Updating the ITRS roadmap for EUV Masks

Identified Team so far:

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Yearly Timeline for updating ITRS tables

- **Thru March: Review the Tables and suggest any major changes and improvements that the table of the chapter needs.**
- **March 9: Table Chairs update status with US TWIG Litho Chair (Greg Hughes)**
- **March 12: US TWIG Litho Chair reviews input with International Litho TWIG (March Meeting)**
- **March – July: review table justifications and proposed detail changes and colors**
- **US TWIG Litho Chair to Review input with International Litho TWIG (July Meeting)**
- **August – Submit Final Tables with embedded equations, colors and definitions.**
- **September – Dec – Brain storm further improvements.**
- **US TWIG Litho Chair to Review input with International Litho TWIG (December Meeting)**

ITRS Roadmap for EUVL masks 2007
ignore top rows common with optical masks

CD uniformity (nm, 3 sigma) [F]								
Isolated lines (MPU gates)	4.8	4.4	4.0	3.7	3.3	2.8	2.5	looser than optical mask
Dense lines DRAM (half pitch)	8.6	7.5	6.5	5.8	5.2	4.6	4.1	looser than optical mask
Contact/vias	8.2	7.2	5.0	4.4	4.0	3.5	3.1	looser than optical mask
Linearity (nm) [G]	9.0	7.9	6.8	6.1	5.4	4.8	4.3	tighter than optical mask, uses .038 x halfpitch instead of .04 x halfpitch
CD mean to target (nm) [H]	4.8	4.1	3.6	3.2	2.9	2.5	2.3	same as optical mask
Defect size (nm) [I]	48	41	36	32	29	25	23	same as optical mask
Data volume (GB) [J]	413	520	655	825	1040	1310	1651	looser than optical mask, one generation relaxed
Mask design grid (nm) [K]	2	2	2	2	2	2	2	looser than optical mask (2x) from 2010 on
EUVL-specific Mask Requirements								
Substrate defect size (nm) [L]	41	39	37	35	34	32	30	EUVL only
Mean peak reflectivity	65%	66%	66%	66%	67%	67%	67%	EUVL only
Peak reflectivity uniformity (% 3 sigma absolute)	0.69%	0.58%	0.47%	0.42%	0.37%	0.33%	0.29%	EUVL only
Reflected centroid wavelength uniformity (nm 3 sigma) [M]	0.08	0.07	0.06	0.05	0.05	0.05	0.04	EUVL only
Absorber sidewall angle tolerance (± degrees) [P]	1	1	0.75	0.69	0.62	0.5	0.5	EUVL only
Absorber LER (3 sigma nm) [N]	3.9	3.4	3.0	2.6	2.4	2.1	1.9	EUVL only
Mask substrate flatness (nm peak-to-valley) [O]	68	59	51	46	41	36	32	EUVL only

Survey to go out requesting input for table

- Survey will go out this week, hopefully by Tuesday, to identified team plus all attendees at today's meeting.
- SEMATECH will identify suggested values, your input can be placed directly below that.

SURVEY OF EUVL MASK SPECIFIC ITEMS FOR REVISED ITRS

SEMATECH suggested changes in purple

		2009	2010	2011	2012	2013
2007 ITRS	Substrate defect size (nm) [L]	37	35	34	32	30
SEMATECH						
YOUR INPUT						
2007 ITRS	Mean peak reflectivity	66%	66%	67%	67%	67%
SEMATECH	Median Reflectivity: minimum value at center of reticle					
YOUR INPUT						
2007 ITRS	Peak reflectivity uniformity (% 3 sigma absolute)	0.47%	0.42%	0.37%	0.33%	0.29%
SEMATECH	Median Reflectivity: maximum uniformity range across quality area			0.20%	0.20%	
YOUR INPUT						
2007 ITRS	Reflected centroid wavelength uniformity (nm 3 sigma) [M]	0.06	0.05	0.05	0.05	0.04
SEMATECH	Median Reflected Wavelength range across quality area		0.06	0.06	0.06	0.05
YOUR INPUT						

ADD IN DEFINITION OF MEDIAN WAVELENGTH

SO ITRS CONSISTENT WITH REVISED SEMI STANDARD P37

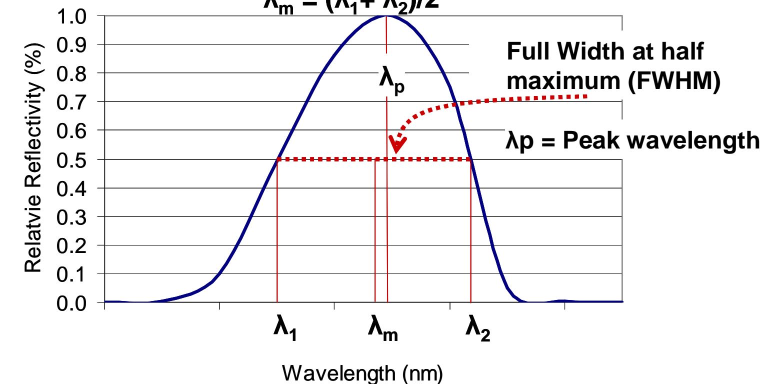


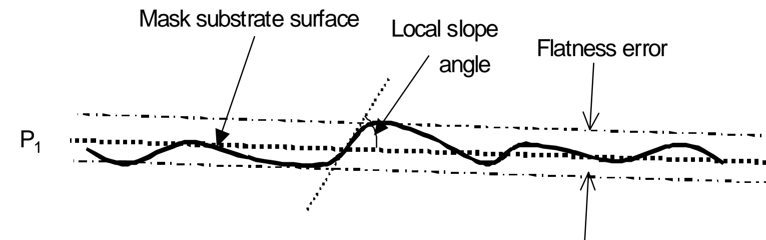
Illustration of the Median Reflected Wavelength from the Multilayer Stack

Survey to go out requesting input for table

2007 ITRS	Absorber sidewall angle tolerance (± degrees) [P]	0.75	0.69	0.62	0.5	0.5
SEMATECH						
YOUR INPUT						
2007 ITRS	Absorber LER (3 sigma nm) [N]	3.0	2.6	2.4	2.1	1.9
SEMATECH						
YOUR INPUT						
2007 ITRS	Mask substrate flatness (nm peak-to-valley) [O]	51	46	41	36	32
SEMATECH	Mask substrate flatness (each side) with no flatness compensation during mask write (nm peak-to-valley)			30	30	23
YOUR INPUT						

NEW ITEMS TO ADD TO ITRS TABLE

SEMATECH	Mask substrate flatness (each side) WITH flatness compensation during mask write (nm peak-to-valley)	300	300	300	300	300
YOUR INPUT						
SEMATECH	Mask substrate back surface local slope over any 20mm x 20mm area (microradians)	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0	
YOUR INPUT						
SEMATECH						
YOUR INPUT						



Definition of Flatness Error and Local Slope Angle

P1 is the least-squares fit plane of the surface.

Survey to go out requesting input for table

Additional items that should be included in the table (and survey)?

- flatness with bow removed
- bow change with time
- aspect ratio of substrate defects
- number of defects allowed
- electrically pertinent defects, so many ‘false' defects

mask qualified in partnership between buyer and shop

- pilot line or learning phase in blue including year, for 2010-2012

blue indicates not manufacturing

- real metrology capability shown, or current electrical requirements
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