



AZ[®] 40XT-11D Photoresist

Thick Positive Chemically Amplified Photoresist Lithographic Performance at 40μm

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AZ's Thick Film Photoresist Roadmap

Lift-off FT: 2-10 μm	TSV / Etch Implant FT: 3-15 μm	Copper/UBM Plating FT: 5-30 μm	Gold Plating FT: 10-30 μm	Solder / Metal Plating FT: >30 μm	MEMS / Ink Jet FT: >30 μm	DUV TFRH/Implant FT: 3 - 8 μm
Commercialized materials		P4620 AZ[®] nLOF Series AZ[®] 10XT AZ[®] 9200 AZ[®] N4000 AZ[®] 4562 AZ[®] PLP30/PLP40 AZ[®] 50XT AZ[®] TX 1311 VS-01HJ				
Materials recently scaled up (latest generation products)		AZ[®] 12XT Series AZ[®] 15nXT Series AZ[®] 125nXT Series AZ[®] 40XT-11D				
Materials under development		AZ[®] EXP 100 AZ[®] LExp 600				

Red=Neg, Blue =Pos; nLOF, N4000, 15nXT, 12XT, 40XT = chemically amplified; 125nXT = photopolymer; 10XT, 9200, P4620, PLP, 50XT = DNQ

AZ[®] Electronic Materials

Thick Photoresist Product Summary

Thick Film Product	Platform	λ	FT Range (um)	Maximum Single coat	Aspect Ratio	Application	Developer Compatibility
P4000 Series	DNQ	g-h	2 - 55	25	2:1	Solder, Cu, Au	400K / TMAH
4500 Series	DNQ	g-h	2 - 55	25	2:1	Solder, Cu, Au	400K / TMAH
9200 Series	DNQ	g-h-i	3 - 50	25	3:1	Solder, Cu, Au	400K / TMAH
10XT	DNQ	g-h-i	4 - 50	25	3:1	Solder, Cu, Au	400K / TMAH
50XT	DNQ	g-h	15 - 65	65	3:1	Solder, Cu, Etch	400K
PLP-30	DNQ	g-h	6 - 25	25	2:1	Au, Cu	303N
PLP-40	DNQ	g-h	20 - 30	30	2:1	Au, Cu	303N
12XT Series	CA	g-h-i	5 - 20	20	4:1	Si, Cu, Au, TSV	TMAH
40XT Series	CA	g-h-i	20 - 100	60	4:1	Etch, Solder, Cu	TMAH / 400K
125nXT Series	PP	g-h-i	20 - 120	120	6:1	Cu, Au, Solder	TMAH / 303N
15nXT Series	CA	g-h-i	5 - 20	20	3:1	Cu, TSV Etch	TMAH
TX 1311	CA	DUV	3 - 5	5	15:1	Cu, NiFe, Si	TMAH

➤ Platform: **DNQ** = Novolak, **CA** = Chemically Amplified, **PP** = Photopolymer

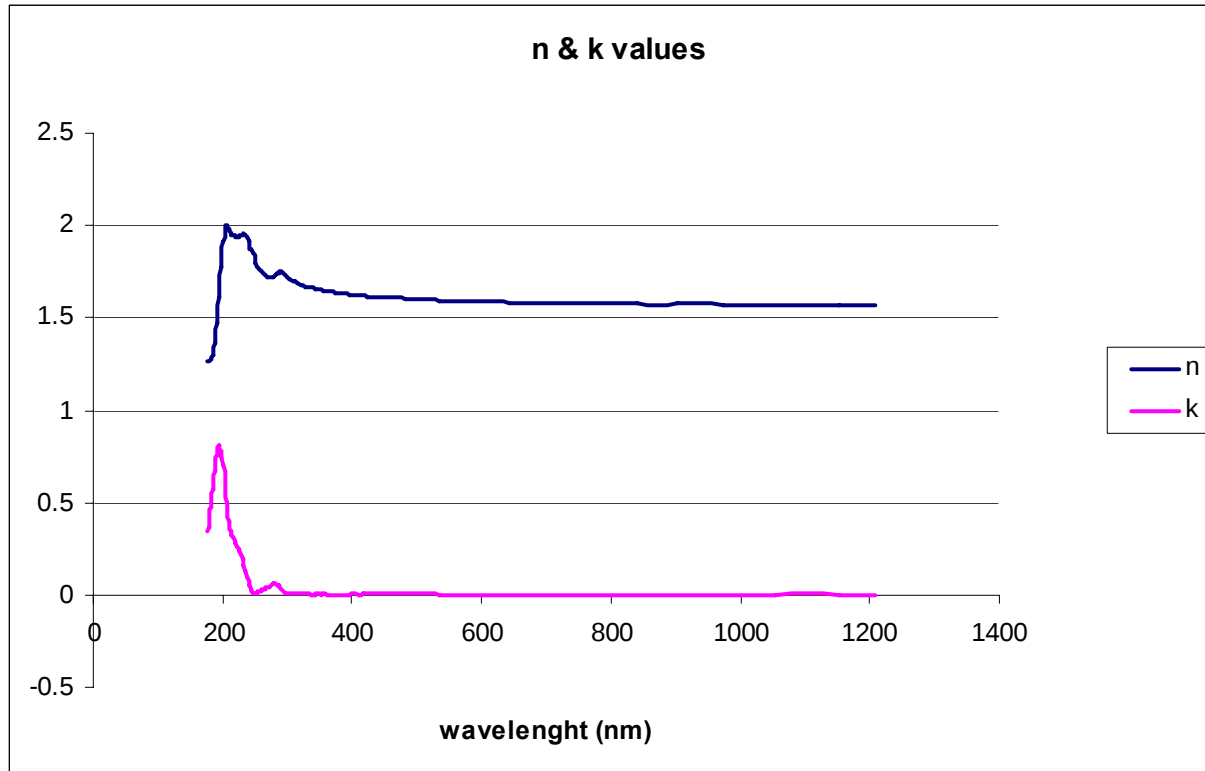
➤ Wavelength: Red font indicates better performance.

➤ Developer Compatibility: Bold font indicates most compatible developer, resulting in shorter develop times and lower exposure energies.



