

Innovation in ILD Polishing: Ultra-Low Defects and Reduced CoO



June 2005



Discussion Topics

- Dielectrics Polishing Needs – Why Ceria?
- General Polish Mechanisms
- Factors Contributing to Cost of Consumables
- Polishing Results
 - Defects
 - Planarization
- Summary

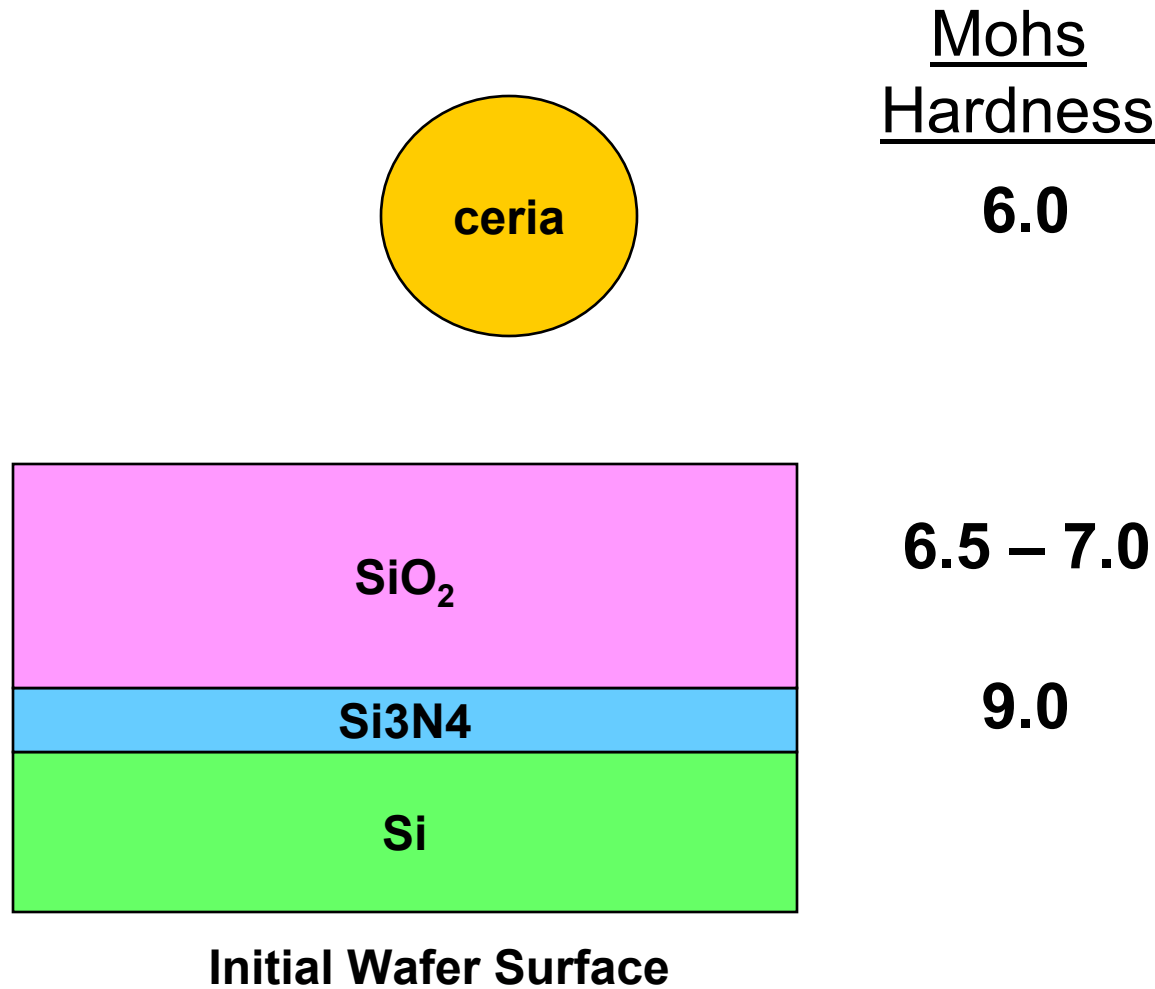
Dielectrics Polishing Needs: iDiel™ 6600 Solution Development

- Market Needs (ILD)
 - Low Cost of Consumable per wafer
 - Ultra-Low defectivity
 - Similar Performance to Traditional Silica Based Slurries in Other Areas
 - Stable, Predictable Performance

