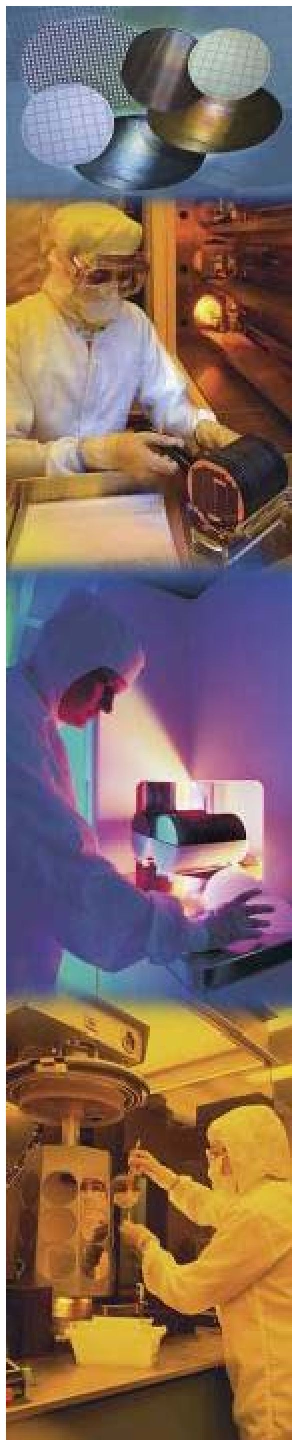

AZ EUV UL Overview

For SEMATECH TWG Presentation

AZ Electronic Materials US Corp.
October 13, 2010

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Talk Outline

- Introduction
- EUV underlayer requirements
- EUV underlayer benefits.
- Summary

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Introduction

- EUV needed by industry
- Resist and tool development underway but challenges remain
  - Image collapse
  - LWR
  - Sensitivity
  - Resolution
- Ancillary materials can help with this
  - Under Layer (covered in this paper)
  - Rinse (see conference papers)

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Fundamental Requirements for EBL Materials

1. Good coatability for very thin film, =/<10nm (resist FT =/< 60nm)
2. Low outgassing under vacuum during EUV exposure
3. Good resist compatibility, good profile and resistance to substrate variation.
4. High etch rate (AZ platform polymers have ~2 times faster etch rate than 193nm resist)

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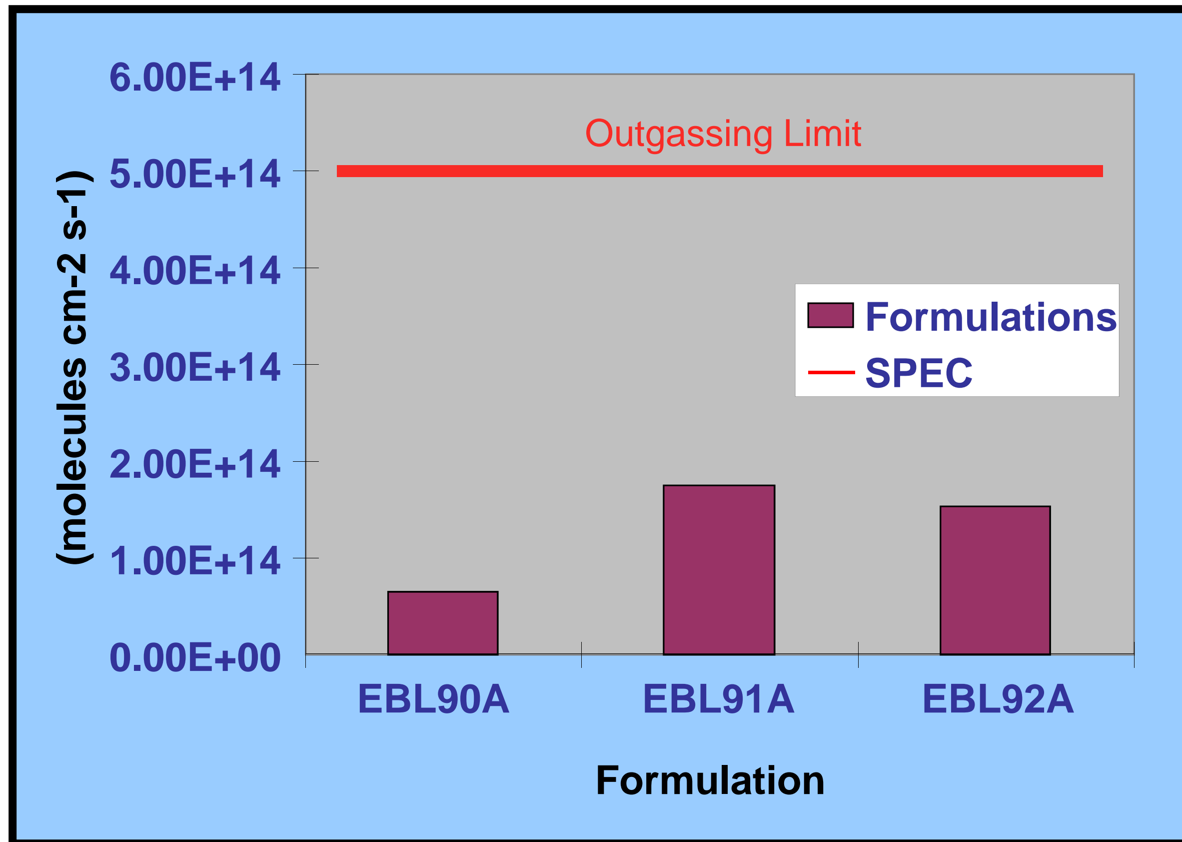
AZ EUV Underlayer Outgassing Summary



