

DNP

Mask Manufacturer as a Supplier

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Contents

1. Current status of EUVL mask manufacturing
2. EUVL mask technology challenges



EUV mask process development (HOYA blank)

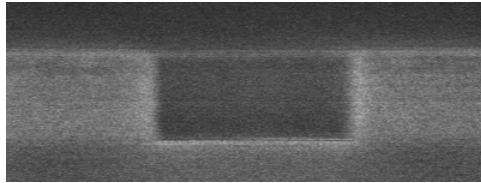
Blank HOYA : Resist PCAR 4000A : Exposure tool 50kV VSB

CD uniformity

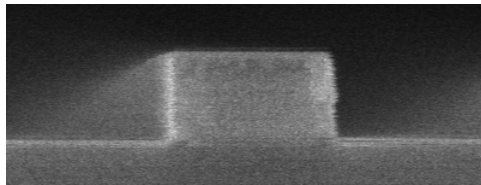
+5nm ■ -5nm □

Cross section image

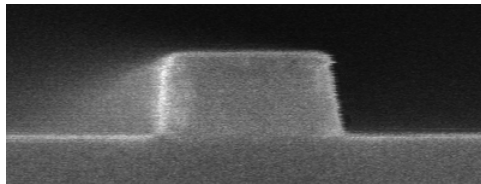
Hole



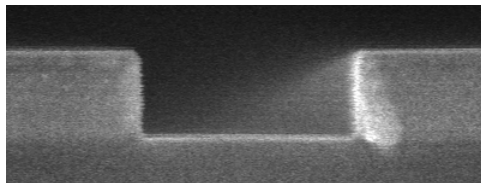
L&S



Isolate line

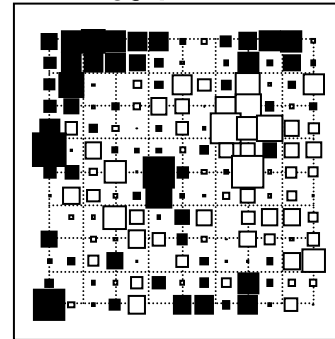


Isolate space

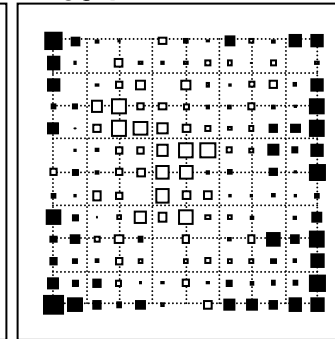


Pattern size 200nm

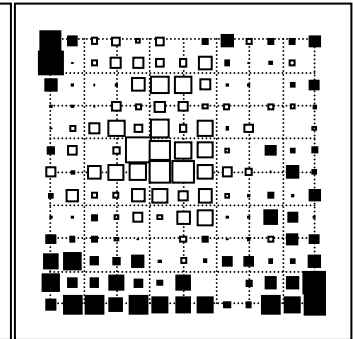
Isolate line
Range : 12.8nm
3σ : 7.7nm



Isolate space
Range : 6.6nm
3σ : 4.4nm



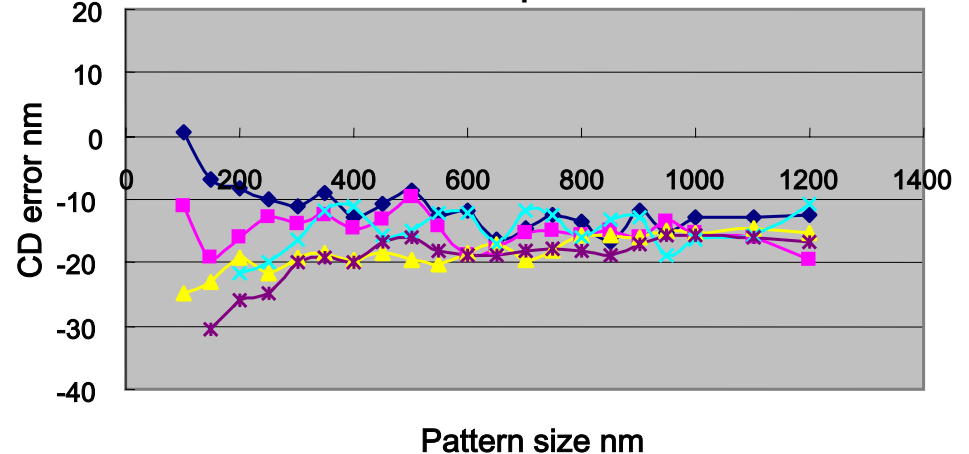
L&S space
Range : 9.6nm
3σ : 5.8nm



CD linearity

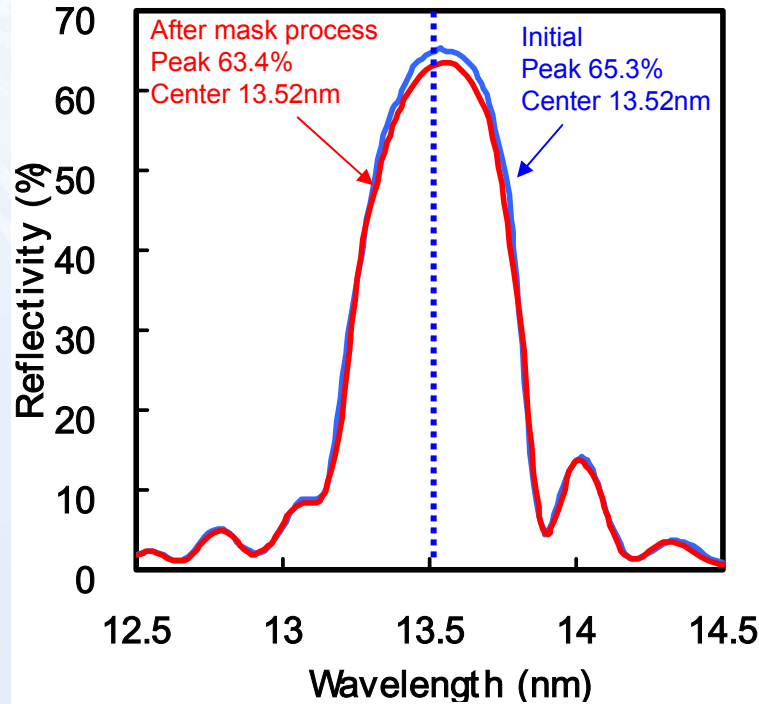
Pattern size 200nm

◆ Iso Hole ■ Dense Hole ▲ Iso Space
