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AZ ECI 3000 Photoresist

Universal i-Line/Crossover
Photoresist Series

GENERAL INFORMATION

AZ ECI 3000 photoresist series are a family of fast positive resists with high resolution capabilities (0.4 µm CDs in production in i-line) enabling wide process latitudes. The resist family is suited for i-line as well as broadband exposure covering g-, h- and i-line illumination wavelengths. It is designed to have superior implant and dry etch resistance. Further characterization highlights show strong wet etch adhesion and good thermal stability. AZ® ECI 3000 photoresist series are specifically tailored for universal application and excellent cost of ownership.

RECOMMENDED PROCESS

Softbake:	90°C, 60 sec (contact) - 90 sec (proximity)
Exposure:	i- & g-line stepper or broadband exposure
Post Exposure Bake (PEB):	110°C, 60 sec (contact) - 90 sec (proximity)
Development:	60 sec, puddle, AZ 300 MIF Developer (non surfactated) or AZ 726 MIF Developer (surfactated)

SUITABLE ANCILLARIES

AZ Aquatar VIII-A top anti-reflective coating
AZ BARLi II bottom anti-reflective coating
AZ EBR 70/30 edge bead remover
AZ 100 Remover or AZ 400T stripper

VISCOSITIES

AZ ECI 3007	~ 0.6 - 1.3 µm FT
AZ ECI 3012	~ 1.1 - 2.4 µm FT
AZ ECI 3027	~ 2.2 – 5 µm FT

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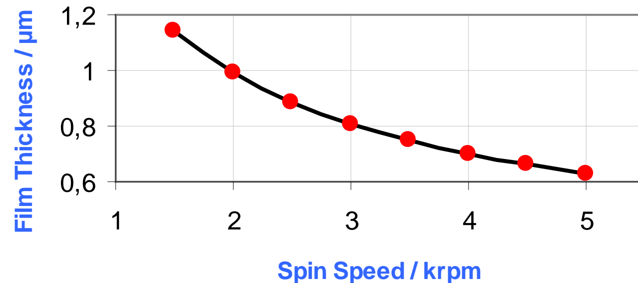
AZ ECI 3007 PHOTORESIST

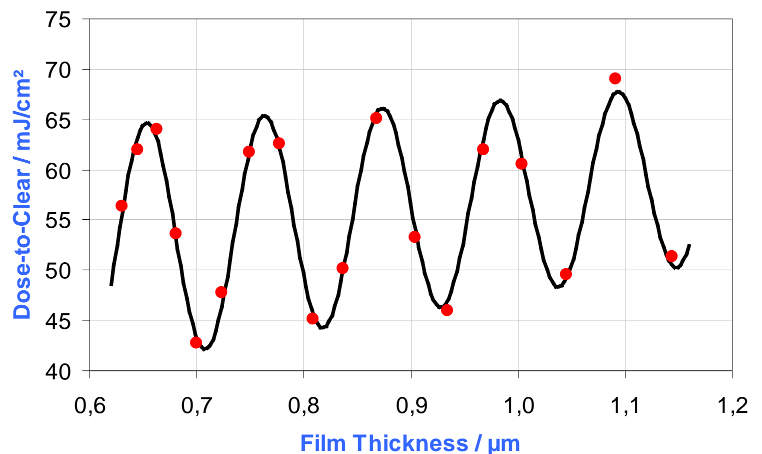
SPIN CURVE
Softbake: 90°C, 60 sec, proximity
Wafer size: 6” (150 mm)
dynamic dispense



FILM THICKNESS	2000 rpm	3000 rpm	4000 rpm	5000 rpm
	0.99 µm	0.81 µm	0.70 µm	0.63 µm

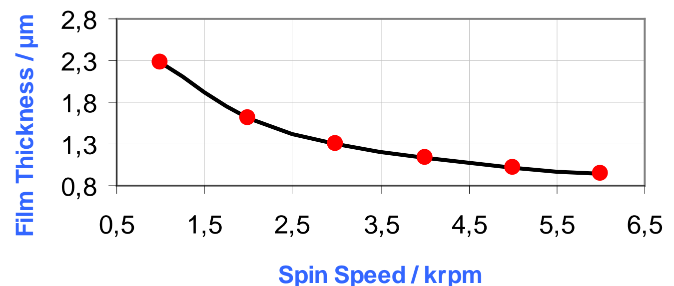
i-LINE THIN FILM INTERFERENCE
(on bare silicon)

Softbake:	90°C, 60 sec, proximity
Exposure:	Nikon NSR-1755i7B i-line stepper 0.54 NA, 0.6 s
PEB:	110°C, 60 sec, proximity
Development:	60 sec, puddle, 23°C AZ® 726 MIF Developer



