Edge Profiling as part of an overall strategy for edge inspection and metrology in IC Fabs

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semi™

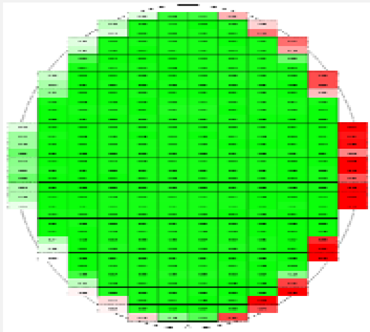
Summary

- Edge is becoming “Prime Time” yield focus at 300mm IC manufacturers
- Not simply defect inspection
  - Defect Inspection + Edge Metrology + Edge Profile
- Edge Profiler (EP) use cases:
  - Litho z-cut (production)
  - Defect/EP correlation, IQC, packaging (engr/dev)

Process control shift toward the wafer edge

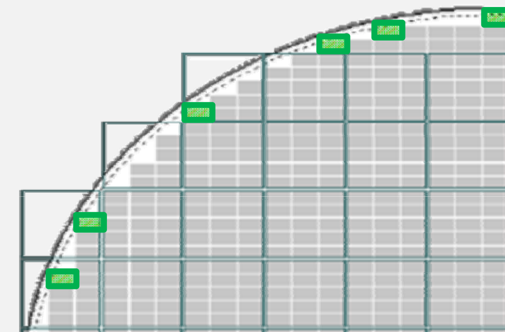
Improving Edge Yield

Lowest yields traditionally at wafer edge



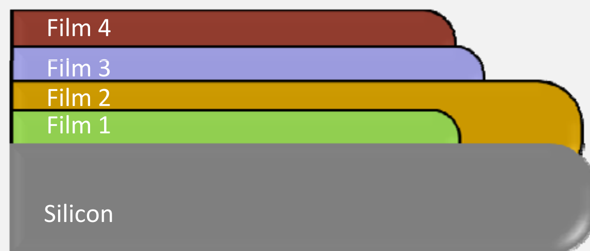
Decreasing Wafer Edge Exclusion

Increase real estate for sellable product



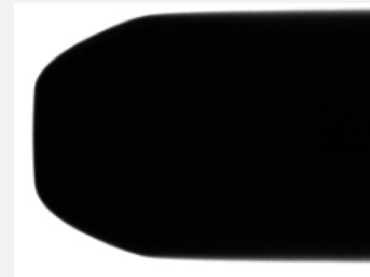
Film Edge Stack Complexity

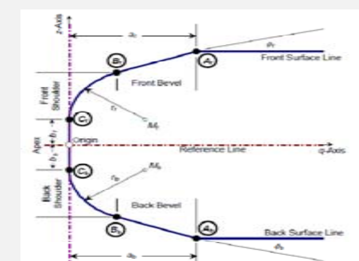
More films; Smaller width tolerances



Need for Edge Profile Control

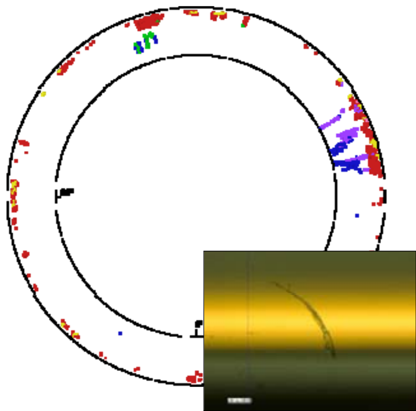
Incoming quality control, iLitho bevel film position (z-cut)





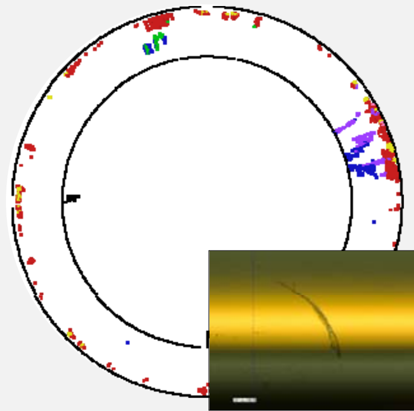
Evolving Edge Process Control Requirements

