

North America Update

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Agenda

- North America participation
- Standards
 - Published to date
 - In revision
 - Future
- ISMT Activities
- Working Groups
 - Chartered & active
 - Future
- International TWG
- Timeline / roadmap

Over 50 Organizations in North America working on EUVL

Laboratories and Universities

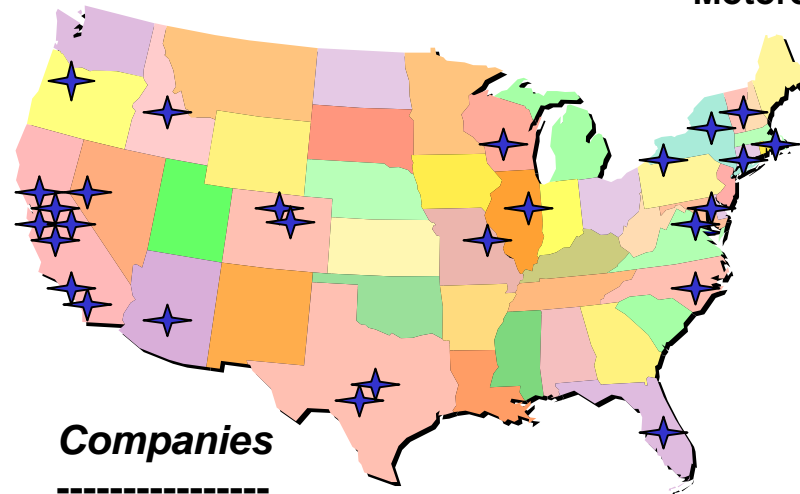
Argonne National Laboratory
Columbia University
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
MIT Lincoln Labs
NIST
NRL
Sandia National Laboratories
Colorado State University
U. of Albany, SUNY
U. of California Berkeley
U. of Central Florida
U. Of Colorado
U. Of Illinois
U. of Maryland
U. of Nevada
U. of Texas
U. of Wisconsin

Consortia

EUV LLC
I-SEMATECH
SEMI
SRC
VNL RDC

IC Companies

AMD
IBM
Infineon USA
Intel
Micron
Motorola



Companies

ADE
AERONEX
ASML
ASML Optics
Conexant
Corning Inc.
Corning Tropel Corp.
Cymer

Dupont Photomask
Etec
EUV Technology
Invax
Janos Tech.
JMAR
KLA-Tencor
Luxel
Ohara

Opimax
ORA
Osmic
Paragon Optics
Photronics
Plex LLC
QED
REO
Rohwedder

RTC LLC
Schott-Lithotec
Shipley
Swales Aerospace
Thermacore
Veeco
Wave Optics
ORA

SEMI Standards

- Published
 - P37 – EUV mask substrate, November 2002
 - P38 – EUV mask blank, November 2002
 - P40 – Mask chuck requirements, November 2003
 - Final approvals given last week.
- Near future works
 - Carrier standard – white paper for PIC
 - Traceability for mask and substrate identifications
 - P37 revision for flatness specification
 - P28, P40 revisions as needed
 - P10 mask ordering

Carrier standard white paper

- At SEMICON/West, task force decided to delay enacting a new standard for EUV mask carrier, and request revising an existing Physical Interfaces & Carriers (PIC) standard. PIC representative Stefan Radloff (Intel) supported this approach.
- SEMI E111, single-capacity RSP150 (SMIF) is the likely candidate.
- Plan to add EUV carrier performance requirements to the standard. Form factor is 150mm SMIF, but once defined, requirements can be applied to any form factor.
- Poll of the Micropatterning and PIC committee members worldwide showed support for this approach, but some members were concerned about the intent, and requested a white paper to clarify the task force's position.
- White paper will be drafted later this year and distributed for comments and revisions before being submitted to PIC committee.

