

# technical datasheet

## AZ<sup>®</sup> MiR<sup>™</sup> 701 Series

### Positive Tone Photoresists

#### APPLICATION

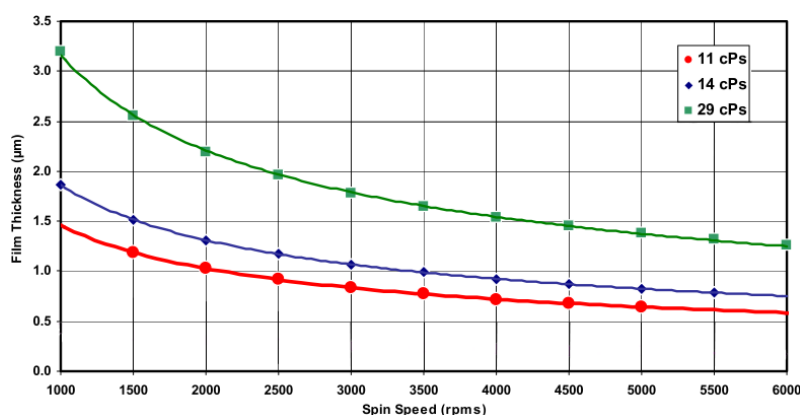
General purpose high resolution photoresist for 0.5 $\mu$ m and 0.35 $\mu$ m technology nodes. Excellent process latitude for both line/space and contact hole applications.

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

#### TYPICAL PROCESS

Soft Bake: 90C/60-90s  
Expose: 365nm sensitive  
Post Expose Bake: 110C/60-90s  
Develop: 60s Puddle or immersion Developer type: MIF  
Substrate: Si, SiO<sub>2</sub>, SiN, BARC

#### SPIN CURVES (150mm wafers)



#### OPTICAL/MODELLING CONSTANTS\*

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

\* Unexposed photoresist film

#### COMPANION PRODUCTS

##### Edge Bead Removal

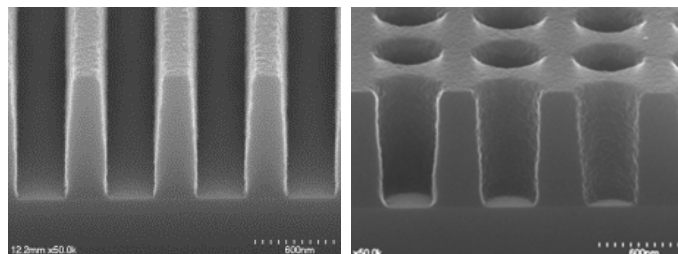
AZ<sup>®</sup> EBR Solvent or AZ<sup>®</sup> EBR 70/30

##### Developers

AZ<sup>®</sup> 300MIF, 726MIF, 917MIF

##### Antireflective Coatings

AZ<sup>®</sup> Aquatar<sup>™</sup> Coating, AZ<sup>®</sup> BARLi II



AZ<sup>®</sup> MiR 701 Photoresist  
0.35 $\mu$ m lines and 0.40 $\mu$ m contact holes in 1.08 $\mu$ m film  
AZ Aquatar TARC  
AZ<sup>®</sup> 300 MIF Develop (60s)

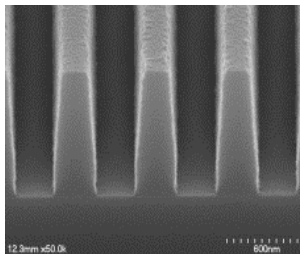


# AZ<sup>®</sup> MiR<sup>™</sup> 701 Series

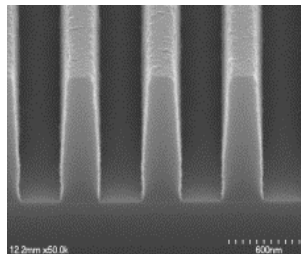
## EXAMPLE PROCESS (0.35µm Line/Space Pattern)

