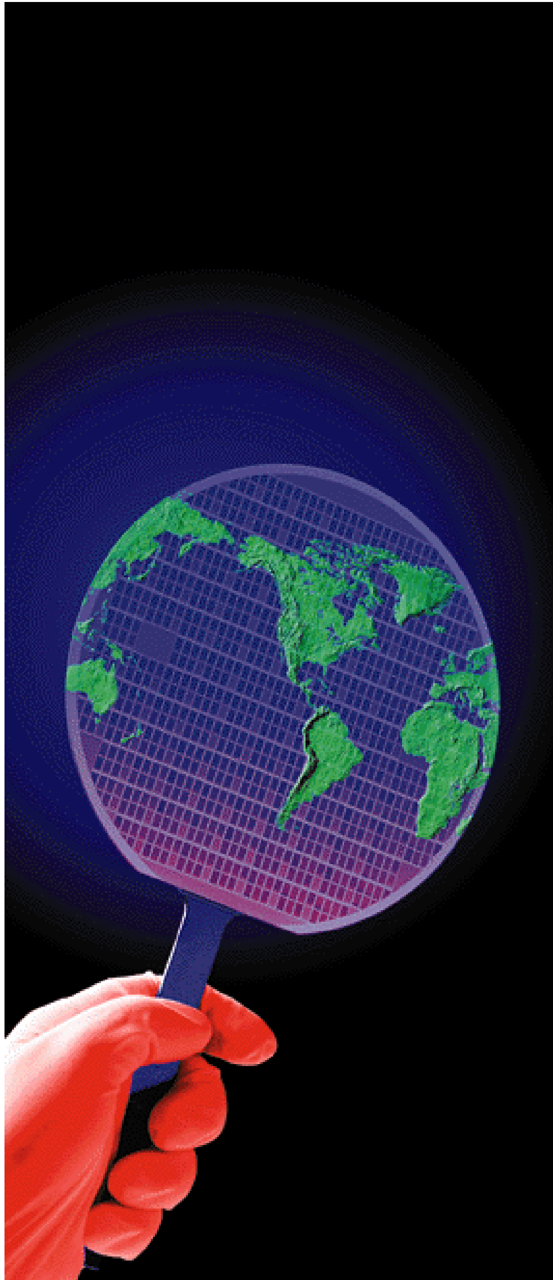
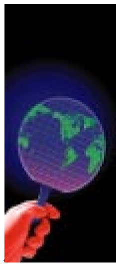


ARCH 8250

A multipurpose 248nm Photoresist

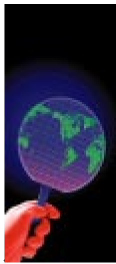


ARCH 8250 Features

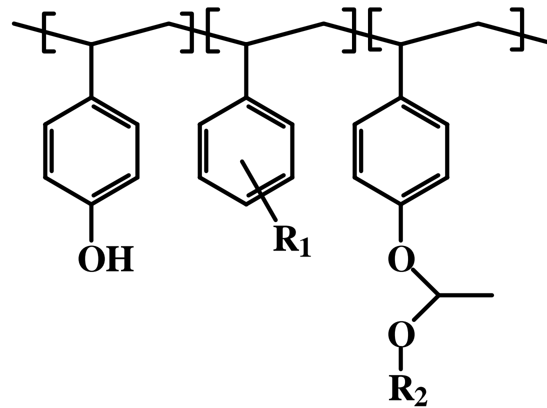
* Multiple substrate compatibility:
- TiN, Organic ARC, SiN, SiON.

* Plasma etch resistance similar to I-Line resists.

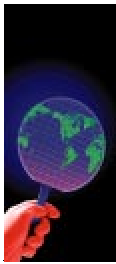
* Multiple level applications:
- Isolated lines, Dense Lines, contacts, posts, etc.



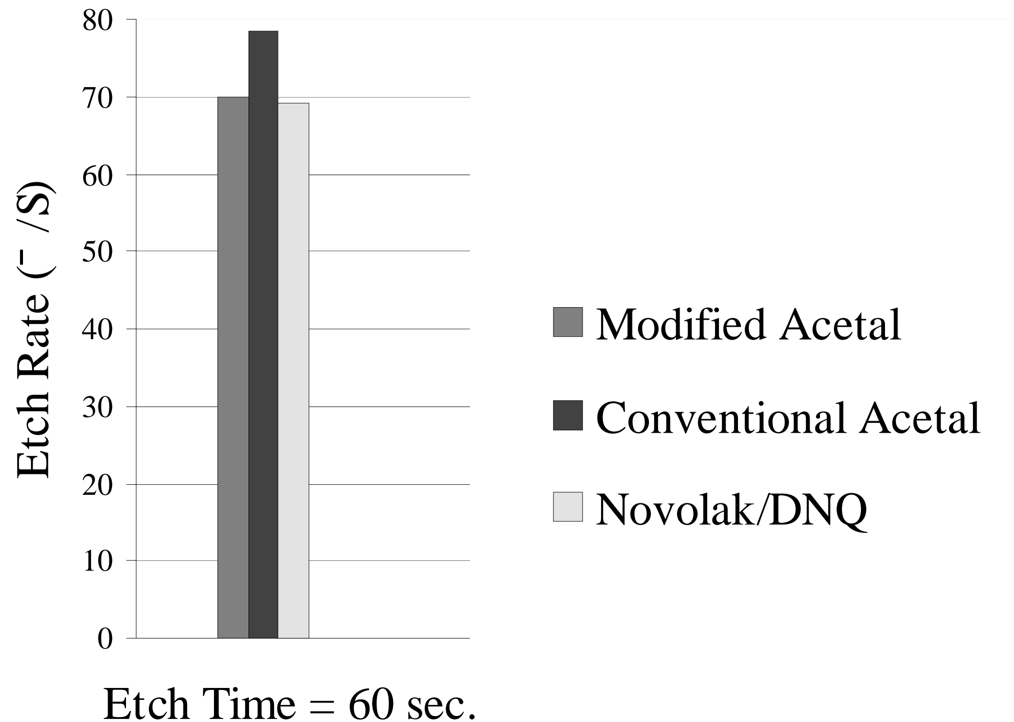
ARCH 8250 Polymer Technology



Modified Acetal-Derivatized Hydroxystyrene Based Polymers



ARCH 8250 Etch Selectivity (Metal)



