

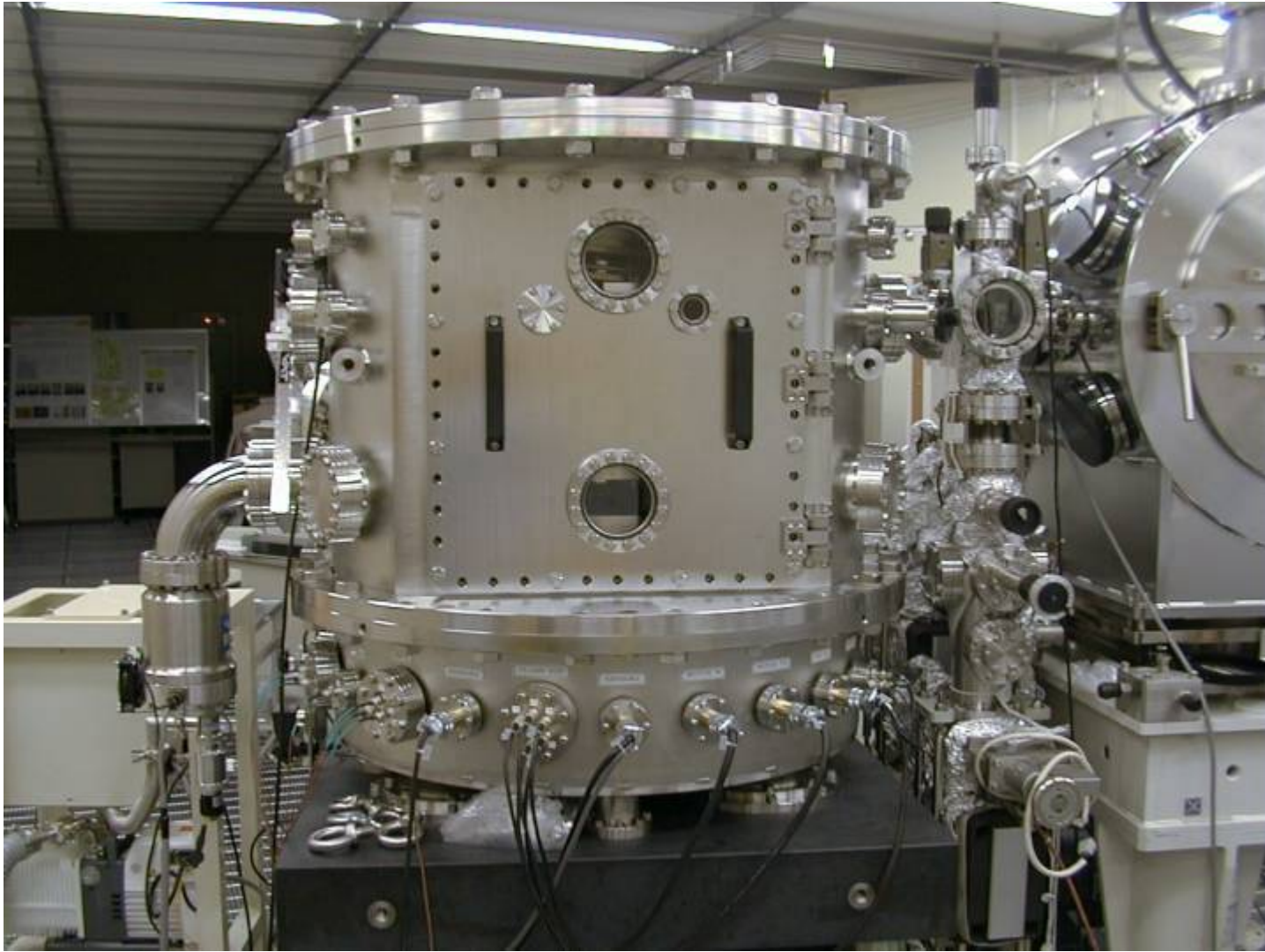
Mar. 3, 2005, 17:50 - 21:45
Fairmont Hotel / Belvedere Room, San Jose, USA