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

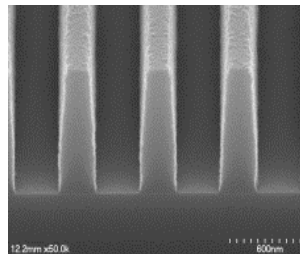
## EXPOSURE LATITUDE



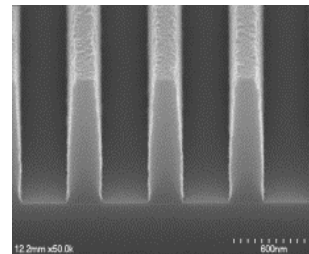
205mJ/cm<sup>2</sup>



215mJ/cm<sup>2</sup>

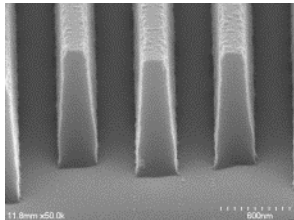


225mJ/cm<sup>2</sup>

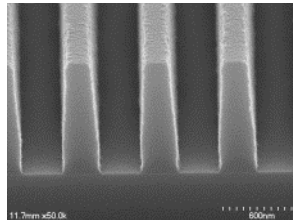


235mJ/cm<sup>2</sup>

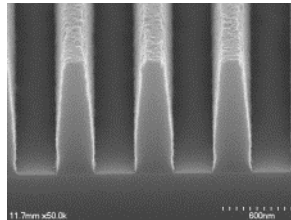
## FOCUS LATITUDE (@ 220mJ/cm<sup>2</sup>)



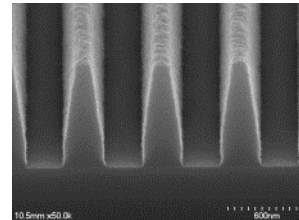
-0.8µm



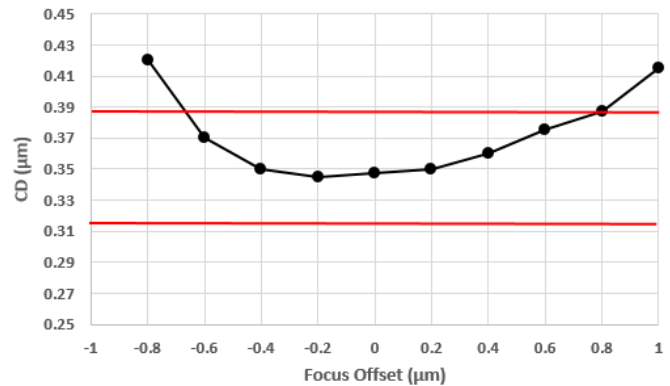
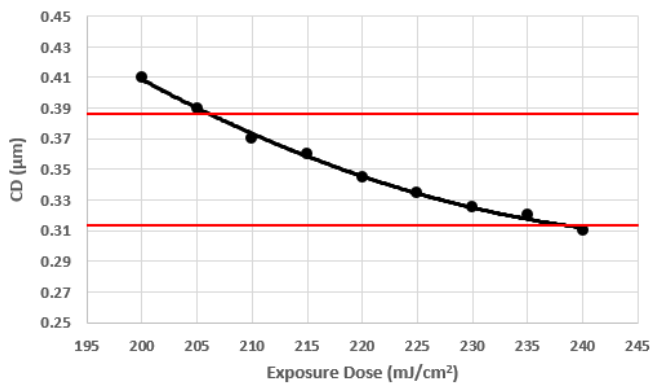
-0.4 µm



+0.4µm



+0.8µm

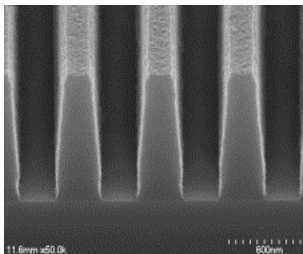


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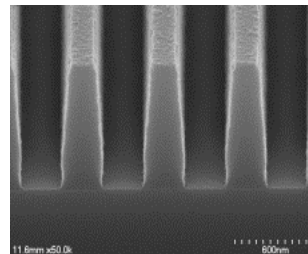
EXAMPLE PROCESS (0.35μm line/space pattern with AZ<sup>®</sup> Aquatar Coating)