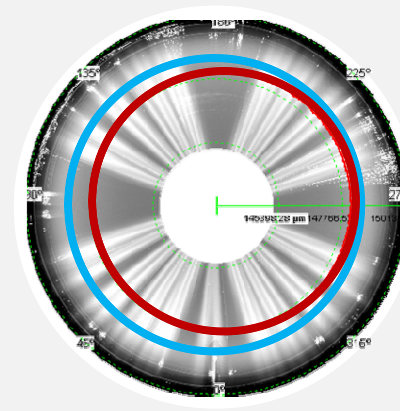
65nm & 45nm processes



Edge Defect Detection & Review

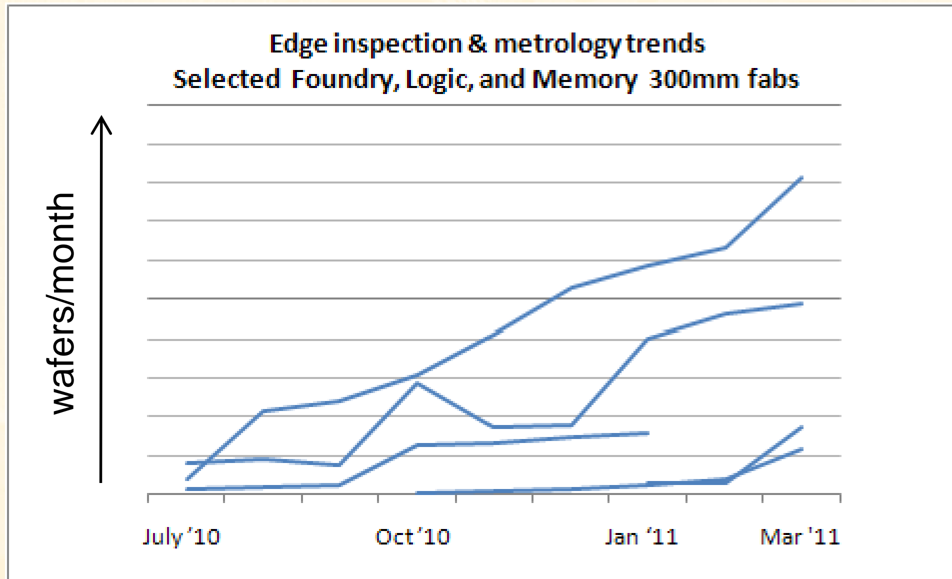
32nm, 28nm, 22nm, iLitho….





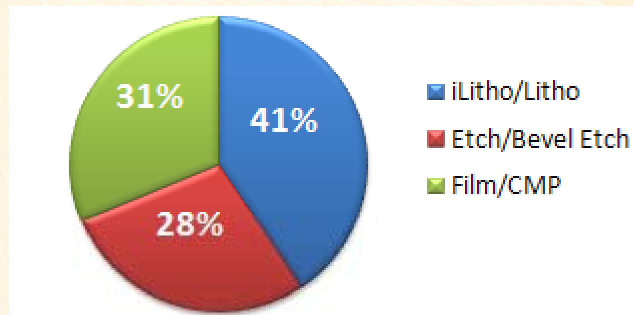
Edge Defect Detection & Review + Film Concentricity Metrology + Edge Profile & Film z-height