<u>LAM Rainbow Etcher</u>

2750 W (source)

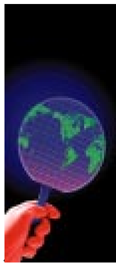
-20 C

200 sccm Ar

40 sccm Cl_2

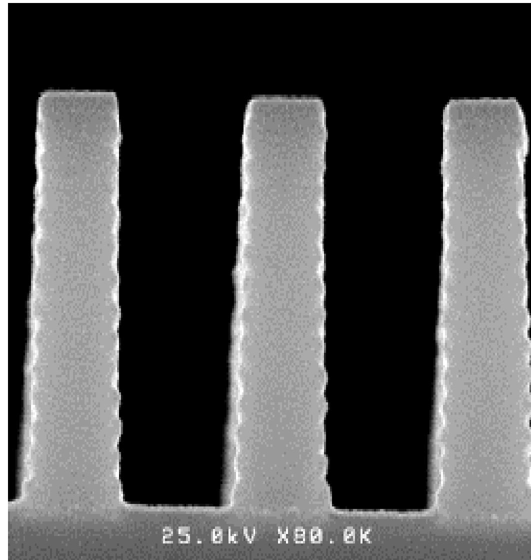
40 sccm BCl_3

pressure: 12 mtorr

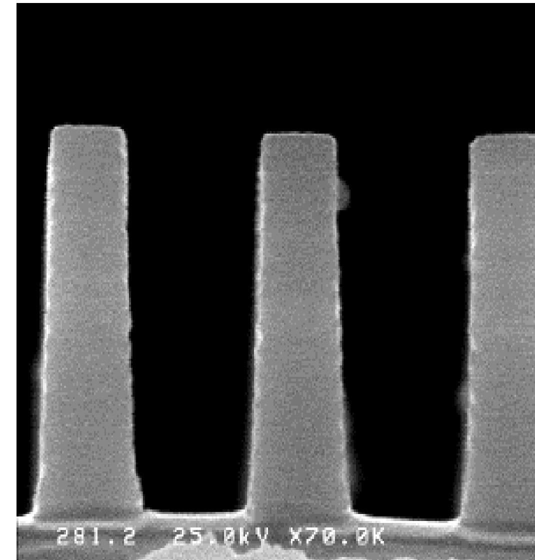


ARCH 8250 on TiN

Substrate Compatibility - 0.30µm Features



400 ¯ TiN
Reflectivity = 35%

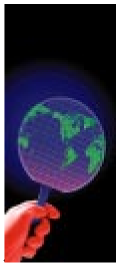


150 ¯ TiN
Reflectivity = 15%

Foot size <10 nm

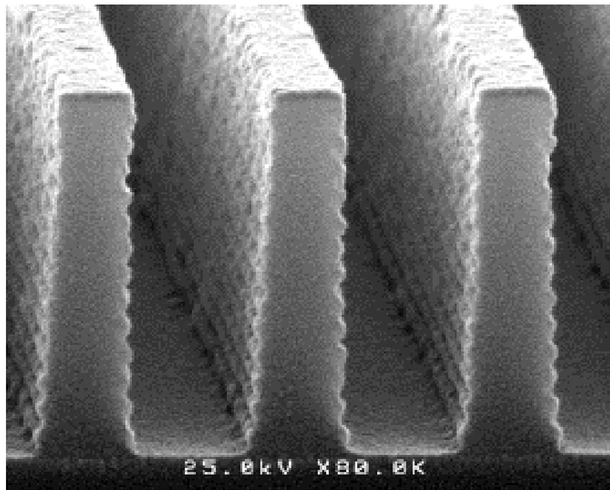
FUJIFILM Olin

ARCH Semiconductor Photopolym

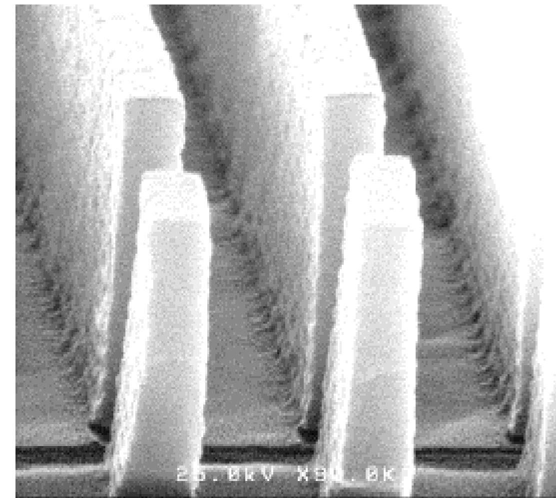


ARCH 8250 on TiN

Substrate Reflectivity and Standing Waves

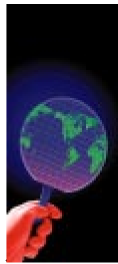


400 ¯ TiN
Reflectivity = 35%



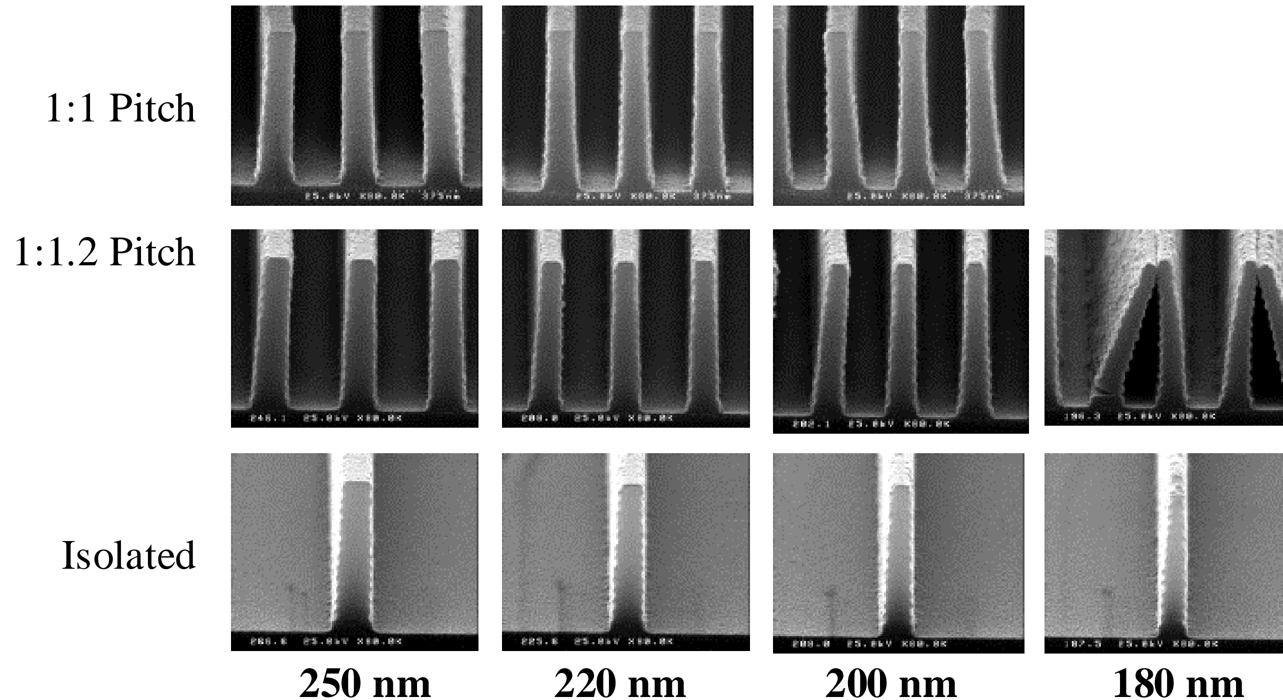
150 ¯ TiN
Reflectivity = 15%

0.25   m line/space
Resist Film Thickness: 9880 ¯



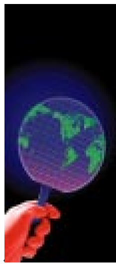
ARCH 8250 on TiN(Binary Mask)

Photospeed: 24 mJ/cm²; Proximity bias (250nm CD): 5.3nm



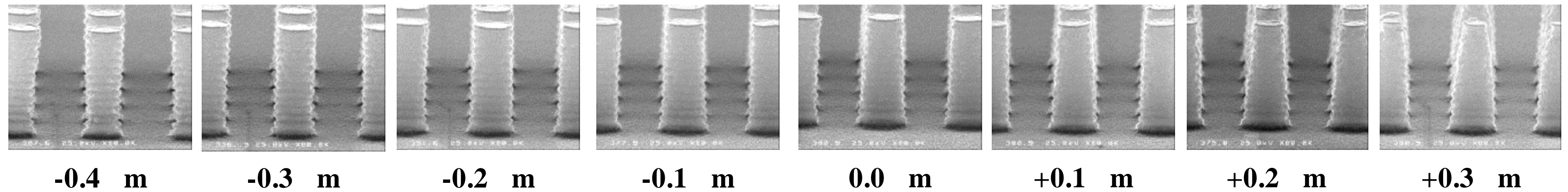
EVALUATION CONDITIONS

Substrate:	TiN; 400Å
Film Thickness:	0.9880µm
Exposure Tool:	ISI 7800 DUV stepper
P.E.B.:	80^0C/60”
S.B.:	120^0C/60”
Development:	60” puddle w/ OPD 4262



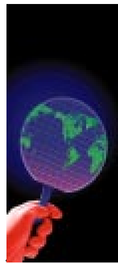
ARCH 8250 on TiN

Focus Latitude for 0.37μm pillars



EVALUATION CONDITIONS

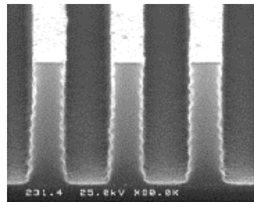
Substrate: TiN; 400Å
Softbake: 120^{0}C/60"
Film Thickness: 0.9880μm
Exposure Tool: ISI 7800 DUV stepper
Dose: 22 mJ/cm^2
P.E.B.: 80^{0}C/60"
Development: 60" puddle w/ OPD 4262



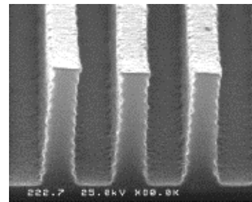
ARCH 8250 on TiN

NA = 0.53   Annular Illumination (s_{outer}: 0.65, s_{inner}: 0.325)

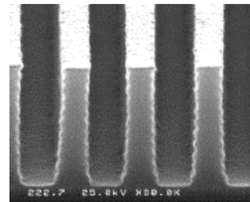
Resolution: ($E_{opt.}$: 12 mJ/cm^2@250nm line-space)



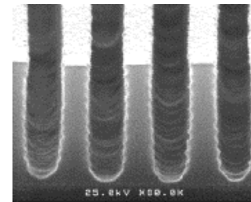
250 nm



200 nm

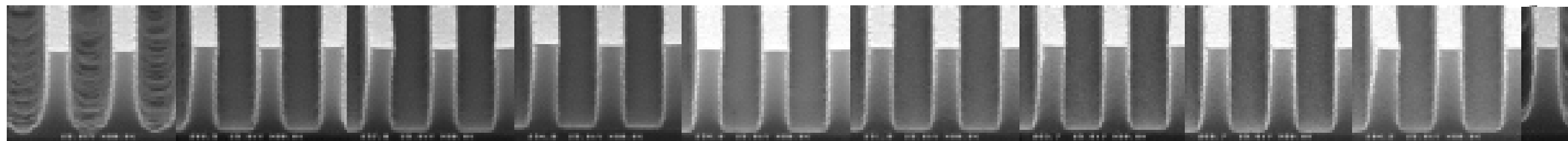


190 nm



180 nm

Focus Latitude (250nm line / space)



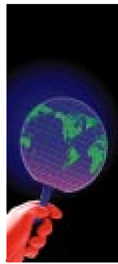
-0.60 m   -0.45 m   -0.30 m   -0.15 m   0.00 m   +0.15 m   +0.30 m   +0.45 m   +0.60 m   +(

EVALUATION CONDITIONS

Substrate:	TiN; 400Å
Softbake:	120^0C/60”
Film Thickness:	0.8000µm
P.E.B.:	80^0C/60”
Development:	60” puddle w/ OPD 4262