AZ[®] 40XT-11D

Photoresist Optical Parameters



Cauchy Parameters

A = 1.560

B = 0.007 μm^{-2}

C = 0.0006 μm^{-4}

n & k Values

$\lambda = 362.04 \text{ nm}$: n = 1.6443 k = 0.002779

$\lambda = 367.41 \text{ nm}$: n = 1.6431 k = 0.000630

AZ[®] 40XT-11D

Process Conditions

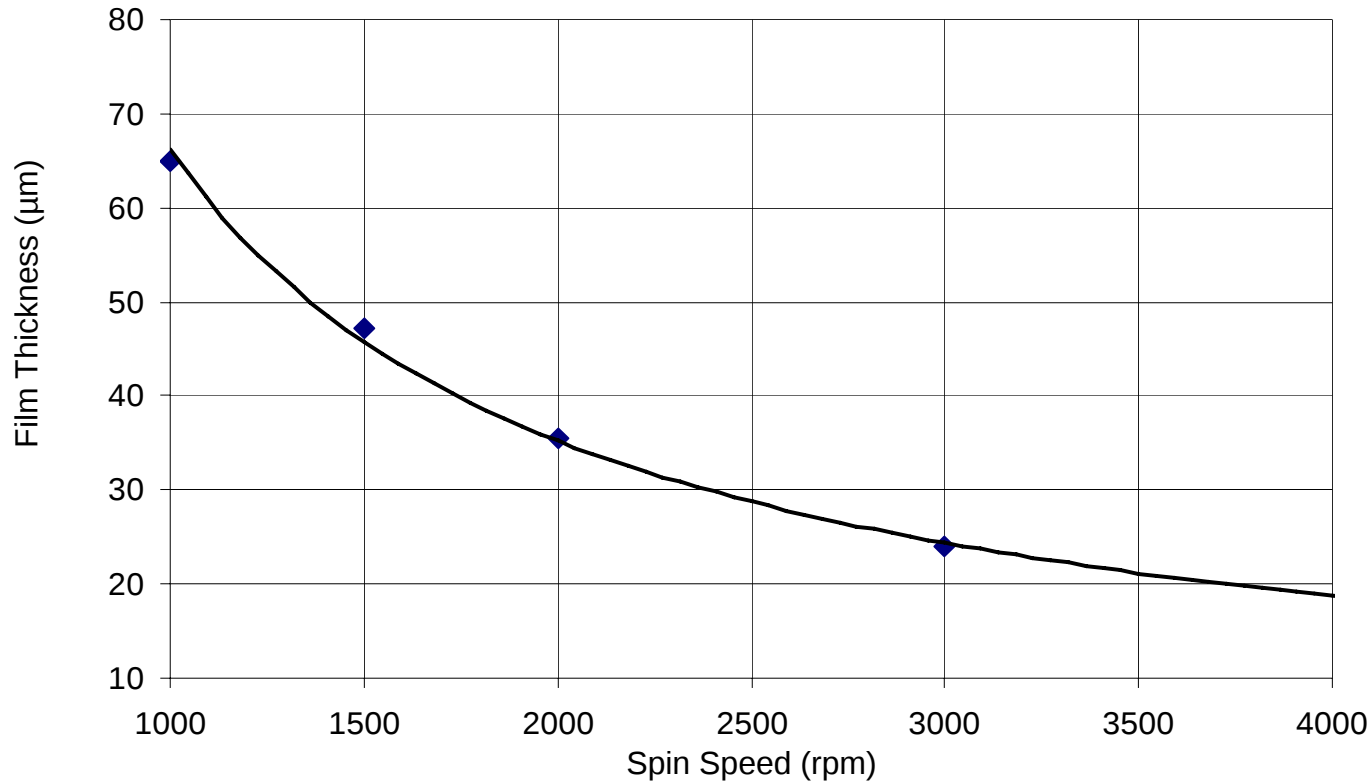
Process Conditions:

Substrate:	200 mm Silicon
Coater Tool:	Suss ACS 300 Plus Coat/ Bake
Coat Process:	Dynamic dispense on Silicon @ 30 rpm
Target FT:	40 µm
Softbake:	126°C hotplate/ 120 sec @ 1.27 mm 126°C hotplate/ 120 sec @ 0.63 mm 126°C hotplate/ 180 sec @ 0.00 mm
Exposure:	Suss MA200 CC Mask Aligner; 20µm proximity gap
PEB:	105°C hotplate/ 10 sec @ 1.3 mm 105°C hotplate/ 10 sec @ 0.6 mm 105°C hotplate/ 80 sec @ 0.0 mm
Develop:	AZ [®] 300 MIF/ 4x60 sec spray/puddle @ 23°C
Analysis:	
Amray SEM	



AZ[®] 40XT-11D Photoresist

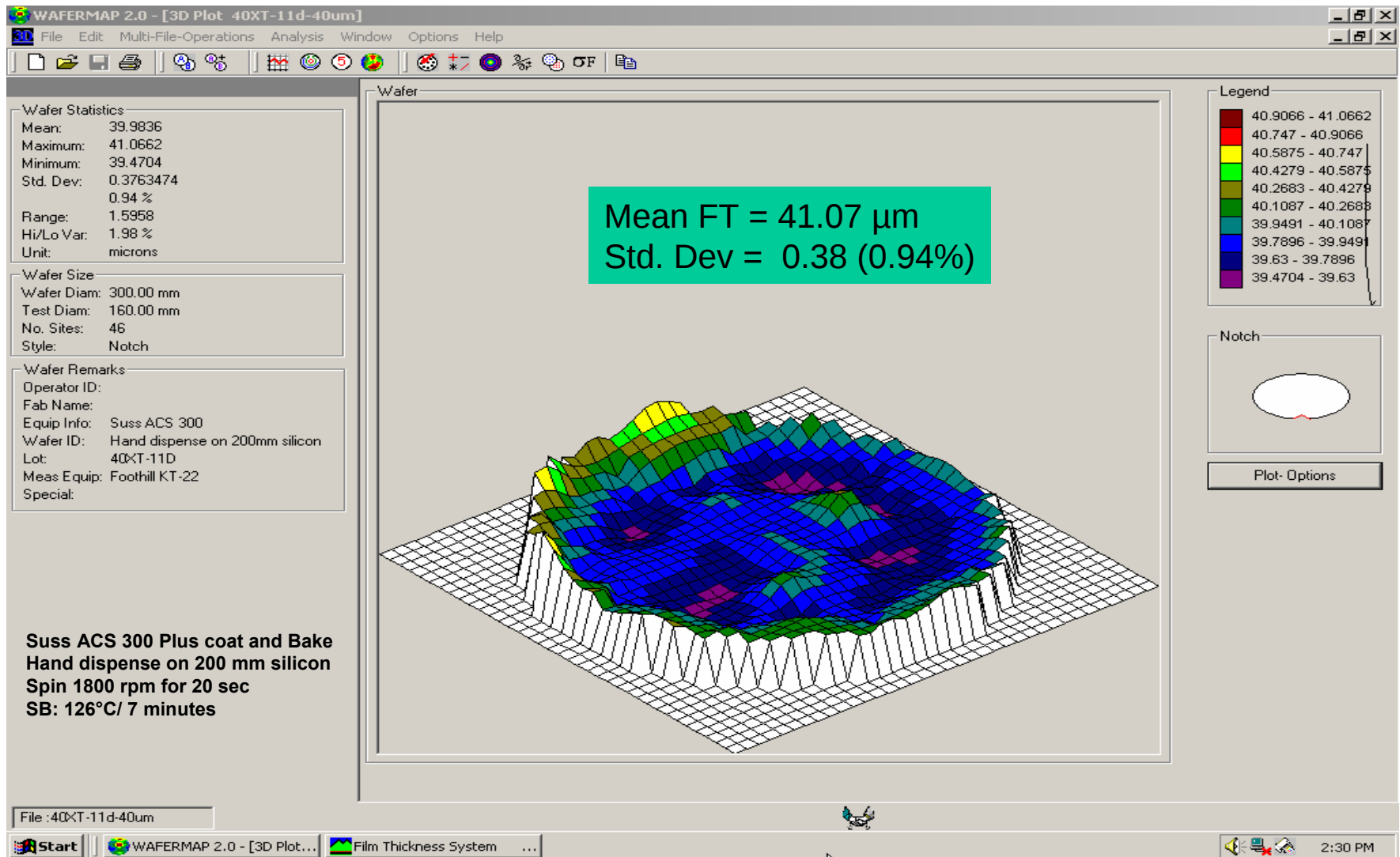
Film Thickness vs. Spin Speed on 200 mm Silicon