IEUVI Resist TWG meeting

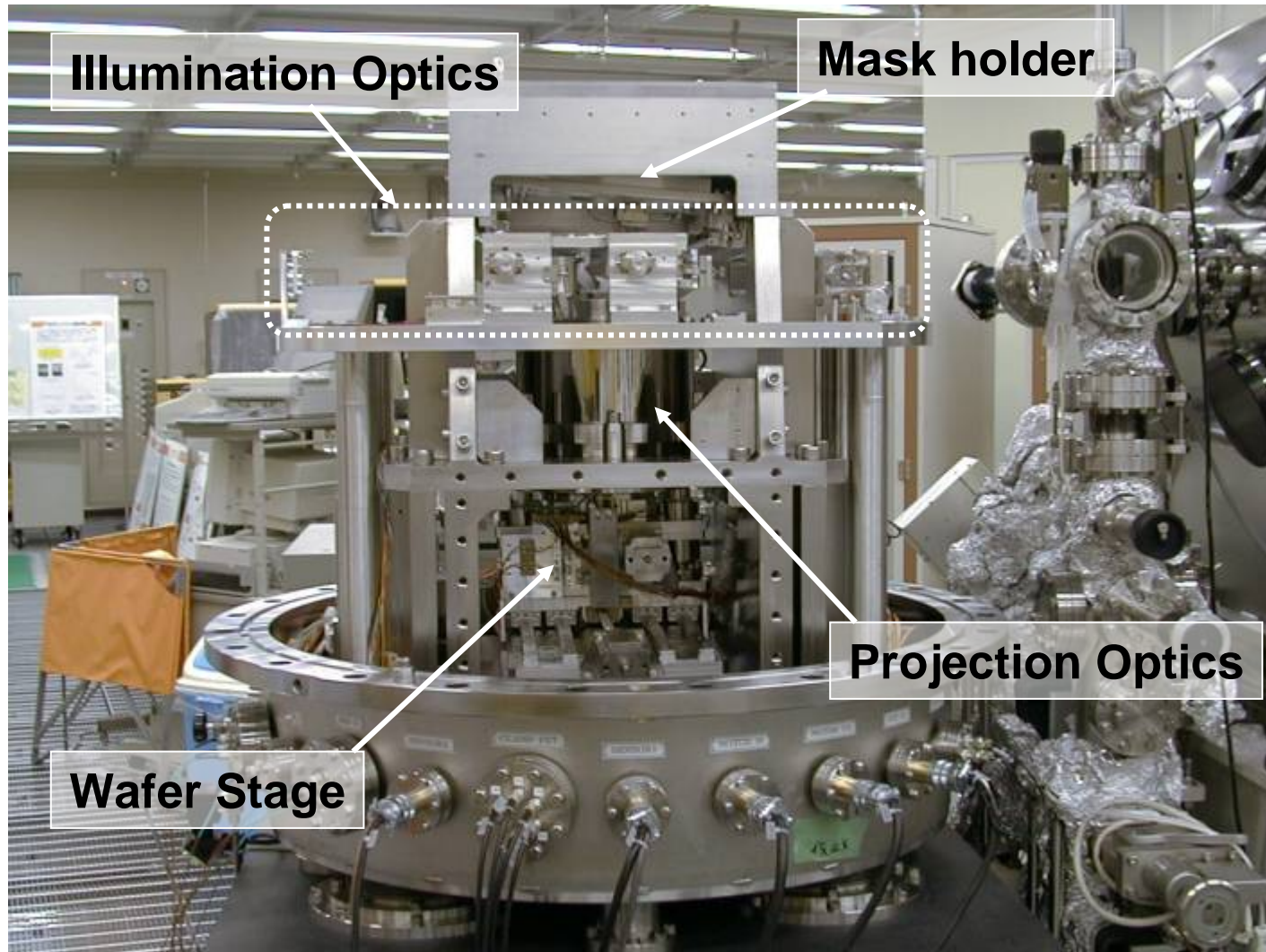
ASET update

ASET EUV Process Technology Laboratory
Iwao Nishiyama

High-NA Small-Field Exposure Tool

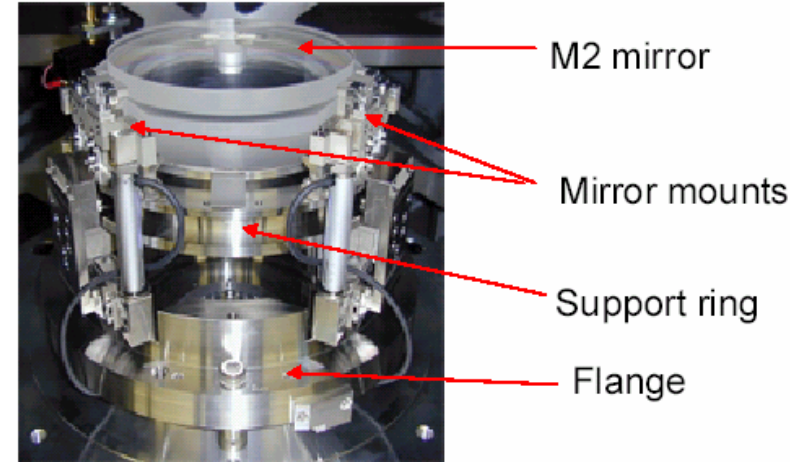


High-NA Small-Field Exposure Tool



Development of HiNA Set-3 optics

- Final wavefront errors were **0.91 nm rms (raw)** and **0.75 nm rms (z36)**.
- MSFR was refined to $\frac{1}{2}$ of Set-2 Optics, **0.17 and 0.2 nm rms**.
- Set-3 optics was installed to Atsugi lab at July, and exposure experiment has just been started at August, 2004.



		LSFR			MSFR			HSFR		
