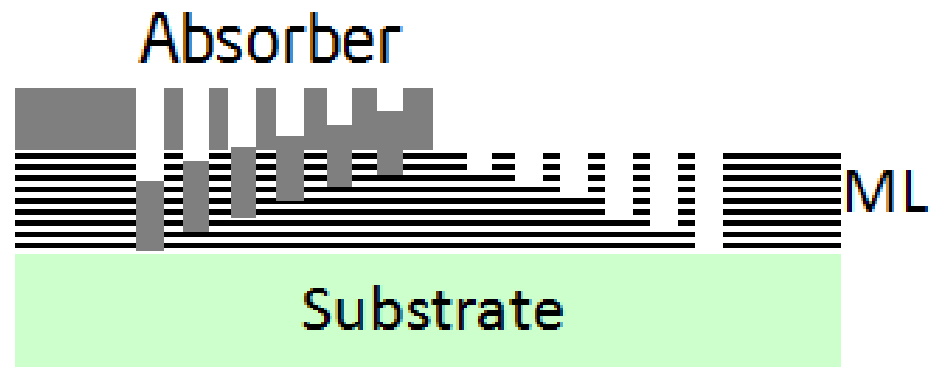
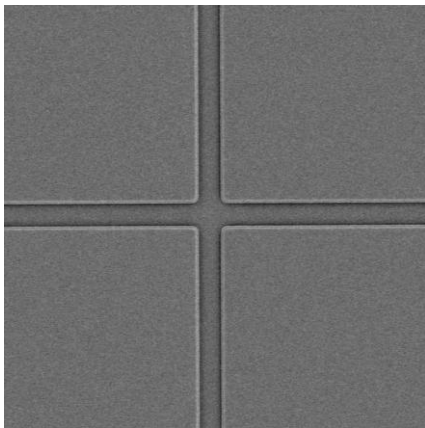


Fiducial Mark requirements from the viewpoints of Actinic Blank Inspection tool for phase defect mitigation on EUVL Mask

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Fabrication of FM

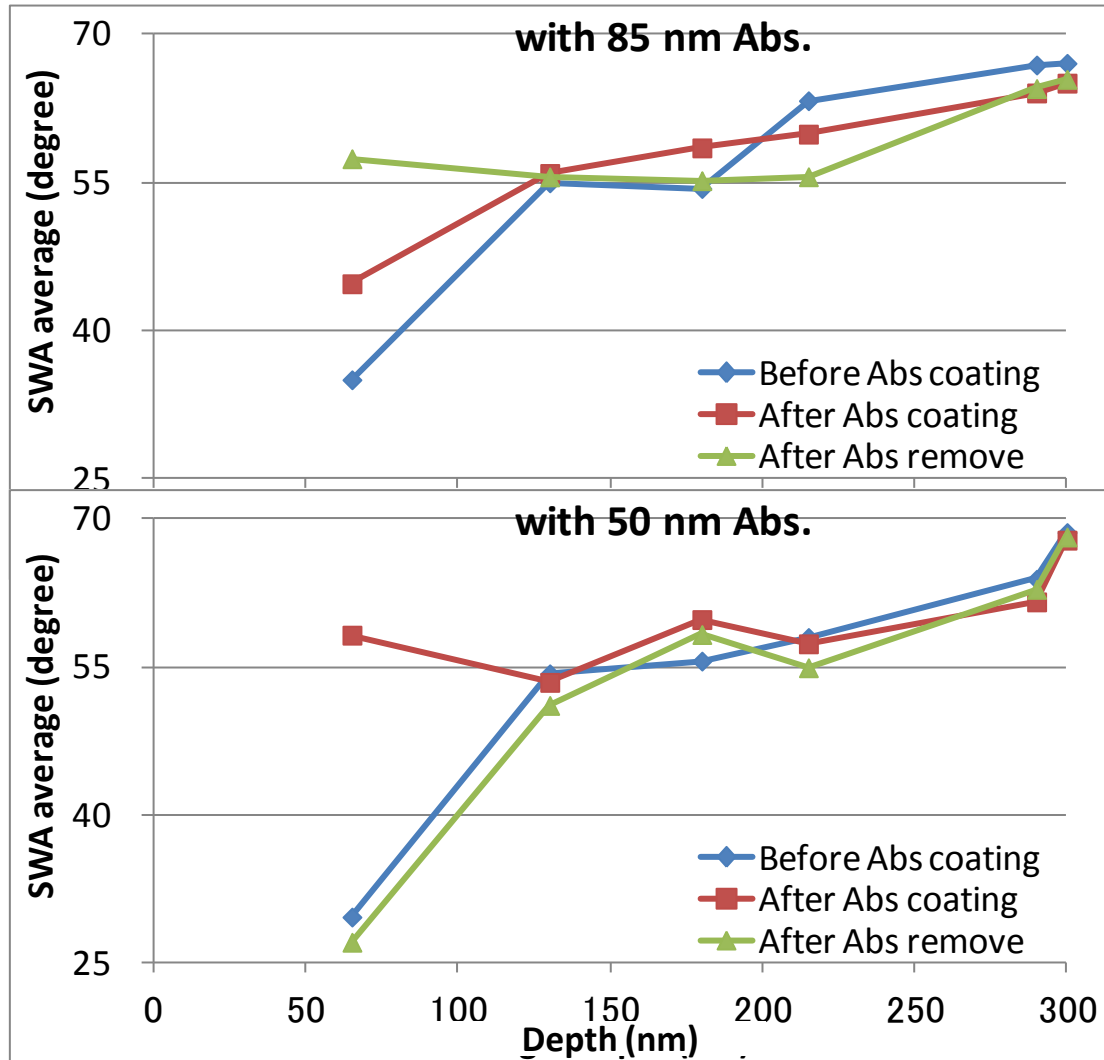
- 2 sets of FM matrix were fabricated by resist exposure by EB writer and ML etching process.
 - Line width: 1, 3, 5, 7 μm
 - Line depth: 65, 130, 180, 215, 290, 300 nm
 - Etching Layer: ML
- One set is covered by absorber, and other one is not.
 - ❑ 2 Masks were prepared. One is coated by 85 nm thickness absorber, and the other is by 50 nm thickness.
- Took data by AFM, SEM, EB writer, and ABI tool.