AZ ECI 3012 PHOTORESIST

SPIN CURVE
Softbake: 90°C, 90 sec, proximity
Wafer size: 6” (150 mm)
dynamic dispense



FILM THICKNESS	2000 rpm	3000 rpm	4000 rpm	5000 rpm
	1.61 µm	1.31 µm	1.13 µm	1.02 µm
STD DEV	1.2 nm	0.8 nm	0.5 nm	1.1 nm

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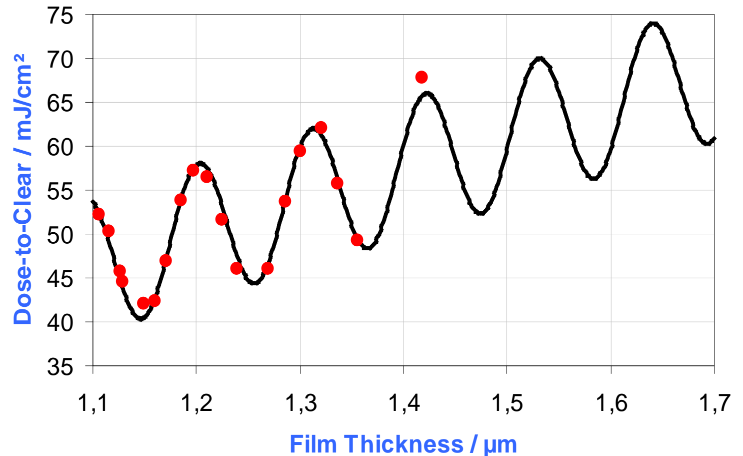
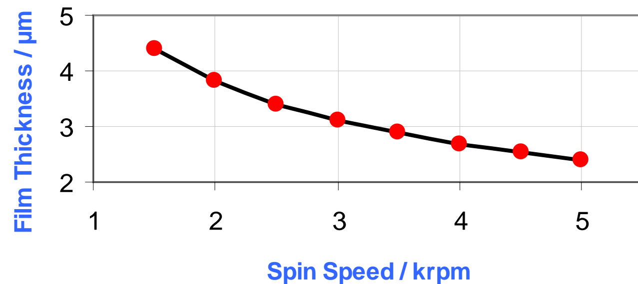
i-LINE THIN FILM INTERFERENCE
(on bare silicon)

Softbake:	90°C, 90 sec, proximity
Exposure:	Nikon NSR-1755i7B i-line stepper 0.54 NA, 0.6 s
PEB:	110°C, 90 sec, proximity
Development:	60 sec, puddle, 23°C AZ 300 MIF Developer



AZ ECI 3027 PHOTORESIST

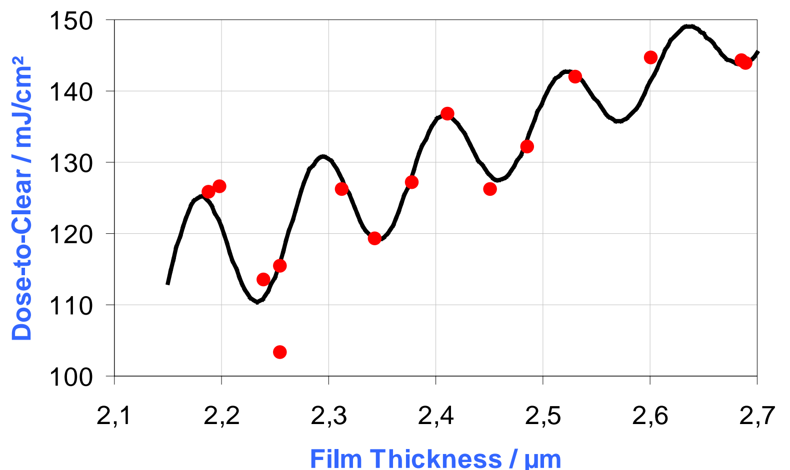
SPIN CURVE
Softbake: 90°C, 60 sec, proximity
Wafer size: 6" (150 mm)
dynamic dispense



FILM THICKNESS	2000 rpm	3000 rpm	4000 rpm	5000 rpm
	3.80 µm	3.11 µm	2.69 µm	2.41 µm

i-LINE THIN FILM INTERFERENCE
(on bare silicon)

Softbake:	90°C, 60 sec, proximity
Exposure:	Nikon NSR-1755i7B i-line stepper 0.54 NA, 0.6 s
PEB:	110°C, 60 sec, proximity
Development:	60 sec, puddle, 23°C AZ 726 MIF Developer



