

EUV Resist Specification Roadmap

Specifications	Alpha (2005)		Beta (2007)		Gamma (2009)	
	Spec	Current**	Spec	Comment	Spec	Comment
Resolution 1:1	45nm	35nm/45nm (C/S)	32nm		32nm	
Resolution contacts	55nm	TBD	45nm		40nm	
Resolution Isolated Lines	32nm	30nm/40nm (C/S)	22nm		18nm	
Depth of Focus	200nm	100nm for 35-nm 1:1 200nm for 50-nm 1:1	225nm	Dense and isolated; DOF at 10% exposure latitude	225nm	Dense and isolated; DOF at 10% exposure latitude
Photospeed (mJ/cm ²)	10 mJ/cm ²	21mJ/cm ² E-size @ 50-nm 1:1	7mJ/cm ²	Assuming ~30 wph	5mJ/cm ²	Assuming > 100 wph if 5 mJ/cm ² , 115W intermediate focus
Line Edge Roughness (3 σ)	< 4 nm	~4 nm @ 50-nm 1:1 ~7 nm @ 35-nm 1:1	< 3nm		< 1.4 nm	LWR < 8% etched gate length; gate length = 18 nm
Wall Profile Angle	>85°	80° @ 50-nm 1:1	> 85°	Measure cross-sections	> 85°	Measure cross-sections
Outgassing	4.7E13 molecules/cm ² -sec	1.60E+13	TBD		TBD	
Pattern Collapse	>3	None observed	>3	Aspect ratio 3:1 for all structures	>3	Aspect ratio 3:1 for all structures
Unexposed Film Thickness Loss	< 10%	10nm	< 5%		< 5%	
PEB Sensitivity	< 2.5 nm/deg C	TBD	<1.5 nm/deg C		< 1 nm/deg C	
Delay Stability @ < 1ppb amine	30min	TBD	30 min	a) pre-exposure, b) under vacuum, c) post-exposure	30 min	a) pre-exposure, b) under vacuum, c) post-exposure
Etch Resistance	Similar to novolak	TBD	Similar to novolak		Similar to novolak	

**Measured top down values for Rohm and Haas resist MET-1K.

C/S=cross section **Green** = spec is met, **Orange** = spec is not met

Samsung EUV Resist Screening Results

Dr. Jung Hwan Hah

Specifications	2007 Spec	Resist A	Resist B	Resist C	Resist D	Resist E
Resolution 1:1	32nm	35 nm	40 nm	60 nm	80 nm	40 nm
Resolution contacts	45nm	NA	NA	NA	NA	NA
Resolution Isolated Lines	22nm	NA	NA	NA	NA	NA
Depth of Focus	225nm	TBD	TBD	TBD	TBD	TBD
Photospeed (mJ/cm ²)	7mJ/cm ²	27.21mJ	16.45mJ	40mJ	40.52mJ	14.59mJ
Line Width Roughness (3 σ)	< 4.2nm	4.69@50nm	3.99@50nm	5.71@70nm	6.2@80nm	5.84@50nm
Wall Profile Angle	> 85°					
Outgassing	TBD	TBD	TBD	TBD	TBD	TBD



EUV Resist Screening Results

SEM Data (top down)

Resist A @LBNL (0.3NA, Ann)

HP50	HP45	HP40	HP35	HP30	HP25	HP20
23.51mJ	24.68mJ	25.92mJ	27.21mJ	28.57mJ	30mJ	31.5mJ
3.99/5.11(inf)	4.09/5.32(inf)	5.30/6.55(inf)	5.98/8.09(inf)			

EUV Resist Screening Results

SEM Data (top down)

Resist B (0.3 NA, Ann)

HP50	HP45	HP40	HP35	HP30	HP25	HP20
14.92mJ	15.67mJ	16.45mJ	17.28mJ	18.14mJ	19.05mJ	20mJ
4.69/8.14(inf)	5.07/5.89(inf)	6.51/8.81(inf)	6.51/9.94(inf)			

EUV Resist Screening Results

SEM Data (top down)

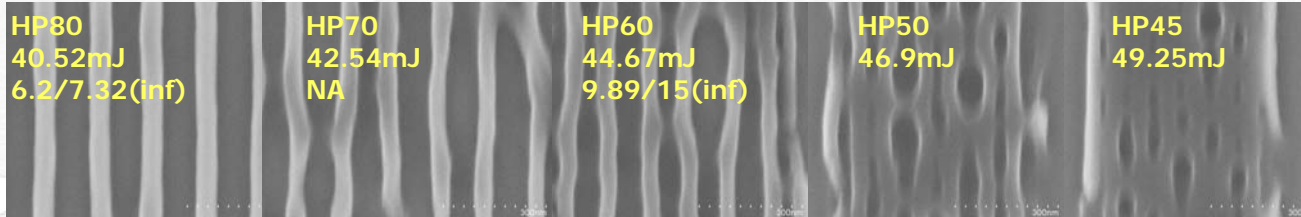
Resist C(Ann)

HP70 38.1mJ 5.71/7.8(inf)	HP60 40mJ 7.39/8.7(inf)	HP50 42mJ 5.61/9.67(inf)	HP45 44.1mJ	HP40 46.31mJ	HP35 48.62mJ	HP30 51.01mJ
---------------------------------	-------------------------------	--------------------------------	----------------	-----------------	-----------------	-----------------

EUV Resist Screening Results

SEM Data (top down)

Resist D(Ann)



EUV Resist Screening Results

SEM Data (top down)

Resist E(Ann)

HP50	HP45	HP40	HP35	HP30	HP25
13.23mJ	13.89mJ	14.59mJ	15.32mJ	16.08mJ	16.89mJ
5.84/7.56(inf)	6.04/8.03(inf)	6.22/6.55(inf)			