Accelerating the next technology revolution

iEUVi Mask TWG

Miami, Florida

October 16, 2011

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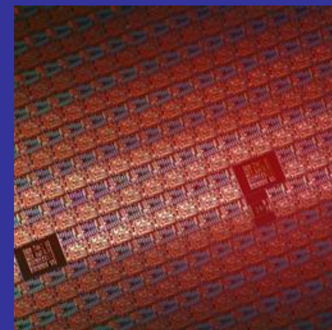

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Quick Introduction From Audience

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- Identify your name
- Organization you represent

- Friendly Reminder: Please turn your cell phone in silent mode.

Mask TWG: Mission & Objective

- Mission:

  Ensure EUV Mask Infrastructure Readiness for:
  - Pilot Line Production 2010 – 2012
  - High Volume Manufacturing 2013 - 2016
- Objectives:
  - Identify Required Standards
  - Coordinate industry-wide conversions
  - Identify any gaps between current industry efforts and projected future needs
  - Highlight gaps to member organizations and IEUVI Board for action

Agenda

Start	Finish	Topic	Who
8:00 AM	8:10 AM	Introduction / house keeping	David Chan, SEMATECH
8:10 AM	8:25 AM	Report-out of IEUVI Mask WTG at BACUS	David Chan, SEMATECH
8:25 AM	8:55 AM	E152 carrier standard update, A/B pod types	Long He, SEMATECH/Intel
8:55 AM	9:25 AM	Gudeng EUV carrier development and evaluation update	Chenwei Ku, Gudeng
9:25 AM	9:55 AM	Entegris EUV carrier status and roadmap	Tom Kielbaso, Entegris
9:55 AM	10:10 AM	Break	
10:10 AM	10:25 AM	Nikon/Canon perspectives of potential improvement of pod performance	Kazuya Ota, Nikon
10:25 AM	10:40 AM	Issues of reticle coatings	Kazuya Ota, Nikon
10:40 AM	10:55 AM	Automation challenges of EUV reticle carriers	Katsushi Hayasaki, Rorze
10:55 AM	11:10 AM	Design and qualify reticle handling	Jacques van der Donck, TNO
11:10 AM	11:25 AM	EUV carrier implementation to EUVL mask tools	Hiroki Miyai, Lasertec
11:25 AM	11:40 AM	Initial learning of in-fab handling	Rik Jonckheere, IMEC
11:40 AM	12:40 PM	Lunch	

A quick note: Q & A welcome. Park most discussions in the afternoon if possible.

Agenda

Start	Finish	Topic	Who
12:40 PM	2:00 PM	Topic discussions & action plans: 1. Shipping strategy, wafer-fab mask acceptence, maskshop last tool? 2. Non-exposure tool implementation: Inspection, Clean, AIMS, Blank dep? 3. How to eliminate carrier types - what need to happen first? 4. Pod cleaning - do we have significant problems there? 5. Reticle storage - how to minimize molecular contamination? 6. ESD? 7. EUV pellicle?	All (LH lead)
2:00 PM	2:25 PM	EUV mask cleaning challenges for 11 nm and 16 nm HP nodes	Abbas Rastegar, SEMATECH
2:25 PM	2:40 PM	Current challenges of EUV mask blank cleaning	Takeya Shimomura, DNP
2:40 PM	2:55 PM	Program and native defect printability	Harry Kwon, SEMATECH/Samsung
2:55 PM	3:10 PM	Break	

Agenda

Start	Finish	Topic	Who
3:10 PM	3:20 PM	IMEC inputs on blank defectivity	Rik Jonckheere, IMEC
3:20 PM	3:40 PM	Sources of defects in mask blank	Vibhu Jindal, SEMATECH
3:40 PM	4:00 PM	Particle defects orginating from Seals and possible solutions	Jeff Blouse, ASNA
4:00 PM	4:20 PM	Detection of small size particles in low pressure and component evaluation	Gregory Denbeaux, CNSE
4:20 PM	4:40 PM	Modeling particle transport in low pressure under plasma conditions	Alex Likhanskii, Tech-X
4:40 PM	5:00 PM	Action plans / Meeting adjourn	Vibhu Jindal, SEMATECH

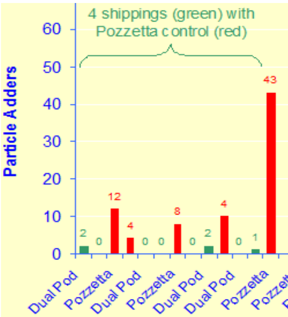
Special iEUVi Mask TWG at SPIE Photomask Conference in Sept. 2011