- **Outgassing was done at IMEC facility using method suggested by ASML.**
- **All three materials meet the outgassing criteria for unlimited exposure on ASML EUV tools.**

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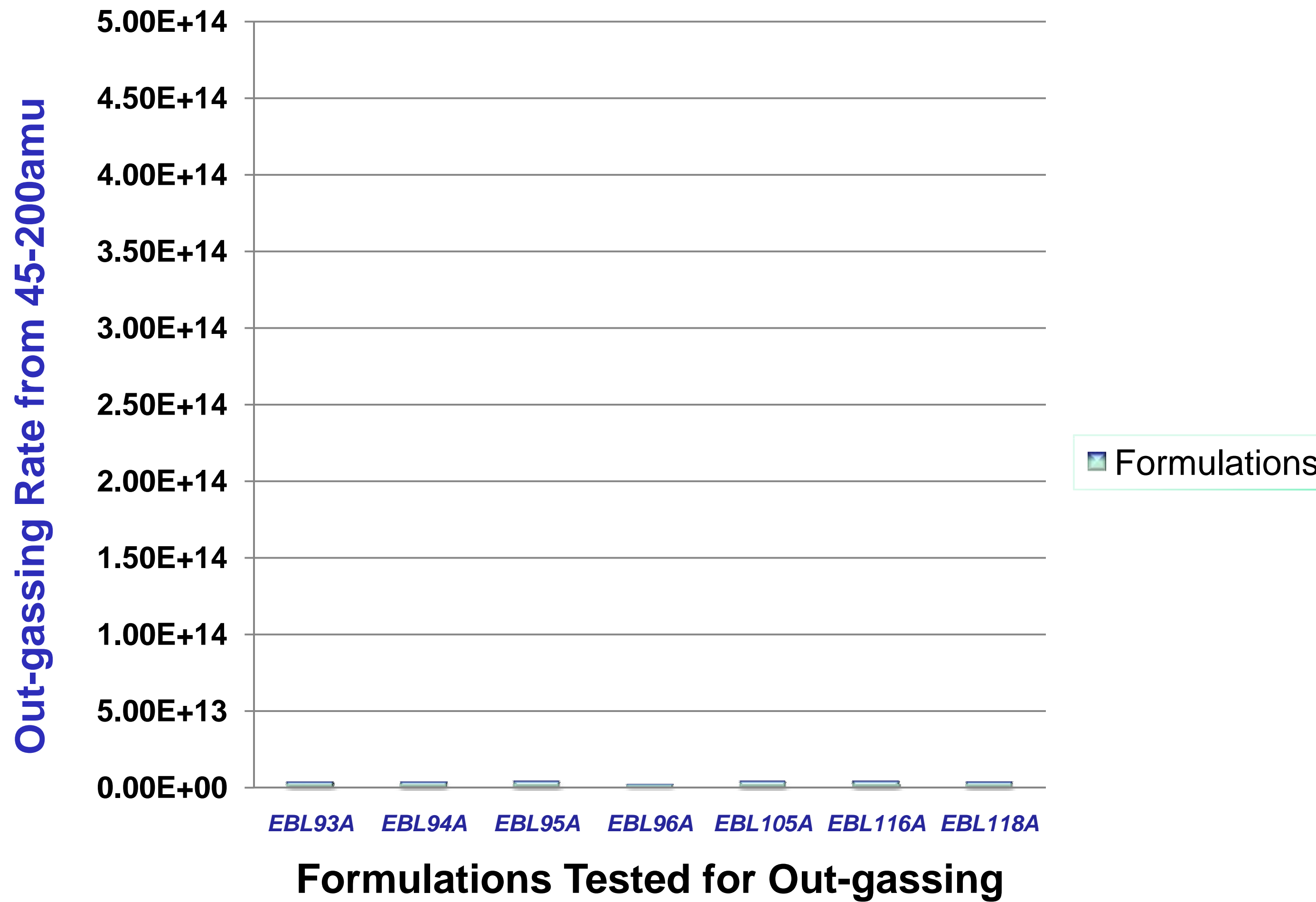
AZ EBL Out-gassing Report from IMEC