			Raw	Z36		ϕ 1mm	0.1mm		10 μ m	1 μ m
Set-2	M1	0.52	0.55	0.22	0.34	0.34	0.25		0.13	
	M2	0.66	0.66	0.40	0.32	0.33	0.23			
Set-3	M1	0.25	0.28	0.14	0.17	0.17	0.13	0.10	0.10	0.09
	M2	0.25	0.25	0.20	0.20	0.18	0.11			

Two illumination systems of ASET HiNA exposure tool

1) Partial coherent illumination

Advantage:

- intensity and angle homogeneity
- cover wide spatial frequency

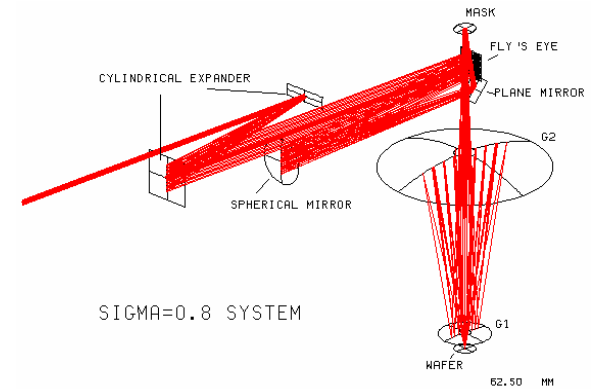
Disadvantage

- sensitive to wavefront error

Application

- **Mask Evaluation**

OPE/MEF, defect printability, off-axis incident effect...



2) Coherent illumination

Advantage:

