P-EP-06

Track process optimization for EUV HVM

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Introduction

Tokyo Electron Limited (TEL™) and imec are continuously collaborating to enhance the quality of processing for EUV, using ASML NXE3300 and TEL CLEAN TRACK™ LITHIUS Pro ™ Z-EUV litho cluster in imec.

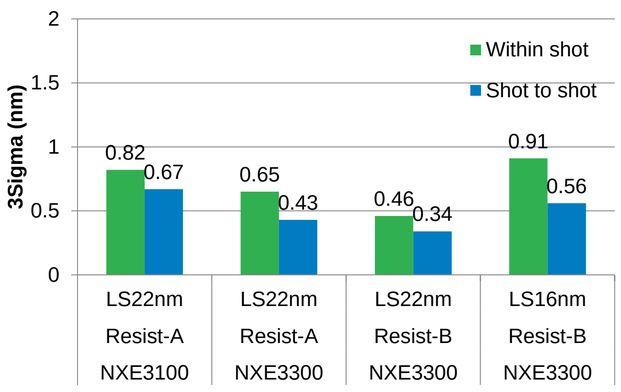
There are several different material approaches for EUV lithography such as chemically amplified positive tone resist (CAR), negative tone resist, and non-CAR resist. Fundamental studies and optimization of individual materials are required for application toward EUV manufacturing.

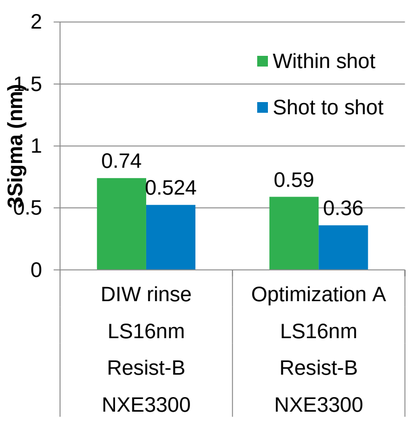
Purpose

To improve defectivity and CDU and then to establish the POR at imec for L/S and CH.

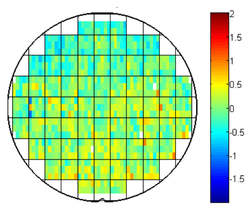
EUV CAR resist

L/S, CDU Comparison

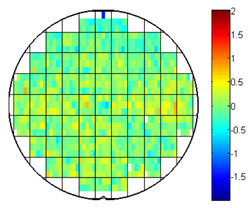




Resist B DIW rinse

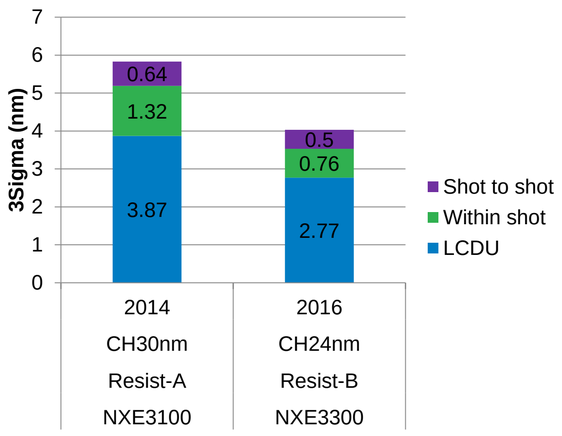


Resist B Optimization

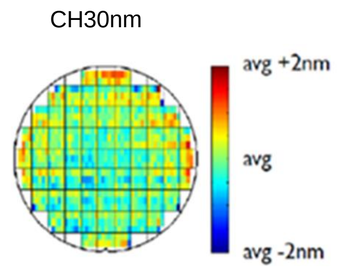


Experimental Condition
Coater/Developer
System : CLEAN TRACK™ LITHIUS Pro™ Z-EUV litho cluster
EUV Scanner
System : ASML NXE3300
Measurement
SEM : Hitachi CG5000
Defectivity : KLA2925, eDR (KLA), SP3 (KLA)