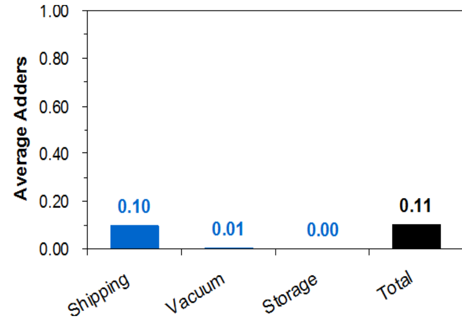
- EUV Source and defect free masks received priority attentions from the industry
- Mask Handling/shipping/storage strategy needs to gain more tractions to support HVM implementation
- Need industry strategy consensus from blank shops, mask shops, to mask users
- Special BACUS Session. Main Reasons:
  - Capture inputs from those in the mask community who normally do not attend EUVL Sym.
  - Invite inputs on topics covered in Mask TWG Agenda

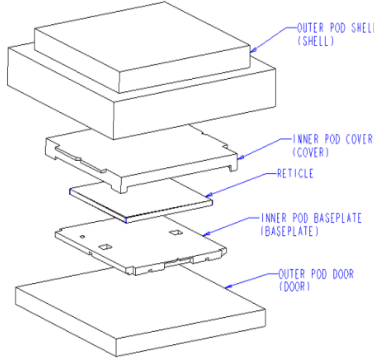
Start	End	Topic	Lead
10:00	10:15	Introduction	David Chan (SMT)
10:15	10:45	EUV Mask Standard Update	Long He (SMT/Intel)
10:45	11:00	Current EUV mask handling status and issue in maskshop	Naoya Hayashi (DNP)
11:00	11:45	Discussion of carrier types, tool implementation, and shipping strategy	Long He (SMT/Intel)
11:45	12:00	Discussion and conclusion	All / David Chan (SMT)
12:00		Meeting Adjourn	

Company	# Participants
Applied Material	2
ASML	1
Carl Zeiss	2
DNP	1
IBM	1
IMEC	1
Intel	3
KLA	1
Lasertec	1
NuFlare	1
Rorze	1
SEMATECH	2
Toppan	2
TSMC	1
Total Companies	14
Total Participants	20

Key EUV Carrier Development Milestone







The good:
Enables NXE3100

The bad:
Particle-free capability has not been demonstrated.

Dual-pod concept demonstrated

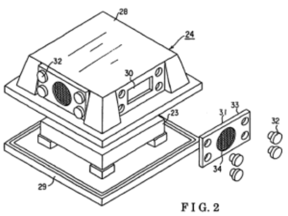
Performance capability demonstrated with sPod

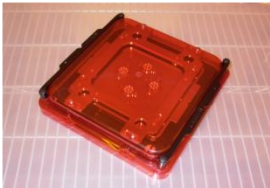
E152 EUV-pod standard established

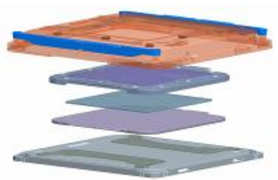
Implementation start

200?