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

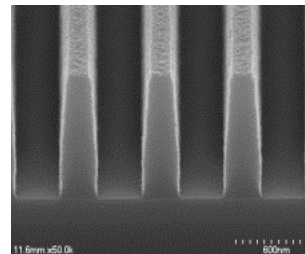
## EXPOSURE LATITUDE



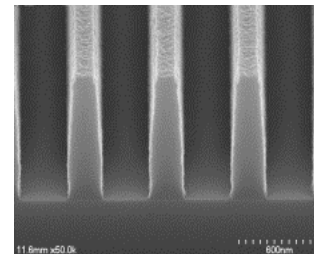
165mJ/cm<sup>2</sup>



175mJ/cm<sup>2</sup>

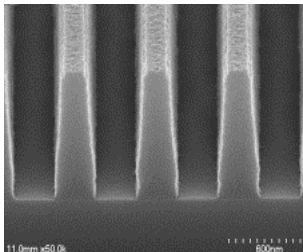


185mJ/cm<sup>2</sup>

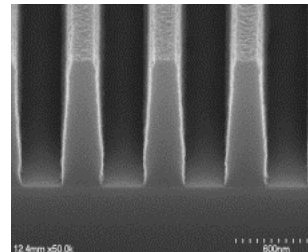


195mJ/cm<sup>2</sup>

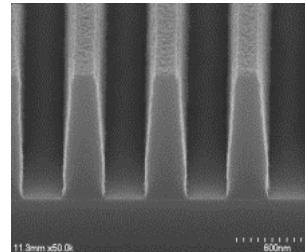
## FOCUS LATITUDE



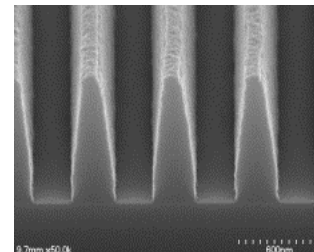
-0.8μm



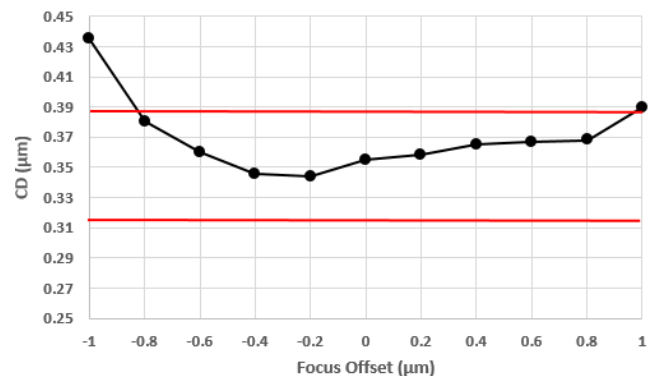
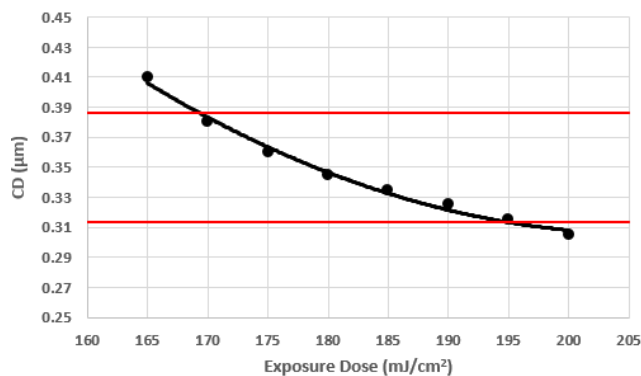
-0.4 μm