Voting Results

GCS Approval Request Topic: **Ownership of Mask Carrier Activity**

Voting Choices:

Yes – approve of Microlithography revising a PIC standard

No – prefer Microlithography to develop a new standard

Results Summary:

Total Votes Received:

4 (Microlithography) + 6 (PIC) = **10 votes** (NA, Europe, Japan)

Yes – Uwe, Iwao, Wes, Shoji, Kouji, Stefan, Stephen = **7 Yes**

No – Jacques, Gerhard, Alfred = **3 No (request white paper)**

EUV Mask Task Force Response – **Draft white paper for further clarification.**

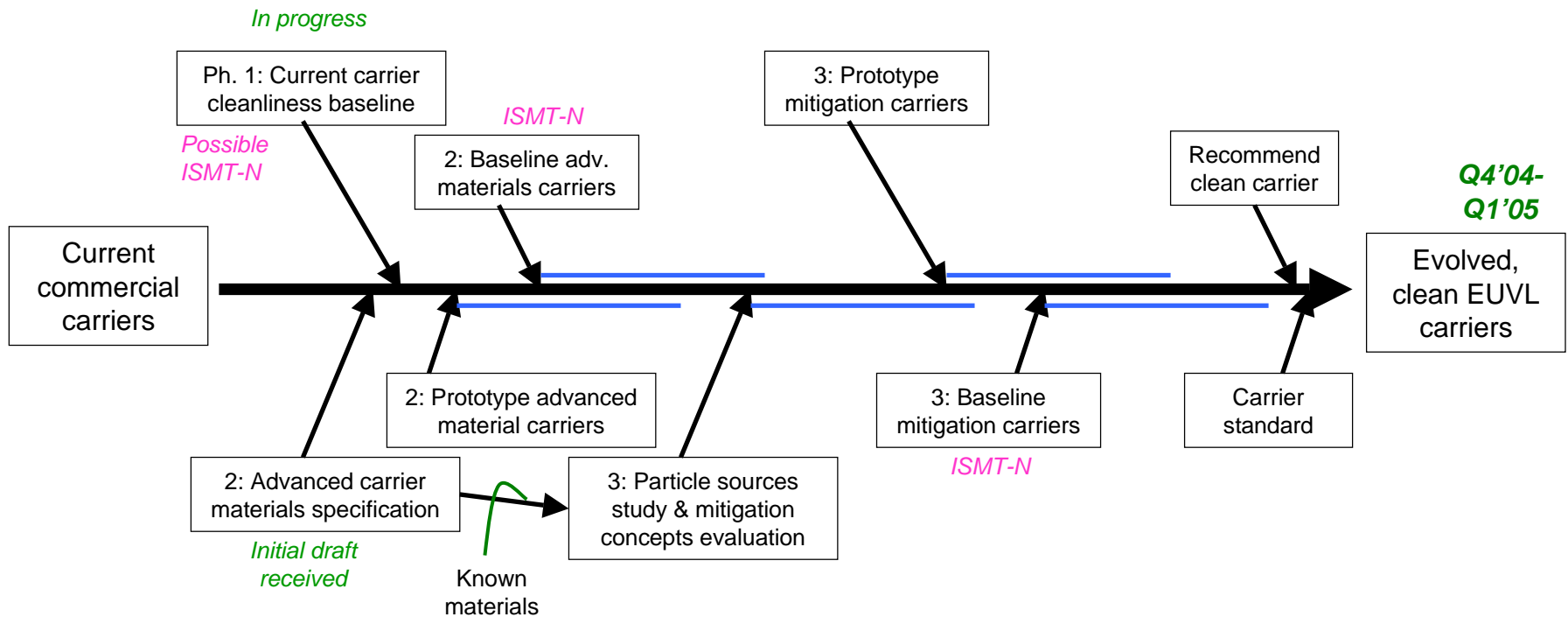
International SEMATECH Mask Activities

- ISMT Projects
 - LITH141 – EUV mask substrate improvement & blanks supply
 - LITH145 – EUV mask handling & protection
 - LITH147 – EUV mask chucking
 - LITH337/338 – Advanced mask cleaning
 - LITH130 – U.Wisconsin mask modeling
 - Blank repair
- ISMT-North / Albany
 - LITH184 – Blank development
 - LITH186 – Blank metrology
 - LITH143/144 – Blanks deposition
 - Cleaning & defects mitigation work