Ceria: The Misunderstood Abrasive

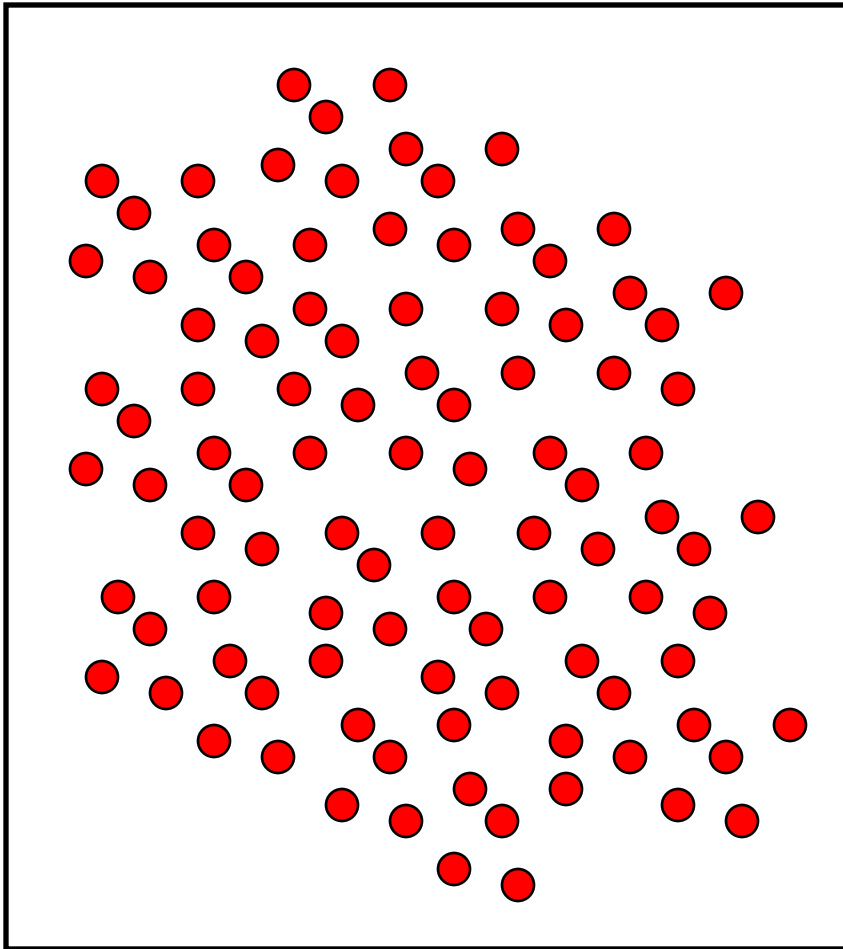


Ceria is not really a “hard” particle

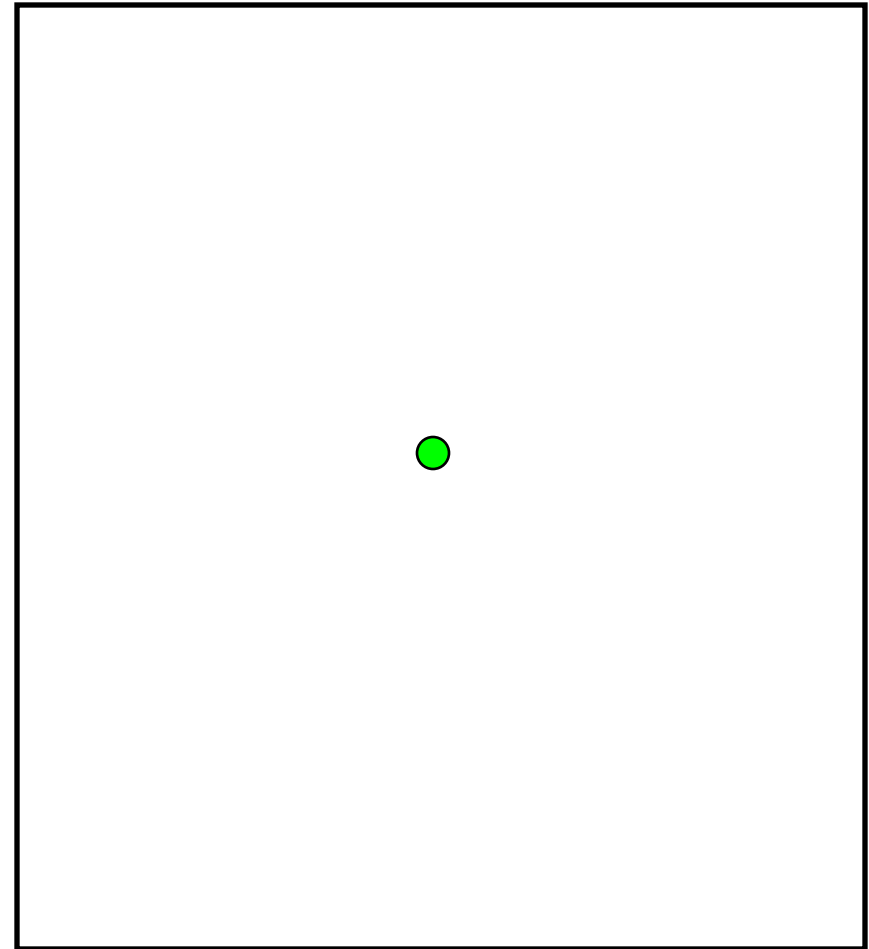


Ceria Is A Much More Efficient Abrasive

Silica System



Ceria System



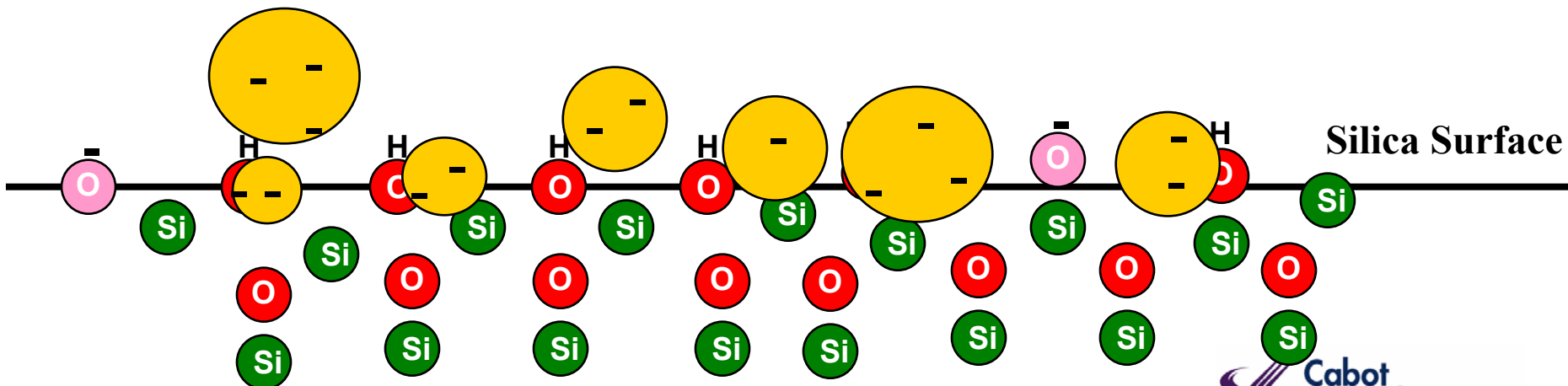
Ceria vs. Silica Polishing Mechanisms

- Conventional Dielectric Polishing Mechanism
 - Silica Based Slurry
 - Ceria Based Slurry