FUJIFILM Olin

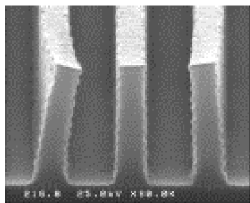
ARCH Semiconductor Photopolym



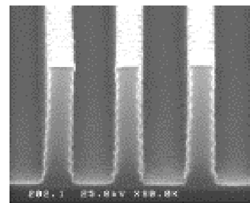
ARCH 8250 on TiN

NA = 0.53 Annular Illumination (s_{outer}: 0.65 s_{inner}: 0.325)

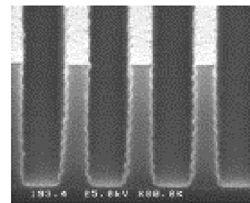
Resolution: ($E_{opt.}$: 12 mJ/cm^2@ 200nm line/250 nm space)



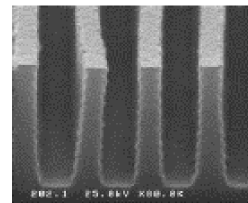
220 nm



200 nm

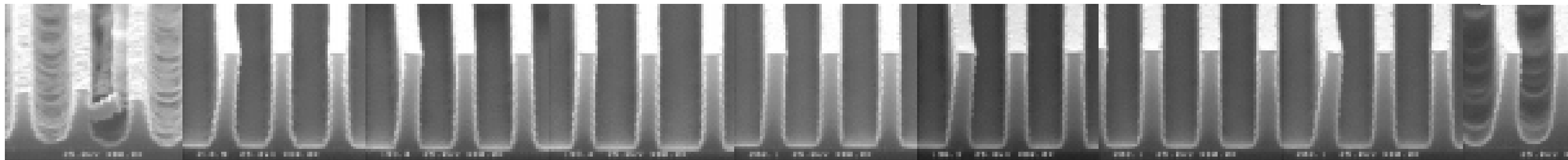


180 nm



170 nm

Focus Latitude (200nm line/250 nm space)



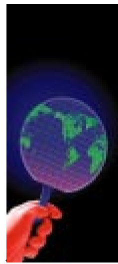
-0.60 m -0.45 m -0.30 m -0.15 m 0.00 m +0.15 m +0.30 m +0.45 m +0.60

EVALUATION CONDITIONS

Substrate:	TiN; 400Å
Softbake:	120^{0}C/60”
Film Thickness:	0.8000µm
Exposure Tool:	ISI 7800 DUV stepper
P.E.B.:	80^{0}C/60”
Development:	60” puddle w/ OPD 4262

FUJIFILM
Olin

ARCH
Semiconductor Photopolym

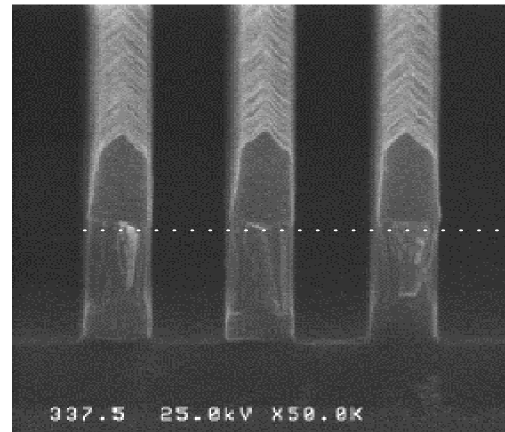


ARCH 8250 on TiN

Focus Latitude, Post-metal Etch

ASML PAS 5500/90
0.50 NA/σ = 0.5

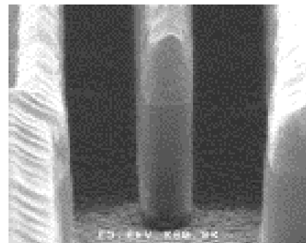
0.30 m line / 0.4 m space



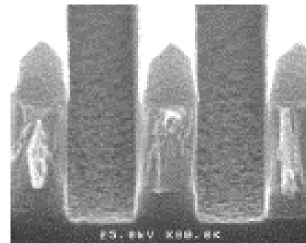
Residual Resist Thickness: 420 nm
(*original resist thickness: 988 nm*)

Resist-Metal Layer Interface

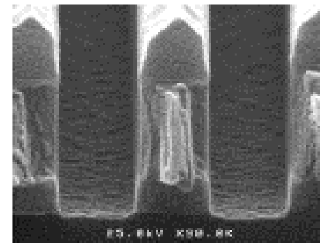
Metal Layer Thickness: 514.3 nm



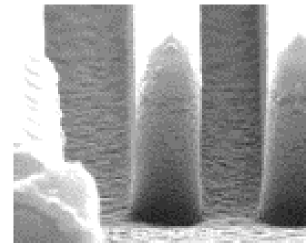
-0.4 m



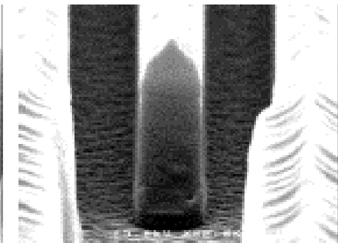
-0.2 m



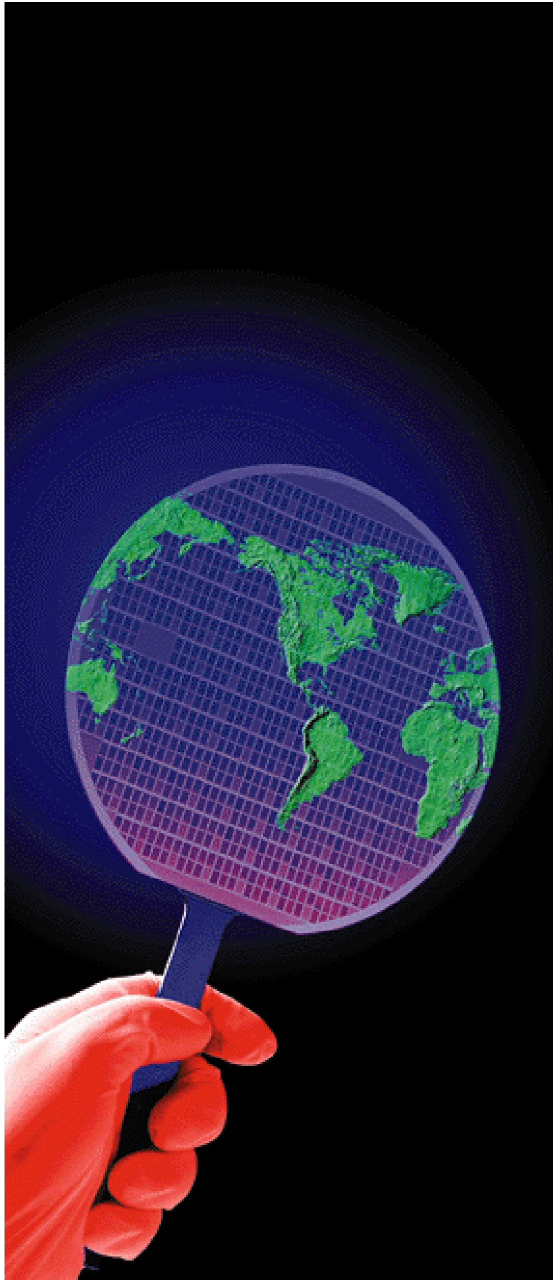
0.0 m



+0.2 m

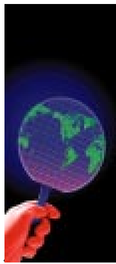


+0.4 m



ARCH 8250

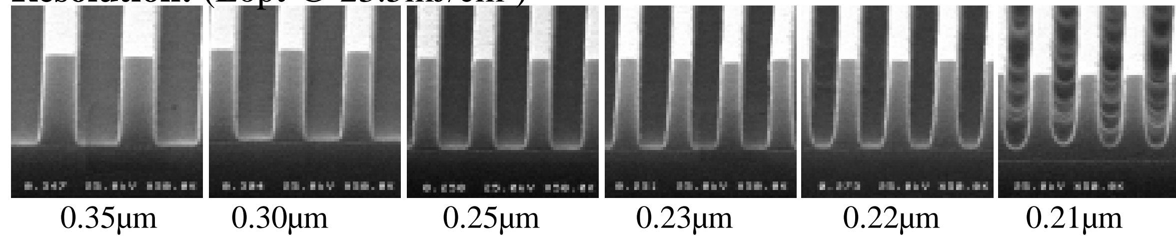
Performance on Organic ARC



ARCH-8250(0.25μm Process)

Resolution: (Eopt @ 23.5mJ/cm²)

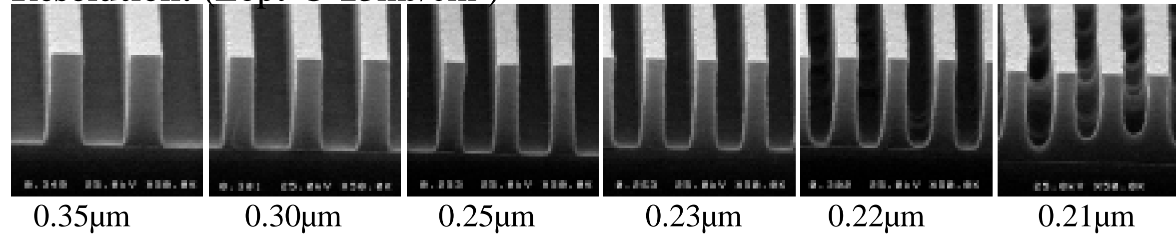
DUV 30 (550Å)