◆ Iso Line * L&S-Space



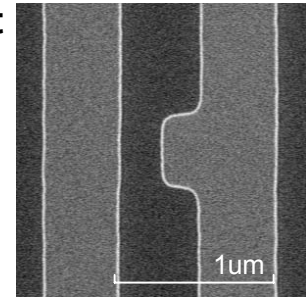
Defect repair with AFM nano-machining (ASET blank)

EUV reflectivity (ASET blank)



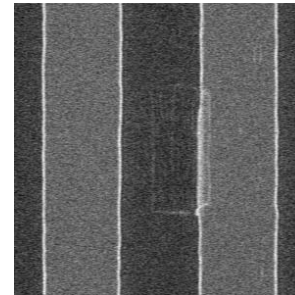
Measurement by ASET

•Designed defect

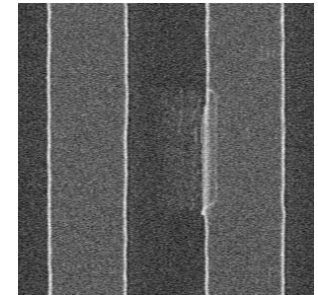


•Defect repair result

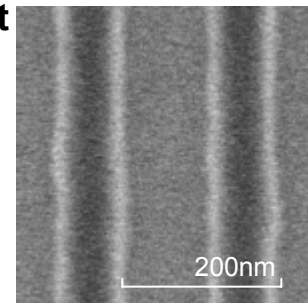
Before buffer layer etching



After buffer layer etching



•Wafer print result



Wafer print by HiNA set-3 (ASET)



Summary & Future Challenges

1. Current Status

- Current 50KeV writer + CAR system will work on EUV absorber patterning down to ~100nm feature size
- CD linearity should be improved with optimized PEC and process conditions
- Certain repair technologies will work on EUV absorber repair

2. Challenges

- Defect control, & cleaning
- Optimized repair technology
- Process development for new material, if needed
- Mask handling
- Infrastructure development (Writer, Inspection, Repair, & Metrology)