- New Chemistry Mechanisms on Dielectric Polishing for iDiel™ 6600
 - Rate Acceleration Mechanism
 - Morphology of Ceria on Defectivity

Dielectric CMP Mechanism of Silica Based Slurry

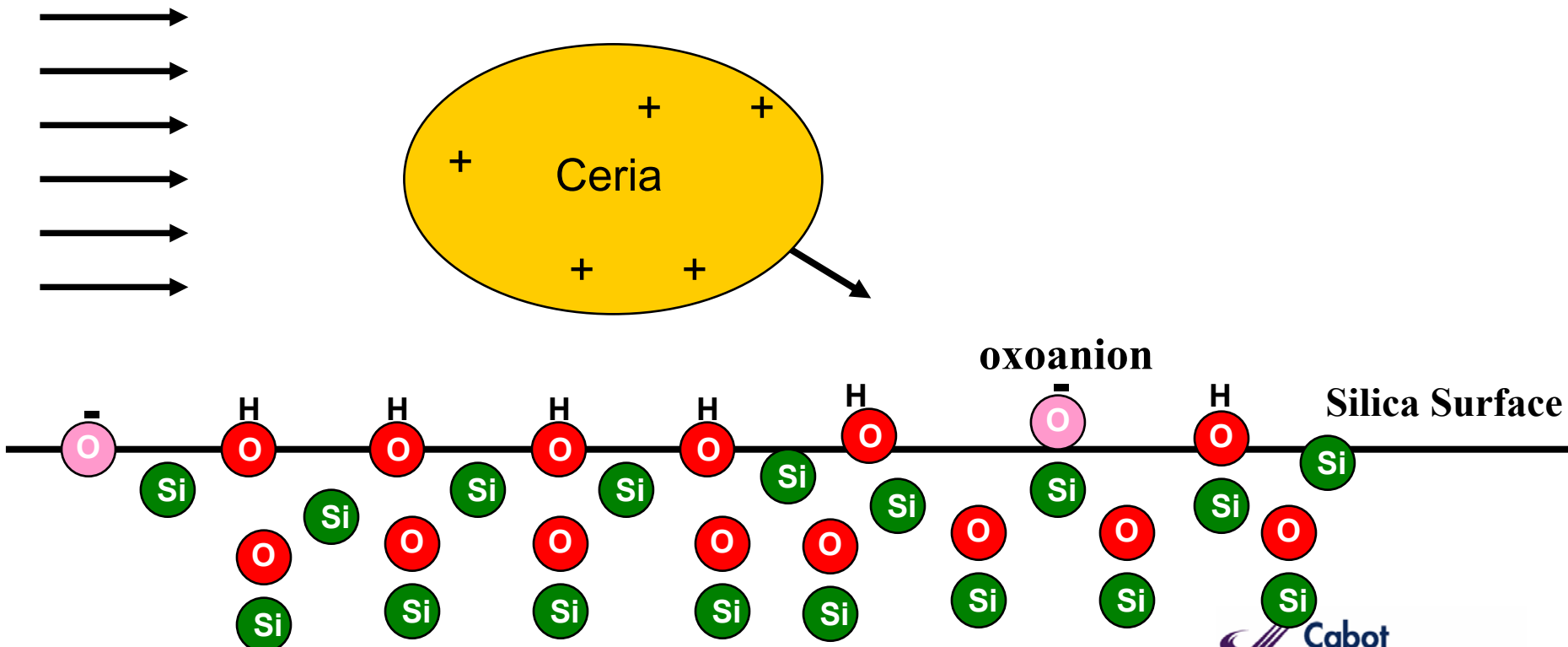
Mechanical Abrasion Oriented

- **Fumed/Colloidal Silica Based Slurry:**
 - High abrasive concentration
 - Limited chemical contribution from high pH (dissolution)