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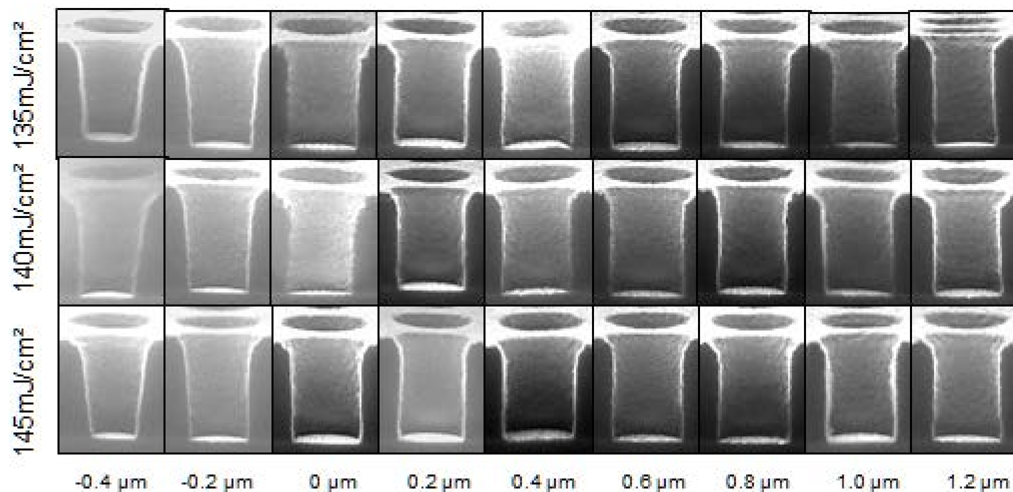
AZ ECI 3007 PHOTORESIST PROCESSon bare silicon substrate
Softbake: 90°C, 90 sec, proximity // 0.763 µm film thickness Emax // Exposure: Nikon NSR-1755i7B i-line stepper, 0.54 NA, 0.6 s // PEB: 110°C, 90 sec, proximity // Development: 60 sec, puddle, AZ® 300 MIF Developer @ 23°C // CD 0.5µm dense C/H process window summary at best point: 140 mJ/cm², 1.37 µm DOF, 29.1% exposure latitude

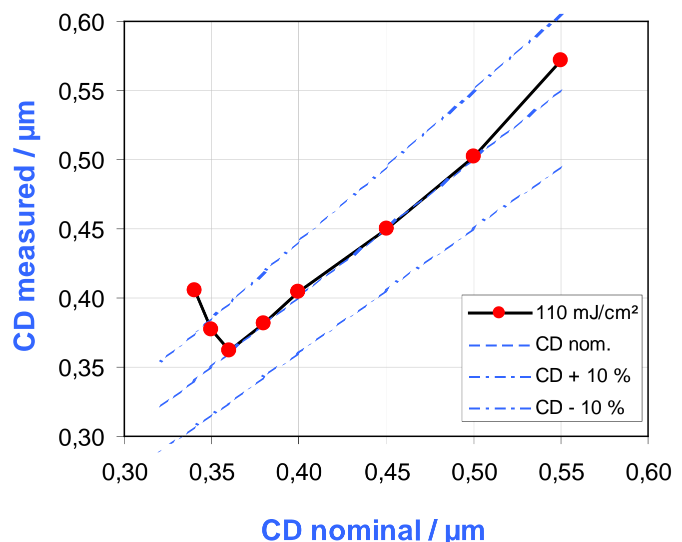
FOCUS LATITUDE 0.5 µm dense contact holes



AZ ECI 3012 PHOTORESIST

LINEARITY
(dense lines on bare silicon)

Softbake: 90°C, 90 sec, proximity
Film Thickness: 1.2 µm, Emax
Exposure: Nikon NSR-1755i7B
i-line stepper
0.54 NA, 0.6 s
PEB: 110°C, 90 sec, proximity
Development: 60 sec, puddle, 23°C
AZ 300 MIF Developer
Measurement: Hitachi S-8840 CD SEM



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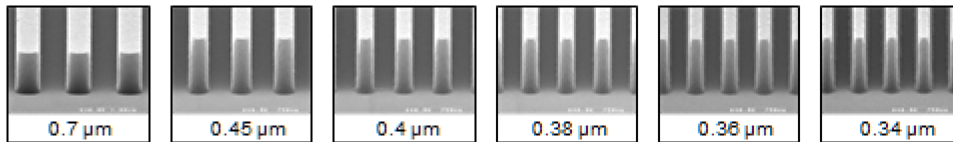
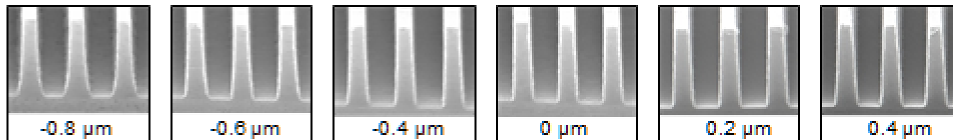
PROCESS on bare silicon substrate
Softbake: 90°C, 90 sec, proximity // 1.2 µm film thickness // Exposure: Nikon NSR-1755i7B i-line stepper, 0.54 NA, 0.6 s // PEB: 110°C, 90 sec, proximity // Development: 60 sec, puddle, AZ 300 MIF Developer @ 23°C