- high contrast for L/S periodic pattern
- insensitive to wavefront error

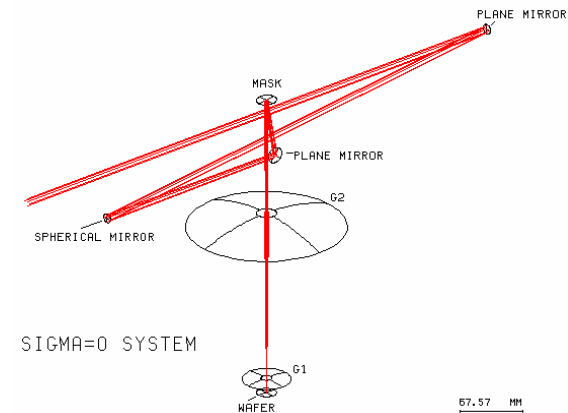
Disadvantage

- effective only for L/S pattern

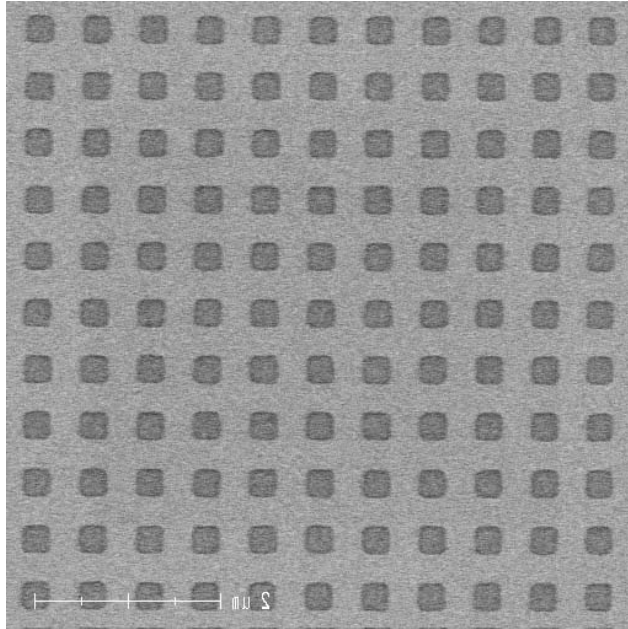
Application

- **Resist Evaluation**

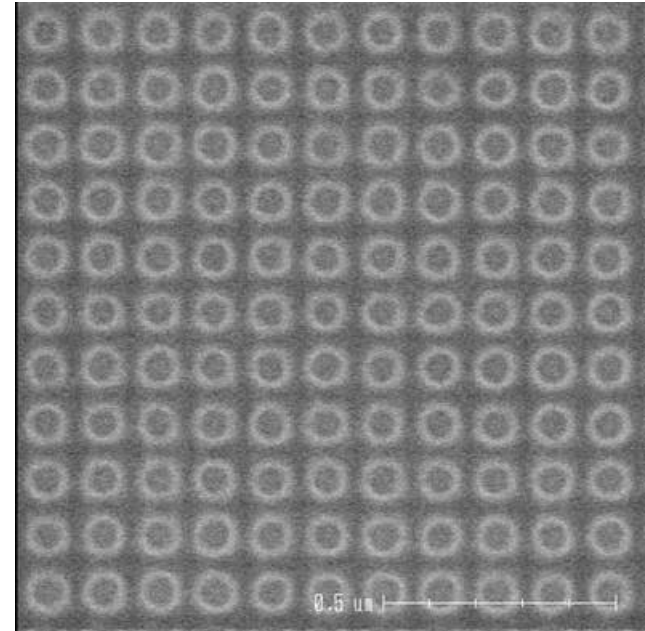
Resolution, LER, Sensitivity, Collapse...



Dense 60-nm C/H patterns ($\sigma \approx 0.8$)



