

Outgas Research Activity in EIDEC



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IEUVI Resist TWG 2011

Agenda

1. EIDEC Outlook

2. Outgas Research in EIDEC

- Tools & Procedure for Outgas Evaluation
- Role of EIDEC
- Result of Preliminary Test

3. Summary

EIDEC Outlook

【1】 Concept

- Succeed to MIRAI-Selete accomplishments
- Globally open consortium
- Mask and resist dedicated development program
- Strategic partners for mask infrastructure

【2】 Target Feature Size: 16 nm hp - 11 nm hp

【3】 Period: 2011/3 – 2016/3

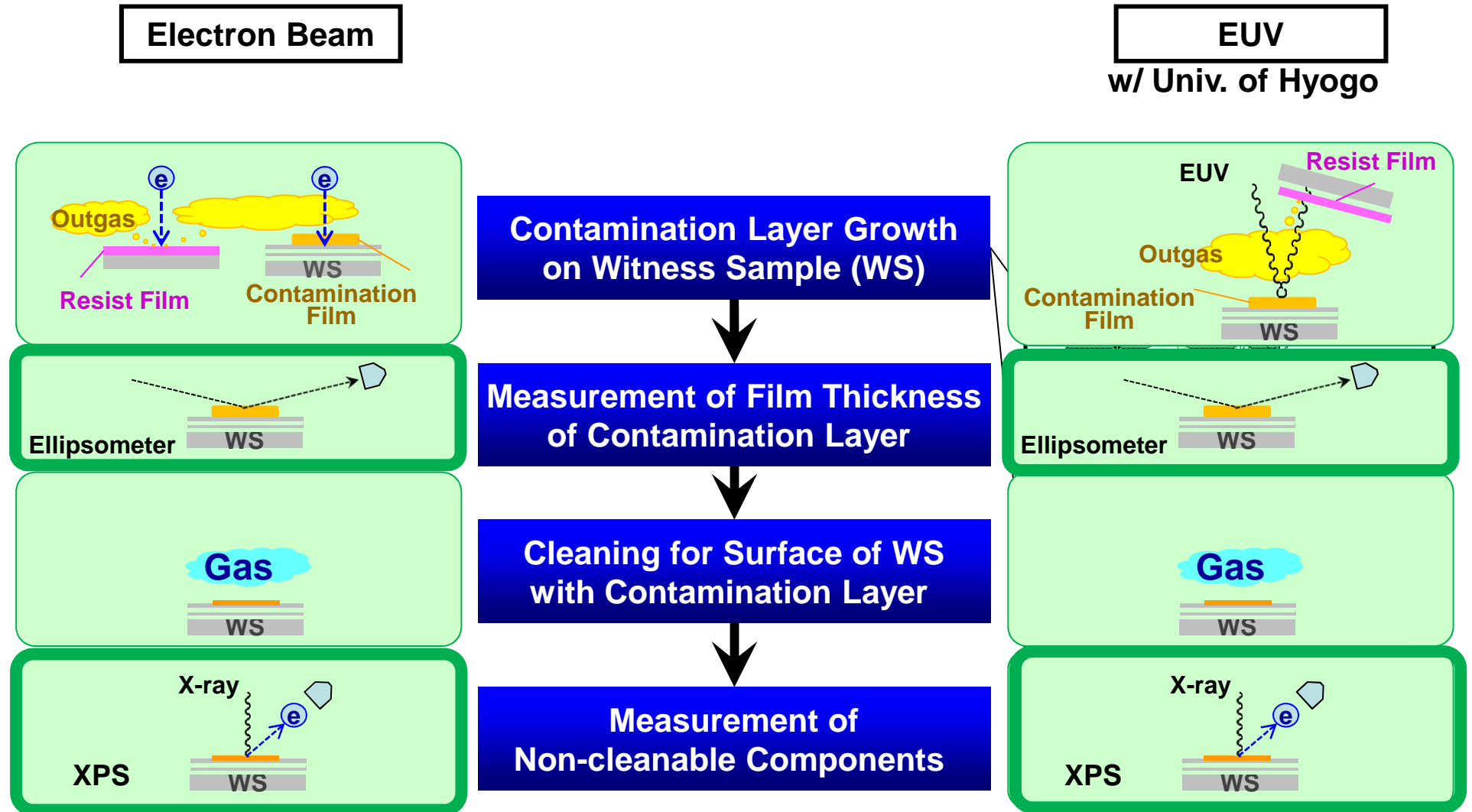
【4】 Location: AIST(*) Super Clean Room

(*) AIST: National Institute of Advanced Industrial Science and Technology

【5】 Development programs

- Blank Inspection technology program
- Pattered mask Inspection technology program
- EUV Resist Material research program
- EUV Resist out-gassing Control program