LITH145 – EUV Mask Protection Strategy

<i>Task</i>	<i>ISMT Project</i>	<i>Working Group</i>	<i>SEMI Standards</i>
Mask Carrier	LITH145	X	Doc. 3553 or existing PIC standard
Exposure tool	<i>Tool Supplier Responsibility</i>		
Inspection	LITH145		
Cleaning	ISMT-N and LITH337	X	
Mask Backside	LITH147	X	P38 Mask Blank
Particle Sources	LITH145 + ISMT-N	X	
Robotics, Gripping, Interface	TBD	X	P38 (handling areas), future interface stds.
Mask Fiducial Mark	LITH145 and ISMT-N	X	Future traceability
Mask & substrate ID marks	Standards (Mask 2003, substrate 2004)		Future traceability
Shipping	LITH145 and ISMT-N		
Mask Shop (post-final inspect)	TBD		

Carrier Evolution Plan



EUV Mask Handling Working Groups

- A Steering Committee and six Working Groups have been chartered, four have been initiated.
 - *Mask Carrier & Particle Study* – joint WG for now (similar early goals).
 - *Mask Backside*.
 - *Mask Cleaning* has not begun formally; meetings including LITH337 project manager have been held.
 - *Mask Fiducial Marks* (new, began 8/03)
 - *Interface, Robotics, & Gripping* will begin Q4'03.
- Participation has included: AMD, Asahi, ASML, Canon, DuPont Photomasks, Entegris, Hoya, IBM, Infineon, Intel, ISMT/ISMT-North, KLA-Tencor, Motorola, Nikon, NuFlare, Osmic, Sandia NL, Schott Lithotec, Zygo.
- Minutes are widely distributed.

EUV Mask Handling WG Chartered Objectives

- *Mask Carrier* – Deliver an EUV mask carrier solution to the industry and incorporate key elements of the carrier solution into a SEMI standard.
- *Particle Study* – Evaluate particle add risk points in the finished mask lifetime pathway, propose appropriate effective mitigation options, assess current state of the art relevant to EUV requirements (no pellicle). Generate realistic particle tolerance specification (not zero) including individual operation/equipment contributory budgets.
- *Mask Backside* – Provide a mask backside film recommendation to the industry. Define a mask front conductive discharging path.
- *Mask Cleaning* – Deliver an incremental EUV mask cleaning option to the industry.
- *Interface, Robotics, & Gripping* – Develop a specification on the performance of robotics, gripping, and tool interfaces for EUV mask-handling tools or subsystems.
- *Mask Fiducial Marks* – (charter not yet formally drafted)

Working Groups Progress

- Addressed issues:
 - Mask backside properties will be specified, both material-intrinsic (e.g., resistivity) and responsive (particles – embed or crush?).
 - Particle contributory budgets for tools/operations will be defined.
 - Mask fiducials will be defined in design and location (ISMT-N pilot experiment).
- Open issues:
 - Mask handling areas must be agreed upon and surface material(s) specified (related to backside).
 - Mask frontside conductive path to be defined (conducting to backside has been dismissed; possibly conducting to sidewall, then off-mask).
 - Substrate traceability will be new but has broad support.

Mask Backside Characteristics

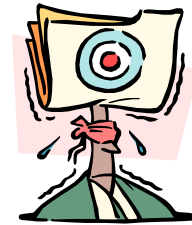
- WG participants were asked to rank characteristics of the mask backside film, 1=important, 5=not.
- Characteristics were selected based upon participant input.
- Quality area considered a closed issue per SEMI P37.

Sheet resistance	1.50
Particle, maximum size	1.50
Particle limits – density	1.67
Particle generation	2.00
Backside flatness	2.00
Electrical conductivity	2.25
Thickness	2.25
Chemical durability (cleaning)	2.33
Stress	2.50
Mechanical durability	2.67
Coverage of handling areas	2.67
Hardness	3.00
Roughness	3.00
Surface particle response	3.33
Quality area	3.33
Thermal conductivity	4.00
Stiffness	4.67

International Technical Working Group

- Standards ITWG met October 2; meeting organizer (Okazaki-san), regional chairs (Hashimoto-san, J.H. Peters, T. White), and associates (S. Hector, Abe-san).

- Chairman was elected (White). ☺ ?



- Members for regional committees were reviewed and suggested (all will be contacted).
- A draft roadmap for standards milestones will be distributed soon; annual goals 2004-07, some more quickly 2003-04.
- Next meetings planned for SPIE 2/04, SEMICON/West 7/04 (for standards), & 3rd EUV Symposium 11/04.