SEMI Standards Updates

1:10 PM – 2:00 PM	**SEMI Standards Updates**	
	• 4466B Draft for Carrier – Voting End February 18	*L. He, Intel*
	• P40 Slightly Revised Draft for Voting April 13	*J. Zimmerman, ASML*
	• P37 New Draft Version – Specifications Moving to ITRS	*K. Orvek, SEMATECH*

SEMI 4466B EUV-pod Ballot Update

Feb. 22, 2009

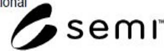
TF Co-chairs:
Long He (Intel)
Dave Halbmaier (Entegris)
John Zimmerman (ASML)

Ballot Voting Update

- **Cycle 1 voting officially ended on 2/18. But, still trying to collect 2 more votes to meet the SEMI minimal voter turn out requirement.**
- **The voting results to be reviewed in SEMI NA PIC Committee Standards meeting on 4/1/09, San Jose, CA**
  - With goal for approval

SEMI Draft Document 4466B: *“Mechanical Specification of EUV Pod For 150 mm EUVL Reticles”*

Semiconductor Equipment and Materials International
3081 Zanker Road
San Jose, CA 95134-2127
Phone:408.943.6900 Fax: 408.943.7943



DRAFT
Document Number: 4466B
Date: 1/9/2009

LETTER (YELLOW) BALLOT

SEMI Draft Document 4466B
NEW STANDARD: MECHANICAL SPECIFICATION OF EUV POD FOR 150mm EUVL RETICLES

1 Purpose

1.1 This standard specifies EUV Pod for the 150 mm Extreme Ultraviolet Lithography (EUVL) reticle, used to ship, transport and store a 6-inch reticle. The EUV Pod consists of an outer pod and a protective inner pod. The EUV Pod is to be used when a conventional reticle carrier does not meet the requirements of EUVL.

2 Scope

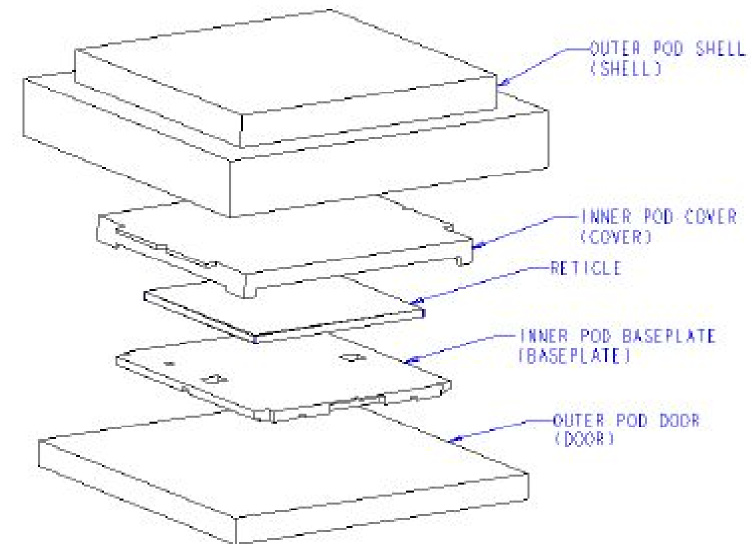
2.1 This standard is intended to set an appropriate level of specification that places minimal limits on innovation while ensuring modularity and their inter-changeability at all mechanical interfaces. Many requirements given in this specification are in the form of maximum or minimum dimensions with very few required surfaces. No material requirements or micro-contamination limits are given in this specification.

2.2 Because of high attenuation feature of EUV light, a conventional pellicle film cannot be placed in front of EUVL reticles. The inner pod is to protect reticles from particle contamination.

2.3 The EUV Pod has the following components and sub-components. The baseplate of inner pod has two possible configurations depending on the intended usage. They are designated Type A and Type B. Detail configuration requirements for each are shown in Table 2.