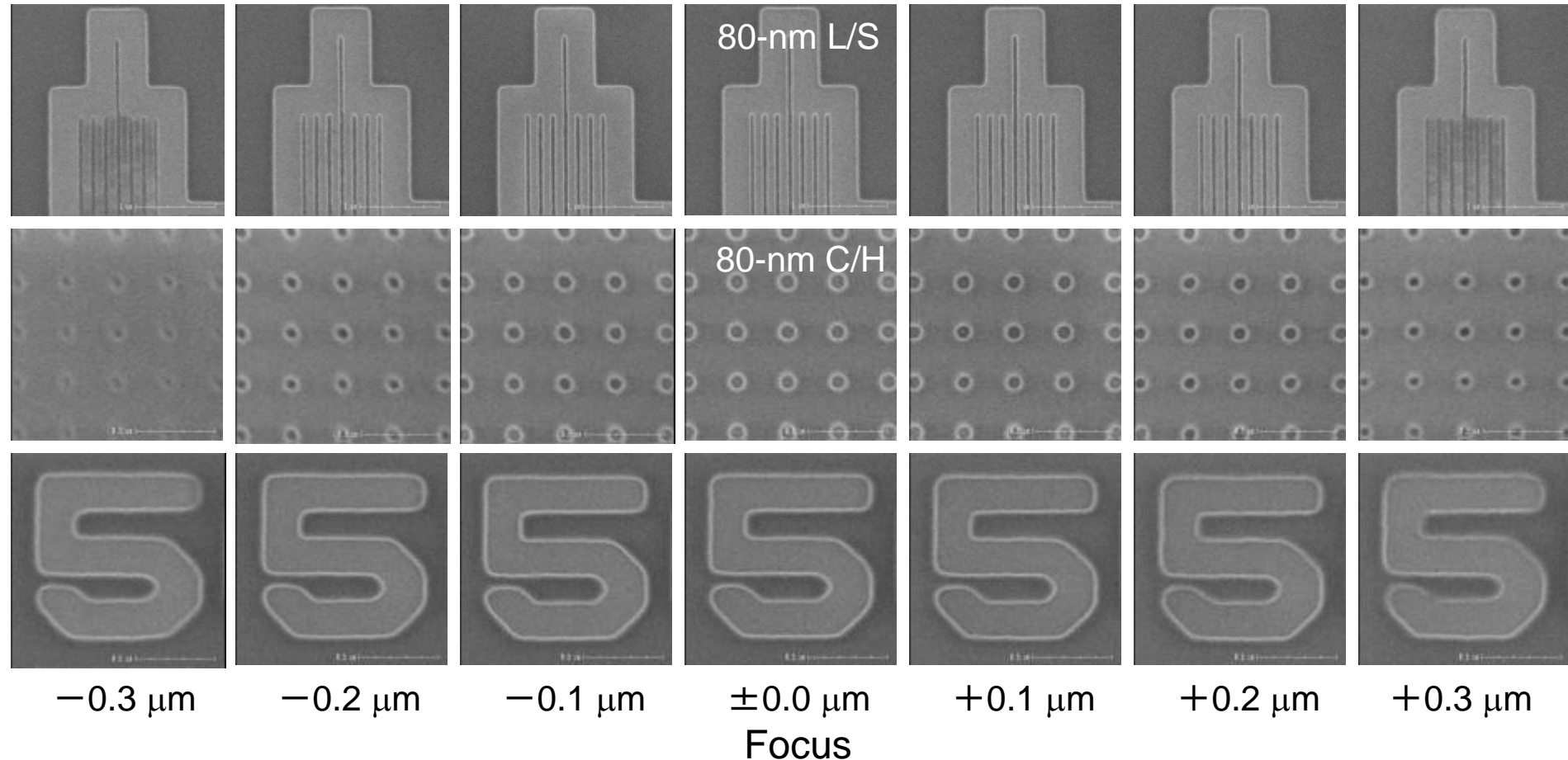
(a) Mask image



(b) Wafer image

Dense 60-nm C/H patterns were successfully fabricated without OPC or PSM.

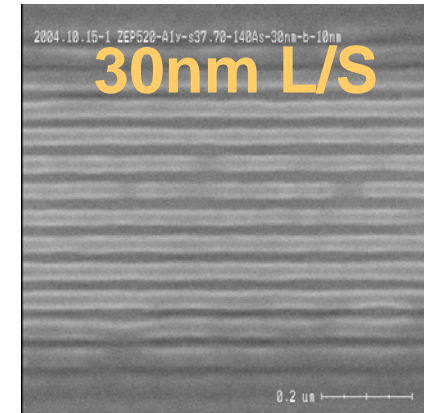
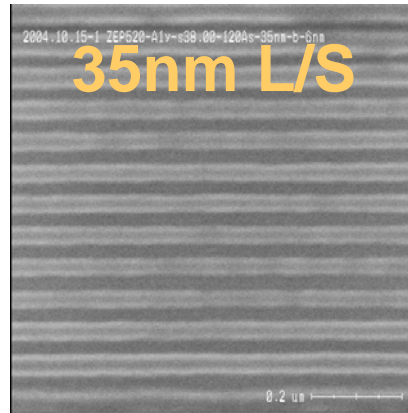
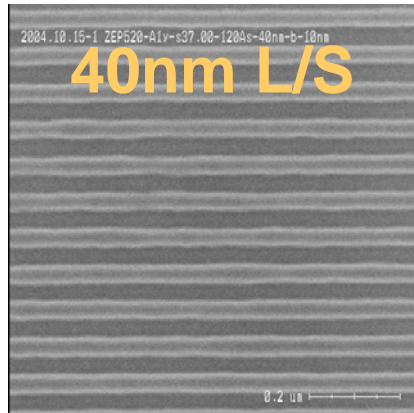
Effect of defocus on pattern fidelity ($\sigma \approx 0.8$)



Since the corner rounding was not much affected by defocus, the resist process might be one of the cause of the rounding.