0.35μm 0.30μm 0.25μm 0.23μm 0.22μm 0.21μm

Resolution: (Eopt @ 23mJ/cm²)

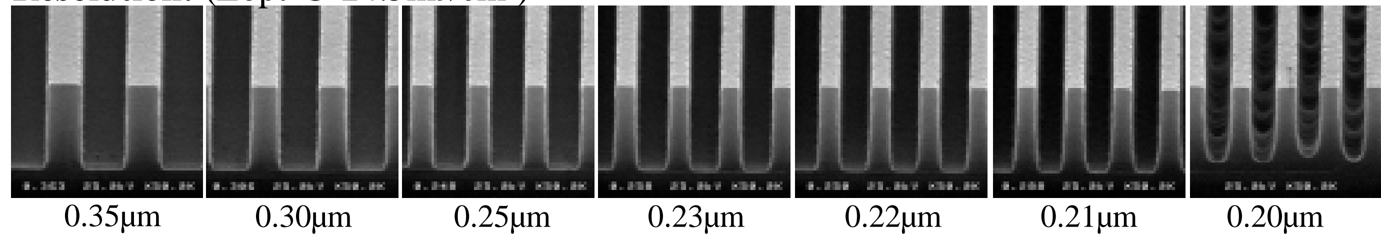
DUV 32 (500Å)



0.35μm 0.30μm 0.25μm 0.23μm 0.22μm 0.21μm

Resolution: (Eopt @ 24.5mJ/cm²)

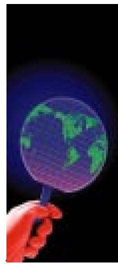
DUV 42 (600Å)



0.35μm 0.30μm 0.25μm 0.23μm 0.22μm 0.21μm 0.20μm

Evaluation Conditions

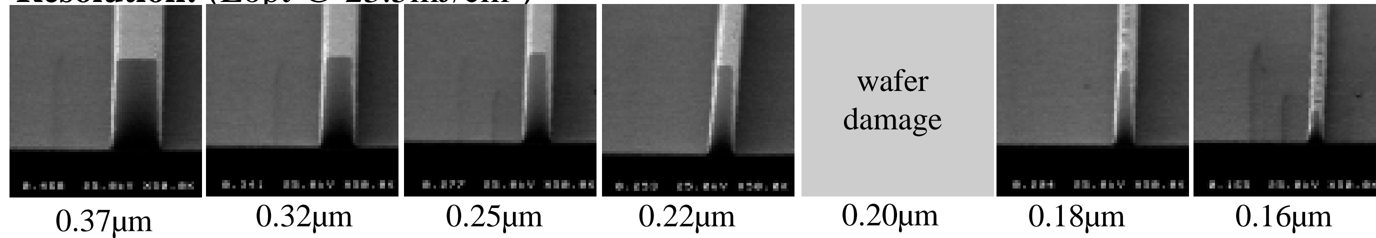
Substrate:	Silicon + DUV BARC
Resist Thickness:	Various (~7800Å)
Soft Bake:	120ºC/60"
Exposure Tool:	ISI-7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	85ºC/60"
Develop:	5"stream/60"puddle OPD4262



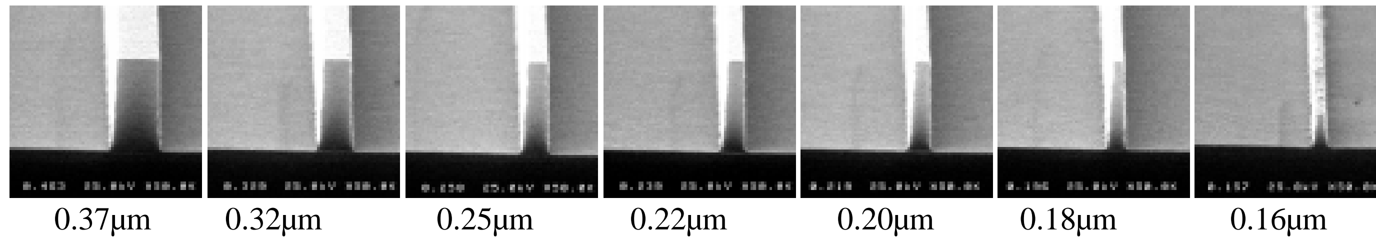
ARCH-8250(0.25µm Process)

Resolution: (Eopt @ 23.5mJ/cm^2)

DUV 30 (550Å)

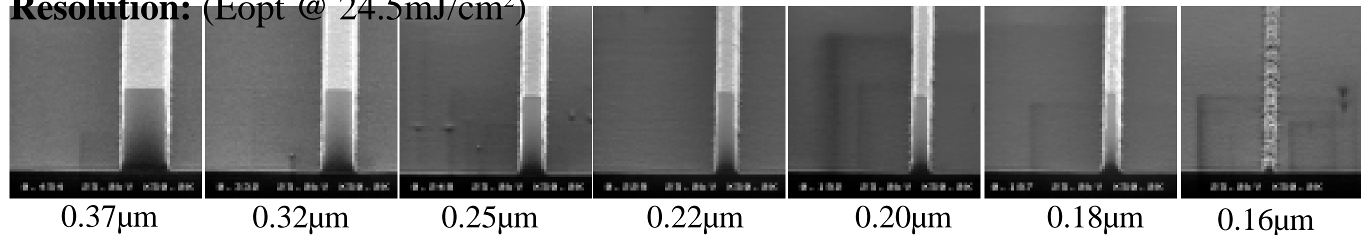


DUV 32 (500Å)



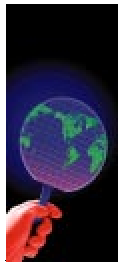
Resolution: (Eopt @ 24.5mJ/cm^2)

DUV 42 (600Å)



Evaluation Conditions

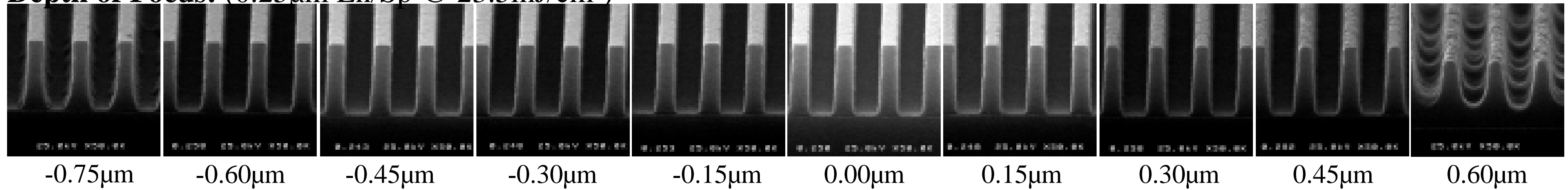
Substrate:	Silicon + DUV BARC
Resist Thickness:	Various (~7800Å)
Soft Bake:	120ºC/60”
Exposure Tool:	ISI-7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	85ºC/60”
Develop:	5”stream/60”puddle OPD4262



ARCH-8250(0.25µm Process)

Depth of Focus: (0.25µm Ln/Sp @ 23.5mJ/cm²)

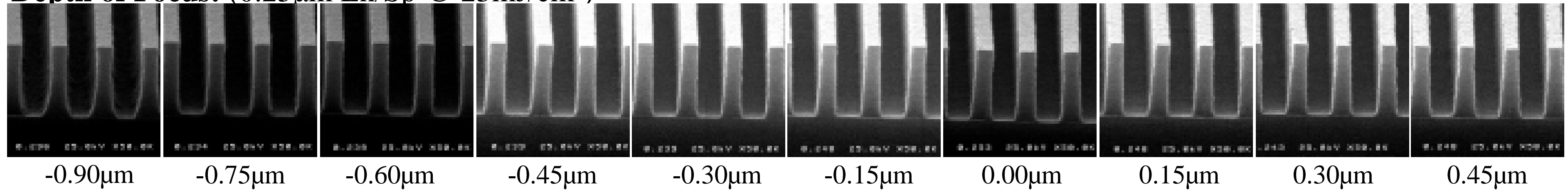
DUV 30



-0.75µm	-0.60µm	-0.45µm	-0.30µm	-0.15µm	0.00µm	0.15µm	0.30µm	0.45µm	0.60µm

Depth of Focus: (0.25µm Ln/Sp @ 23mJ/cm²)