Key:
Required feature: ▪
Optional feature: ◊

SEMI Draft Document 4466B



SEMI 4466 carrier concept

It Primarily Specifies Mechanical Interfaces of EUV-Pod, To Allow Innovation

❶ All allowed EUP-pod variations share identical mechanical interfaces, *including outer pod to loadport, between inner pod and outer pod, and inner pod handling.*

❷ Carrier suppliers / users are responsible to specify next level requirements beyond mechanical interfaces.

❸ Additional ID features defined by the standard for exposure tools to accept specific pod configurations

❹ It requires non-exposure tools to interface with all EUV-pod configurations.

Two Baseplate Types: A and B

Table 2 Type A/B Inner Pod Baseplate Specification

Feature	*Symbol Used*	*Figure*	*Section*	*Specification*	
				Type A	*Type B*
Reticle Location Tolerance	x1	6	5.5	± 0.55 mm	± 0.25 mm
Reticle Location Tolerance	y1	7	5.5	± 0.55 mm	± 0.25 mm
Front Edge Grip Exclusion Volumes		3	5.2	Required	Not Required
Baseplate Apertures		5, 8	5.9	Required	Not Required
Baseplate Corner Notch	x22	5, 8	5.8	72.00 ± 0.20 mm	Prohibited
Baseplate Corner Notch	y38	5		3.00 ± 0.25 mm	Prohibited
Secondary Baseplate Exclusion Volume	y5	5	5.7.1	3.00 ± 0.25 mm	Prohibited
Secondary Baseplate Exclusion Volume	z3	7	5.7.1	6.00 ± 0.25 mm	Prohibited
Baseplate Notch	y29	5	5.7.1	3.00 ± 0.25 mm	Prohibited
Cover Edge Limit (above base plate, along x22)	z17	7		5.00 mm, Minimum	Prohibited
Baseplate Exclusion Volume	y28	5, 8	5.7.1	50.00 ± 0.25 mm	40.00 ± 0.25 mm
Baseplate Exclusion Volume	x4	5	5.7.1	25.00 ± 0.25 mm	~~20.00 ± 0.25 mm~~
Baseplate Registration Hole Assignments		5, 8	5.14	A, B, C, D, E, F	A, B, C

a: Position tolerance
b: Window
c: Recess
d: Baseplate extension
e: Add. ID
d
e

Editorial error: should be "Prohibited"

- All the differences are limited to the baseplate.
- Refer to Section 2.3 and Appendix 1 for detail and related information.

Possible Carrier Dedication

- **Carefully studying SEMI 4466B, one will find no additional efforts for non-exposure tools to interface with all possible baseplate types, because their interface specifications are identical.**
  - But, future goal should be minimal, or no dedication.

	Type B	Type A		
		Vender X	Vender Y	Vender Z
Exp. Tool (Vender X)	Incompatible	Compatible	Incompatible	Incompatible
Exp. Tool (Vender Y)	Incompatible	Incompatible	Compatible	Incompatible
Exp. Tool (Vender Z)	Incompatible	Incompatible	Incompatible	Compatible
Any other tools: Inspection, Clean, etc…	Compatible	Compatible	Compatible	Compatible

Color codes: Compatible Incompatible

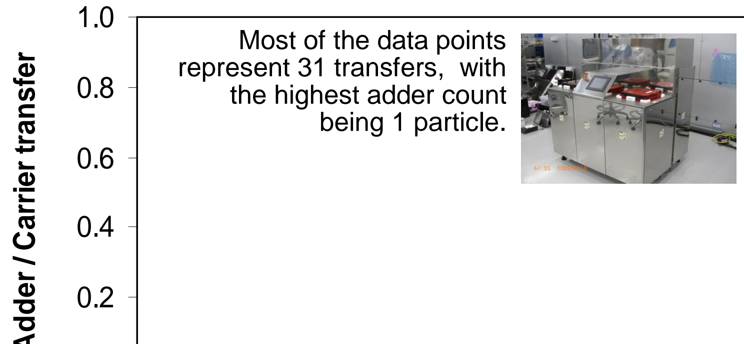
Recommendations for Near Term Standard Improvements