2007		2008		2009		2010		2011	
H1	H2	H1	H2	H1	H2	H1	H2	H1	H2

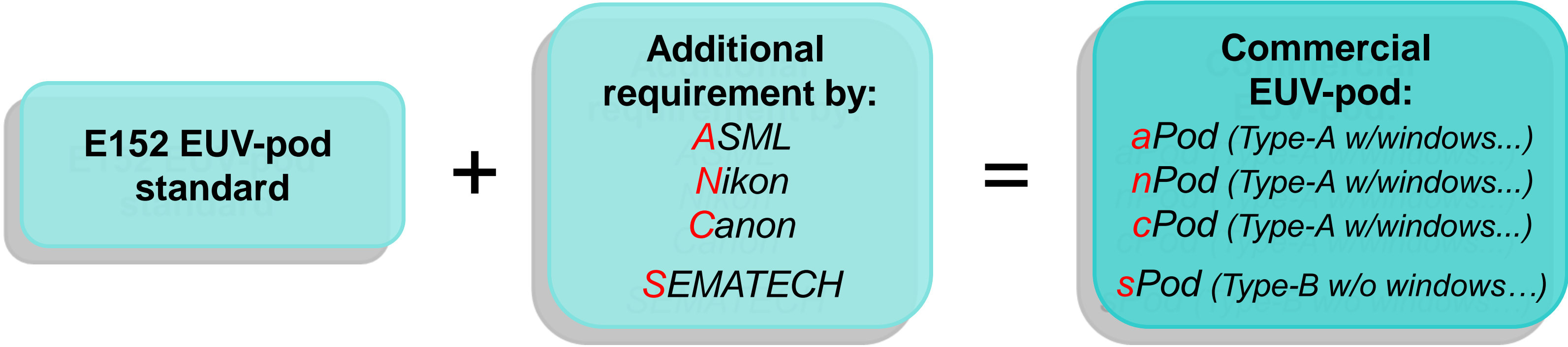






SEMATECH/Entegris outer-pod JDA for commercial availability of a-, n-, c-, and s-Pod.

(SEMATECH) Carrier Assessment: No Complete Carrier Solution Exists



All data published previously by SEMATECH were from sPod carriers, unless indicated otherwise.

Need	Carrier	Risk	Comment
NXE3100 tools	aPod	*(?)*	Insufficient data to conclude
***Non-exposure* tools** (clean, inspection, etc.)	aPod, sPod	*L*	Require full tool compliance with E152 standards
Shipping	aPod	*M/H*	Palletized packaging, not demonstrated
	sPod	*L*	Require a *particle-free* transfer
	Clamp shell boxes	*H*	Require clean at wafer fab arrival
***In-fab* storage**	aPod, sPod	*L/M*	Need data

The Bottom Lines

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Tool automation:

- *Exposure tools interface with Type-A only.*
- *All other tools interface with both Type-A and -B carriers, when compliant with E152.*
  - ***Type-A allows more mask positioning errors than Type-B: 0.3 mm more.***
  - ***Type-A allows end-effectors to contact mask front edges. Assess to mask front edges is "Not required" for Type-B.***

Particle protection:

- *The best Type-A pod that one could possibly build is equal to Type-B, but not to exceed it, based on following tree assumptions:*
  - *Mask and pod should not have any relative movement when pod is moved, by securing mask in place as best as possible.*
  - *Robotic fingers should stay away from mask front as far as possible.*
  - *Flatter baseplate provides fuller coverage to mask front than that with lowered areas.*

Issue and Discussion

- Technical Issue
  - There are still some risk of adder.
  - Dual Pod is not designed for shipping without very critical packaging specifications.
- Cost Issue
  - Use and maintain Dual Pod in maskshop and mask shipping will heavily increase EUV mask cost.
- Discussion
  - There will be frequent mask cleaning and re-qualification in FAB, anyway.