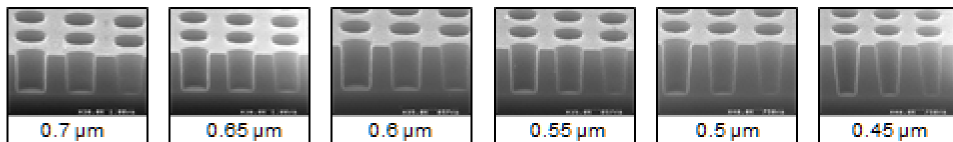
LINEARITY dense lines, 110 mJ/cm²



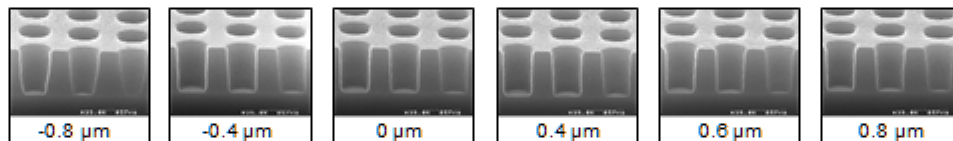
FOCUS LATITUDE 0.4 µm dense lines, 110 mJ/cm²



LINEARITY dense contact holes, 136 mJ/cm²



FOCUS LATITUDE 0.6 µm dense contact holes, 136 mJ/cm²



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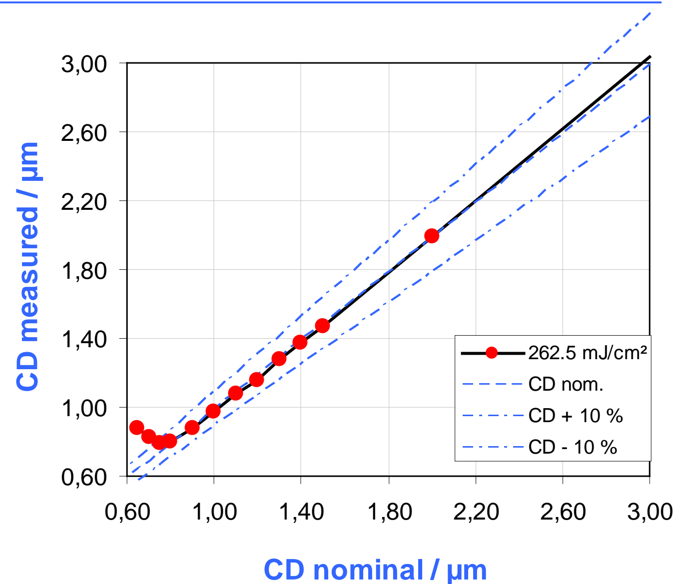
AZ ECI 3027 PHOTORESIST

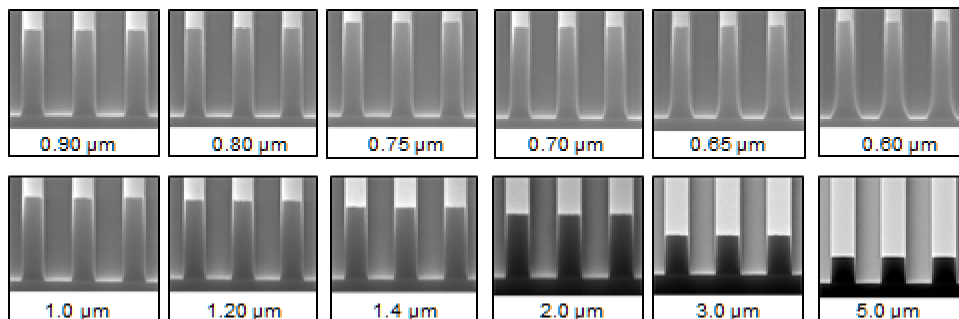
LINEARITY
(dense lines on bare silicon)

Softbake:	100°C, 60 sec, proximity
Film Thickness:	2.5 µm
Exposure:	Nikon NSR-1755i7B i-line stepper 0.54 NA, 0.6 s
PEB:	120°C, 60 sec, proximity
Development:	60 sec, puddle, 23°C AZ 726 MIF Developer
Measurement:	Hitachi S-8840 CD SEM

