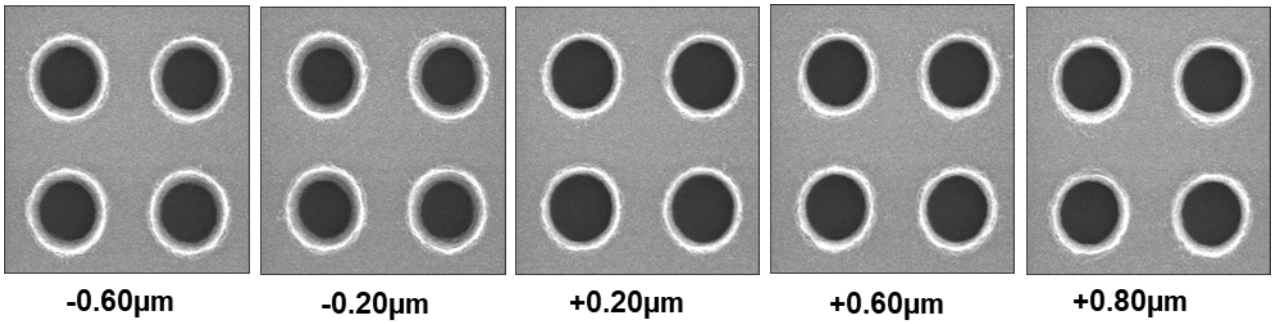
EXAMPLE PROCESS (0.50µm Contact Hole Pattern with AZ Aquatar™ Coating)

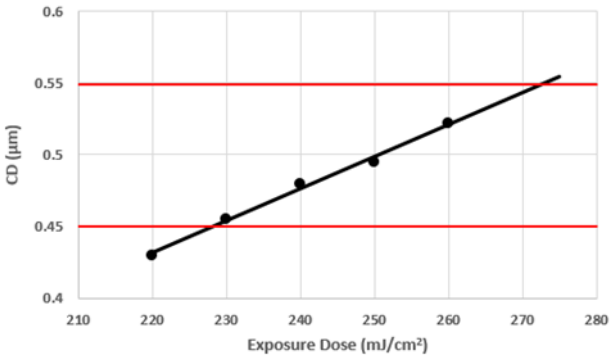
Process Step	Parameters
Coat	AZ® MiR™ 701 14cps, 1.08µm thick film on Si
Soft Bake	90°C, 90 seconds, direct contact hotplate
Expose	ASML /250 i-line stepper @ 300mJ/cm^2 nominal, 0.56NA, 0.75σ
Post Expose Bake	110°C, 90 seconds
Develop	AZ 300MIF, 60 second single puddle