AFM measurement summary

Sidewall Angle (SWA) average

Calculated from 4 data of same width target FMs

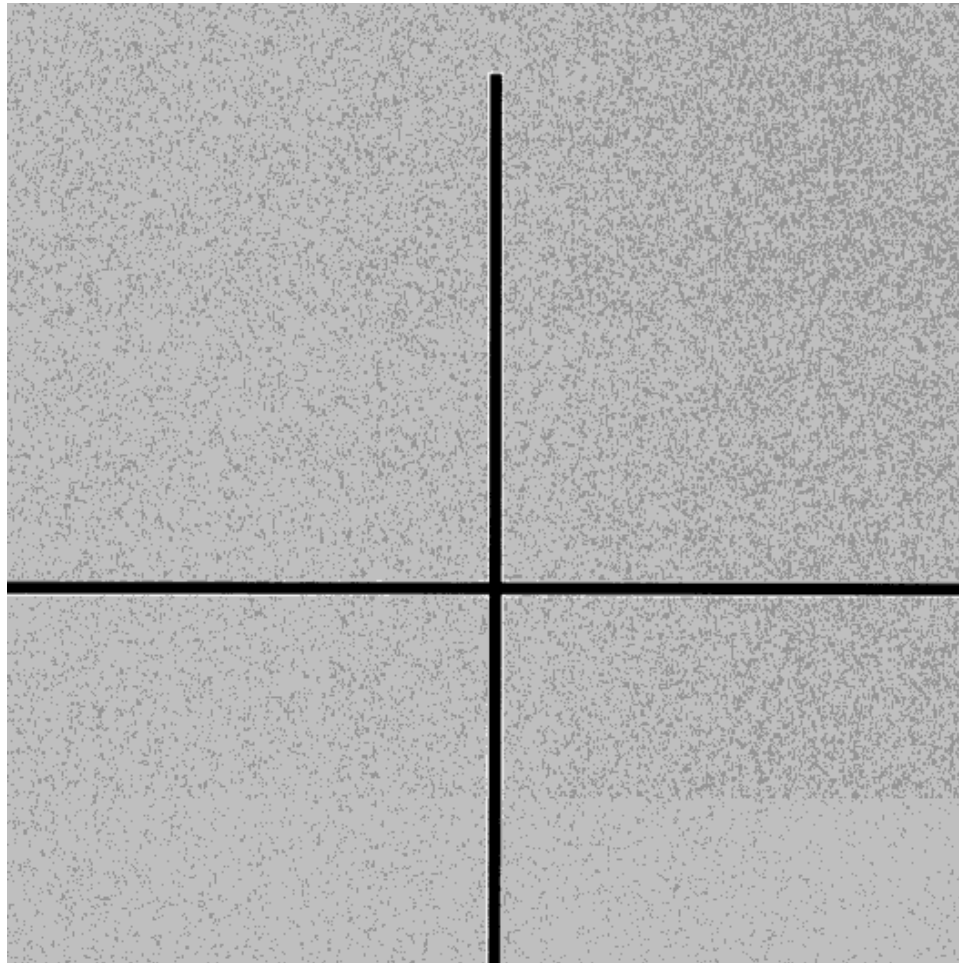


SWA of Shallower depth FMs varied by process.

Deeper ones' are relatively stable.