Suss ACS 300 Plus coat and Bake
Hand dispense on 200 mm silicon
Spin 1000-3000 rpm for 20 sec
SB: 126°C/ 7 minutes

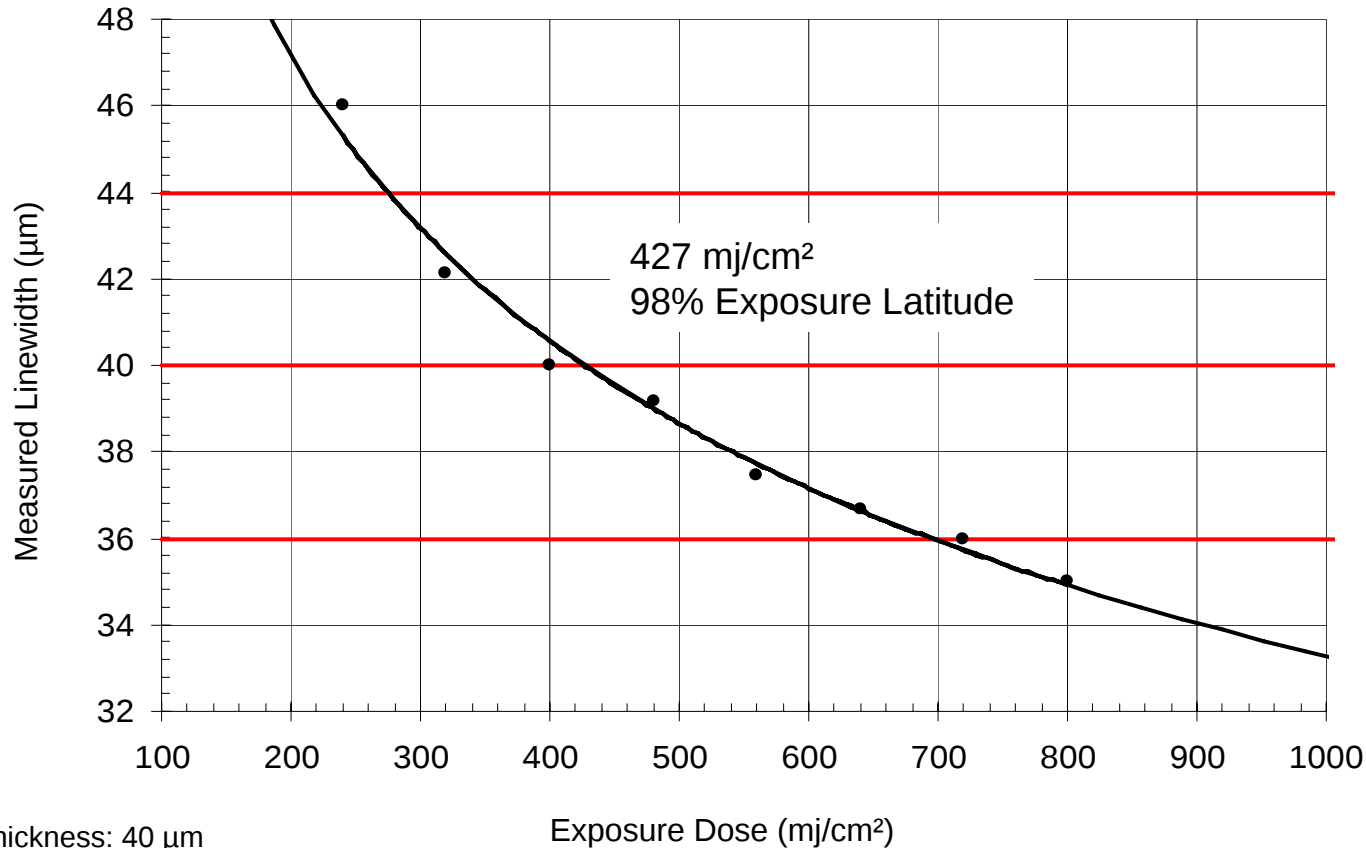
AZ[®] 40XT-11D Photoresist, FT=40 μm

Coat uniformity on 200 mm Silicon



AZ[®] 40XT-11D Photoresist, FT=40 μm

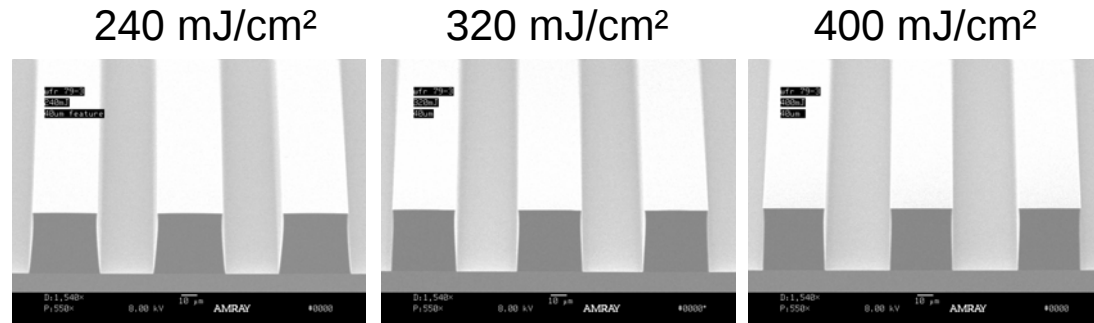
40 μm L/S Exposure Latitude



Film Thickness: 40 μm
Suss ACS 300 Plus coat and Bake
SB: 126°C/ 7 minutes
Suss MA200 CC Mask Aligner/ 20 μm proximity gap
PEB: 105°C/ 100 seconds
AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

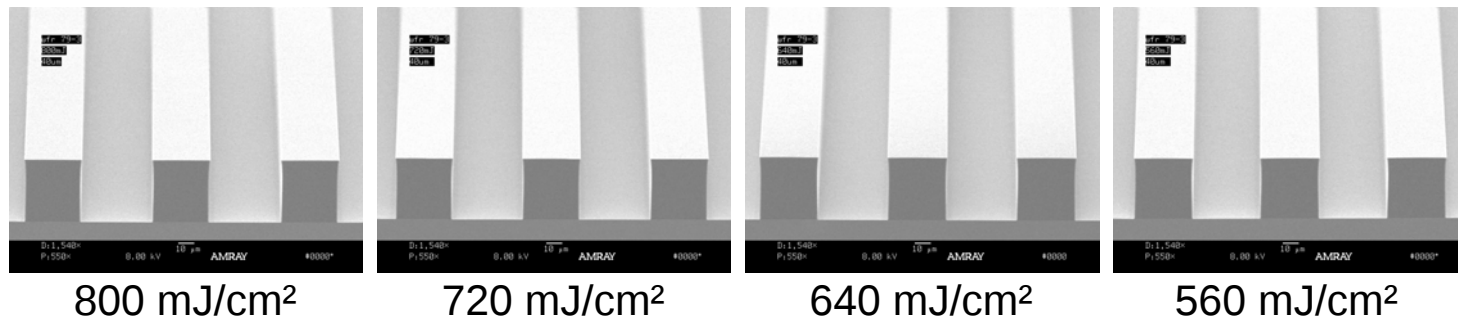
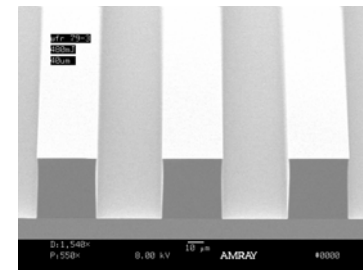
AZ[®] 40XT-11D Photoresist, FT=40 μm