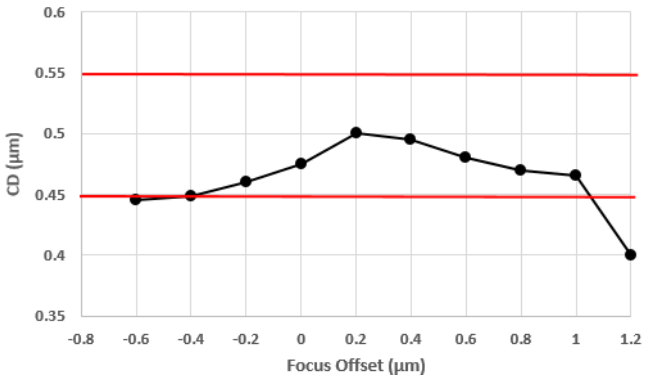
EXPOSURE LATITUDE



FOCUS LATITUDE

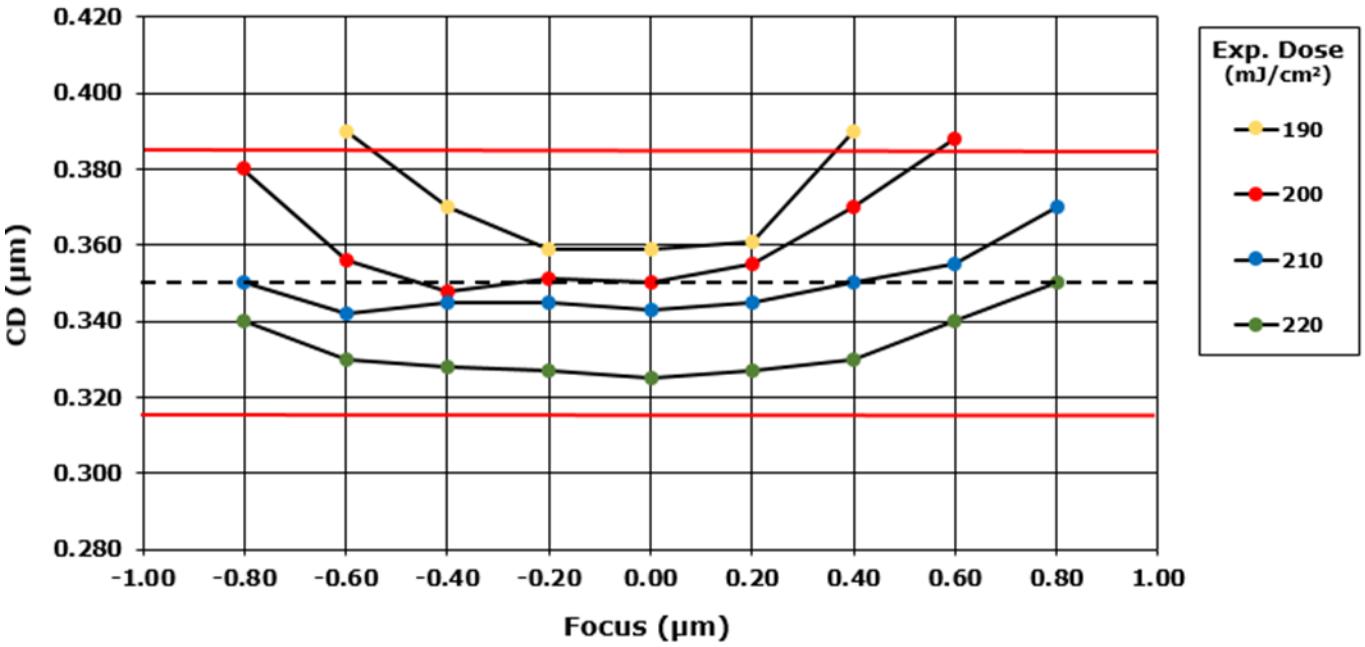




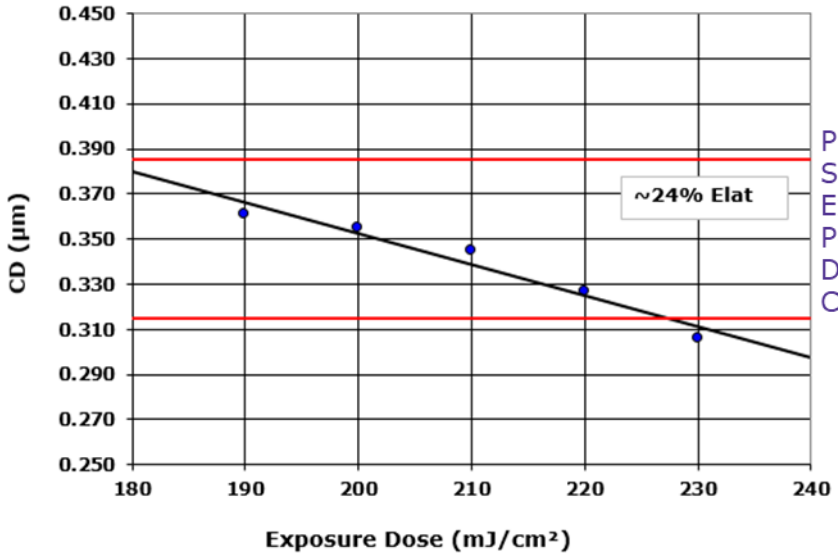


EXAMPLE PROCESS WINDOWS

FOCUS/EXPOSURE CURVES (Bossung Plots for 0.35µm Dense Lines)