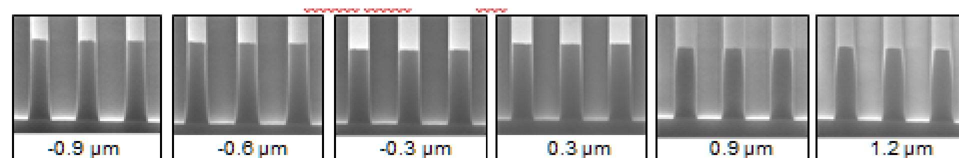


PROCESS on bare silicon substrate
Softbake: 100°C, 60 sec, proximity // 2.5 µm film thickness // Exposure: Nikon NSR-1755i7B i-line stepper, 0.54 NA, 0.6 s // PEB: 120°C, 60 sec, proximity // Development: 60 sec, puddle, AZ® 726 MIF Developer @ 23°C // CD 1.3µm dense lines process window summary at best point: 270 mJ/cm², 1.3 µm DOF, 32.4% exposure latitude

LINEARITY dense lines, 262.5 mJ/cm²



FOCUS LATITUDE 1.3 µm dense lines, 262.5 mJ/cm²



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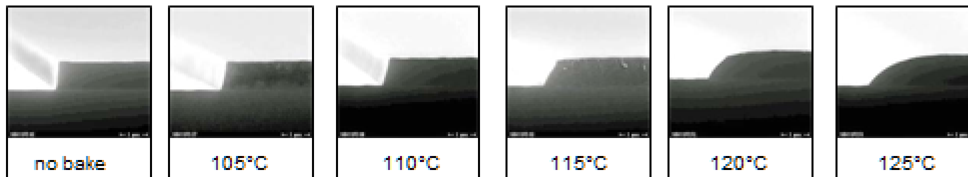
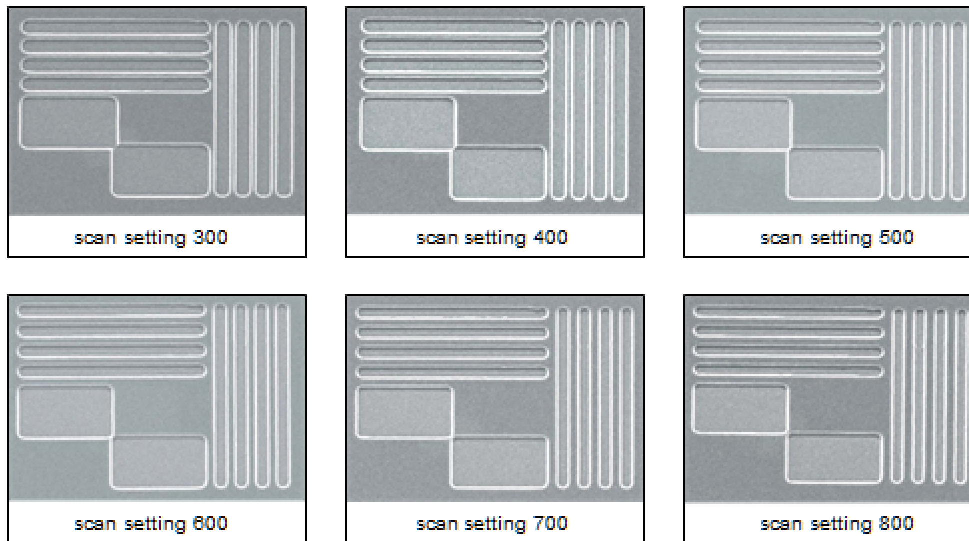
AZ ECI 3012 PHOTORESIST

THERMAL STABILITY 100 µm edge, 1.2 µm film thickness, contact hardbake 60 sec at temperature
Softbake: 90°C, 90 sec, proximity // Exposure: Nikon NSR-1755i7B i-line stepper, 0.54 NA, 0.6 s // PEB: 110°C, 90 sec, proximity // Development: 60 sec, puddle, AZ® 300 MIF Developer @ 23°C



BROADBAND EXPOSURE LATITUDE 3 µm lines, 1.2 µm film thickness
Softbake: 90°C, 60 sec, contact // Exposure: Perkin Elmer 340 Series Projection Mask Aligner, Aperture: 1, Slit Width: 1 mm // PEB: 110°C, 60 sec contact // Development: 60 sec, puddle, AZ 300 MIF Developer @ 23°C