+0.4μm



+0.8μm

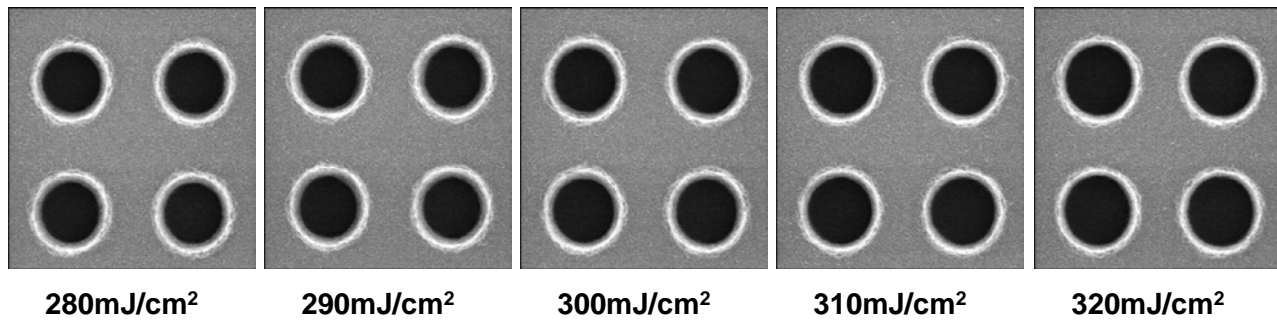


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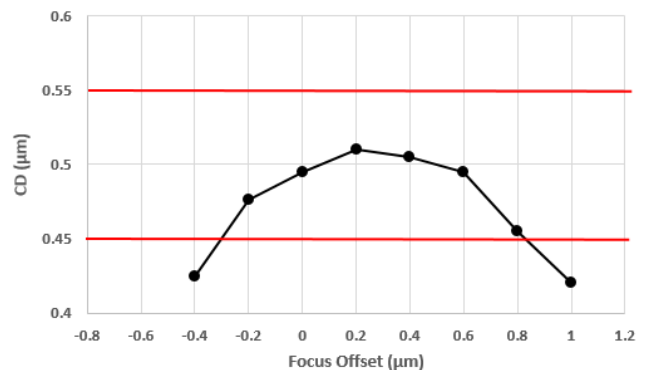
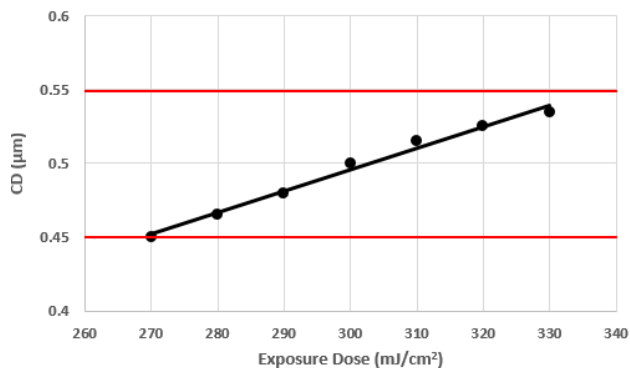
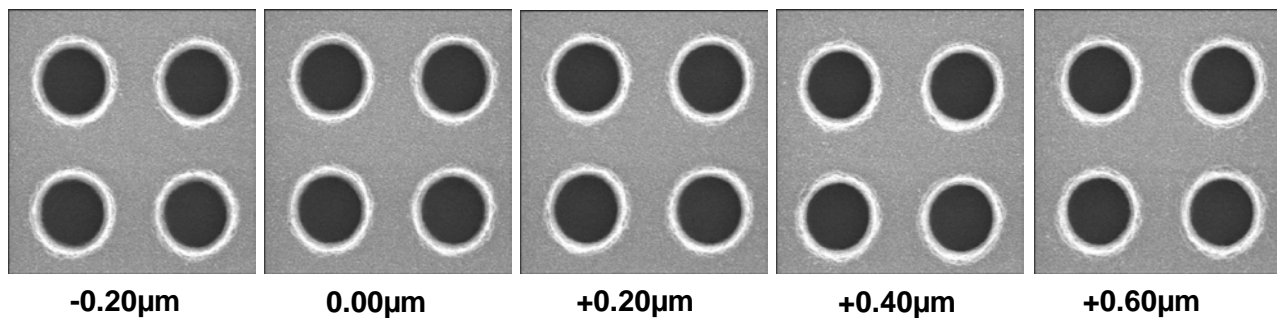
## EXAMPLE PROCESS (0.50 $\mu$ m contact hole pattern)