EXPOSURE LATITUDE

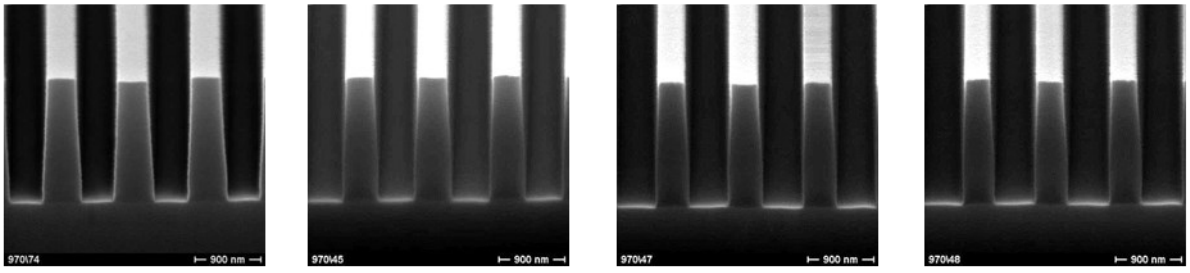


Photoresist Film Thickness: 0.97µm (Emax)
Soft Bake: 90C, 60s
Expose: ASML i-line stepper, 0.57NA
Post Expose Bake: 110C, 60s
Develop: AZ 300MIF, 60s single puddle
CD: 0.35µm dense lines (pitch 1:1)

REFERENCE PROCESS (0.50µm Line/Space Pattern 1.73µm Thick Film

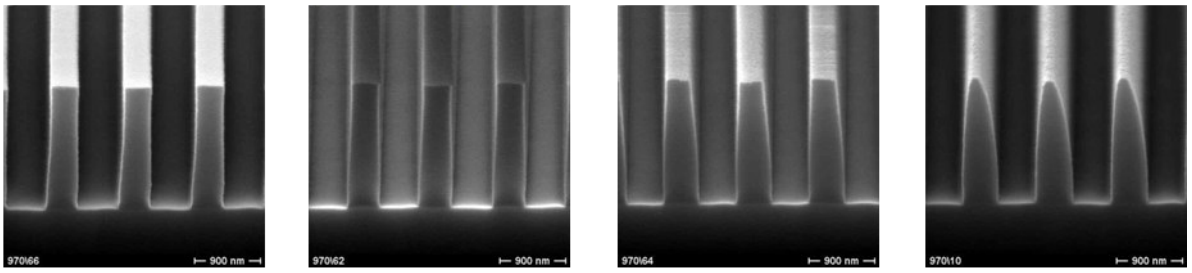
Process Step	Parameters
Coat	AZ MiR 701 29cps, 1.73µm thick film on Si
Soft Bake	90°C, 60 seconds, hotplate
Expose	Nikon i-line stepper @ 210mJ/cm^2 nominal, 0.54NA, 0.6σ
Post Expose Bake	110°C, 90 seconds
Develop	AZ 626MIF, 60 second single puddle