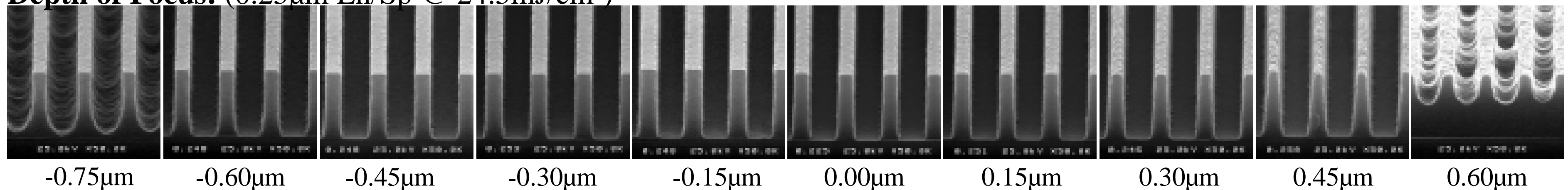
DUV 32



-0.90µm	-0.75µm	-0.60µm	-0.45µm	-0.30µm	-0.15µm	0.00µm	0.15µm	0.30µm	0.45µm

Depth of Focus: (0.25µm Ln/Sp @ 24.5mJ/cm²)

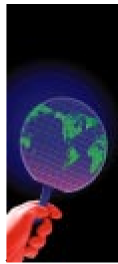
DUV 42



-0.75µm	-0.60µm	-0.45µm	-0.30µm	-0.15µm	0.00µm	0.15µm	0.30µm	0.45µm	0.60µm

Evaluation Conditions

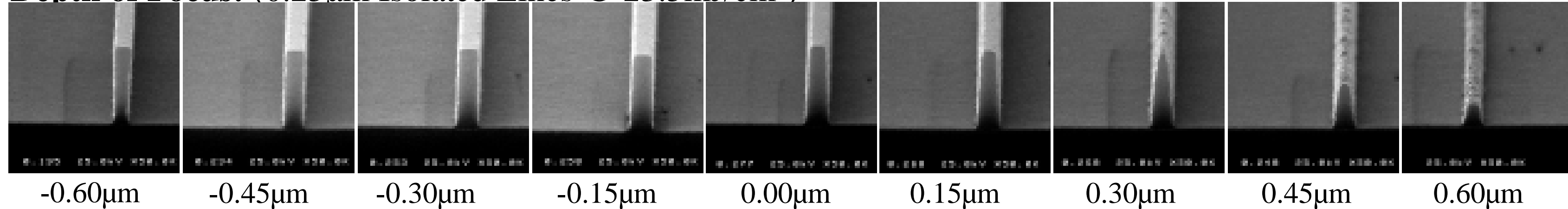
Substrate:	Silicon + DUV BARC
Resist Thickness:	Various (~7800Å)
Soft Bake:	120ºC/60”
Exposure Tool:	ISI-7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	85ºC/60”
Develop:	5”stream/60”puddle OPD4262



ARCH-8250(0.25µm Process)

Depth of Focus: (0.25µm Isolated Lines @ 23.5mJ/cm²)

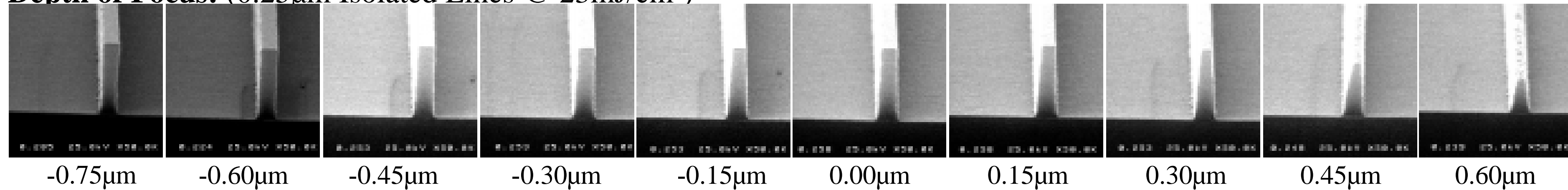
DUV 30



-0.60µm -0.45µm -0.30µm -0.15µm 0.00µm 0.15µm 0.30µm 0.45µm 0.60µm

Depth of Focus: (0.25µm Isolated Lines @ 23mJ/cm²)

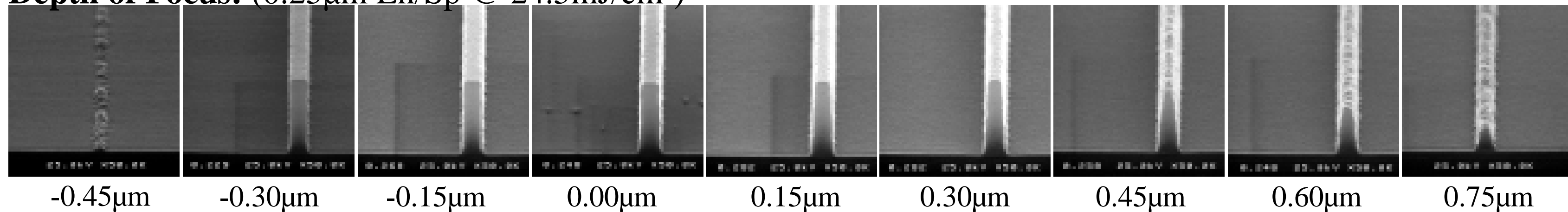
DUV 32



-0.75µm -0.60µm -0.45µm -0.30µm -0.15µm 0.00µm 0.15µm 0.30µm 0.45µm 0.60µm

Depth of Focus: (0.25µm Ln/Sp @ 24.5mJ/cm²)

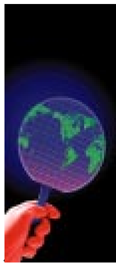
DUV 42



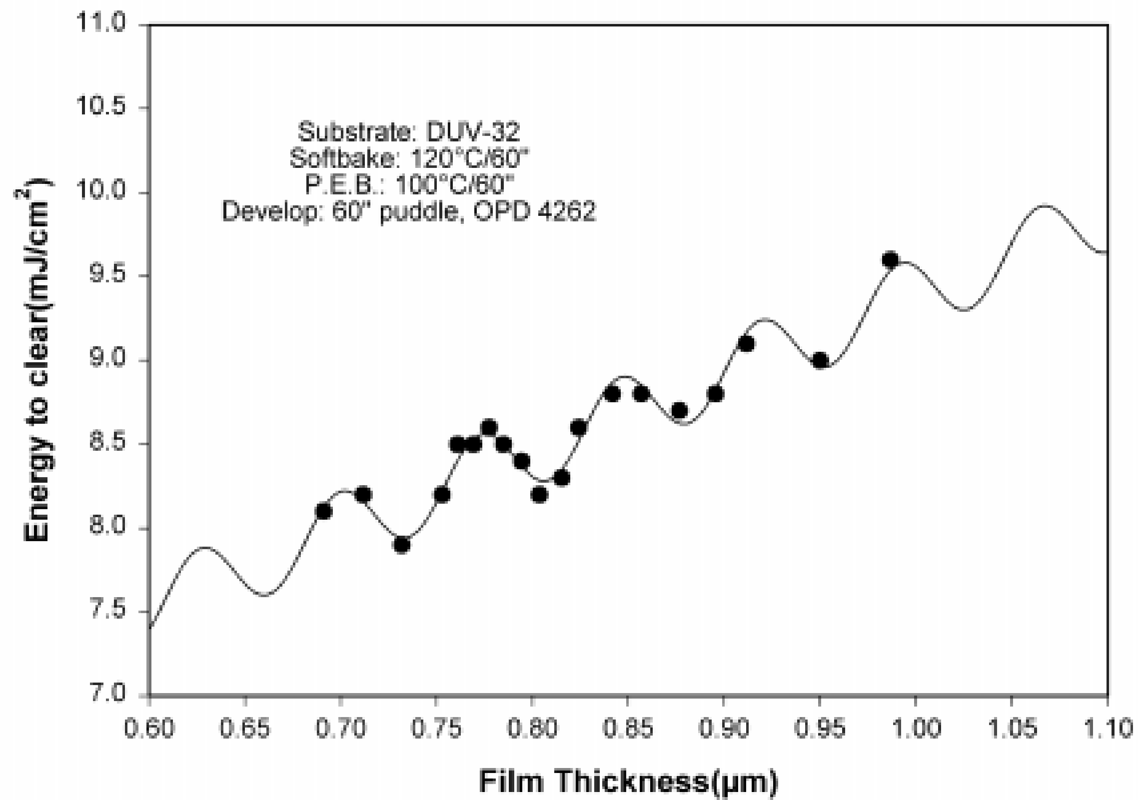
-0.45µm -0.30µm -0.15µm 0.00µm 0.15µm 0.30µm 0.45µm 0.60µm 0.75µm

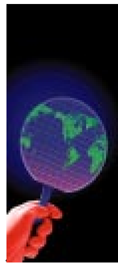
Evaluation Conditions

Substrate:	Silicon + DUV BARC
Resist Thickness:	Various (~7800Å)
Soft Bake:	120ºC/60"
Exposure Tool:	ISI-7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	85ºC/60"
Develop:	5"stream/60"puddle OPD4262