Wafer Edge Inspection is Increasing

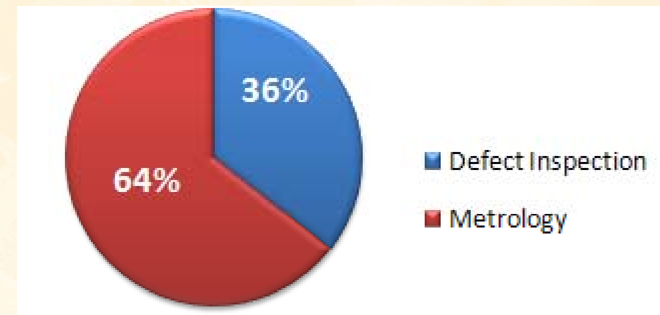


VisEdge CV300R-EP

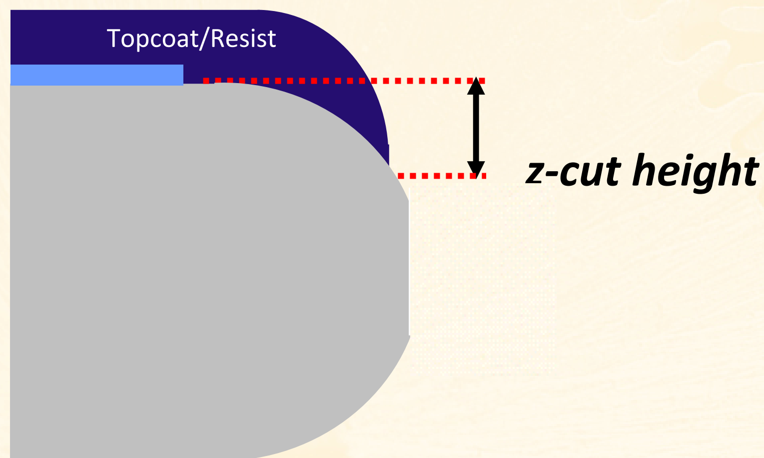
Edge Applications

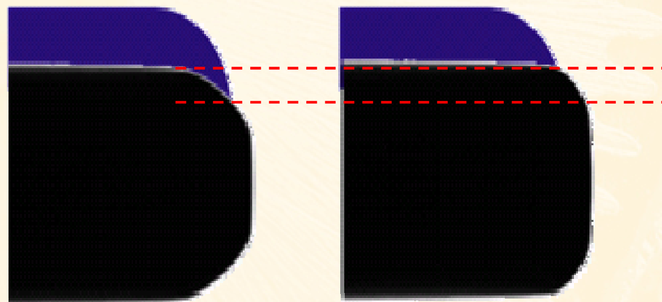


Production Use Cases



Immersion Litho Edge Metrology Monitoring





- z-cut height control
  - Film too high on bevel → risk water leakage
  - Film too low on bevel → risk film de-lamination
- Loss of meniscus @ scanner → risk fouling bath

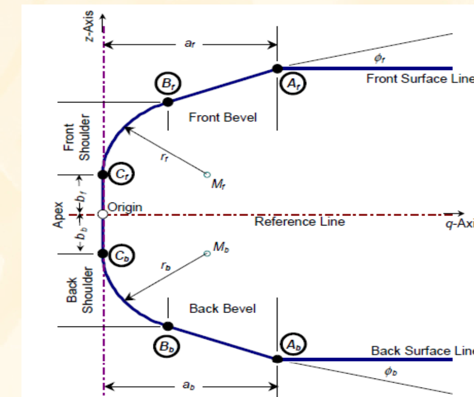
- Accurate z-cut measurement requires integrated Edge Profile correction

Edge Profiler & SEMI Model

Edge Attribute Description (SEMI M73)

		Segment Parameters	*Symbol*	*Unit*	*Explanation*
Wafer thickness, t (µm)#1	Edge Width, a_f or a_b (µm)#2	Front Bevel Angle	ϕ_f	°	Angle between front surface and front bevel, taken as positive into the wafer.
		Front Shoulder Radius	r_f	µm	Radius of the arc of the front shoulder.
		Front Apex Length	b_f	µm	Distance from origin to the beginning of the front shoulder arc.
		Front Apex Angle	β_f	°	Angle between z-axis and front apex, taken as positive in the $+q$ direction.
		Back Apex Angle	β_b	°	Angle between z-axis and back apex, taken as positive in the $+q$ direction.
		Back Apex Length	b_b	µm	Distance from origin to the beginning of the back shoulder arc.
		Back Shoulder Radius	r_b	µm	Radius of the arc of the back shoulder.
		Back Bevel Angle	ϕ_b	°	Angle of the back surface and back bevel, taken as positive into the wafer.