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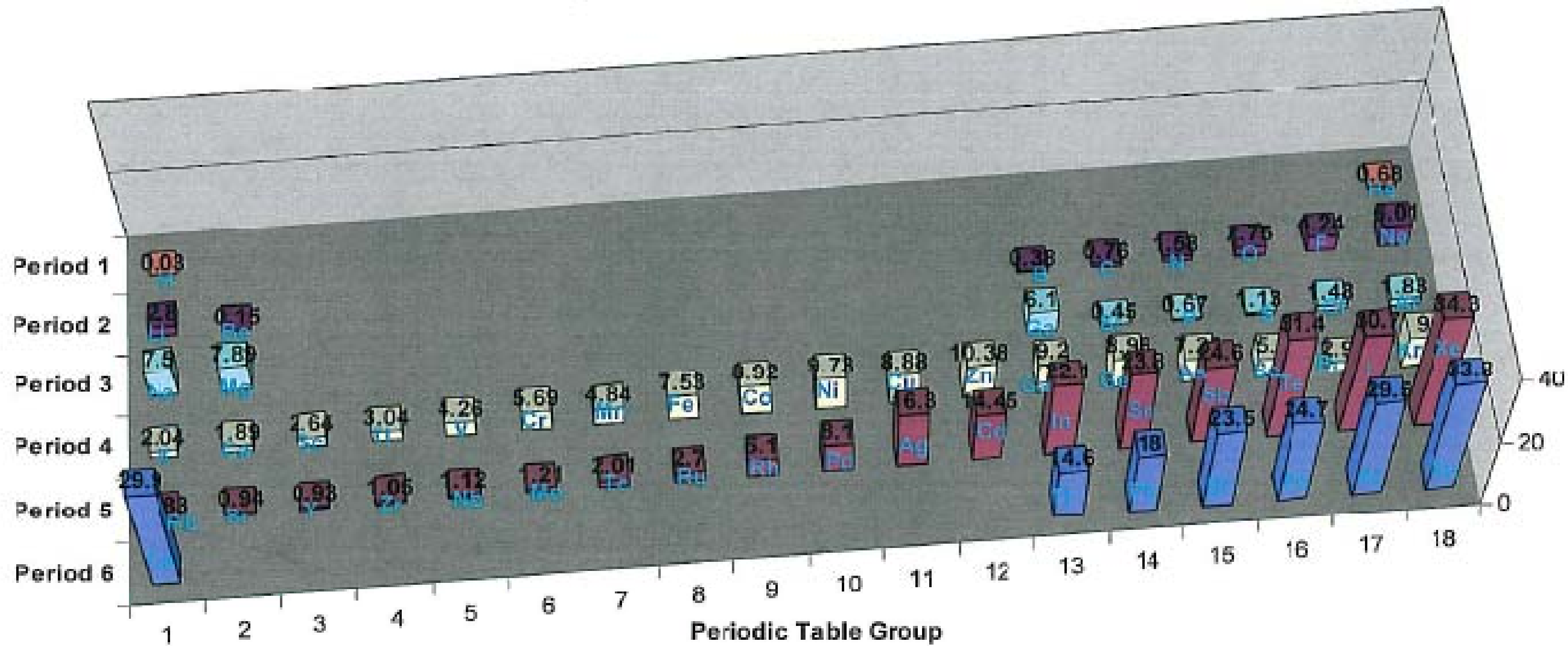
Atomic EUV Absorbance



- EUV absorbance may affect underlayer performance
- AZ is actively investigating this effect