40 μm L/S Exposure Latitude



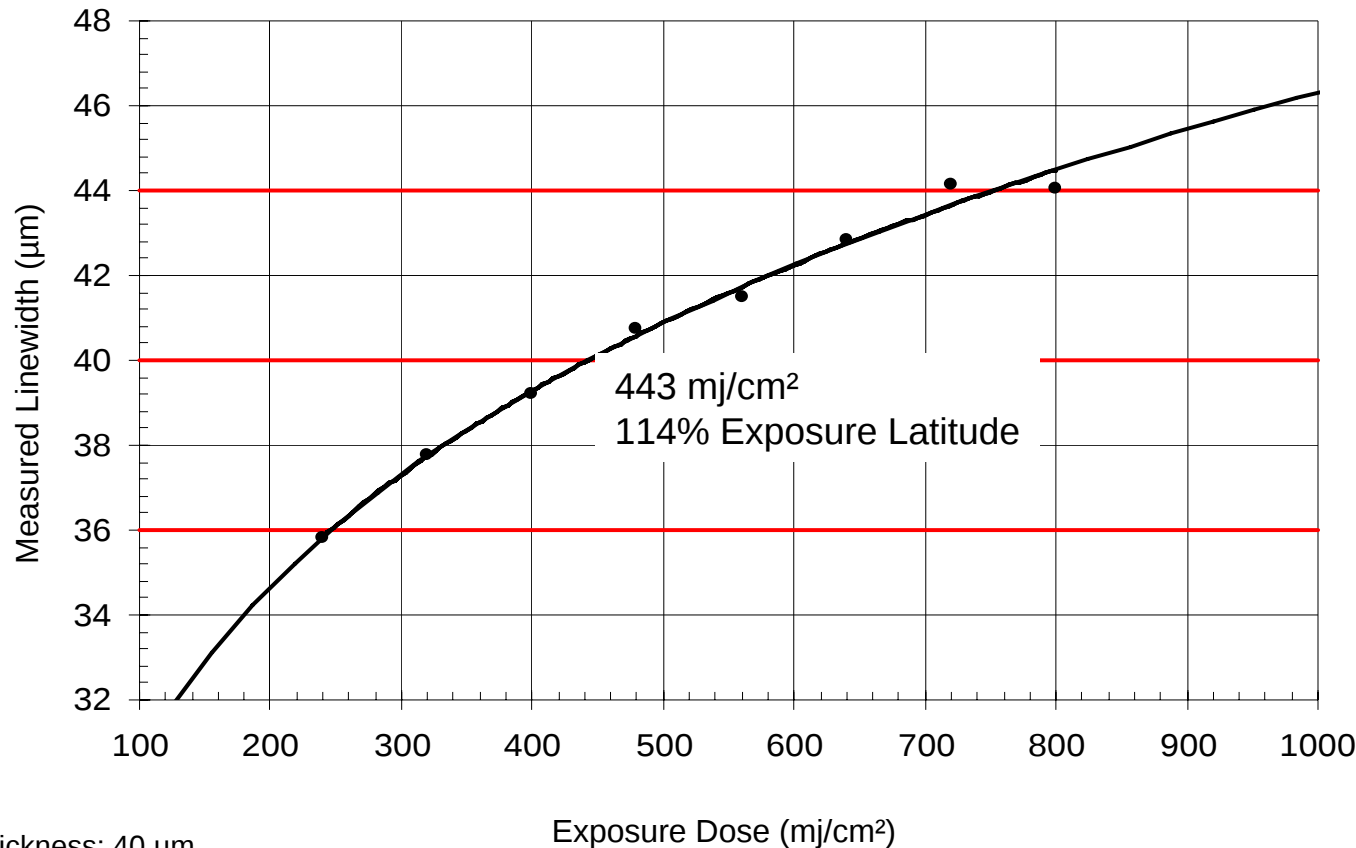
Film Thickness: 40 μm
 Suss ACS 300 Plus coat and Bake
 SB: 126°C/ 7 minutes
 Suss MA200 CC Mask Aligner/ 20 μm proximity gap
 PEB: 105°C/ 100 seconds
 AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

480 mJ/cm²



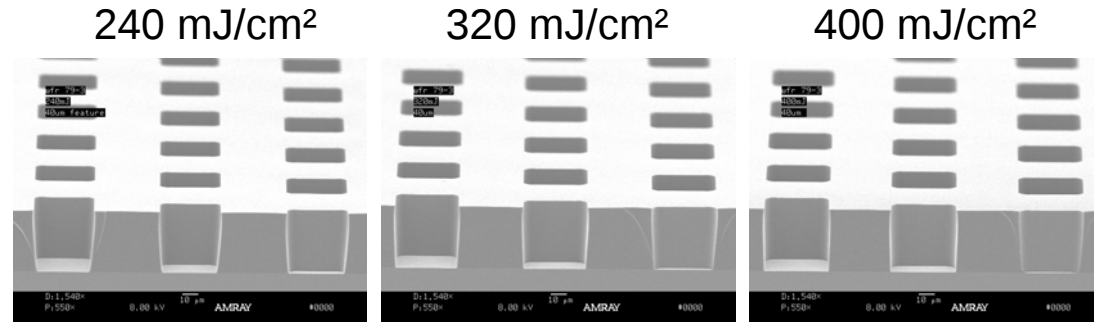
AZ[®] 40XT-11D Photoresist, FT=40 μm

40.0 μm Contact Holes Exposure Latitude



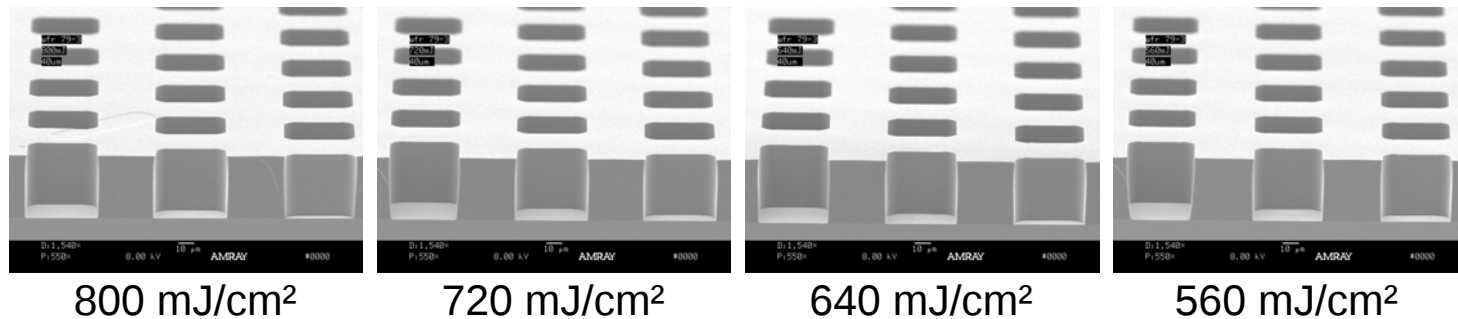
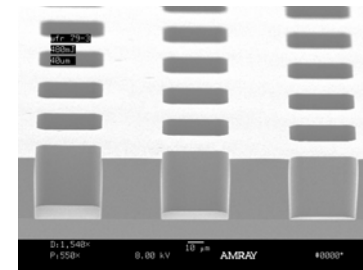
Film Thickness: 40 μm
Suss ACS 300 Plus coat and Bake
SB: 126°C/ 7 minutes
Suss MA200 CC Mask Aligner/ 20 μm proximity gap
PEB: 105°C/ 100 seconds
AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