Tools & Procedure for Outgas Evaluation



Role of EIDEC for Resist Outgassing

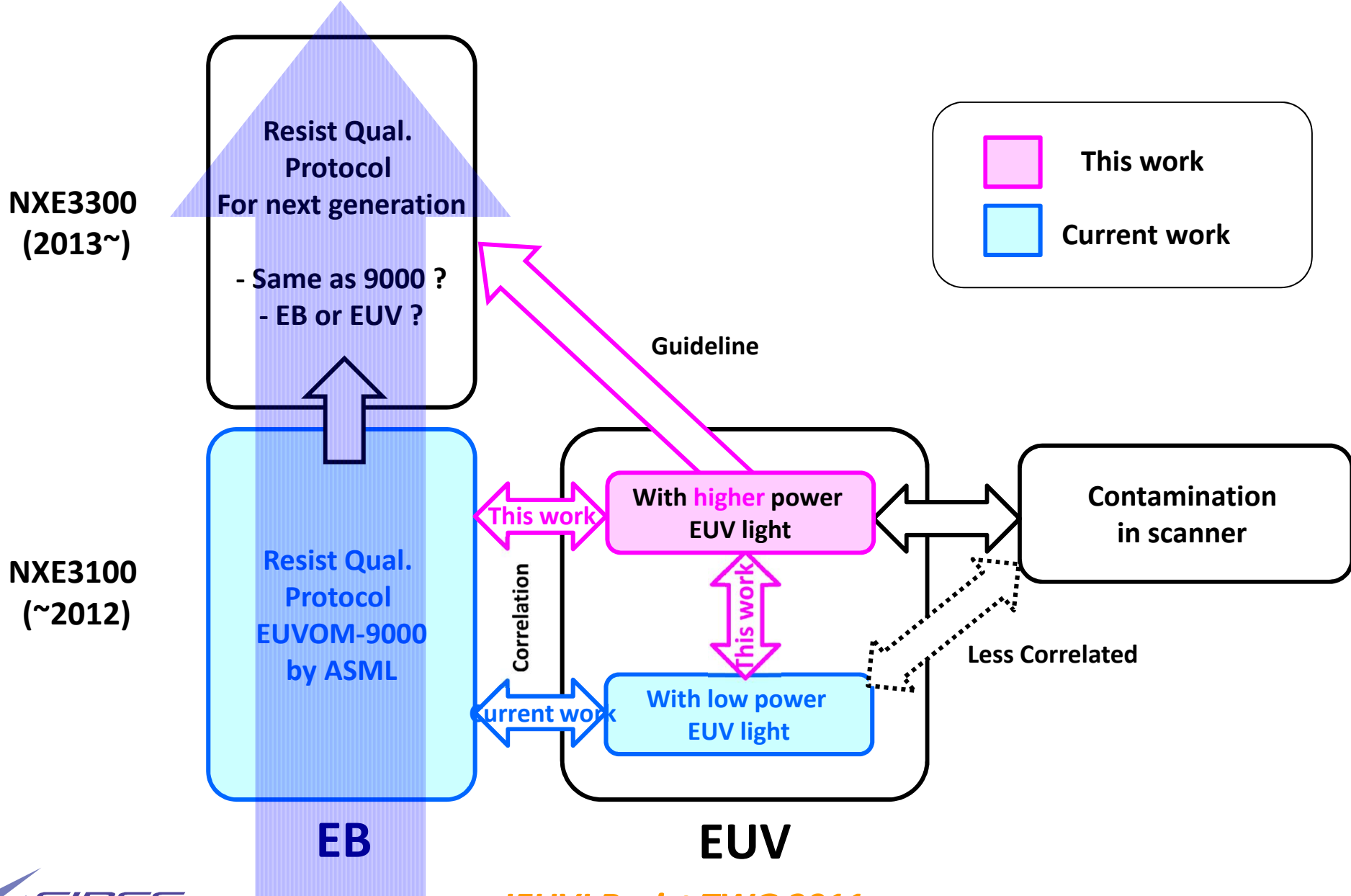
For NXE3100 Generation (Near Future: 2011~2012)

- To setup the infrastructures for EUV resist outgassing qualification
 - EB-based method proposed by ASML
 - To fix the uncertainty of EUVOM-9000
- To check relevancy of the EB-based method
- To have function of EUV resist outgassing qualification