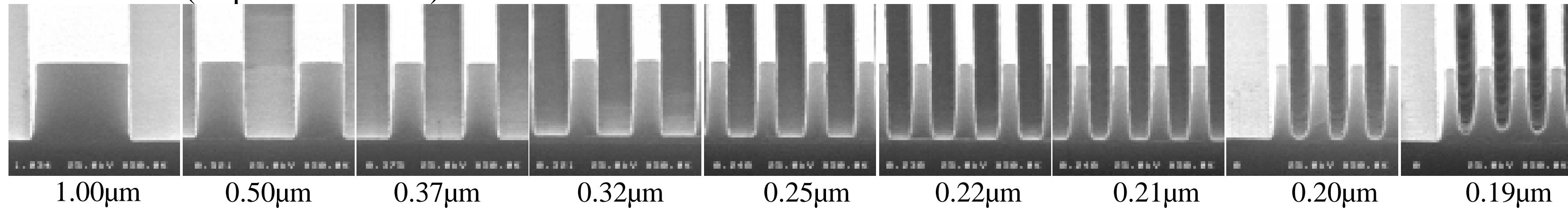
ARCH 8250 Swing Curve



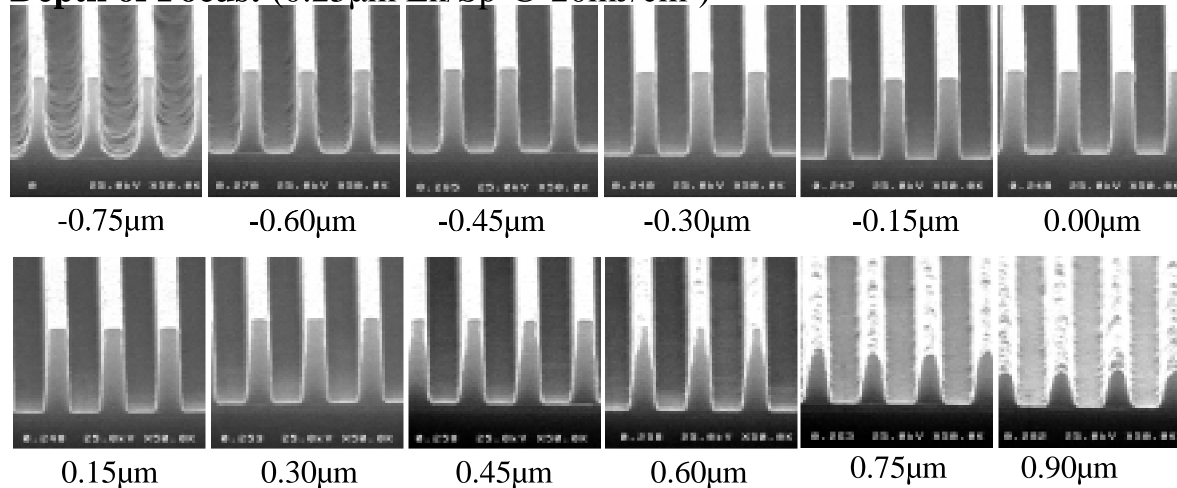


ARCH 8250(0.25μm Process)

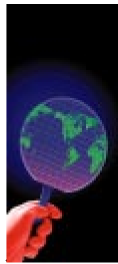
Resolution: (Eopt @20mJ/cm²)



Depth of Focus: (0.25μm Ln/Sp @ 20mJ/cm²)

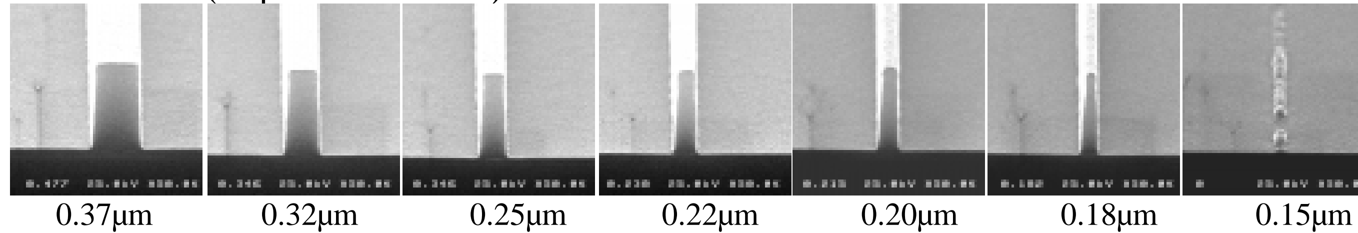


Evaluation Conditions	
Substrate:	Si + 500Å DUV32
Resist Thickness:	0.78μm
Soft Bake:	120°C/60”
Exposure Tool:	ISI 7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	100°C/60”
Develop:	5”stream/60”puddle OPD4262
Reticle:	Benchmark

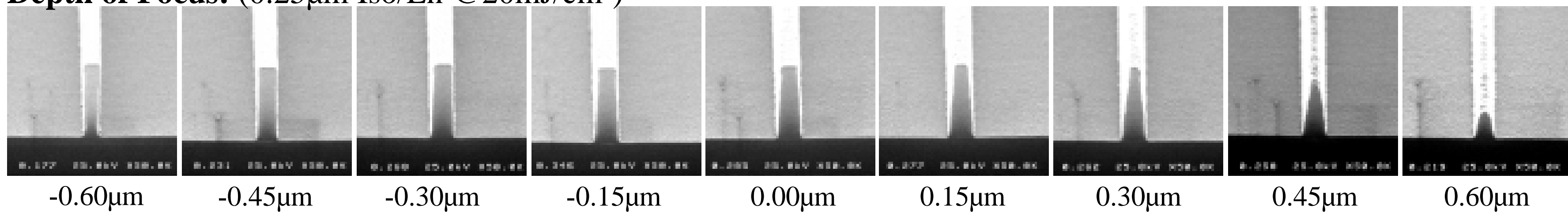


ARCH 8250(0.25µm Process)

Resolution: (Eopt: @20mJ/cm²)

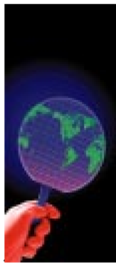


Depth of Focus: (0.25µm Iso/Ln @20mJ/cm²)

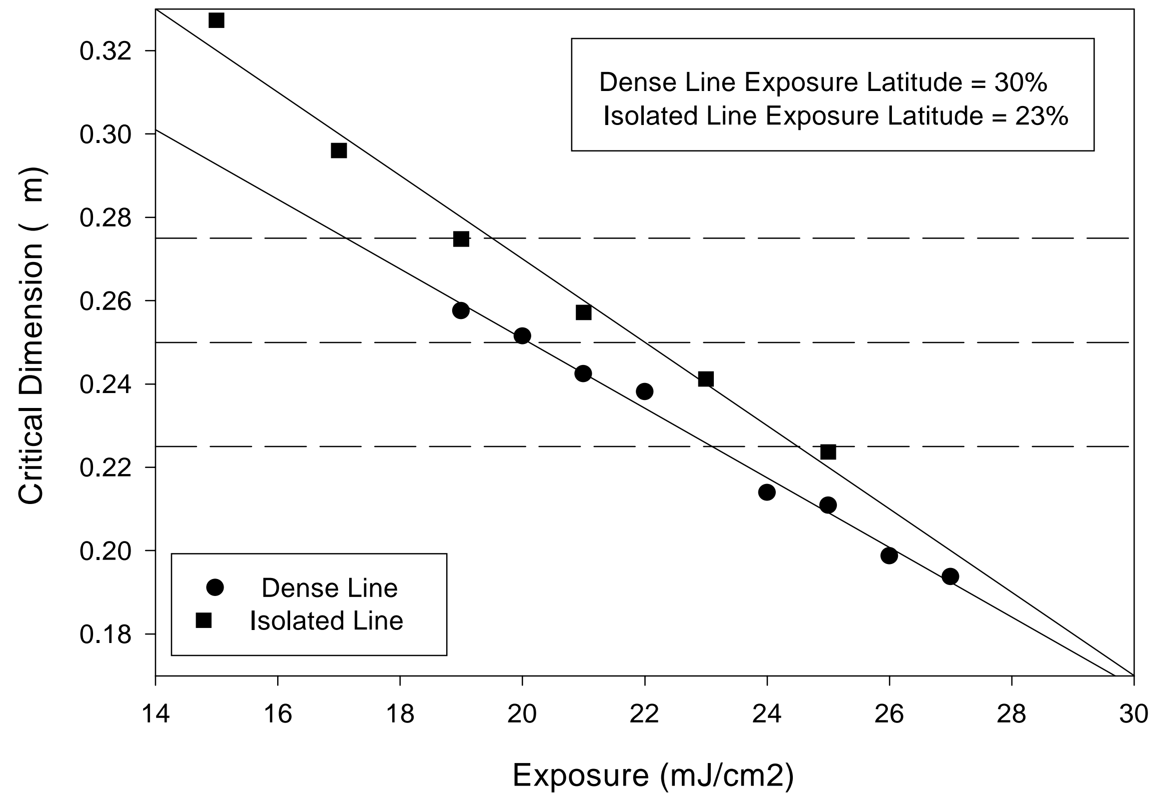


Evaluation Conditions

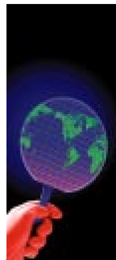
Substrate:	Si + 500Å DUV32
Resist Thickness:	0.78µm
Soft Bake:	120°C/60”
Exposure Tool:	ISI 7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	100°C/60”
Develop:	5”stream/60”puddle OPD4262
Reticle:	Benchmark



ARCH 8250(0.25µm Process)