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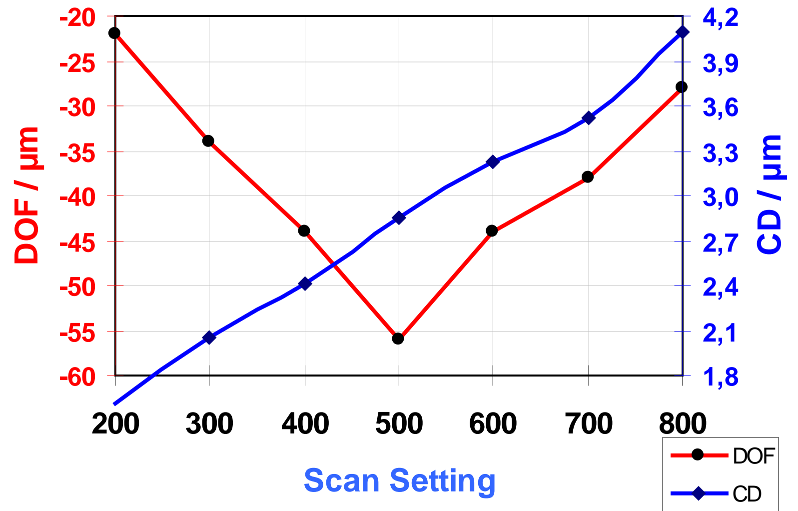
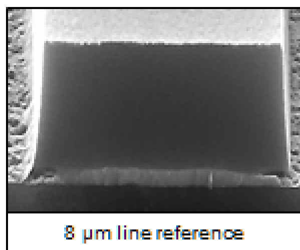
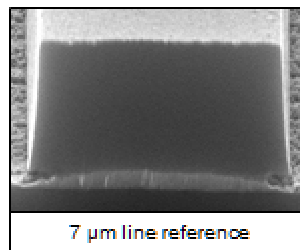
DOF / EXPOSURE LATITUDE
3 µm lines
(Perkin Elmer 340 Series)

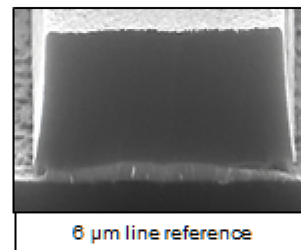
Substrate:	Silicon
Softbake:	90°C, 60 sec, contact
Film Thickness:	1.2 µm
Exposure:	Perkin Elmer 340 Aperture: 1 Slit Width: 1 mm
PEB:	110°C, 60 sec, contact
Development:	60 sec, puddle, 23°C AZ 300 MIF Developer

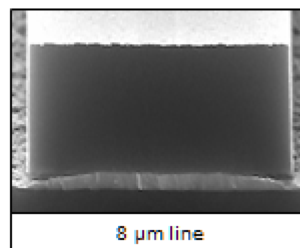


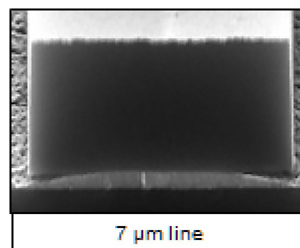
ADHESION ON ITO
Softbake: 90°C, 90 sec, proximity // 1.7 µm film thickness // Exposure: Nikon NSR-1755i7B i-line stepper, 0.54 NA, 0.6 s // PEB: 110°C, 90 sec, proximity // Development: 60 sec, puddle, AZ® 300 MIF Developer @ 23°C // ITO etching: etch time (70 sec) immersion in $FeCl_3$/HCl at 45°C, ITO thickness: 200 nm