AZ[®] 40XT-11D Photoresist, FT=40 μm 40 μm Contact Holes (1:1 Pitch) Exposure Latitude

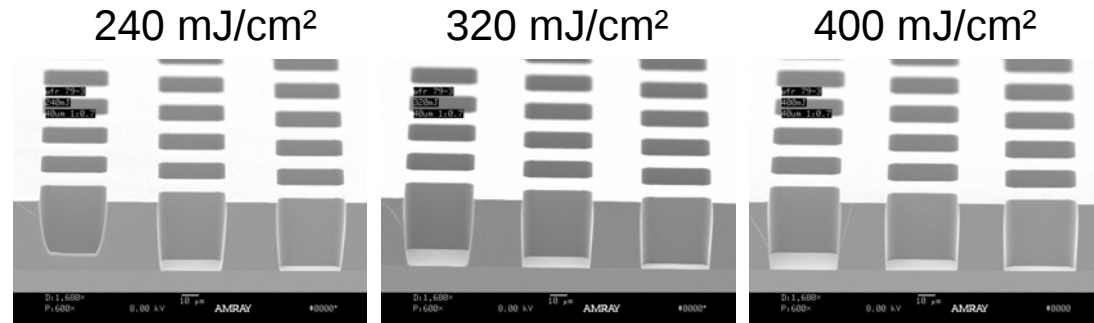


Film Thickness: 40 μm
Suss ACS 300 Plus coat and Bake
SB: 126°C/ 7 minutes
Suss MA200 CC Mask Aligner/ 20 μm proximity gap
PEB: 105°C/ 100 seconds
AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

480 mJ/cm²

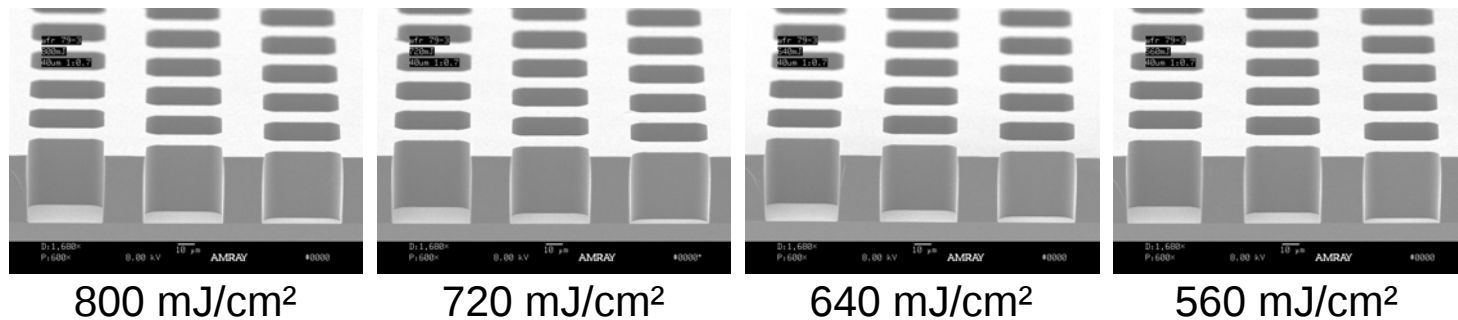
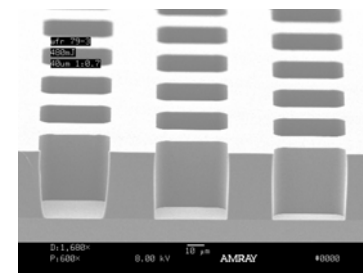


AZ[®] 40XT-11D Photoresist, FT=40 μm 40 μm Contact Holes (1:0.7 Pitch) Exposure Latitude



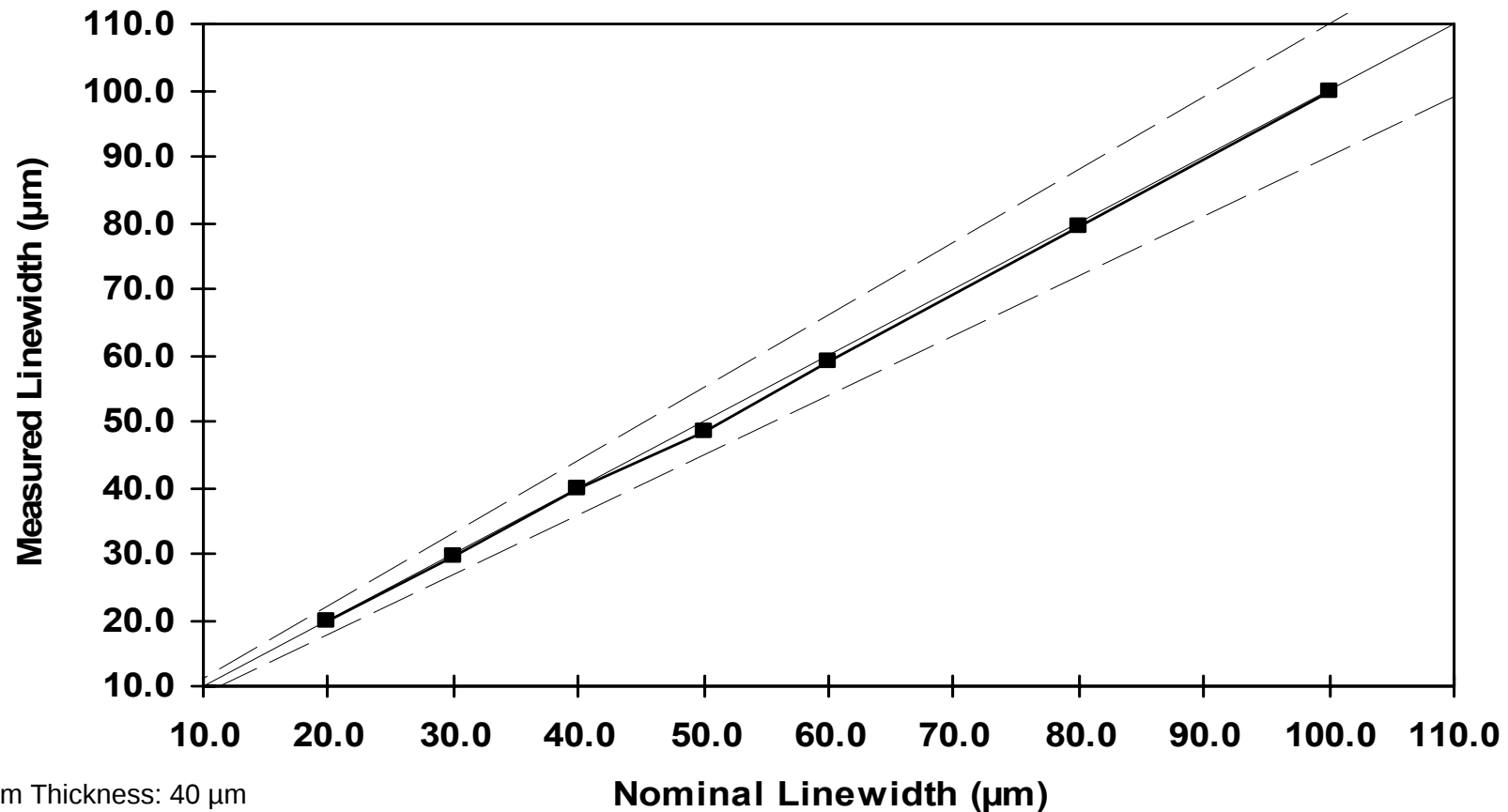
Film Thickness: 40 μm
Suss ACS 300 Plus coat and Bake
SB: 126°C/ 7 minutes
Suss MA200 CC Mask Aligner/ 20 μm proximity gap
PEB: 105°C/ 100 seconds
AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