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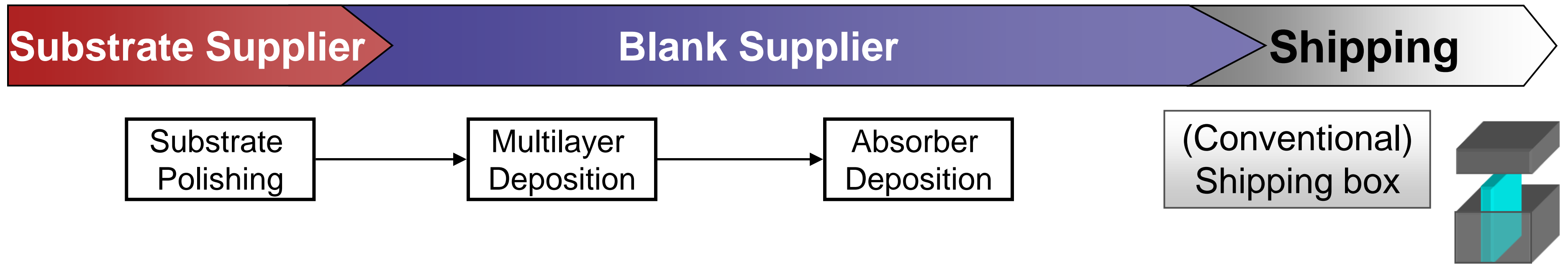
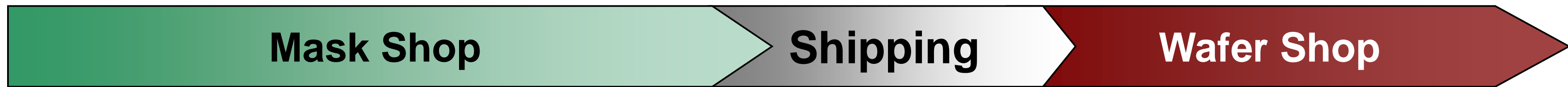
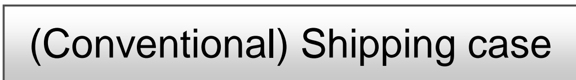
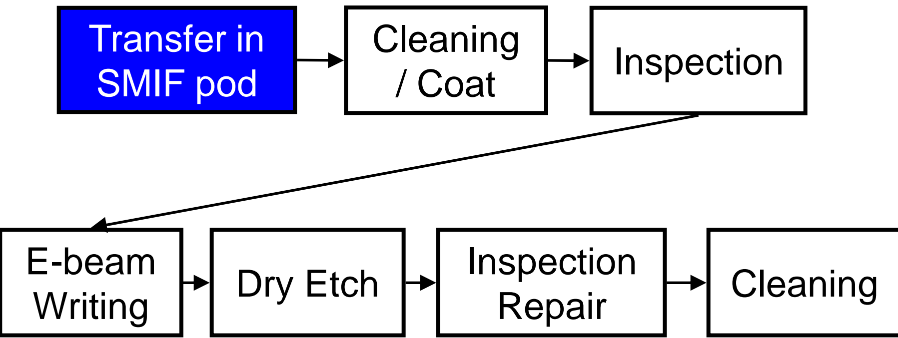
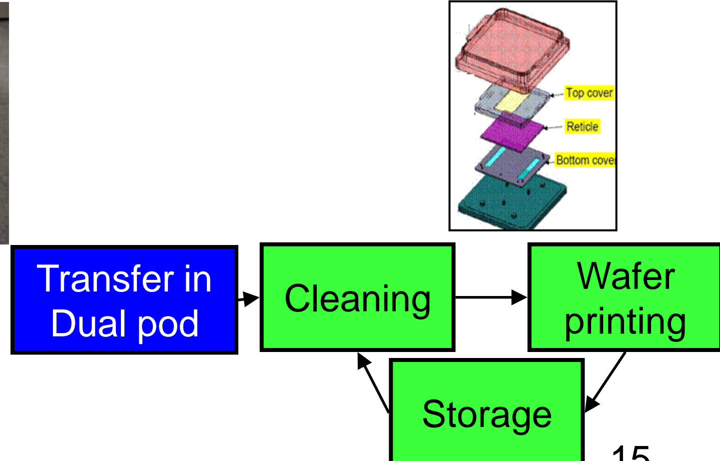
Proposed EUV mask handling flow











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Summary

- Dual Pod is most clean EUV mask handling tool.
- However, there will be some risk of particle adder when shipping.
- Using Dual Pod during whole EUV mask manufacturing flow will add serious cost on the mask. So that, mask maker would like to use current SMIF Pod and shipping box in production line and shipping.
- Solution will be usage of Dual Pod in FAB for handling during exposure, mask cleaning, re-qualification, and storage.

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Major Points at BACUS Mask TWG

- Defect Free Handling is key to EUV HVM implementation but currently no industry consensus on how to make it happen.
- SEMI standard allows two types of pods – scanner specific and non-scanner applications. Standard approach is to provide minimum “must have” but maximum flexibility in solution paths.
- DP capabilities will cause $ and time. Consensus based on “must have” instead of “nice to have”; “data” versus “opinions”. Need to have consensus what process/metrology tools are required to have such capability.
- Question raised why we used any shipping protocol other than the “best” demonstrated method from mask shop to wafer fab. Current, S-Pod data is the best.

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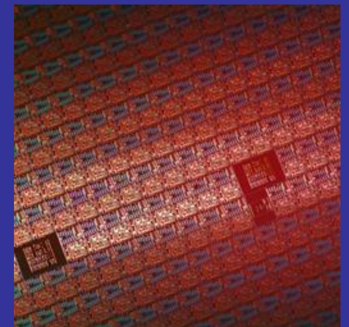
Closing Remarks



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Next meeting of IEUVI Mask TWG(s)

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- We are looking for suggestions in tasks priorities and topics of discussions
- Inputs on meeting formats, etc. are welcome
- Schedule:

  @ SPIE, Feb 2012, San Jose USA