For NXE3300 and beyond generation (Far Future: 2012~)

- To check adequacy of current methodology leveraging high power EUV facility in New SUBARU
- To clarify guideline of modification of resist qualification
 - Cleanable / Non-cleanable contamination

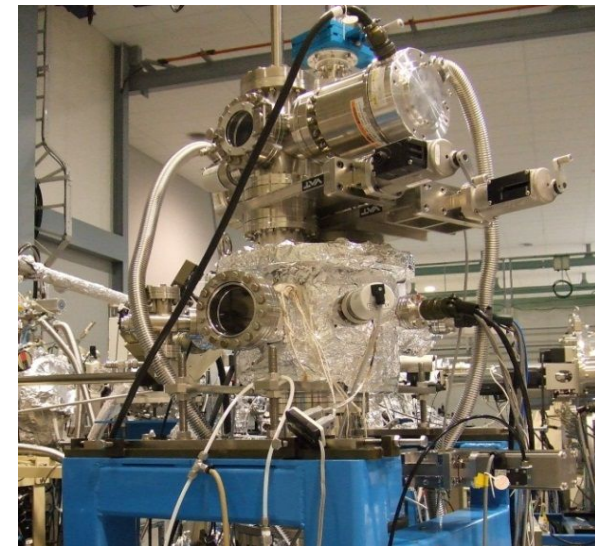
Role of EIDEC for Resist Outgassing



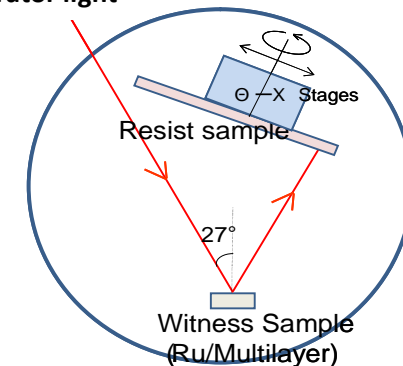
High Power EUV Tool for Contamination Test

Collaboration with Univ. of Hyogo

		High Power EUV Tool
Power		~235mW/cm ² (on WS) ~75mW/cm ² (on Resist)
Vacuum Conditions	Base Pressure	< 2 x 10 ⁻⁶ Pa Controllable
	Pressure during Contamination Test	~1.2 x 10 ⁻⁵ Pa Controllable
	Pumping	~2000L/s Controllable
Temp. of resist wafer		Not controlled
Total exposed area		~ 12 inch wafer (8inch x 3 wafers)