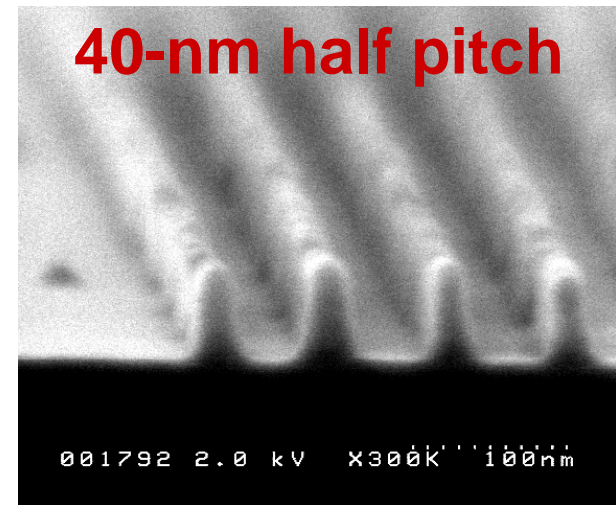
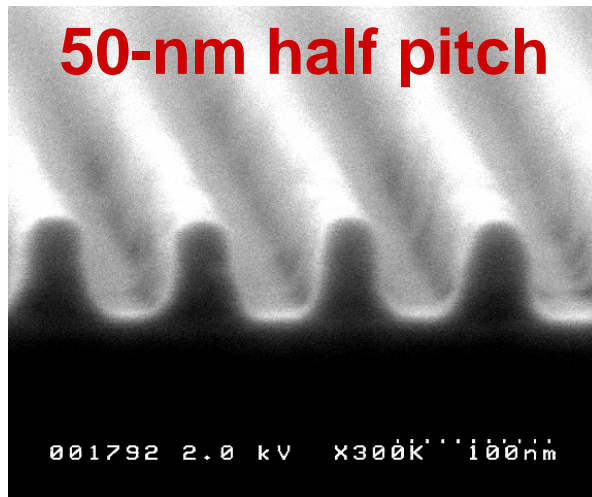
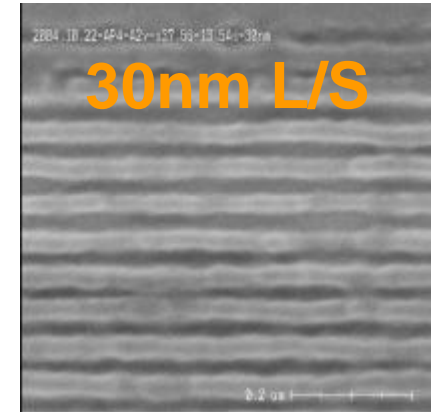
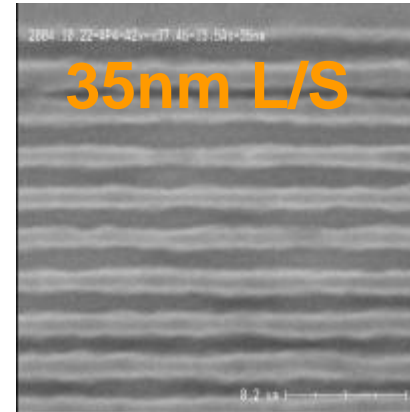
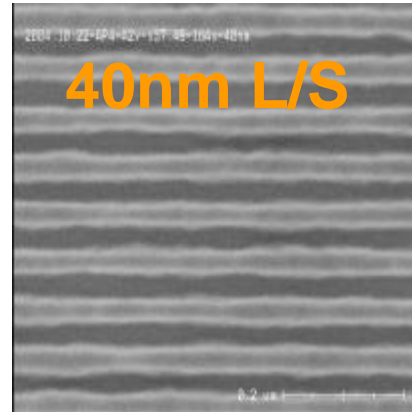
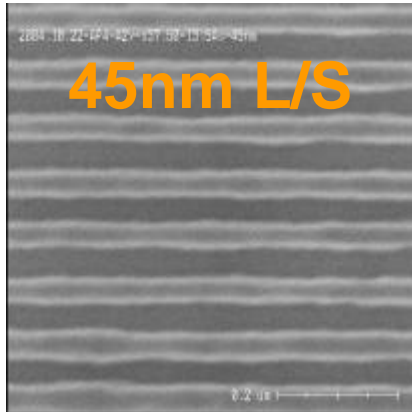
HINA3: L/S Pattern delineation ($\sigma \approx 0.0$)

Non-chemically amplified resist: ZEP520A 90nm^t



HINA3: L/S Pattern delineation ($\sigma \approx 0.0$)

Chemically amplified resist (CAR): 92 nm^t



Contamination/Optics lifetime testing facilities

Outgas Evaluation Apparatus at SBL-2 of Super ALIS



Summary

We have started resist evaluation in collaboration with resist suppliers. By using coherent illumination of HiNA Set-3, we can evaluate the resist performance up to 30 nm resolution.

Outgas evaluation apparatus has just been installed, and will be utilized for evaluation of outgassing rate and species.