Process Step	Parameters
Coat	AZ MiR 701 14cps, 1.08 $\mu$ m thick film on Si
Soft Bake	90C, 90 seconds, direct contact hotplate
Expose	ASML /250 i-line stepper @ 300mJ/cm <sup>2</sup> nominal, 0.56NA, 0.75 $\sigma$
Post Expose Bake	110C, 90 seconds
Develop	AZ 300MIF, 60 second single puddle

## EXPOSURE LATITUDE



## FOCUS LATITUDE

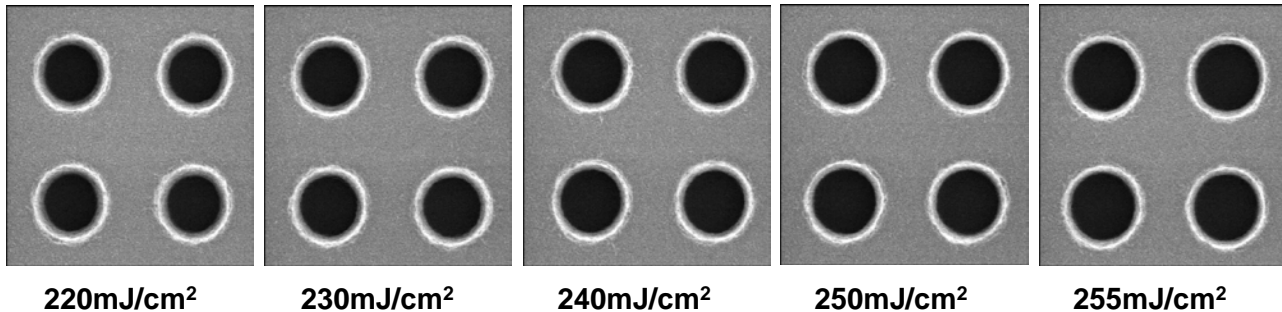


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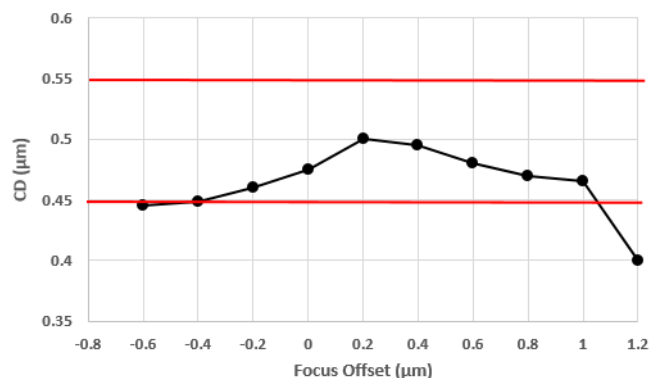
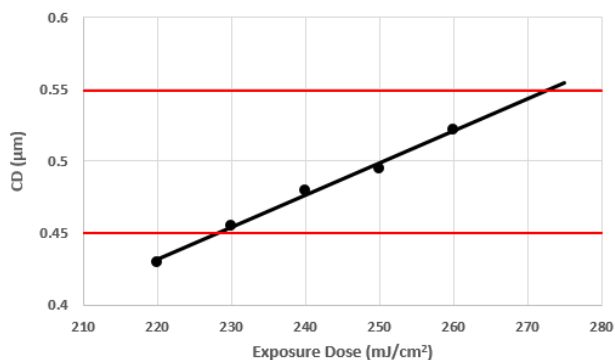
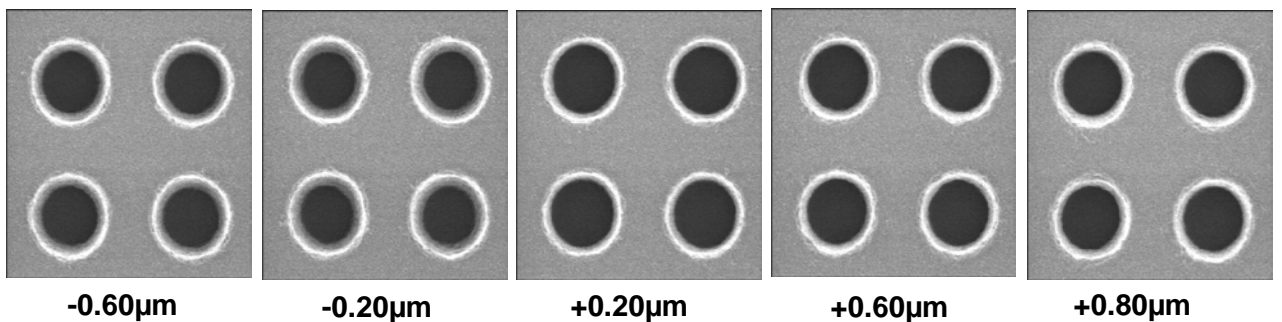
## EXAMPLE PROCESS (0.50µm contact hole pattern with AZ Aquatar Coating)