EXPOSURE LATITUDE

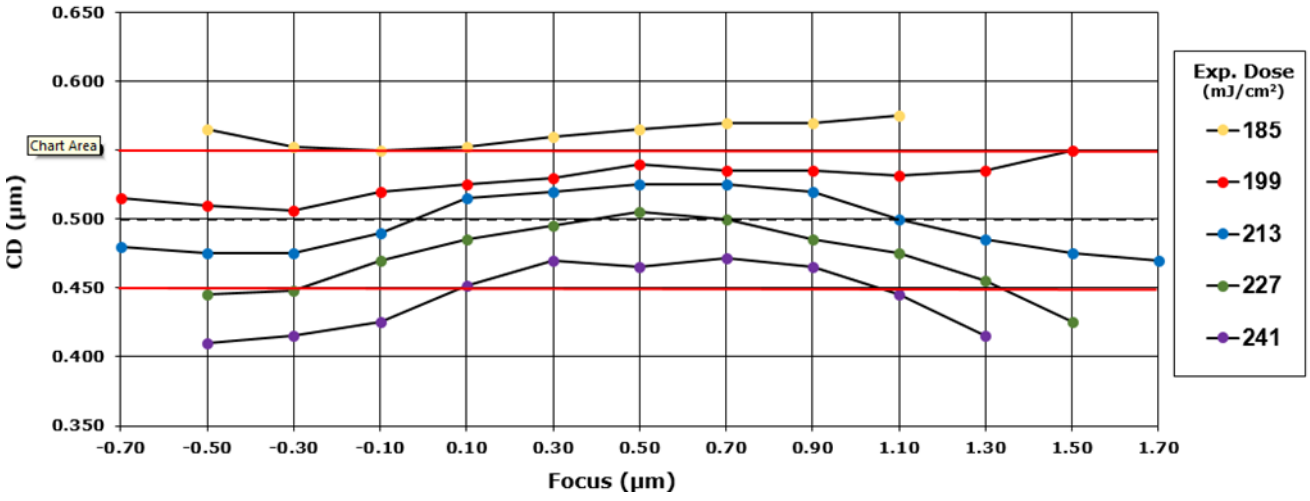


185mJ/cm^2 199mJ/cm^2 213mJ/cm^2 227mJ/cm^2

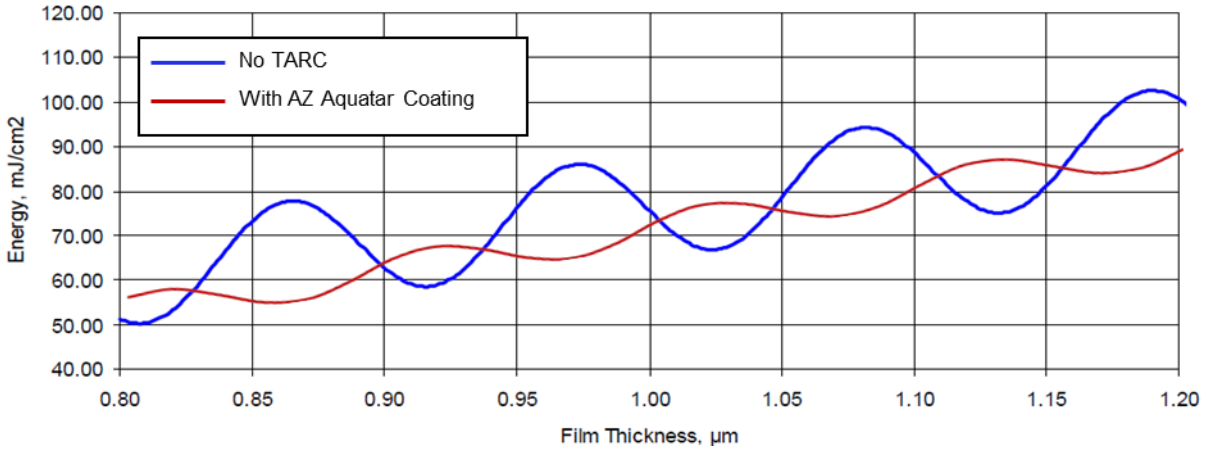
FOCUS LATITUDE @ 213 mJ/cm^2



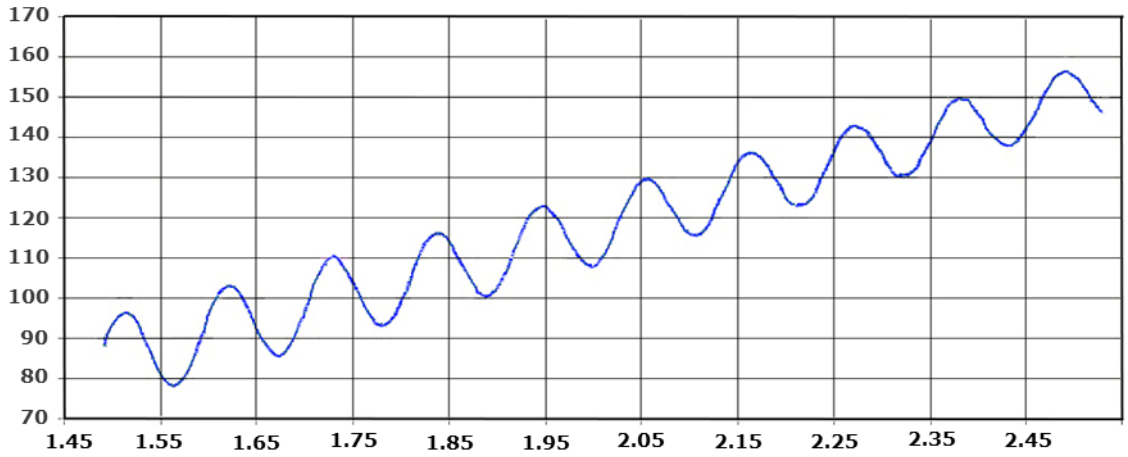
-0.90µm -0.30µm +0.10µm +0.50µm



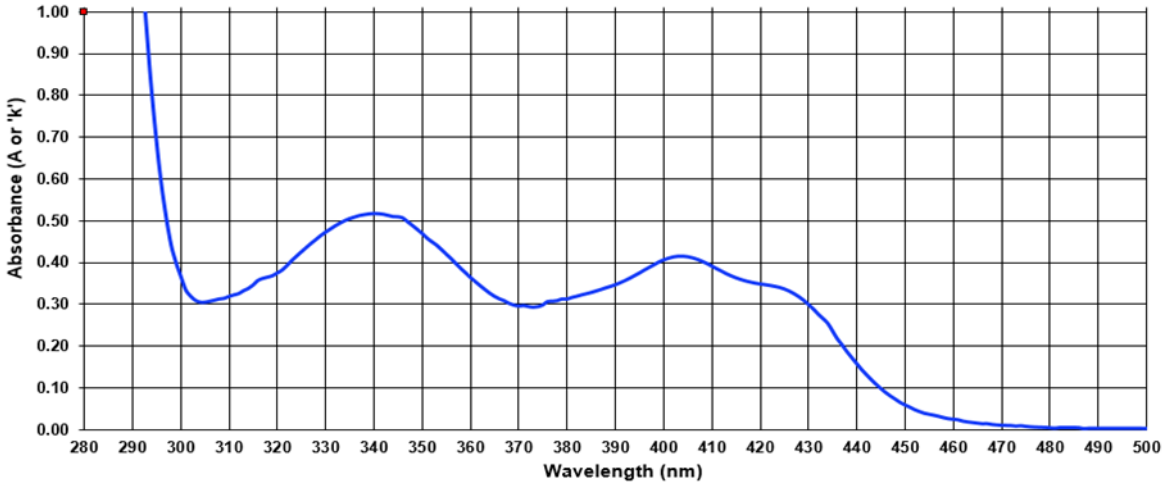
DOSE TO CLEAR SWING CURVE IN AZ 300MIF DEVELOPER



DOSE TO CLEAR SWING CURVE IN AZ 626MIF DEVELOPER



ABSORBANCE (Normalized to 1/µm, ellipsometric)



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 MiR™ 701. 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 stable lithographic and adhesion performance. Soft bake temperatures for AZ MiR 701 should be in the 90°-100°C range. Temperatures towards the high end of this range will improve adhesion to metals.

EXPOSURE

AZ MiR™ 701 is sensitive to exposure wavelengths between 310 and 450nm. 365nm is recommended.

ANTI-REFLECTIVE COATINGS

Top Anti-Reflective Coatings (TARCs) such as AZ Aquatar™ Coating will improve photospeed and within die CD uniformity of printed features. TARCs may also reduce pattern defect density by improving developer wettability. This effect is most pronounced on