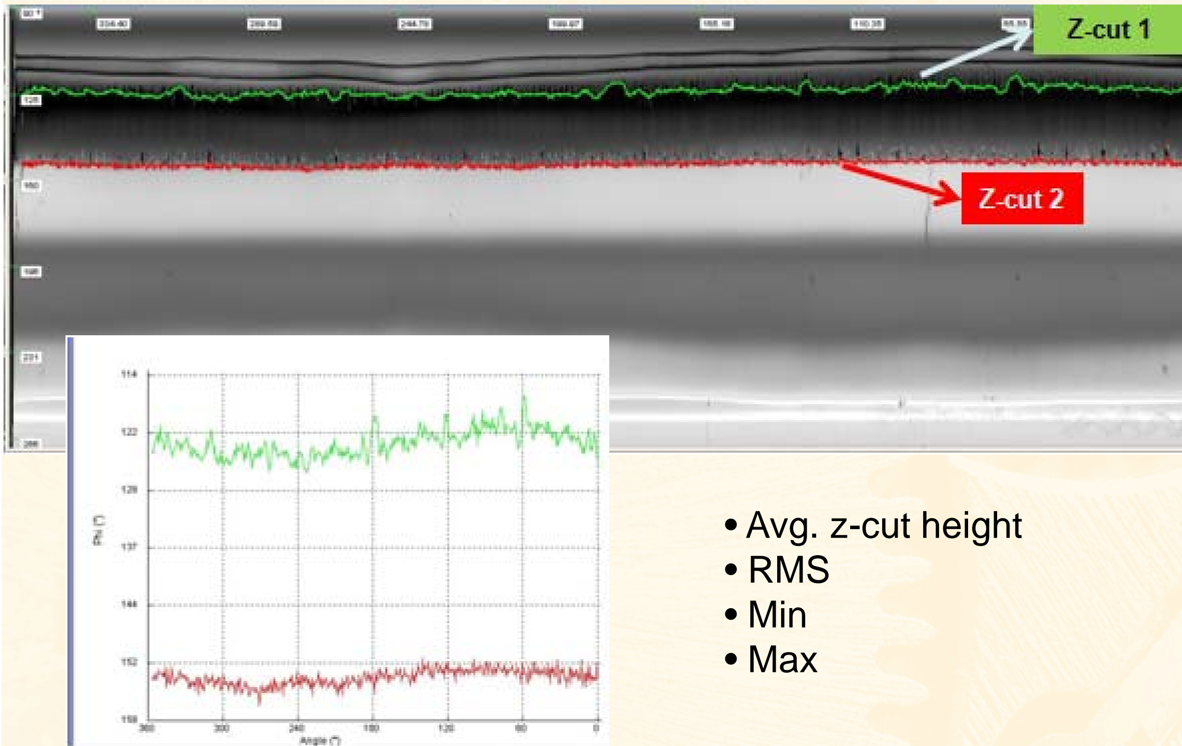
SEMI M73 Model

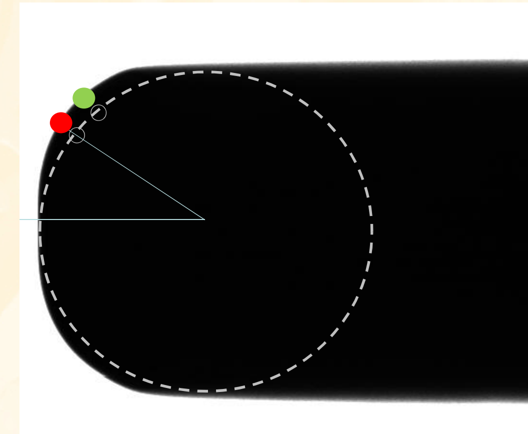


VisEdge CV300R-EP integrates Edge Profiler measurements into EBR position measurement algorithms