480 mJ/cm²



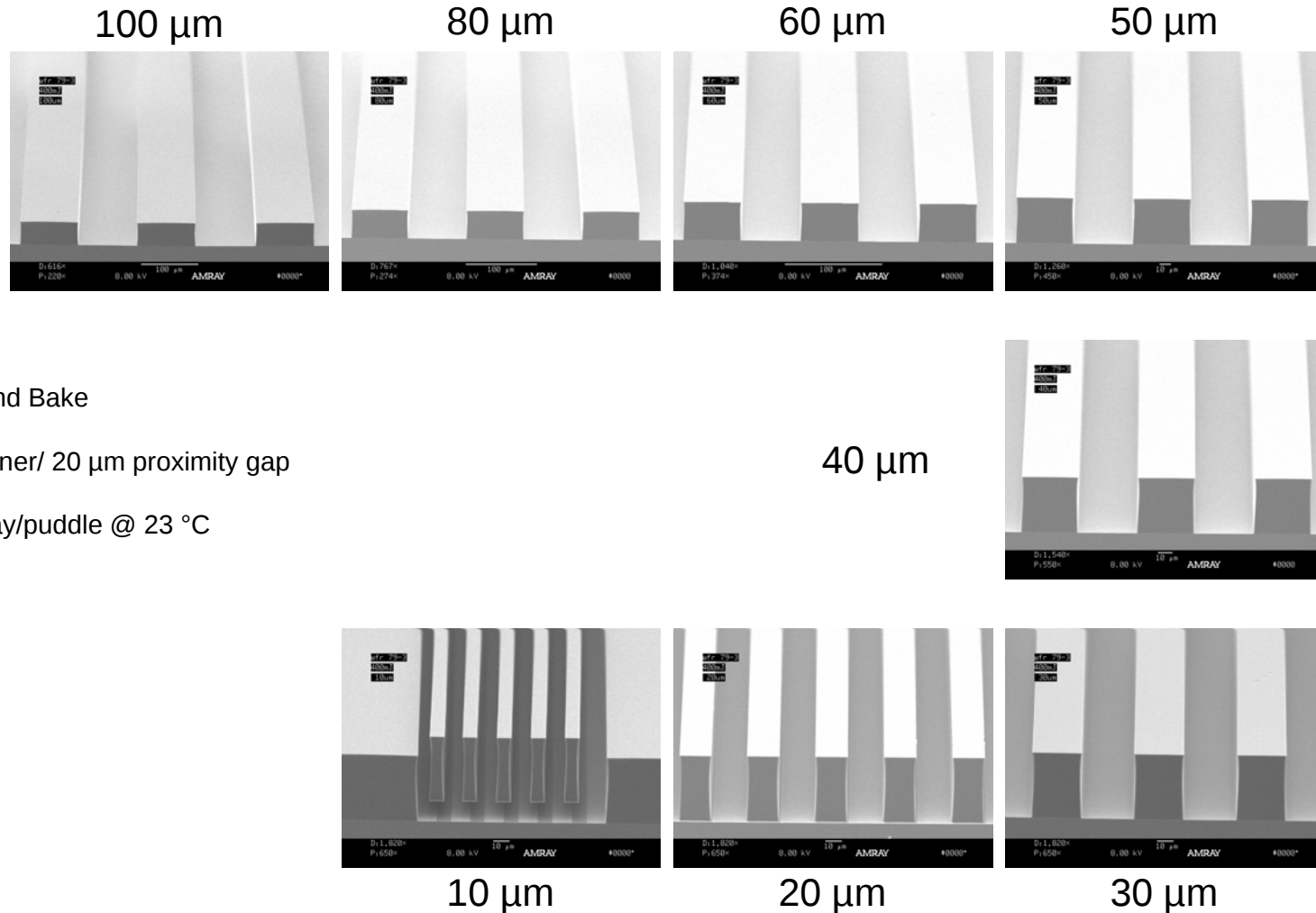
AZ[®] 40XT-11D Photoresist, FT=40 μm

L/S Linearity @ 400 mJ/cm²



Film Thickness: 40 μm
Suss ACS 300 Plus coat and Bake
SB: 126°C/ 7 minutes
Suss MA200 CC Mask Aligner/ 20 μm proximity gap
PEB: 105°C/ 100 seconds
AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