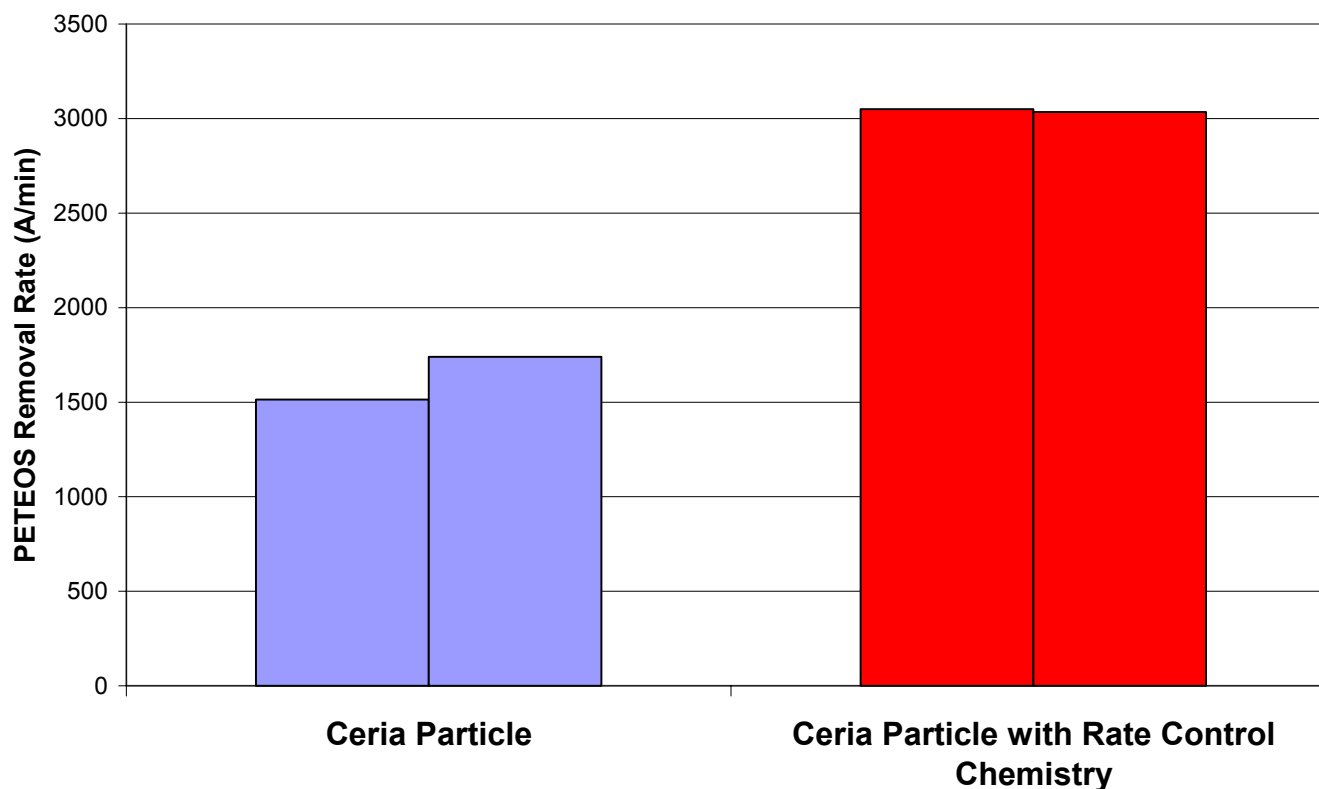
Ceria Polishing Mechanism

Particle Has Strong Chemical Interaction with Surface



High Efficiency Rate Acceleration Chemistry

Ceria Rate Control Chemistry



Higher Oxide Removal Rate with a Host of Rate Acceleration Molecules in Ceria Slurry
Most Consistent Removal Rate with Chemistry Oriented Slurry

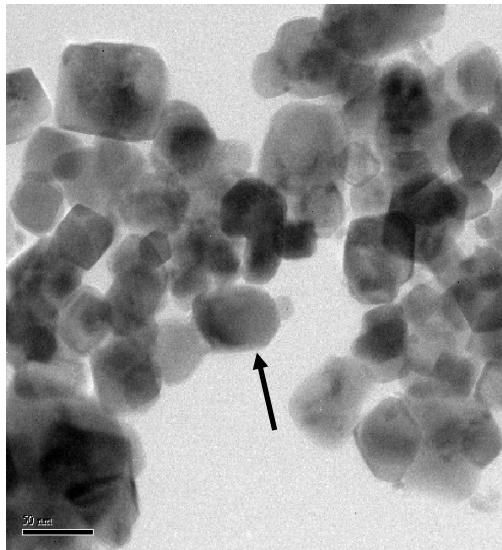
Impact of Abrasive Morphology on Defectivity