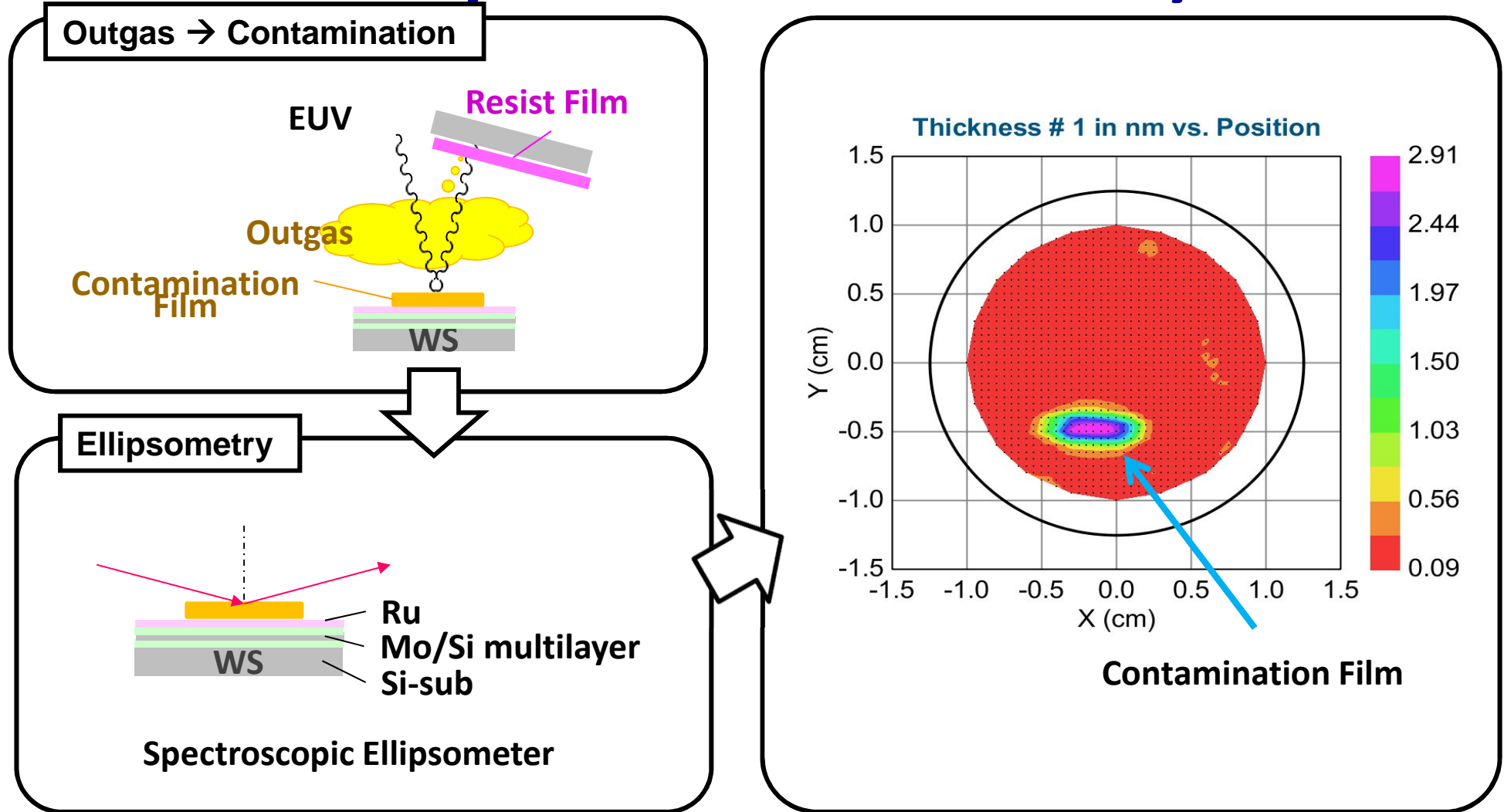


Undulator light



- The experimental setup is attached to the 10.8-meter-long undulator of the synchrotron radiation facility (New-SUBARU).