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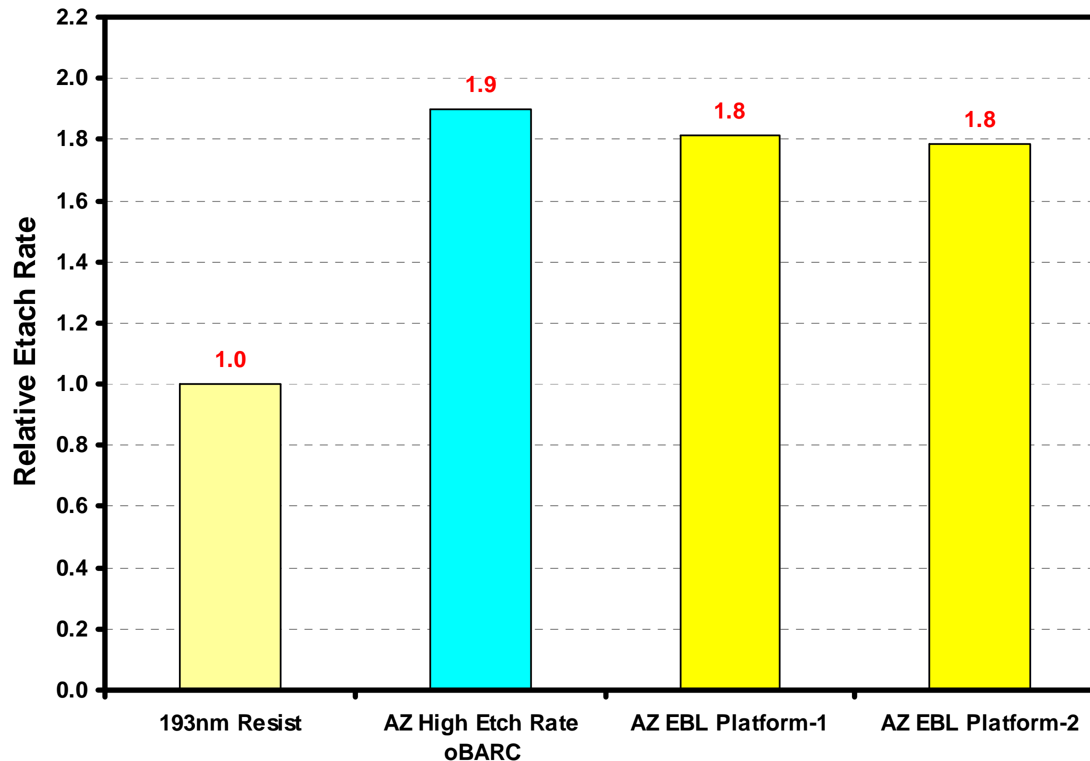
Preliminary Etch Selectivity Test for AZ EBL Platform Polymer *vs.* 193nm Resist



Test Condition

Ar	150(SCCM)
O2	20(SCCM)
CF4	50(SCCM)
H2 Pressure	266
Trigger Pressure	5.00Pa
Process time	10sec
Top Power	500W
Wafer Power	100W

Currently, AZ is focusing on development of high etch rate platforms for EBL applications. As shown in above graph, AZ EBL Platforms have as high as 1.8 etch selectivity compared to regular 193nm photoresist. Etch rate is tunable if necessary.