To Lower Defect Count

Rounded Edge and Corner

Narrow Particle Size Distribution

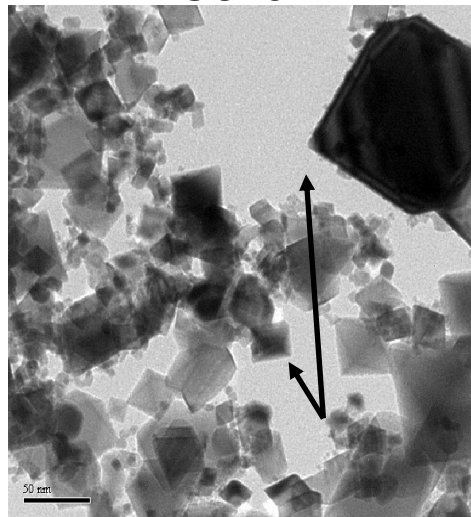
Ceria A



Scale = 50 nm

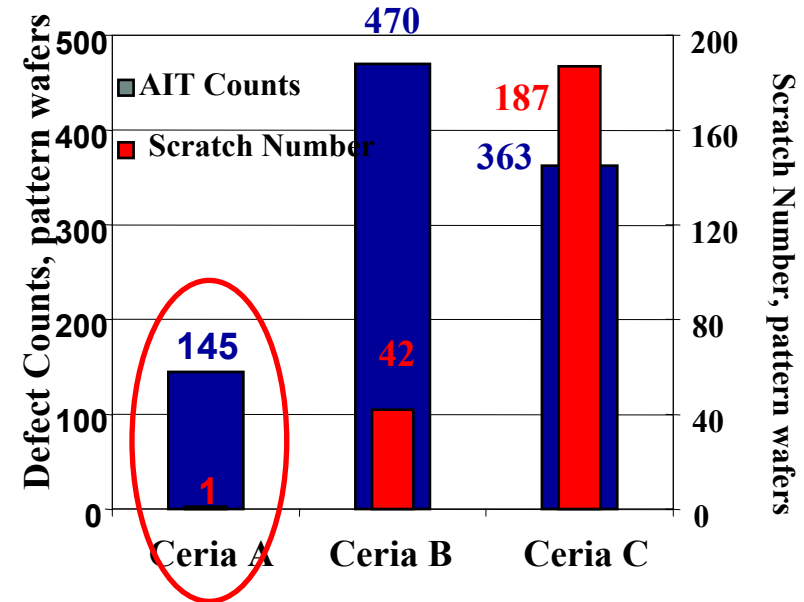
Small, uniform particles
with rounded edges

Ceria B



Scale = 50 nm

Large, uncontrolled particles
with sharp edges



iDiel™ 6600 Comparison to Fumed Silica

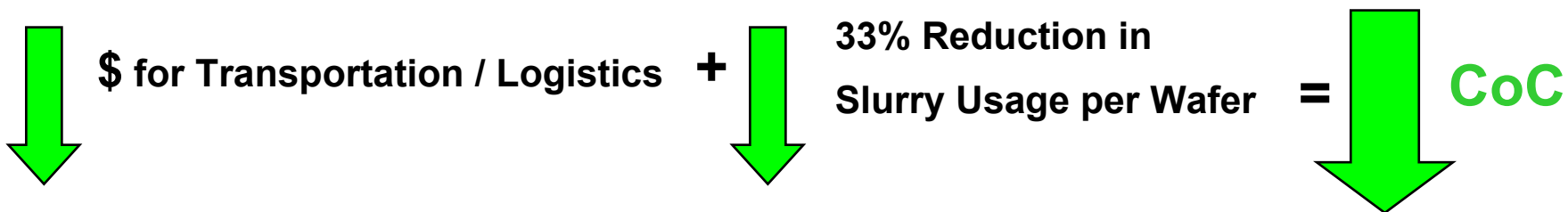
	Semi-Sperse® 25E	iDiel™ 6600
Abrasive Type	Fumed Silica	Ceria
Chemistry	pH ~ 11 KOH	High Purity (no KOH) Rate Control Additives
Mechanism	Primarily mechanical	Balanced Chemical & Mechanical
Particle Concentration (POU)	12.5%	< 0.50%
Method of Use	Single Component 2X Concentrate	Single Component 6X Concentrate

iDiel™ 6600 Comparison to Fumed Silica

	Semi-Sperse® 25E	iDiel™ 6600
Downforce	4 psi	3 psi
TEOS pattern RR	4700 Å/min	6000 Å/min
BPSG/PSG defects (norm.)	1X	0.2X (80% reduction)
TEOS defects (norm.)	1X	0.6X (40% reduction)
TEOS: SiN Selectivity	5:1	>50:1