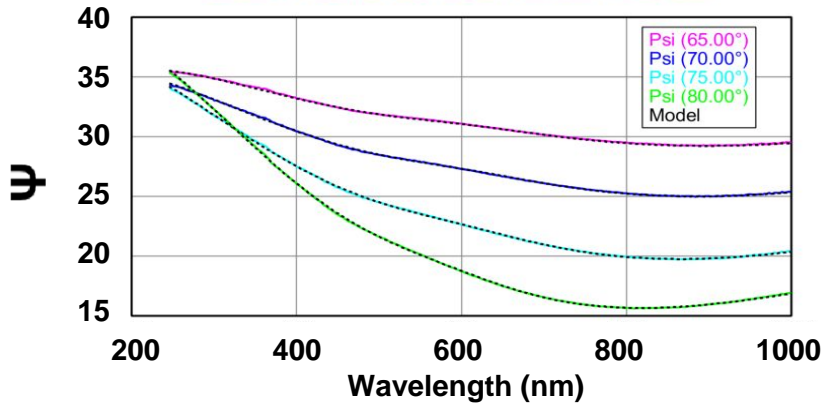
Preliminary Contamination Test by EUV



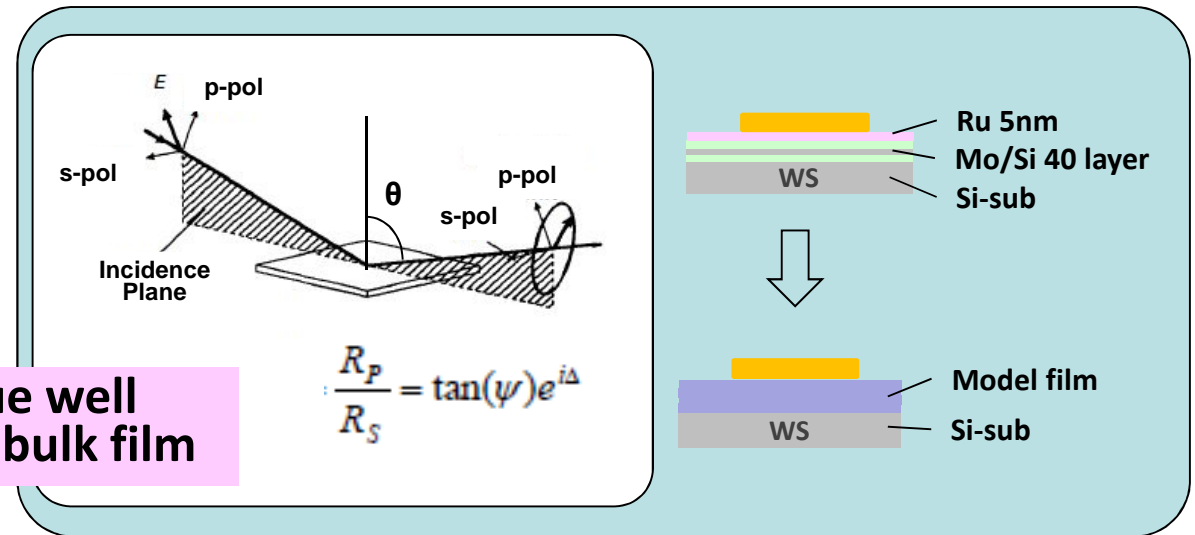
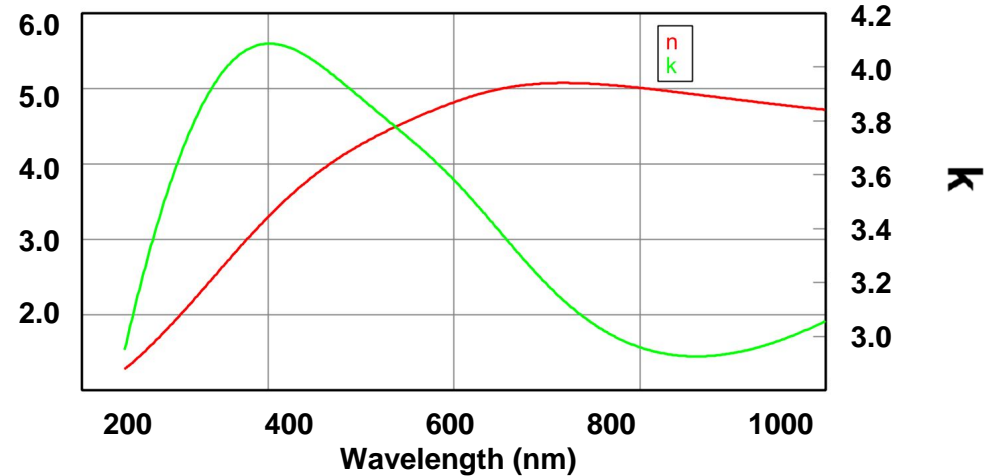
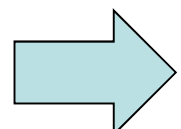
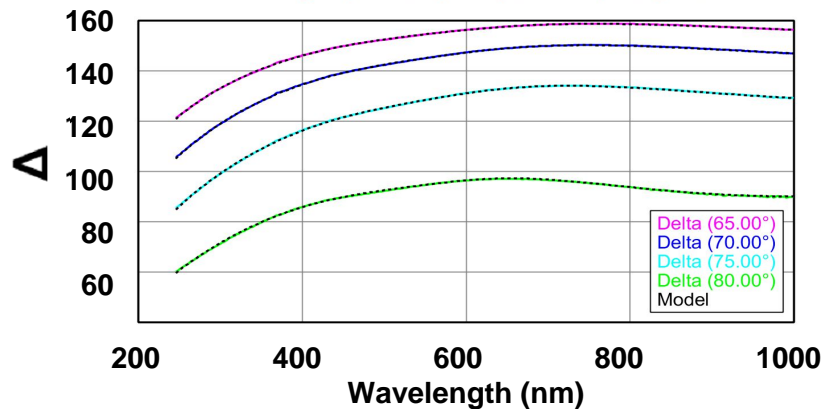
- The contamination film is identified by ellipsometry.
- The thickness was ~3 nm, but correlation with other metrology tools is necessary.

Modeling of Substrate for Ellipsometer

Variable Angle Spectroscopic Ellipsometric (VASE) Data



Variable Angle Spectroscopic Ellipsometric (VASE) Data



$$\frac{R_P}{R_S} = \tan(\psi)e^{i\Delta}$$

- The model fits with measured value well
- Ru (5nm) / ML can be treated as a bulk film

Summary

- EIDEC has started as the technological successor of MIRAI-Selete project in April 2011.
- EIDEC will play a role of representative of the resist suppliers who has joined EIDEC.
- EIDEC has already set most of desired tools for outgas evaluation. EB-based tool will be installed in Dec.
- EIDEC has obtained the result of preliminary outgas testing using high power EUV light with Univ. of Hyogo.
- EIDEC will make clear the behavior of non-cleanable components with EUV and EB.

Acknowledgement

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END