- **Eliminate the needs for further Type-A carrier dedication if possible among exposure tool venders, and/or different tool sets from a single vender.**
  - Share the same window glass/optical property, by adopting similar wavelengths to read and align EUVL mask.
- **Eliminate the two extensions of Type A baseplate, which is defined by y38 and x22, etc…**
  - Pave the way to eliminate Type A, B dedication in the future.
- **But, for now leave the general Type A and Type B alone, until demonstrating at least one of the two types meets 16nm hp requirements.**
  - Unlikely to have the needed inspection capability in two years

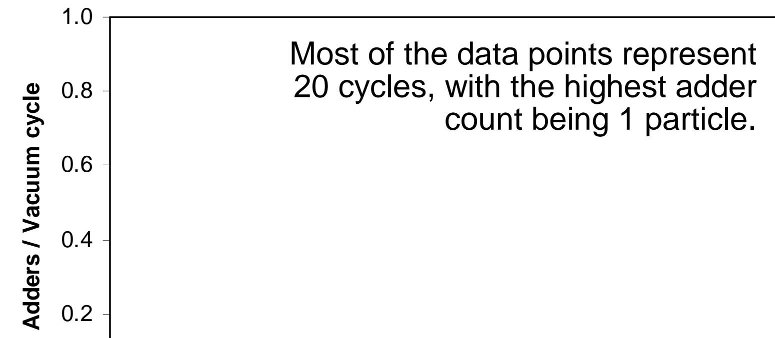
EUV Pod Provides Nearly Particle-free Protection in All Key Areas @53nm Inspection Capability

He, et al. – Proc. SPIE 6921, 69211Z (March 21, 2008)

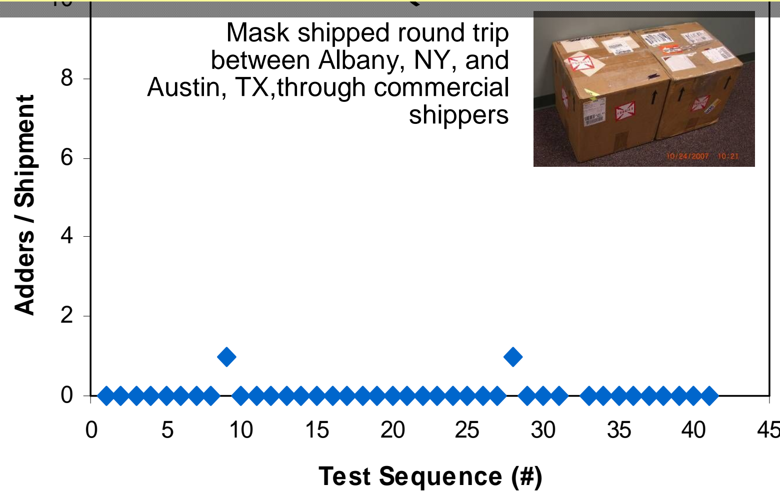
Mechanical Handling (atmosphere)

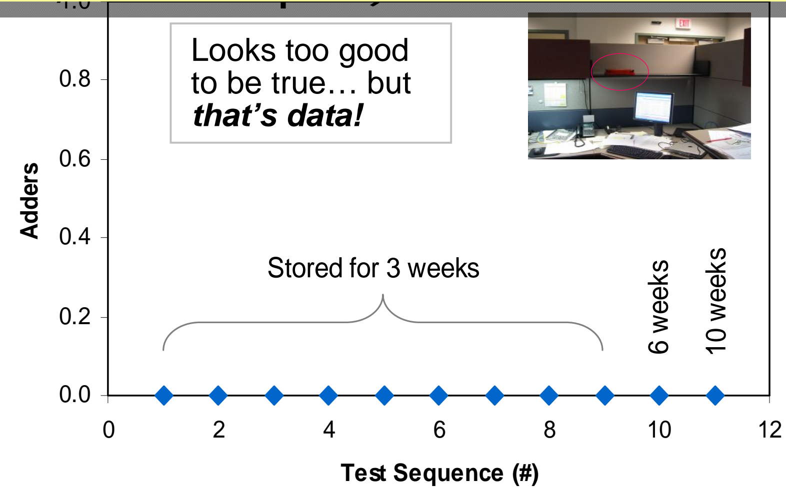


Vacuum Protection



For latest results with 40nm inspection sensitivity, attend Session 4, EUV Mask, on Tuesday (*He et al. 7271-18, @5:30pm*)