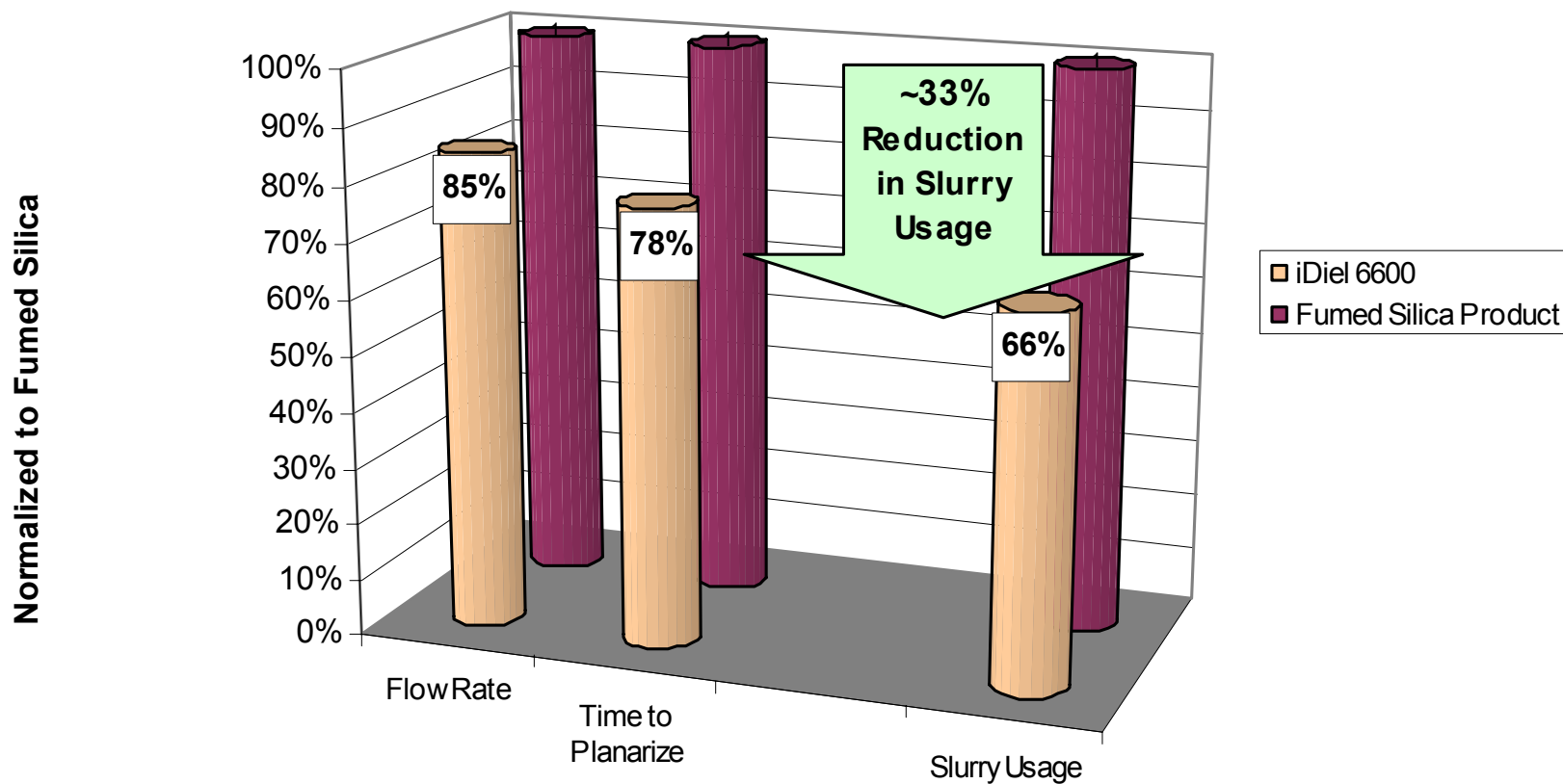
iDiel™ 6600 Low Cost of Consumable

	Semi-Sperse® 25E	iDiel™ 6600
Dilution	2X	6X
Typical Flowrate	150 mL/min	125 mL/min
Polish Time (8K step)	125 sec	<100 sec