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Benefits for EBL Materials

1. Better Z factor for resists
2. Improved resist profile
3. Wide substrate compatibility

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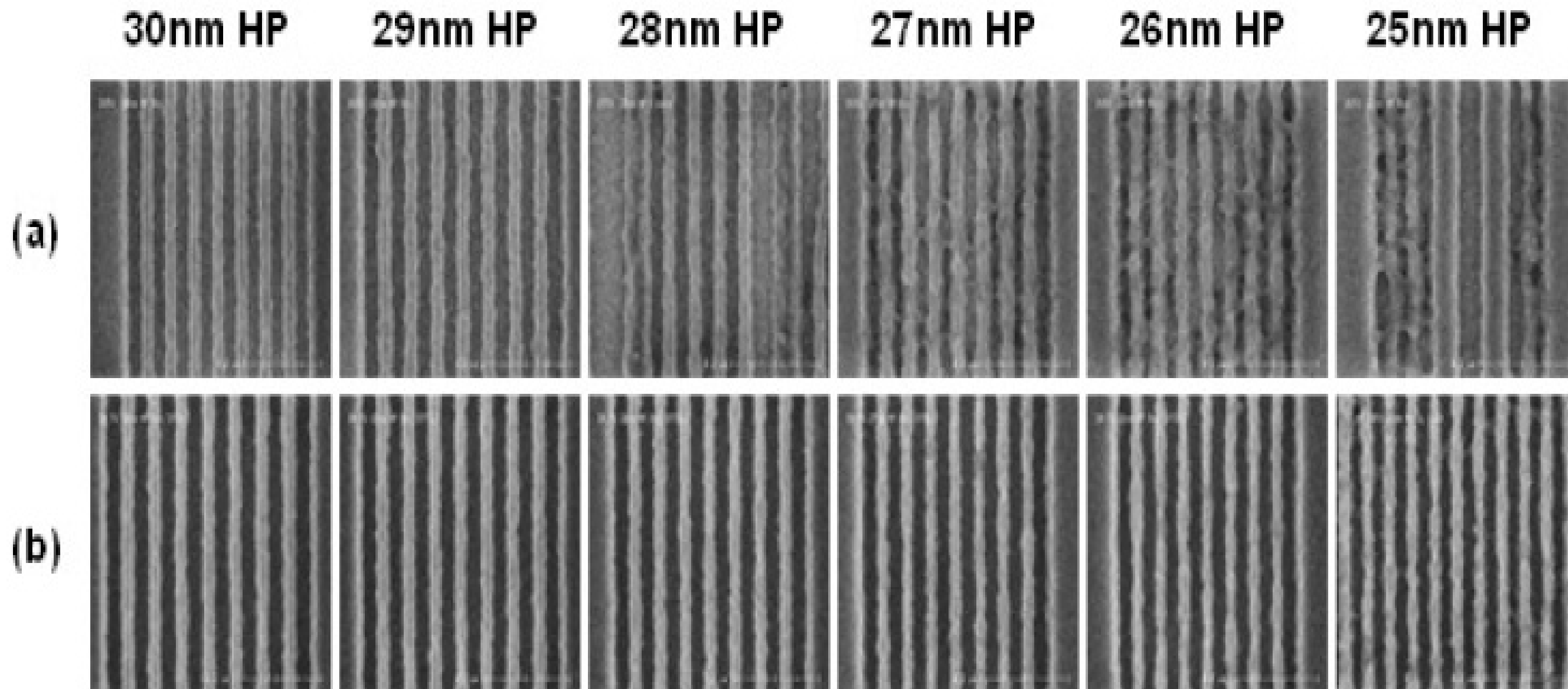
Introduction- EUV Underlayer Improves EUV Resist Z-factor



Results from SEMATECH/Intel; (a) w/o (b) w/ an underlayer demonstrating an improved resolution