Inspection sensitivity: 53nm PSL equivalent; inspected area: 142 mm x 142 mm; Mask: quartz

Thank You Everyone

for continued interest, support, and dedication

SEMI-4584 (P40) Voting Status

Co-authors:
John Zimmerman (ASML)
Tsuneyuki Hagiwara (Nikon)
Kazuya Ota (Selete)
Akira Miyake (Canon)
Kevin Orvek (SEMATECH)

Feb. 22, 2009

SEMI-4584 Document 1st Ballot: Oct 20, 2008 – Nov 19, 2008

Parameter	P-40 (2002)	4584 (2009)	P-40 Notes
Mean clamping Pressure (kPa)	15 ± 1.5	Delete	Limiting
Max clamping pressure in contact area (kPa)	Not Specified	< 2,000	
P-V flatness- quality area (nm)	48	< 32	Update
P-V flatness-sub aperture (nm) 75mm, etc	24, etc	Delete	Not really required
Local Slope Error (μrad) (over 20 x 20 mm²)	Not Specified	< 1	Minimizes IPD type errors
Stiffness (N-m)	> 30,000	> 300,000	Update
Pin Pitch (mm)	< 10	Delete	Limiting

- Recommendations for changes to P-40 are made so that the required mounted reticle distortion is assured
  - Node update
  - Removes limits but adds upper bounds
  - Correctly establishes flatness requirements
  - Removes geometry (pins)

Summary Of 4584 (P40) Voting Results
Oct 20, 2008 – Nov 19, 2008

As Cast Ballot Tally Summary For Document 4584			
Return Percentage	**60%**	**Voting Member Returns:** **Voting Member Distribution:**	**36** **60**
Total votes Received:	41	*Number of Abstains:*	*24*
Number of Accepts: **Accept %:**	16 94%	**Number of Rejects:**	1
Total Comments:	2	**Total Rejects:**	1
Comment Issuer(s):		*Reject Issuer(s):*	
Intel - Long He IMEC - Rik Jonckheere		SELETE - Kazuya Ota	

- Revised draft will be submitted for voting cycle Apr 27 – May 27
- SEMI committee adjudication SEMICON WEST July 14-16

Reject #1

Reject No. 1 (only reject received)

Voter: SELETE - Kazuya Ota

Negative:
In table 4, bending stiffness is 30,000 Nm, the value is the same as the current P40. Before the ballot, John Zimmerman and I agreed to change the value to 300,000 Nm.

Action:
This value will be corrected to 300,000 Nm in the new ballot.

Content Comment And Response

Comment No. 1 (voted Accept)

Voter: Intel - Long He

Comments:

1. SEMI-4584 seems to specify "requirements," but leaves how to measure them to users and suppliers. Apparently, there are waving rooms which could make the specifications mean much less. It would be more useful to standardize the measurement methods, even leave requirement specifications to users and suppliers. Overall, this standard is insignificant to broad industry.

Action: Comment retracted

2. In Section 2.1.1, the statement "As an option, the requirements may be used in other tools used to fabricate or measure EUV masks" is unnecessary and only cause confusion. It should be deleted from final publication.

Action: This statement will be reworded from the new draft. Section 5.4 will be eliminated as it is redundant.