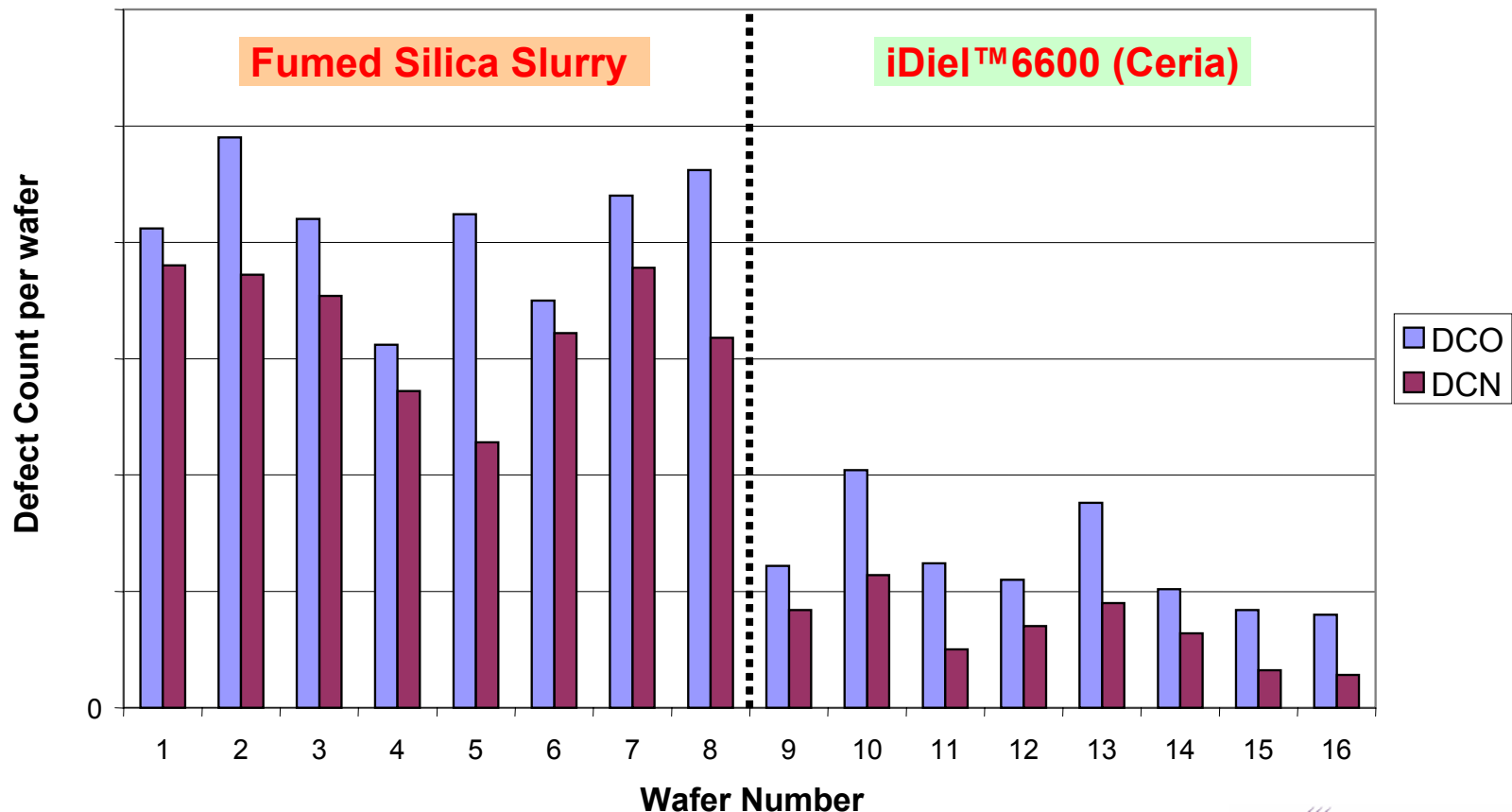
iDiel™ 6600 Low Cost of Consumable

iDiel 6600™ Slurry Usage Efficiency
Reduction in Slurry Usage per Wafer Pass measured on SKW 7 Wafers