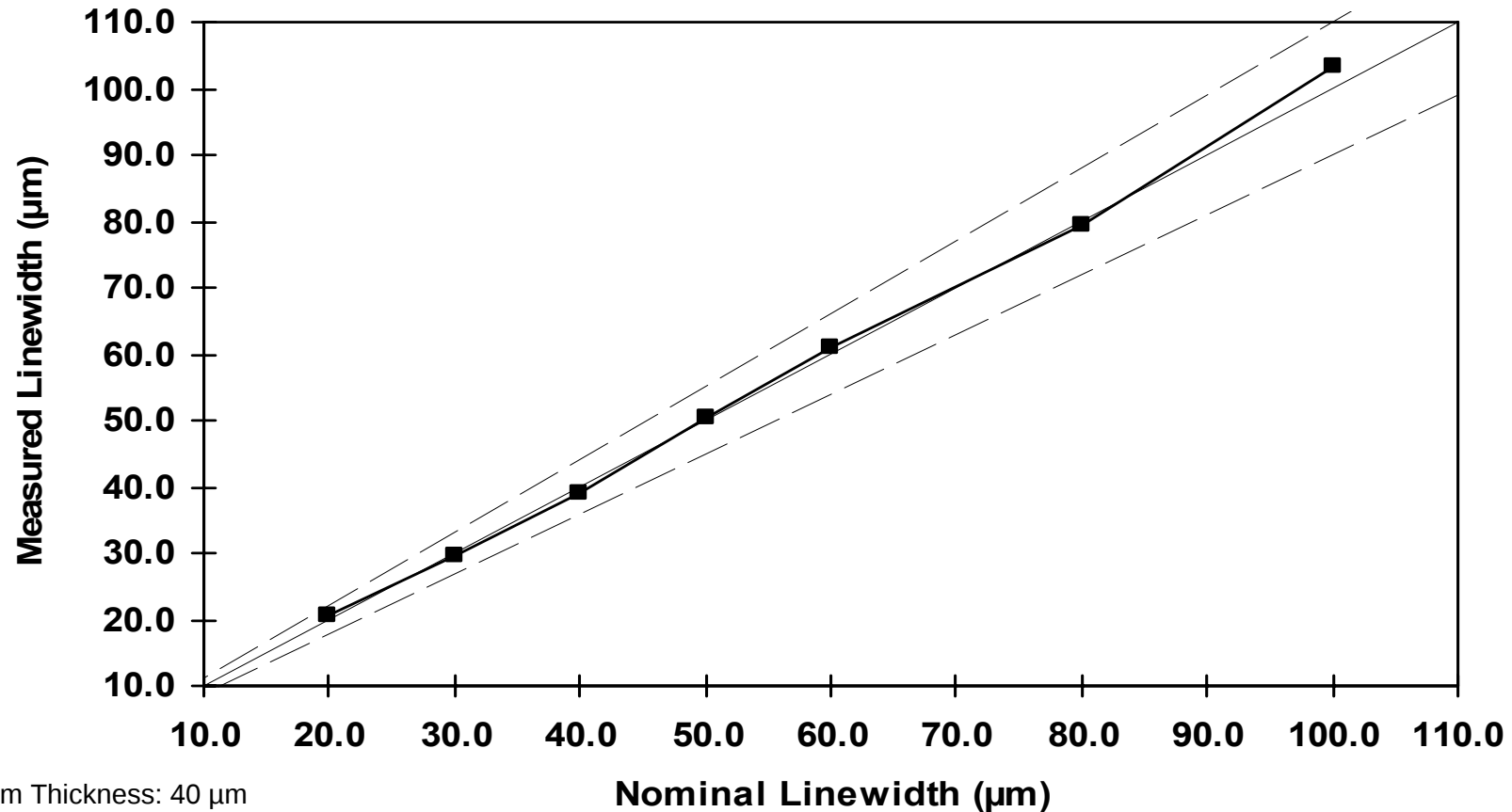
AZ[®] 40XT-11D Photoresist, FT=40 μm L/S Linearity on Silicon @ 400 mJ/cm²



Film Thickness: 40 μm
 Suss ACS 300 Plus coat and Bake
 SB: 126°C/ 7 minutes
 Suss MA200 CC Mask Aligner/ 20 μm proximity gap
 PEB: 105°C/ 100 seconds
 AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

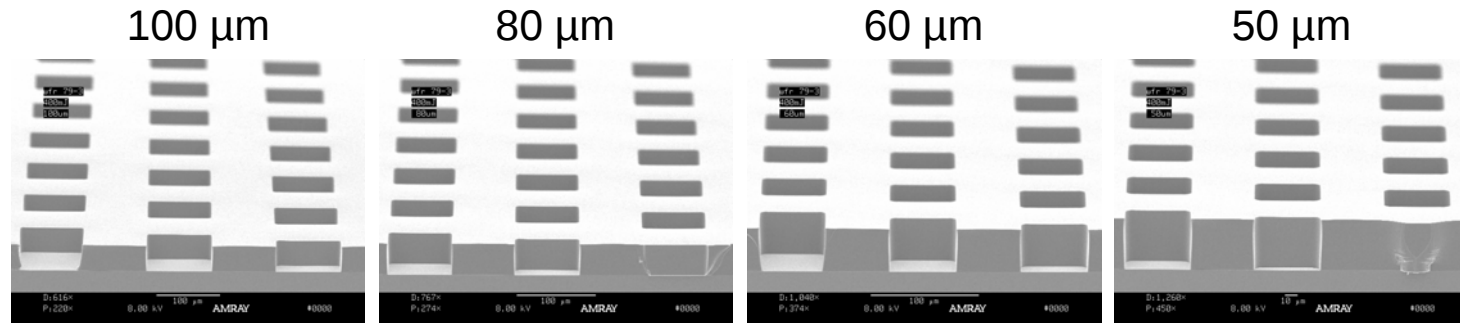
AZ[®] 40XT-11D Photoresist, FT=40 μm

Contact Holes (1:1 Pitch) Linearity @ 400 mJ/cm^2



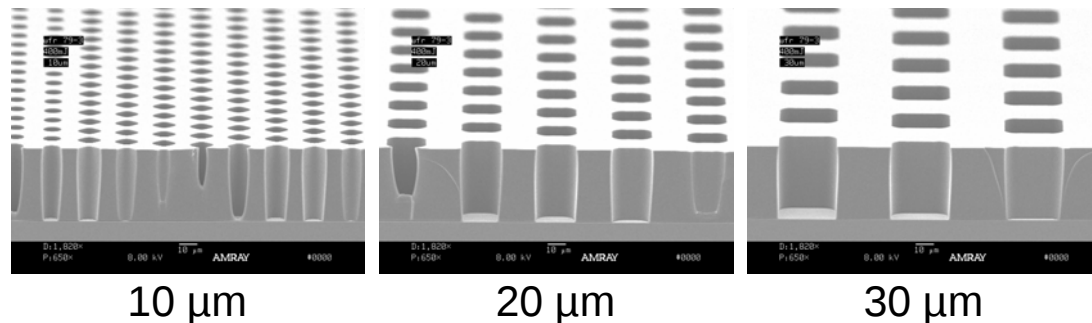
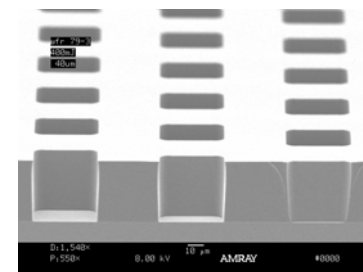
Film Thickness: 40 μm
Suss ACS 300 Plus coat and Bake
SB: 126°C/ 7 minutes
Suss MA200 CC Mask Aligner/ 20 μm proximity gap
PEB: 105°C/ 100 seconds
AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

AZ[®] 40XT-11D Photoresist, FT=40 μm Contact Holes (1:1 Pitch) Linearity @ 400 mJ/cm²