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

## EXPOSURE LATITUDE



## FOCUS LATITUDE

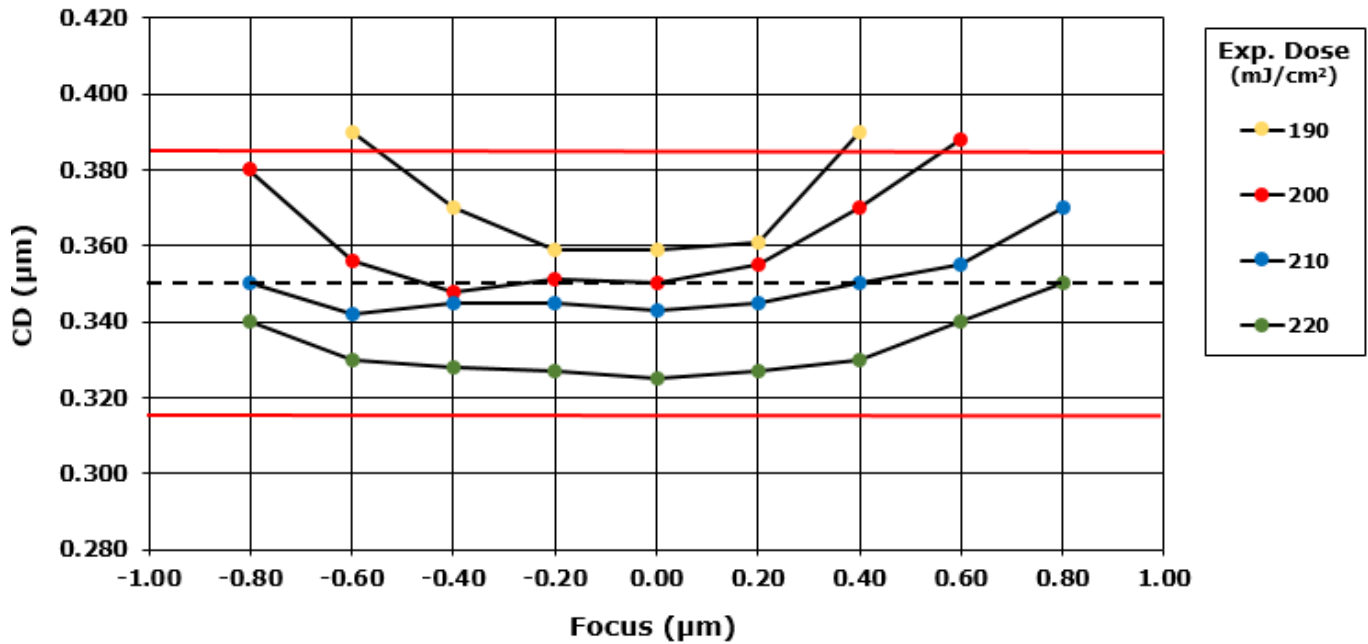




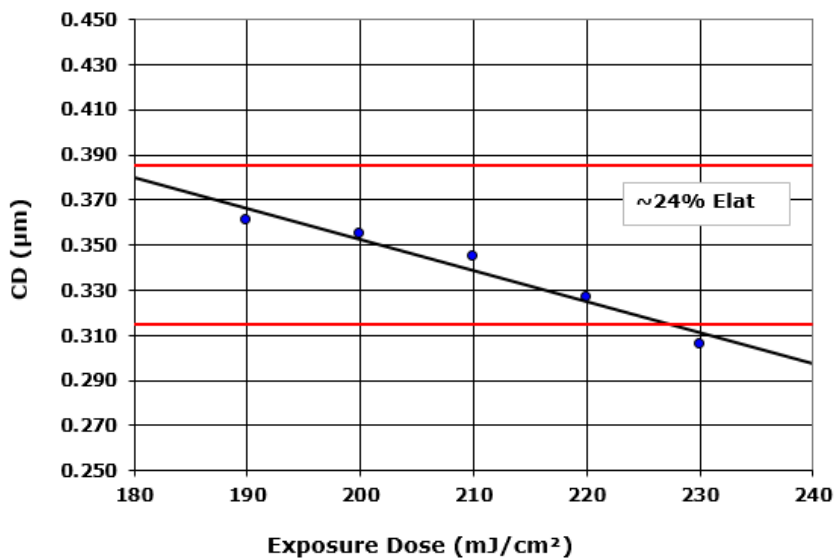
# AZ<sup>®</sup> MiR<sup>™</sup> 701 Series

## EXAMPLE PROCESS WINDOWS

### FOCUS/EXPOSURE CURVES (Bossung Plots for 0.35 $\mu$ m dense lines)



### EXPOSURE LATITUDE

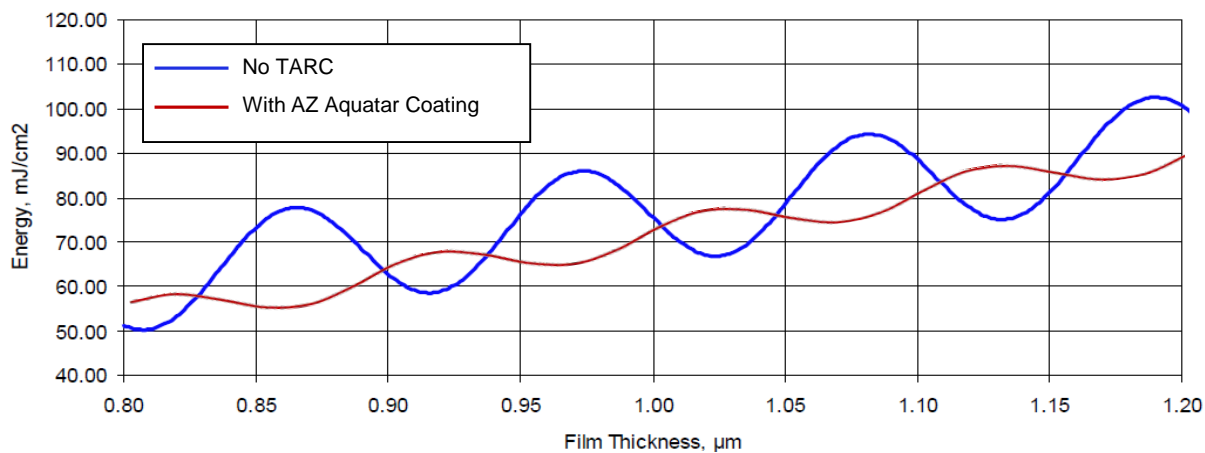


Photoresist Film Thickness: 0.97 $\mu$ m (Emax)  
Soft Bake: 90C, 60s  
Expose: ASML i-line stepper, 0.57NA  
Post Expose Bake: 110C, 60s  
Develop: AZ 300MIF, 60s single puddle  
CD: 0.35 $\mu$ m dense lines (pitch 1:1)