iLitho Resist + BARC z-cut - Example

Scan Image

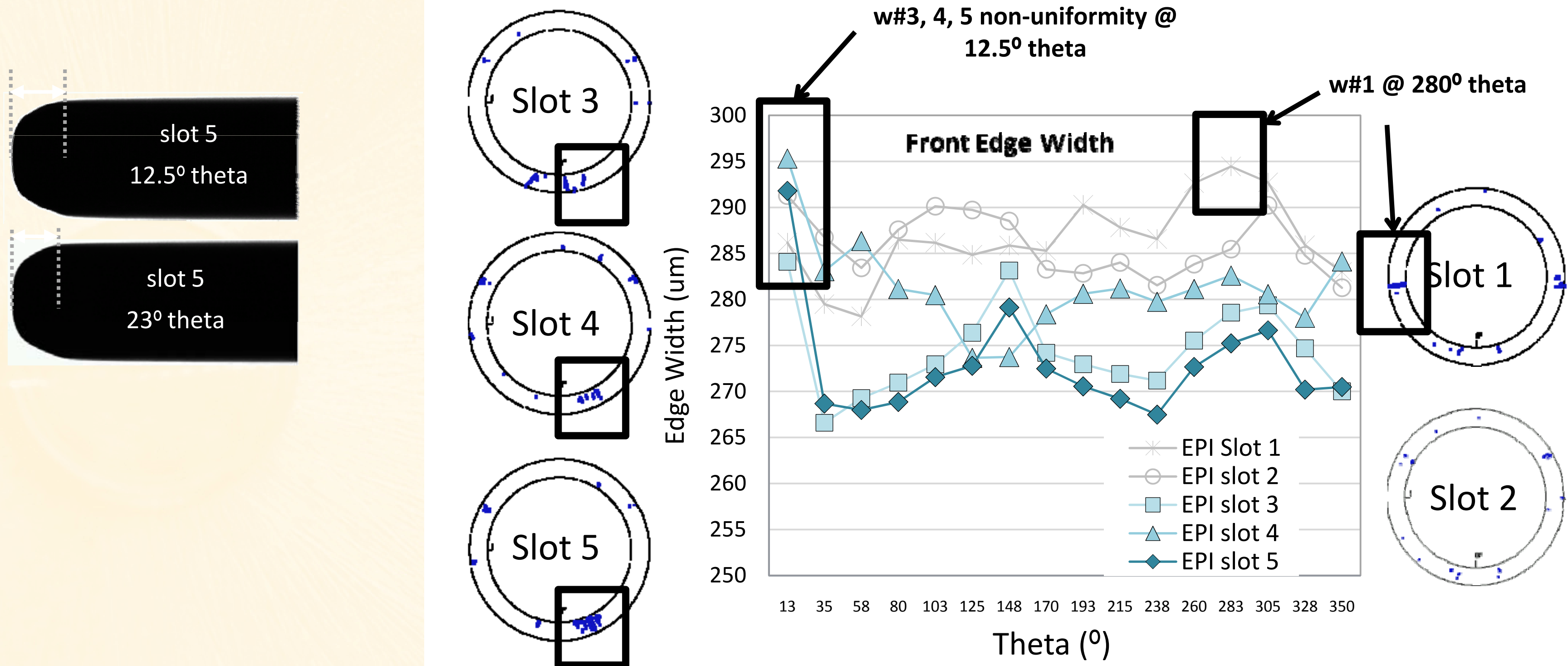




- Avg. z-cut height
- RMS
- Min
- Max

EBR metrology + Edge Profile correction for accurate z-cut height

Edge Profile & Edge Defectivity



Investigating influence of EP shape on edge process defectivity

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VisEdge CV300R-EP

Performance Leadership in Edge Inspection & Metrology

- Comprehensive edge control system: defect inspection, film metrology & wafer profiling
- Full edge zone coverage
- Patterned area algorithms for edge and partial die
- Integrated Edge Profiler

VisEdge CV300R-EP

Control the Edge….Raise the Yield

THANK YOU