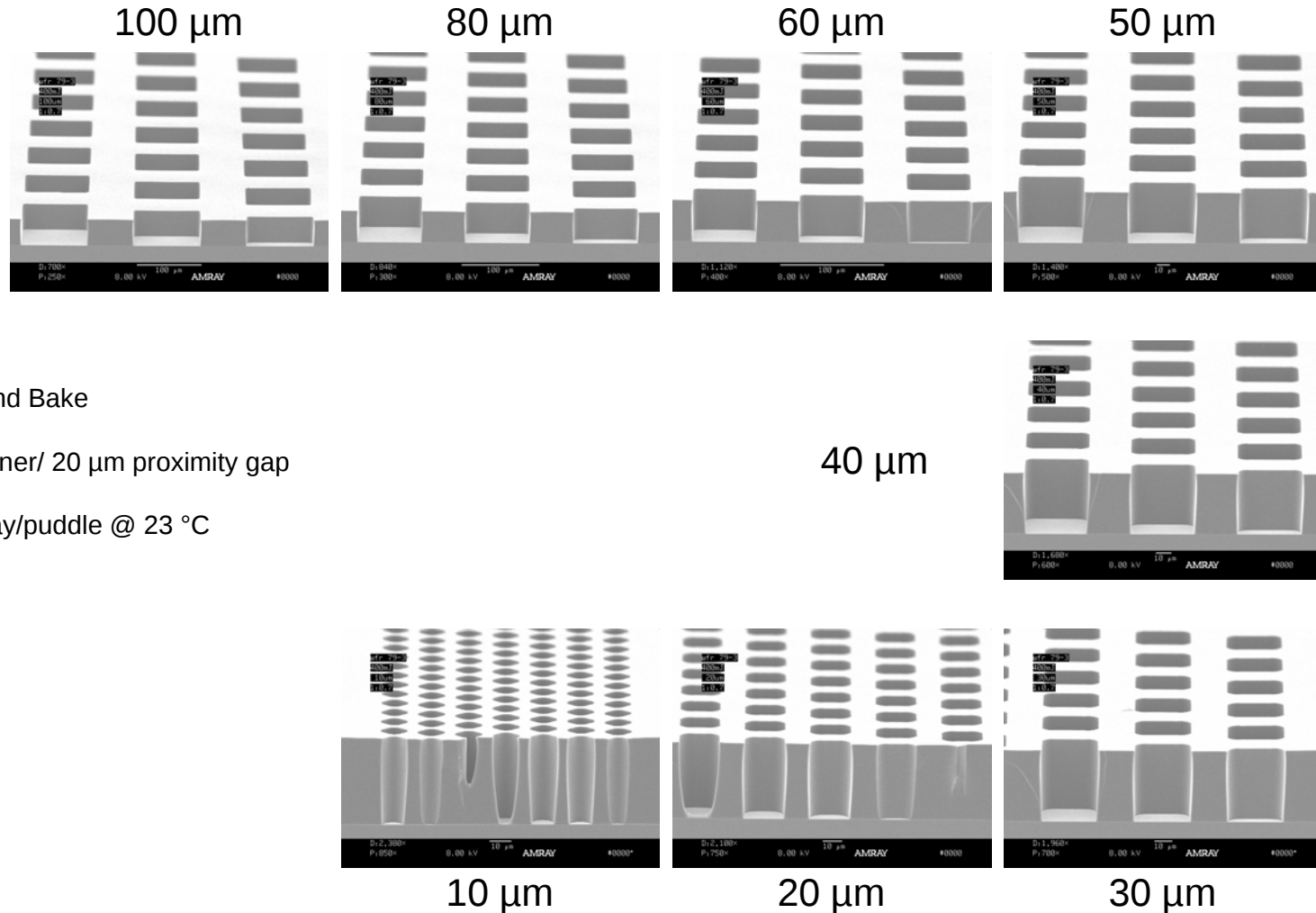


Film Thickness: 40 μm
 Suss ACS 300 Plus coat and Bake
 SB: 126°C/ 7 minutes
 Suss MA200 CC Mask Aligner/ 20 μm proximity gap
 PEB: 105°C/ 100 seconds
 AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

40 μm



AZ[®] 40XT-11D Photoresist, FT=40 μm Contact Holes (1:0.7 Pitch) Linearity @ 400 mJ/cm^2



Film Thickness: 40 μm
Suss ACS 300 Plus coat and Bake
SB: 126°C/ 7 minutes
Suss MA200 CC Mask Aligner/ 20 μm proximity gap
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AZ 300 MIF/ 4X60 sec spray/puddle @ 23 °C

AZ[®] 40XT-11D Photoresist

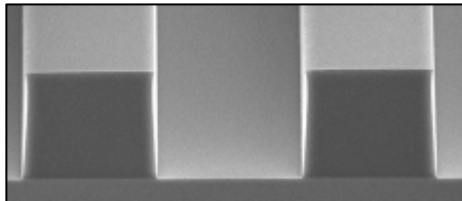
Lithographic Performance Summary:

Resist	Features (1:1)	Film Thickness (μm)	DTP 40 μm (mJ/cm^2)	Exposure Latitude 40 μm (%)	Linearity (μm)
AZ [®] 40XT-11D	Dense Lines	40	427	98	20
AZ [®] 40XT-11D	Contact Holes	40	443	114	20

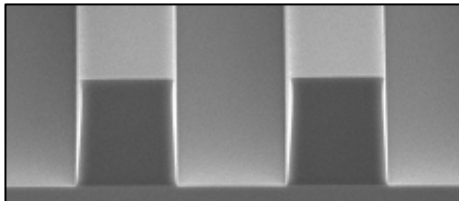
AZ[®] 40XT-11D

Performance on Silicon at 40μm FT

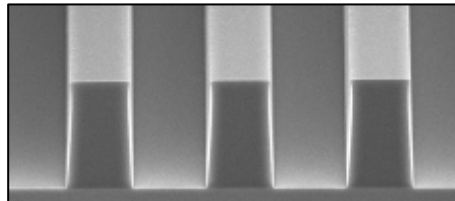
40 μm



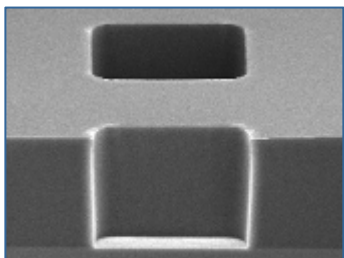
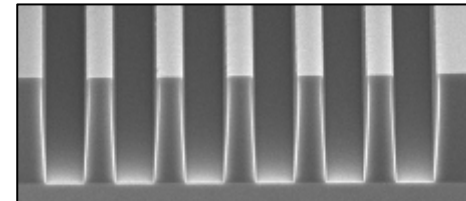
30 μm



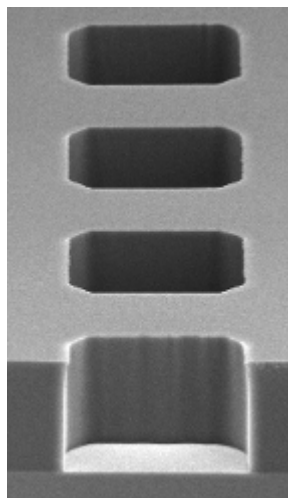
20 μm



10 μm



DTP = 250 mJ/cm²



Softbake: 115°C/60sec @ 0.05" gap, + 60sec @ 0.025" gap, + 240sec @ 0.002" gap
EBR: EBR 600 for 60 sec followed by bake 115°C/10sec @ 0.002" gap
Exposure: Suss MA-200, Broadband, proximity exposure; Exposure gap: FT+30μm (70μm)
PEB: 100°C/30sec @ 0.002" gap
Develop: 3x60 sec puddle AZ 300 MIF Developer @23°C

AZ[®] 40XT-11D Summary

-  **Chemically Amplified Platform**
-  **Vertical profiles on aligners**
-  **Excellent photospeed; good develop time**
-  **TMAH Developer compatible**
-  **Superior overall throughput**
-  **Superior adhesion on substrates**
-  **Superior DRIE performance, ideal for MEMS**
-  **Copper substrate compatible**
-  **Good plating compatibility**
-  **Standard wet strip process for removal**