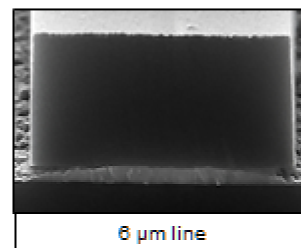

8 µm line reference


7 µm line reference


6 µm line reference


8 µm line


7 µm line


6 µm line

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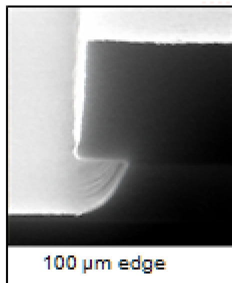
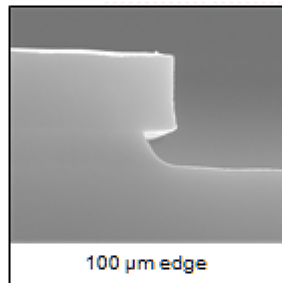
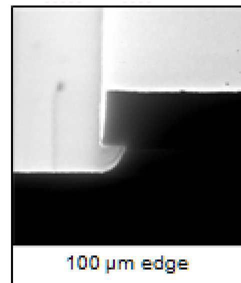
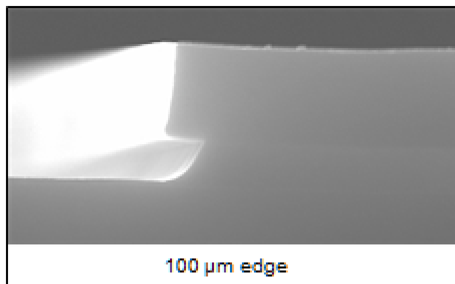
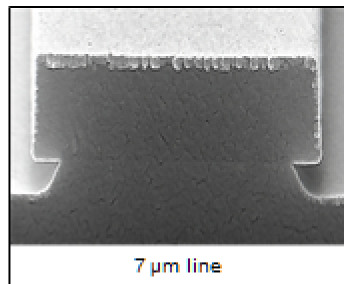
ADHESION ON THERMAL OXIDE
Thermal oxide thickness: 690 nm // Primer HMDS, vacuum 30 min // Resist thickness: 1.33 µm on 2" wafer // Softbake: 90°C, 60 sec, contact // Exposure: Suss MA 56 // PEB: 110°C, 60 sec, contact // Development: 60 sec, immersion, AZ® 300 MIF Developer @ 23°C // Oxide etch solution: Merck AF 87.5-12.5 @ 22°C // oxide etch time: 6 min // Remaining oxide thickness after etch: 75 nm


100 µm edge


100 µm edge

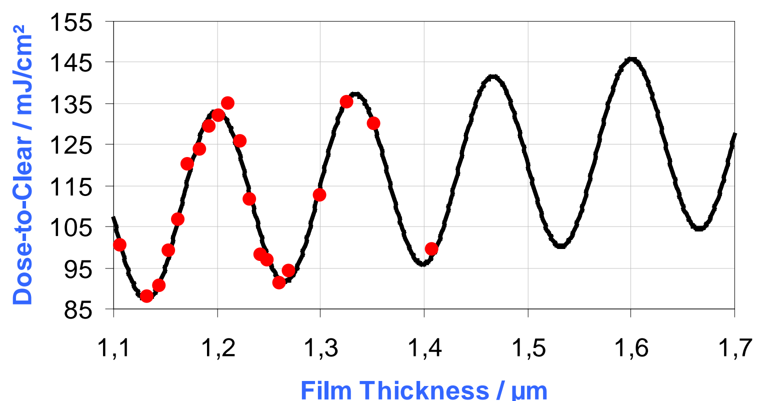

100 µm edge


100 µm edge


7 µm line

g-LINE THIN FILM INTERFERENCE
(on bare silicon)

Softbake:	90°C, 90 sec, proximity
Exposure:	Nikon NSR-1505G7E g-line stepper 0.54 NA, 0.5 s
PEB:	110°C, 90 sec, proximity
Development:	60 sec, puddle, 23°C AZ 300 MIF Developer



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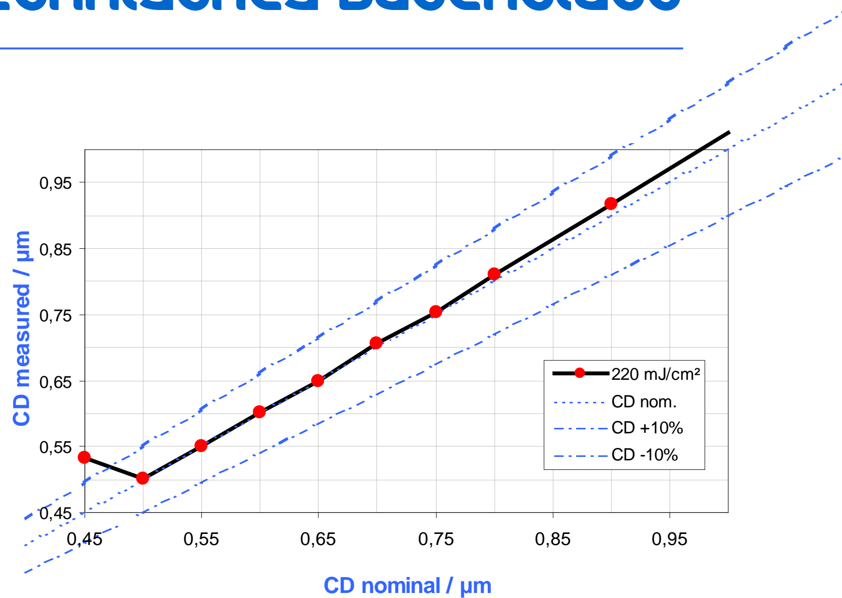
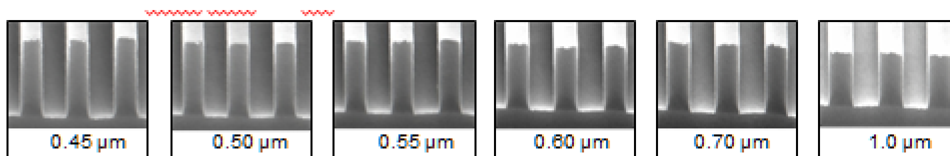
LINEARITY
(dense lines on bare silicon)