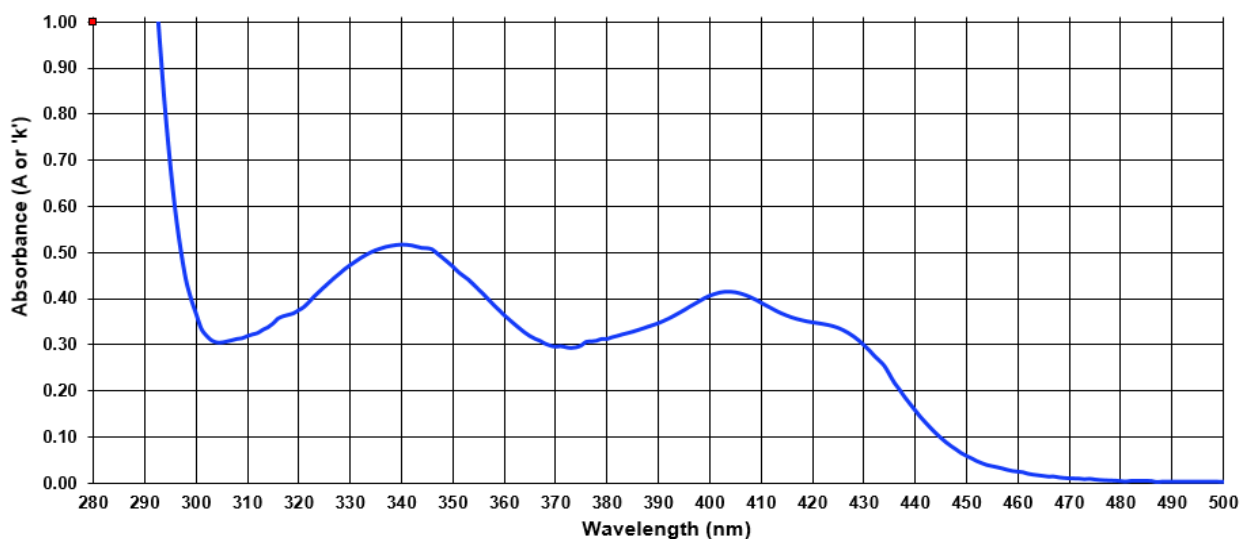


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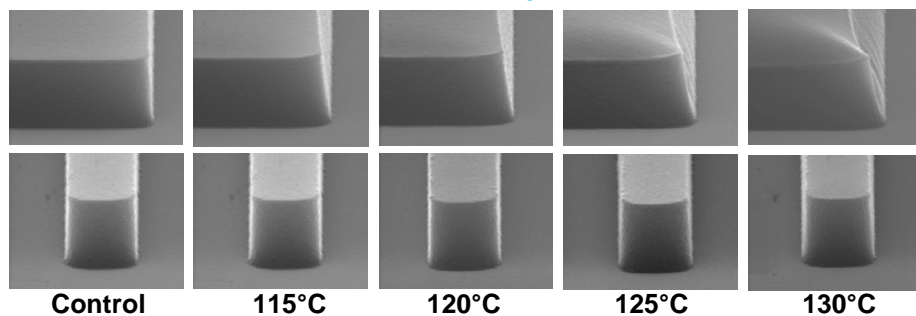
## DOSE TO CLEAR SWING CURVE



## ABSORBANCE (Normalized to 1/μm, ellipsometric)



## THERMAL STABILITY (pad and 1μm line)



# AZ<sup>®</sup> MiR<sup>™</sup> 701 Series

## 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 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 stable lithographic and adhesion performance. Soft bake temperatures for AZ MiR 701 should be in the 90-100C 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<sup>™</sup> 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 and times may be application specific. As a general rule, PEB temperatures should be in the 110 to 115C 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 120C range to ensure minimal thermal distortion of the pattern.

### STRIPPING

MiR 701 series resists are compatible with industry standard solvent based removers. AZ 300T or AZ 400T is recommended.





# AZ<sup>®</sup> MiR<sup>™</sup> 701 Series

## 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.

## STORAGE

AZ MiR 701 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°-55F.

## 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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