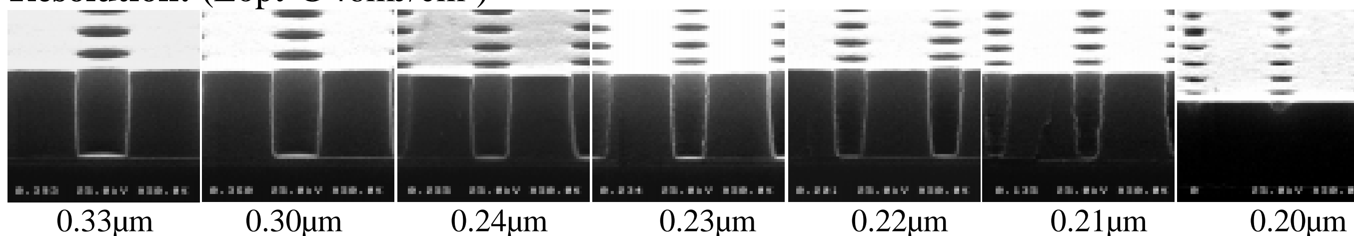


Substrate = Si + 550¯ DUV 32
Film thickness = 0.78um
Soft Bake =**120C/60"**
Exposure = ISI 7800
Illumination = 0.53NA/0.74Sigma
PEB = 100C/60"
Development = 5"/60" stream/puddle
w/ OPD 4262



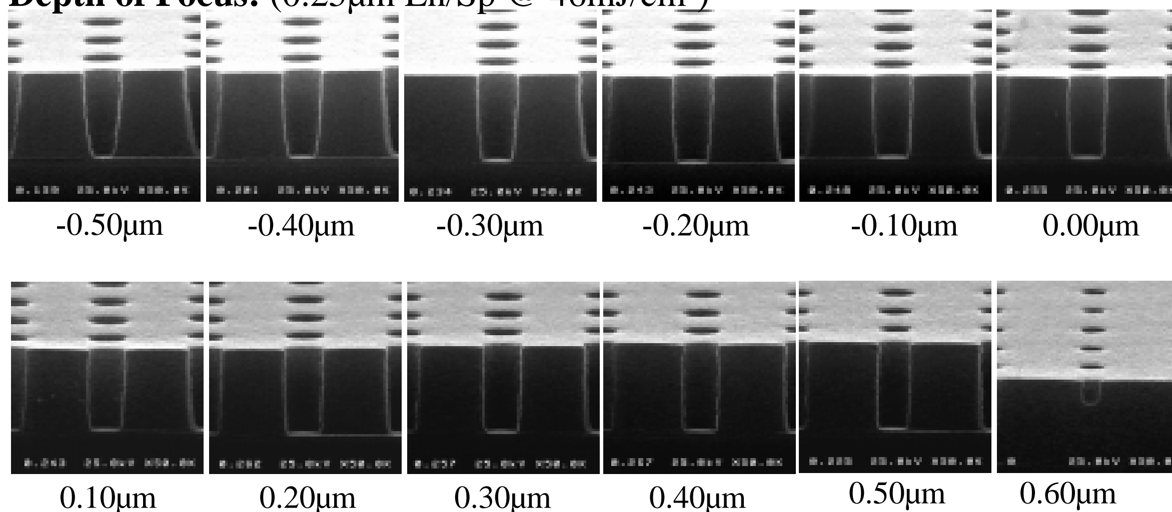
ARCH-8250(0.25µm Process)

Resolution: (Eopt @46mJ/cm^2)



0.33µm 0.30µm 0.24µm 0.23µm 0.22µm 0.21µm 0.20µm

Depth of Focus: (0.25µm Ln/Sp @ 46mJ/cm^2)

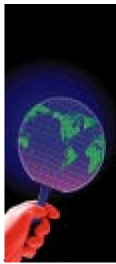


-0.50µm -0.40µm -0.30µm -0.20µm -0.10µm 0.00µm

0.10µm 0.20µm 0.30µm 0.40µm 0.50µm 0.60µm

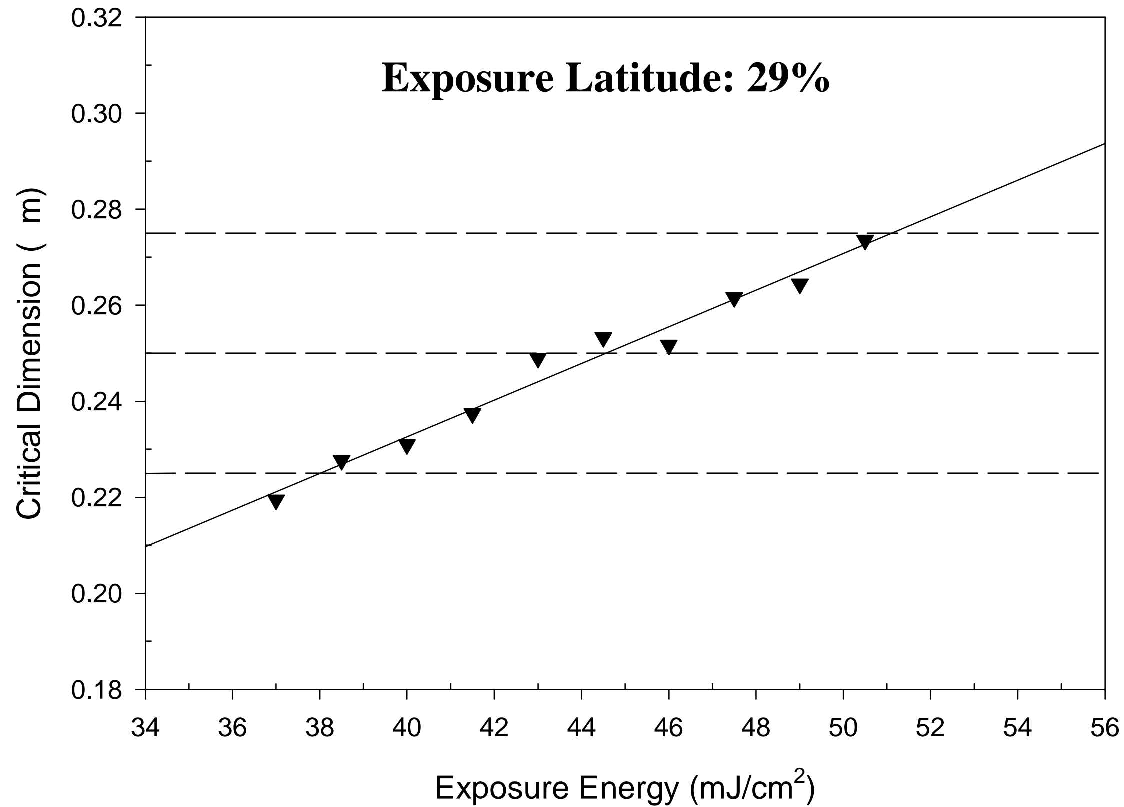
Evaluation Conditions

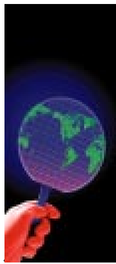
Substrate:	Si + 500Å DUV32
Resist Thickness:	0.78µm
Soft Bake:	120°C/60”
Exposure Tool:	ISI 7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	100°C/60”
Develop:	5”stream/60”puddle OPD4262
Reticle:	Benchmark



ARCH 8250(0.25μm Process)

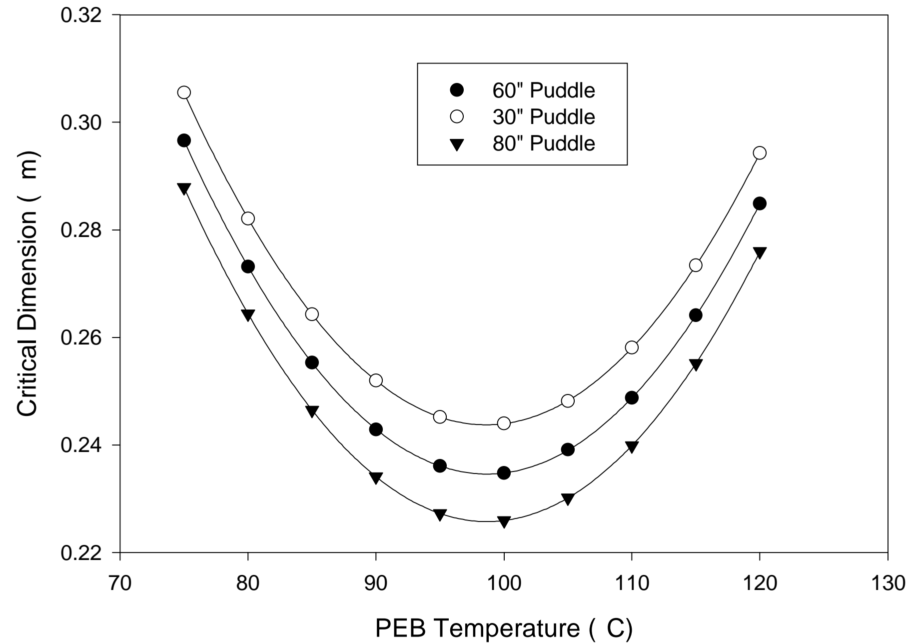
Exposure Latitude (0.25μm CH) - based on KLA data