Content Comment And Response

Comment No. 2 (Voted Accept)

Voter: IMEC - Rik Jonckheere

Comment:

1. [Section] 3.1 should refer to THE title of the EXISTING P37, not the update being made

Action: Section 3.1 shall be changed from:

SEMI P37 — SPECIFICATION FOR EXTREME ULTRAVIOLET LITHOGRAPHY SUBSTRATES AND PILOT- LINE MASKS

to: SEMI P37-1102: SPECIFICATION FOR EXTREME ULTRAVIOLET LITHOGRAPHY MASKS SUBSTRATES

2. [Section] 5.4 may be redundant, as it is repeating 2.1.1

Action: Section 5.4 will be eliminated, and section 2.1.1 will be worded as indicated on the previous slide.

SEMI P37 Status

Co-authors:
Kevin Orvek (SEMATECH)
John Zimmerman (ASML)
Tsuneyuki Hagiwara (Nikon)
Akira Miyake (Canon)
Kazuya Ota (Selete)
Yoshiaki Ikuta (AGC)
Tsutomu Shoki (HOYA)

Feb. 22, 2009

SEMI P37 – Substrates and Blanks

- Last year's draft ran into a lot of dissent on performance specifications
- This year we will try to go into ballot with a simpler standard that is more like latest optical substrate standard P1-0708.
  - 1) To define key specifications for EUV substrates that ensure physical compatibility with EUV carriers, process equipment, and EUV scanners;
  - 2) To define key film specifications for EUV blanks required to ensure usability in any EUV scanner;
  - 3) And, to provide definitions of key properties to be specified between the user and supplier for EUV substrates and blanks.
- Some key parameters may need to change in 2013 with a new revision
- Performance specifications will be listed in a revised ITRS roadmap for EUVL Masks (next topic in agenda)

SEMI P37

6 EUV Substrate Specifications

6.1 EUV Substrate Materials

6.1.1 Substrate materials - LTEM, CTE

6.2 EUV Substrate Physical Dimensions

6.2.1 edge length and thickness

6.2.2 rounded corners

6.2.3 chamfered edges

6.2.4 notches

6.3 EUV Substrate Flatness Components

6.3.1 flatness error definition (least squares fit). The flatness quality area and the flatness error are to be specified between the user and the supplier. The International Technology Roadmap for Semiconductors (ITRS) provides recommended values for EUV substrate flatness error.

6.3.2 The backside local slope angle is defined. The maximum backside local slope angle is to be specified between the user and the supplier.

6.3.3 The wedge error is defined and a maximum value provided.

SEMI P37

7 EUV Blank Film Layer Specifications

7.1 Backside Conductive Layer

7.1.1 backside conductive area

scanner suppliers want 150mm x 150mm

but that puts it near physical edge of glass with bevels, and blank suppliers cannot prevent films on beveled edge or even sidewalls

are films allowed on the sides ?

7.1.2 sheet resistance

7.2 Frontside Multilayer Stack

7.2.1 film stack to be designed for 6º incident light, and median EUV reflected wavelength λm

These are key to permit any ML blank to be used on any scanner

ASML, Nikon have agreed on 13.53nm, Canon considering

Angle will change in future (≥2013), and wavelength may as well

7.2.1.2 minimum value for the median EUV reflectance and the uniformity of the reflectance across the quality area are to be specified between the user and the supplier. The International Technology Roadmap for Semiconductors (ITRS) provides recommended values for EUV reflectivity and uniformity.

SEMI P37

APPENDIX

- **ASML recommends putting three-page appendix at end with definition figures and tables of non-binding values:**
  - **Flatness:**
    - **define quality area**
    - **two paths, superpolish vs. e-beam IP compensation**
    - **flatness front and back**
    - **backside local slope**
  - **Multilayer film:**
    - **define quality area**
    - **minimum %R and range, and range of λ**
  - **Absorber film:**
    - **%R at EUV λ**
    - **%R at inspection λ**
  - **Total films bow, for both superpolish and e-beam compensation**

SEMI P37

P37 STANDARD VOTING PLAN:

- submission date Apr 13, voting Apr 27 – May 27
- or, submission date May 18, voting Jun 1 – Jul 1
- either way SEMI committee adjudication during SEMICON West