contact hole layers where CD's are below 0.70µm. For line/space patterns below 0.5µm, a Bottom Anti-Reflective Coating (BARC) such as AZ BARLi II™ may be required to improve CD uniformity and control reflective notching of pattern features.

POST EXPOSE BAKE

A PEB should be employed to maximize process latitudes and to mitigate standing wave effects cause by monochromatic exposure. PEB temperatures should be in the 110° to 115°C range.

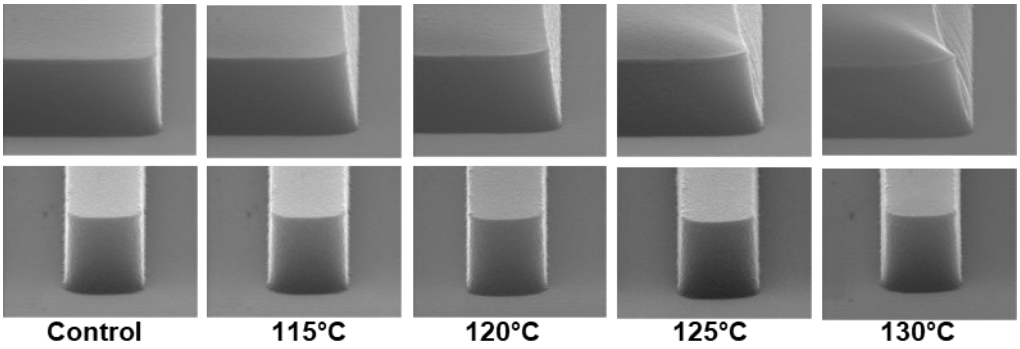
DEVELOPING

AZ MiR™ 701 series photoresists are compatible with industry standard 0.26N (2.38%) TMAH developers. AZ 300MIF or AZ 726MIF 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 110° to 120°C range to ensure minimal thermal distortion of the pattern.

Thermal Stability of large pad and 1.0µm line



COMPATIBLE MATERIALS

AZ MiR™ 701 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 MiR™ 701 Series materials contain Ethyl lactate and n-Butyl acetate solvents. 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 MiR™ 701 is compatible with drain lines handling similar organic solvent based materials.

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