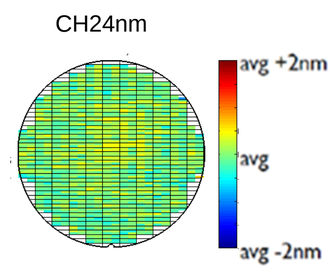
CH CDU Comparison



CH30nm



CH24nm

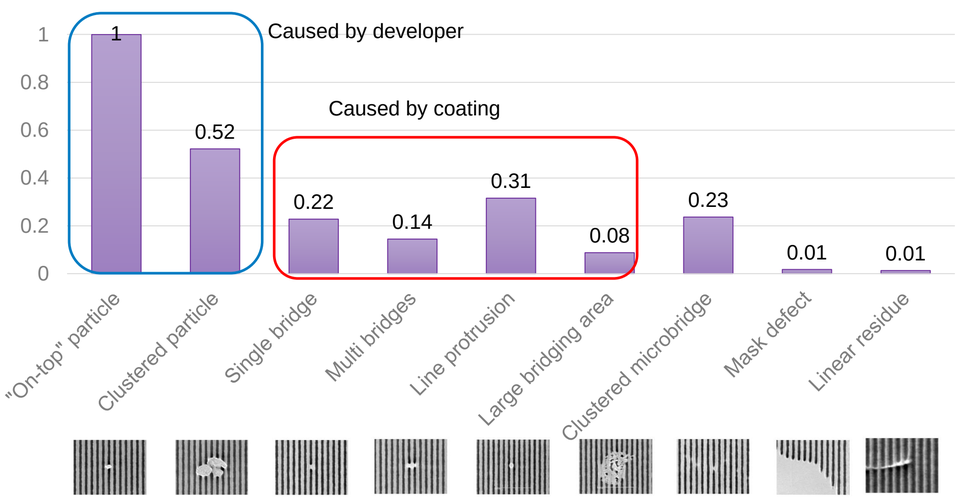


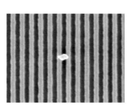
- Optimization for 16nm HP process CDU, resulted in comparable results with 22nm HP CDU.

- Initial processing conditions were setup for 24nmHP CH evaluation
- Further development planned to improve the defectivity and CDU.

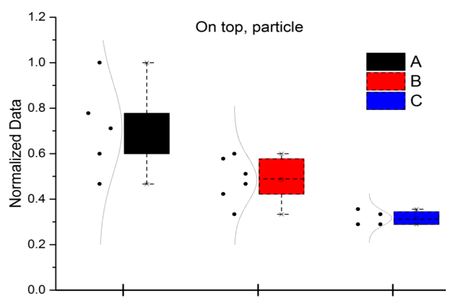
L/S defectivity improvement

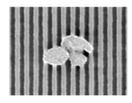
First leaning of defectivity by LS22nm



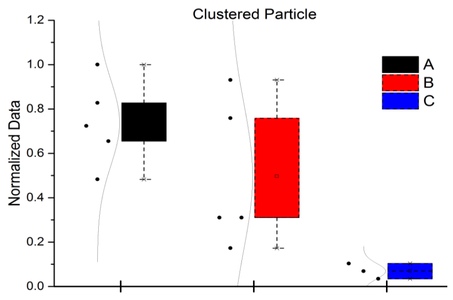


On-top particle





Clustered particle



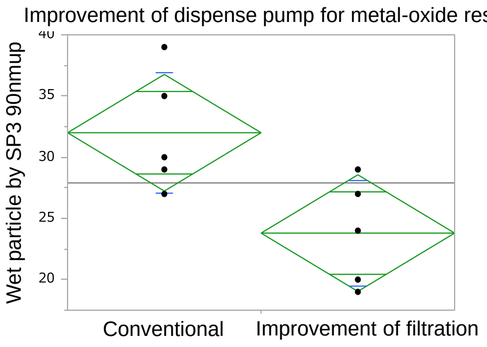
	A	B	C
Filter for developer	A=20nm DEV	B=5nm UPE	C=1nm UPE AUC

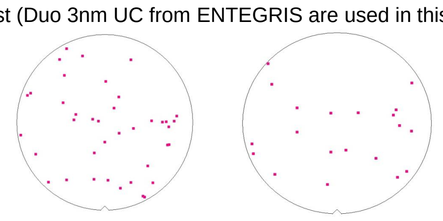
- Defect pareto revealed developer defects as largest contributor
- Developer related defects are greatly reduced by filtration pore size, improved membrane cleanliness and membrane functionalization.
- Optimization of coated particle defect density via resist filtering is ongoing.

EUV non-CAR metal-oxide resist

Wet particle improvement by coating process

Improvement of dispense pump for metal-oxide resist (Duo 3nm UC from ENTEGRIS are used in this experiment.)

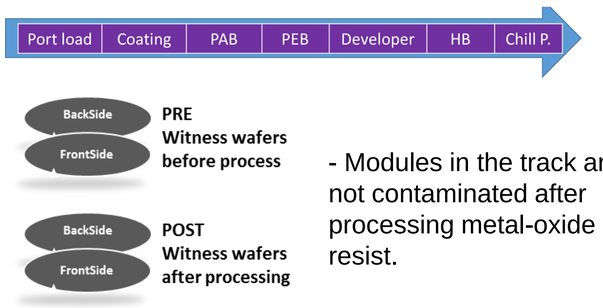




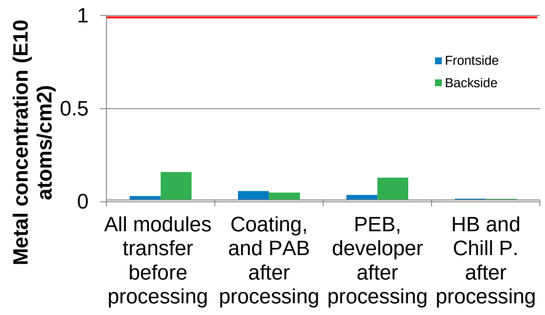
- By applying our technology for filtration, in film defectivity is improved for metal-oxide resist..

Preventing cross metal-contamination in Track

We compared metal-contamination witness samples before and after processing 100 wafers.



- Modules in the track are not contaminated after processing metal-oxide resist.



Conclusion

- **Initial data of L/S 16nm and CH 24nm with NXE3300 were established.**
- **Develop defects were significantly reduced by smaller pore size filtering.**
- **In metal-oxide resist, development for defectivity and technology for preventing cross-contamination were established.**

Acknowledgement

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- Inpria Corporation for non-CAR resist evaluation