Softbake:	90°C, 90 sec, proximity
Film Thickness:	1.2 µm, Emax
Exposure:	Nikon NSR- 1505G7E g-line stepper 0.54 NA, 0.5 s
PEB:	110°C, 90 sec, proximity
Development:	60 sec, puddle, 23°C AZ 300 MIF Developer
Measurement:	Hitachi S-8840 CD SEM

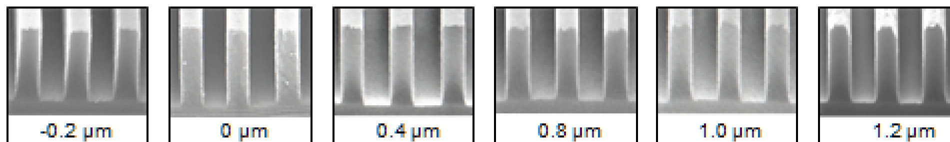


PROCESS on bare silicon substrate
Softbake: 90°C, 90 sec, proximity // 1.2 µm film thickness // Exposure: Nikon NSR-1505G7E g-line stepper, 0.54 NA, 0.5 s // PEB: 110°C, 90 sec, proximity // Development: 60 sec, puddle, AZ® 300 MIF Developer @ 23°C

LINEARITY dense lines, 220 mJ/cm²



FOCUS LATITUDE 0.5 µm dense lines, 220 mJ/cm²



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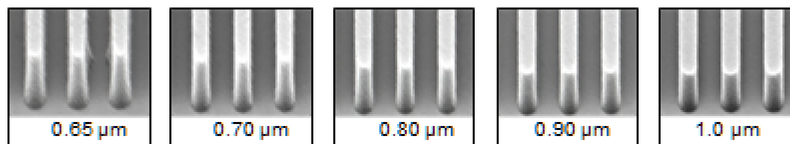
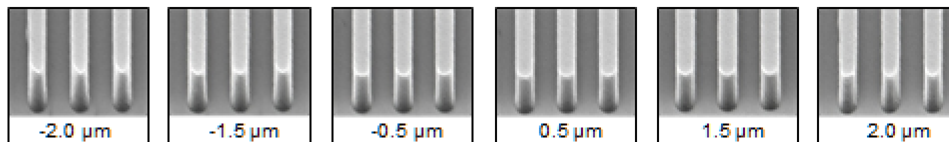
ULTRATECH 1500 PERFORMANCE on bare silicon substrate
Softbake: 90°C, 90 sec, proximity // 1.2 µm film thickness // Exposure: Ultratech 1500 1X stepper // PEB: 110°C, 90 sec, proximity // Development: 60 sec, puddle, AZ 300 MIF Developer @ 23°C

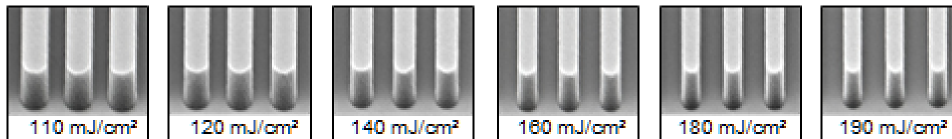
LINEARITY dense lines, 180 mJ/cm²



FOCUS LATITUDE 1.0 µm dense lines, 180 mJ/cm²



EXPOSURE LATITUDE 1.0 µm dense lines



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CAUCHY COEFFICIENTS	A	B	C
Unbleached	1.6018	0.0098963 µm²	0.00068636 µm⁴
	1.6018	9.8963 x 10^5 Å²	6.8636 x 10^{12} Å⁴
Bleached	1.5952	0.0084508 µm²	0.0006556 µm⁴
	1.5952	8.4508 x 10^5 Å²	6.556 x 10^{12} Å⁴

REFRACTIVE INDEX		365 nm	405 nm	435 nm	633 nm
Unbleached	n	1.7014	1.6803	1.6826	1.6308
	k	0.0202	0.0244	0.0166	0
Bleached	n	1.6913	1.6670	1.6530	1.6204
	k	0.0017	0.0010	0	0.0001

DILL PARAMETERS	A	B	C
i-line	**0.64 µm⁻¹**	**0.075 µm⁻¹**	**0.0159 cm²/mJ**
h-line	**0.76 µm⁻¹**	**0.035 µm⁻¹**	**0.0244 cm²/mJ**
g-line	**0.45 µm⁻¹**	**0.036 µm⁻¹**	**0.0152 cm²/mJ**

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