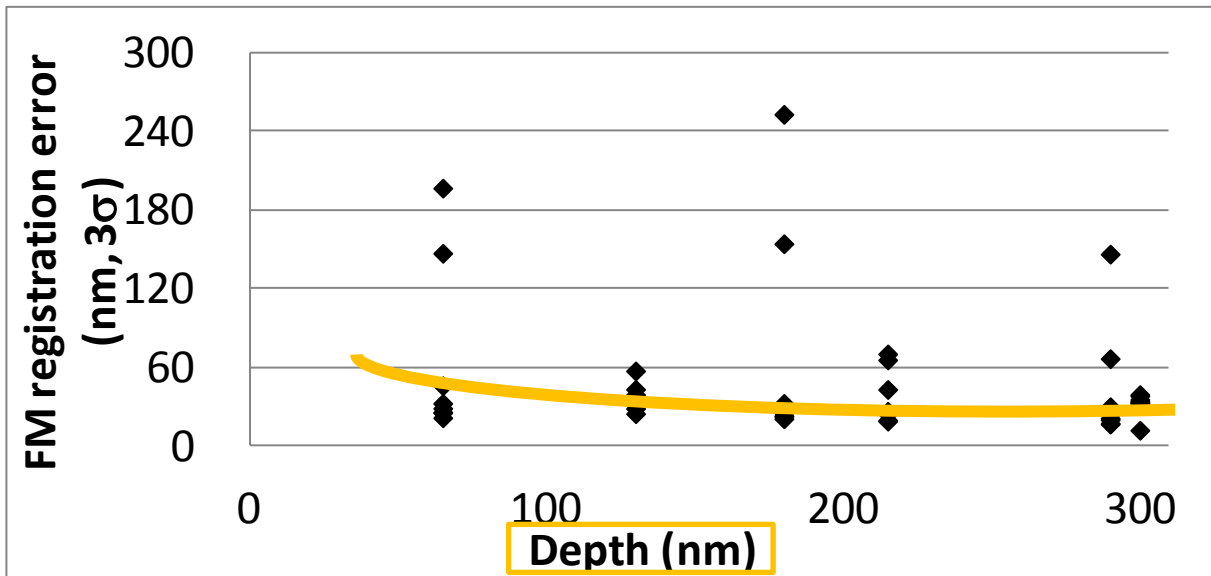
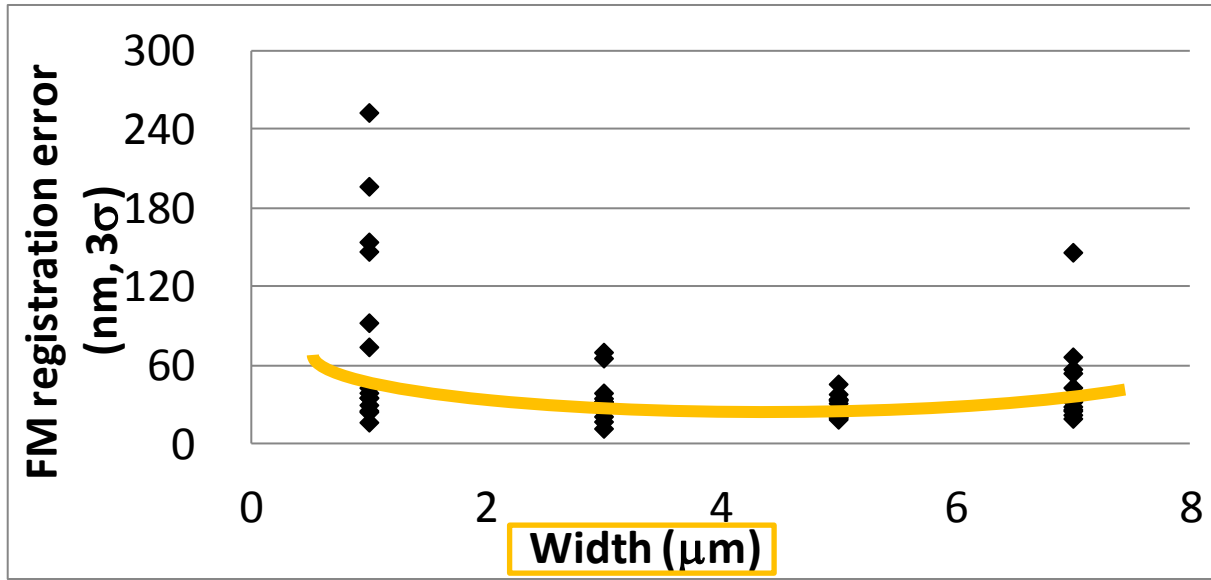
As SWA change may cause edge position shift, **> 100 nm depth is proper.**

ABI Measurement & Center location calculation



1. Obtain position information of edge on V&H lines (total 128 points)
2. Compensate rotation
3. Calculate line center locations and their accuracy on V&H lines

FM registration error (3σ) by ABI



Generally, deeper & wider FM is better. However, these results don't meet the proposed requirement.
($< 10 \text{ nm}$)

Need ABI's improvement of FM registration accuracy.

Summary

FM recommendations are:

- ✓ ML etched
- ✓ > 100 nm line depth
- ✓ 3-5 μm line width

ABI tool is required to equip Magnified Optics to achieve $< 10 \text{ nm}$ (3σ) error for mitigation ^(MO) i.e. smaller pixel size on mask (position & size).

We need further optimization of FM for the MO of LT ABI tool.

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Backup

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