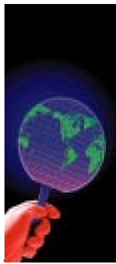




ARCH 8250(0.25µm Process)

0.25µm P.E.B. Sensitivity

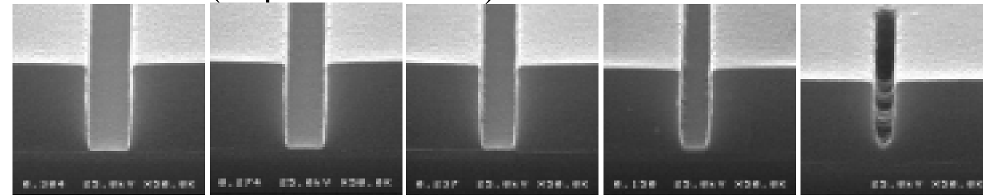




ARCH 8250(0.15µm Process)

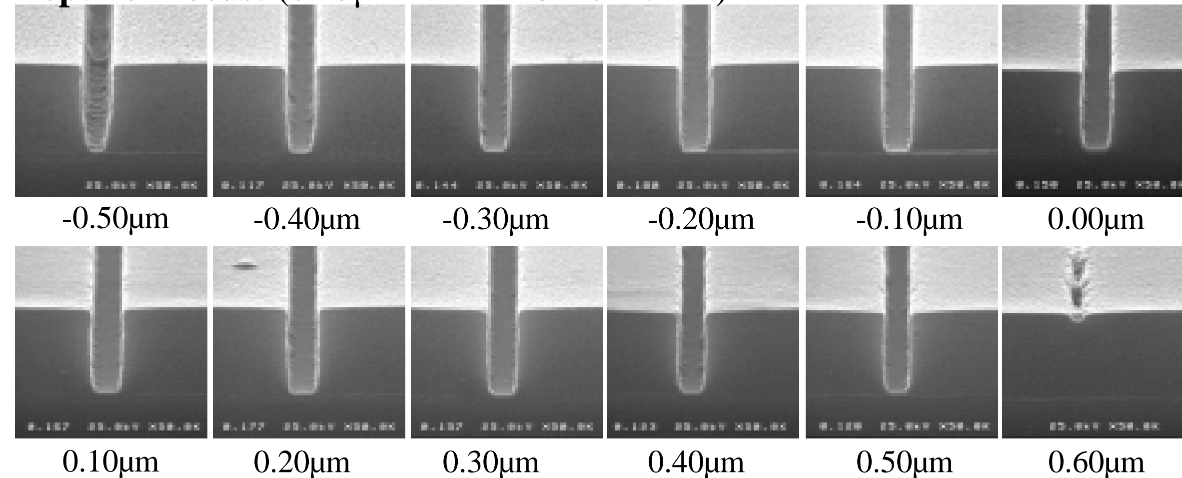
Eopt @ 0.18µm Trench sized to 0.15µm: 46mJ/cm²

Resolution: (Eopt @46mJ/cm²)



Reticle CD/Measured CD 0.25/0.30µm 0.22/0.27µm 0.20/0.24µm 0.18/0.15µm 0.17µm

Depth of Focus: (0.15µm Trench @ 46mJ/cm²)

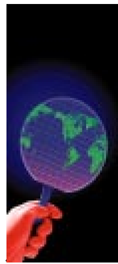


-0.50µm -0.40µm -0.30µm -0.20µm -0.10µm 0.00µm

0.10µm 0.20µm 0.30µm 0.40µm 0.50µm 0.60µm

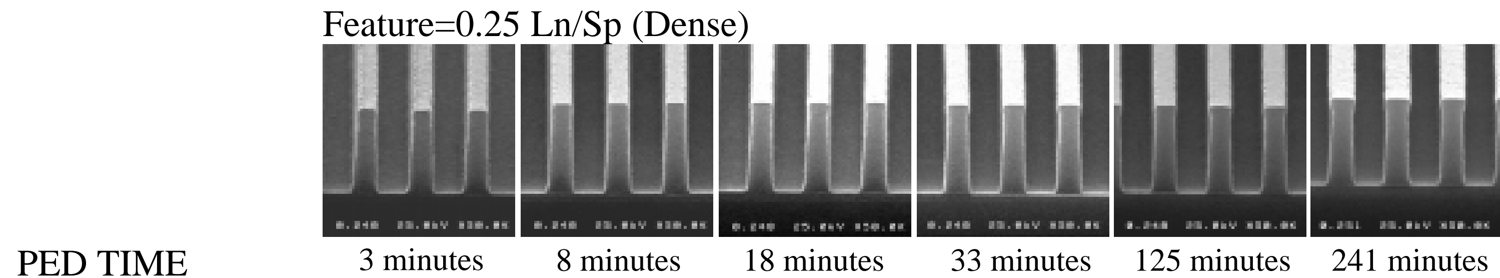
Evaluation Conditions

Substrate:	Silicon+ 500Å DUV 32
Resist Thickness:	0.78µm
Soft Bake:	120°C/60"
Exposure Tool:	ISI-7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	100°C/60"
Develop:	5"stream/60"puddle OPD4262



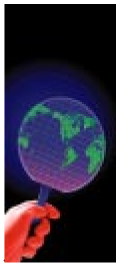
ARCH-8250(0.25µm Process)

Post Exposure Delay Stability



Evaluation Conditions

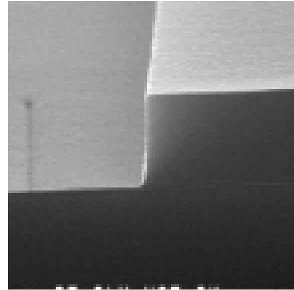
Substrate:	Silicon + 500Å DUV32
Resist Thickness:	0.78µm
Soft Bake:	120°C/60”
Exposure Tool:	ISI 7800
NA/Sigma:	0.53/0.74
Post Exposure Bake:	100°C/60”
Develop:	5”stream/60”puddle OPD4262
Wafer Storage for PED:	In cleanroom



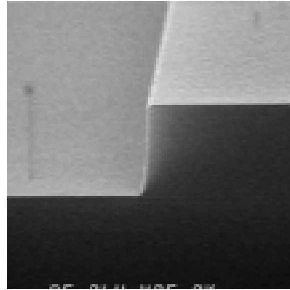
ARCH-8250(0.25μm Process)

Thermal Deformation Temperature

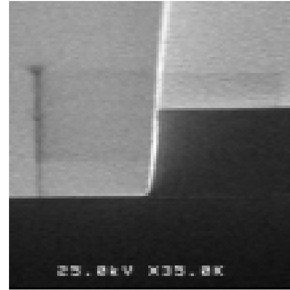
Bulk Pad



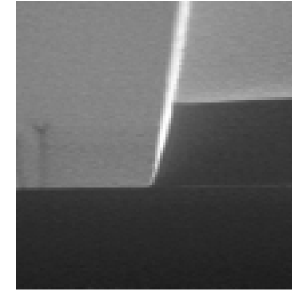
no bake



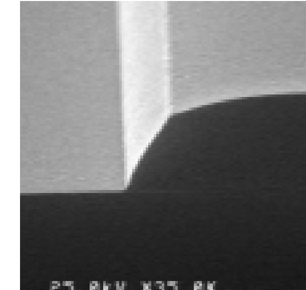
120°C



130°C

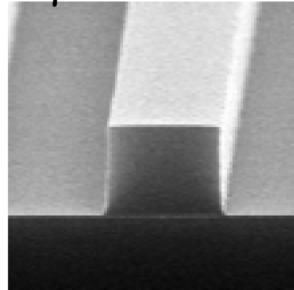


140°C

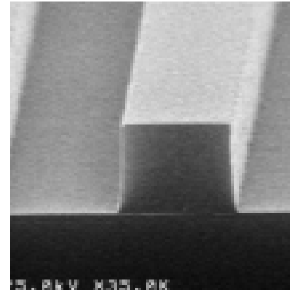


150°C

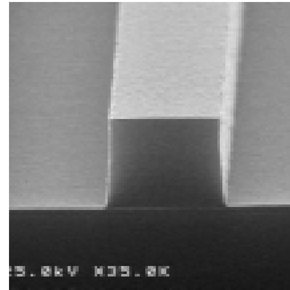
1.0μm Dense Line



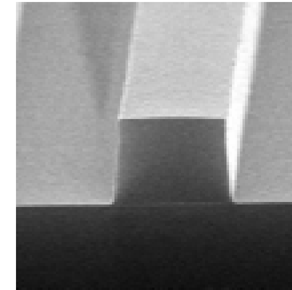
no bake



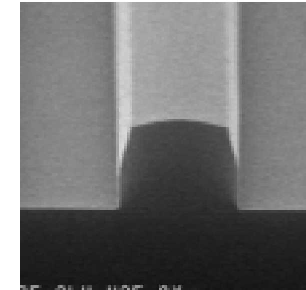
120°C



130°C



140°C



150°C

Evaluation Conditions

Substrate:	Silicon + 500A DUV 32
Resist Thickness:	0.7800μm
Soft Bake:	120°C/60”
Exposure Tool:	ISI 7800 DUV stepper
NA/Sigma:	0.53 / 0.74
Post Exposure Bake:	100°C/60”
Develop:	5.0”stream/60”puddle OPD4262