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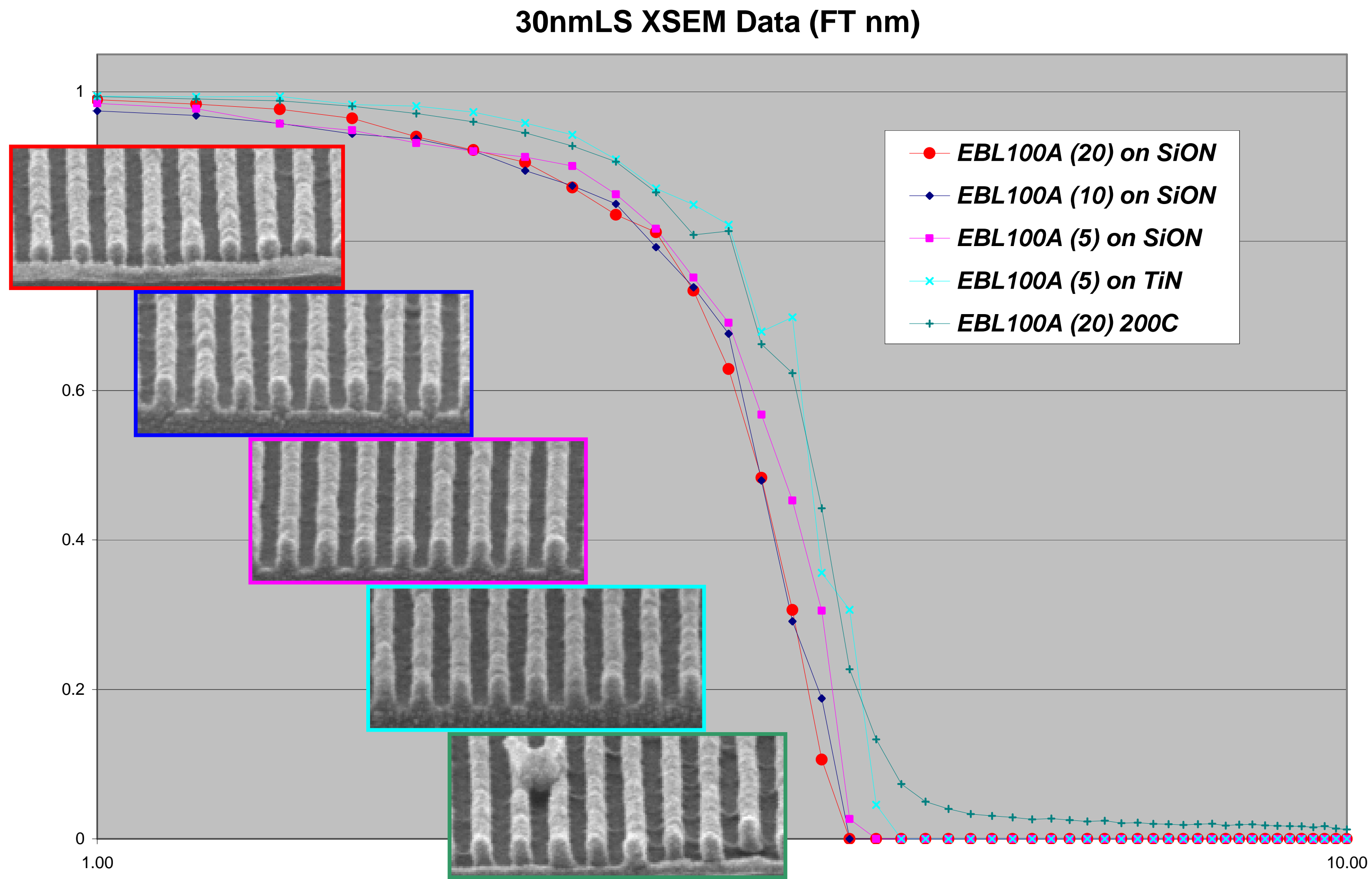
AZ EBL Substrate Compatibility



- **No typical resist poisoning observed due to the use of those basic substrates (results need to be confirmed again).**

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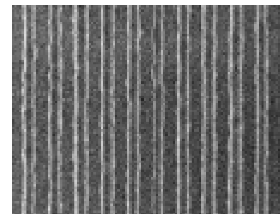
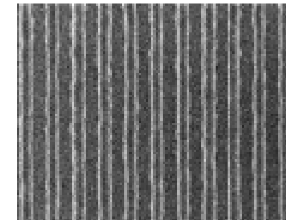
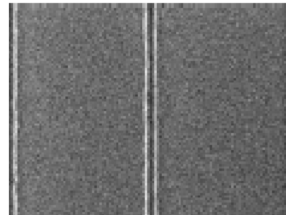
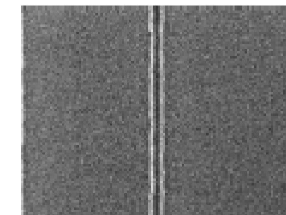
AZ EBL95A and 96A Benchmark Data from IMEC

	EBL 95A	EBL 96A
Dose-to-size for 30nm L/S (≤15mJ/cm2)	11.1mJ/cm2	11.1 mJ/cm2
3 sigma LER on 30nm L/S (≤4.0nm)	4.7nm	4.5nm
Max Exp latitude (≥ 15%)	17.2%	14.1%
Max DOF	120nm	160nm
DOF at 10% EL (≥ 120nm)	120nm	160nm
Exp latitude at 150nm DOF	-	13.1%
Top view @ Best Energy & Focus		

	EBL 95A	EBL 96A
Dose-to-size for 30nm ISO.	10.4 mJ/cm2	10.3 mJ/cm2
Max Exp latitude (≥ 15%)	21.8%	21.8%
Max DOF	200nm	220nm
DOF at 10% EL (≥ 100nm)	200nm	220nm
Exp latitude at 80nm DOF	21.8%	21.7%
Top view @ Best Energy & Focus		

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Conclusions

- Underlayers for EUV can be made that meet fundamental requirements

- EUV resist performance, substrate compatibility and resist profile can be improved

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