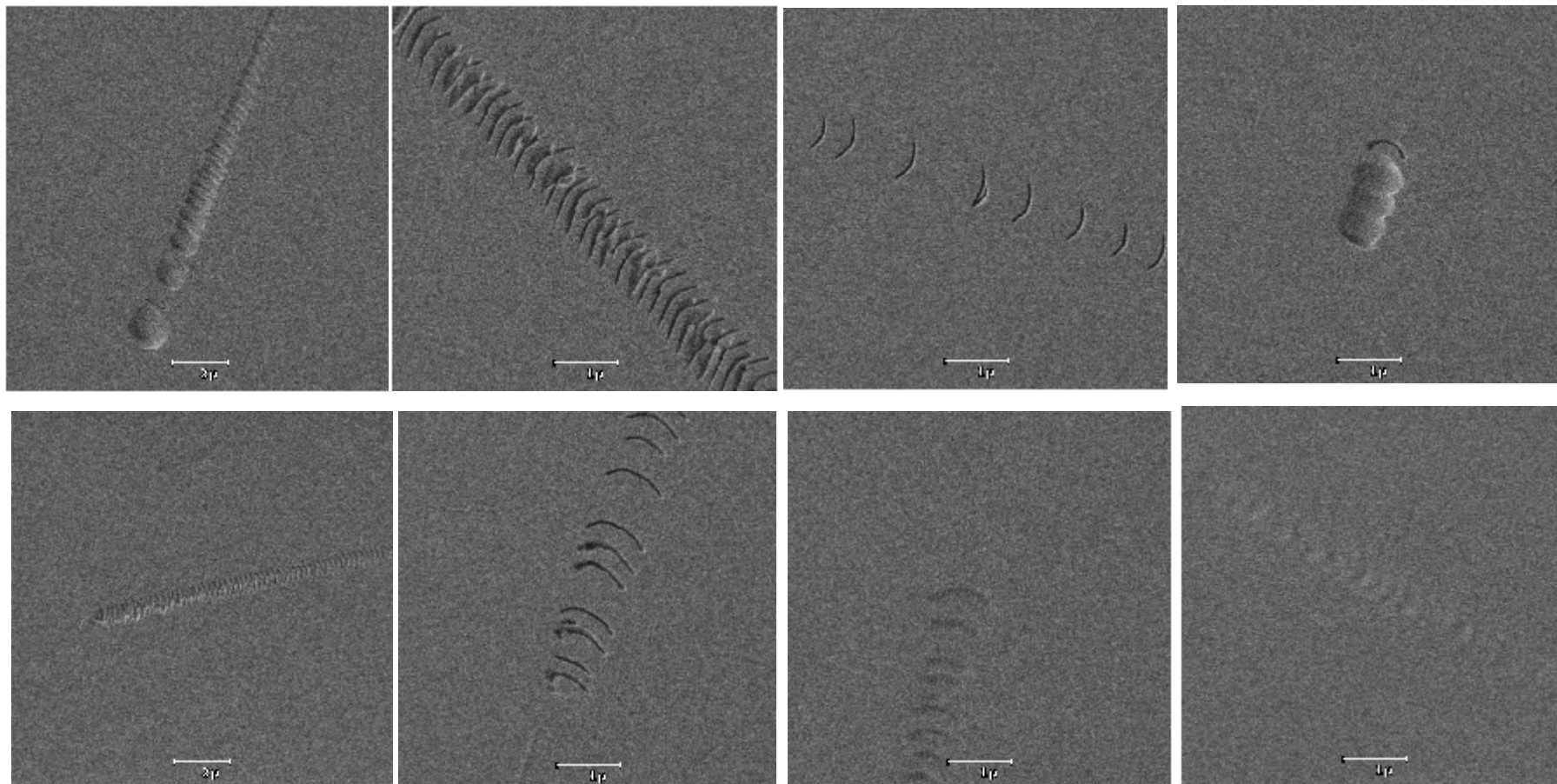
Defectivity Reduction with iDiel™ 6600

Defectivity Comparison (SP1 total counts) (PSG Blanket Wafers, Post HF)



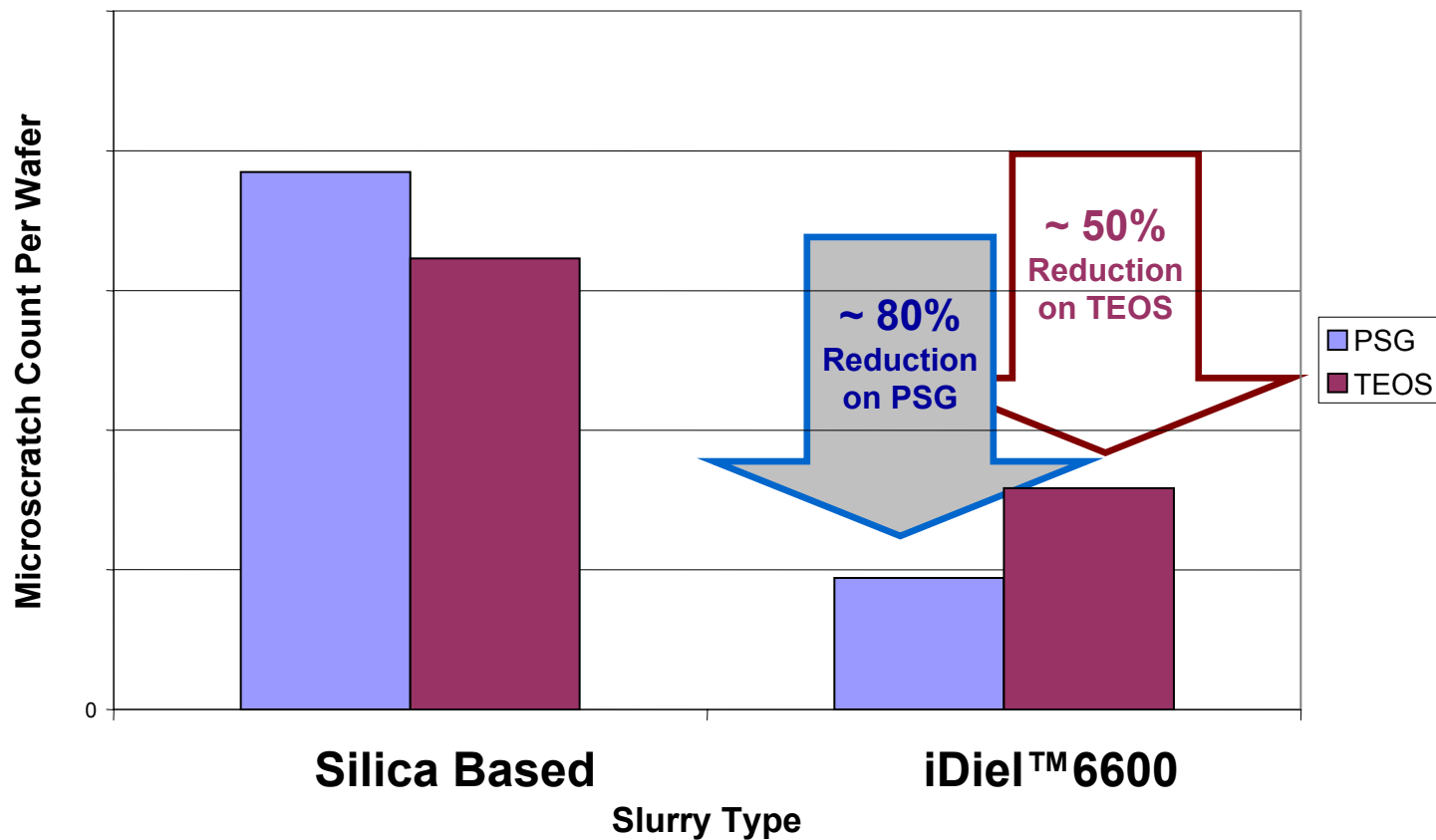
Example of Defect Classification by SEMVison

Class#25 : general micro-scratch



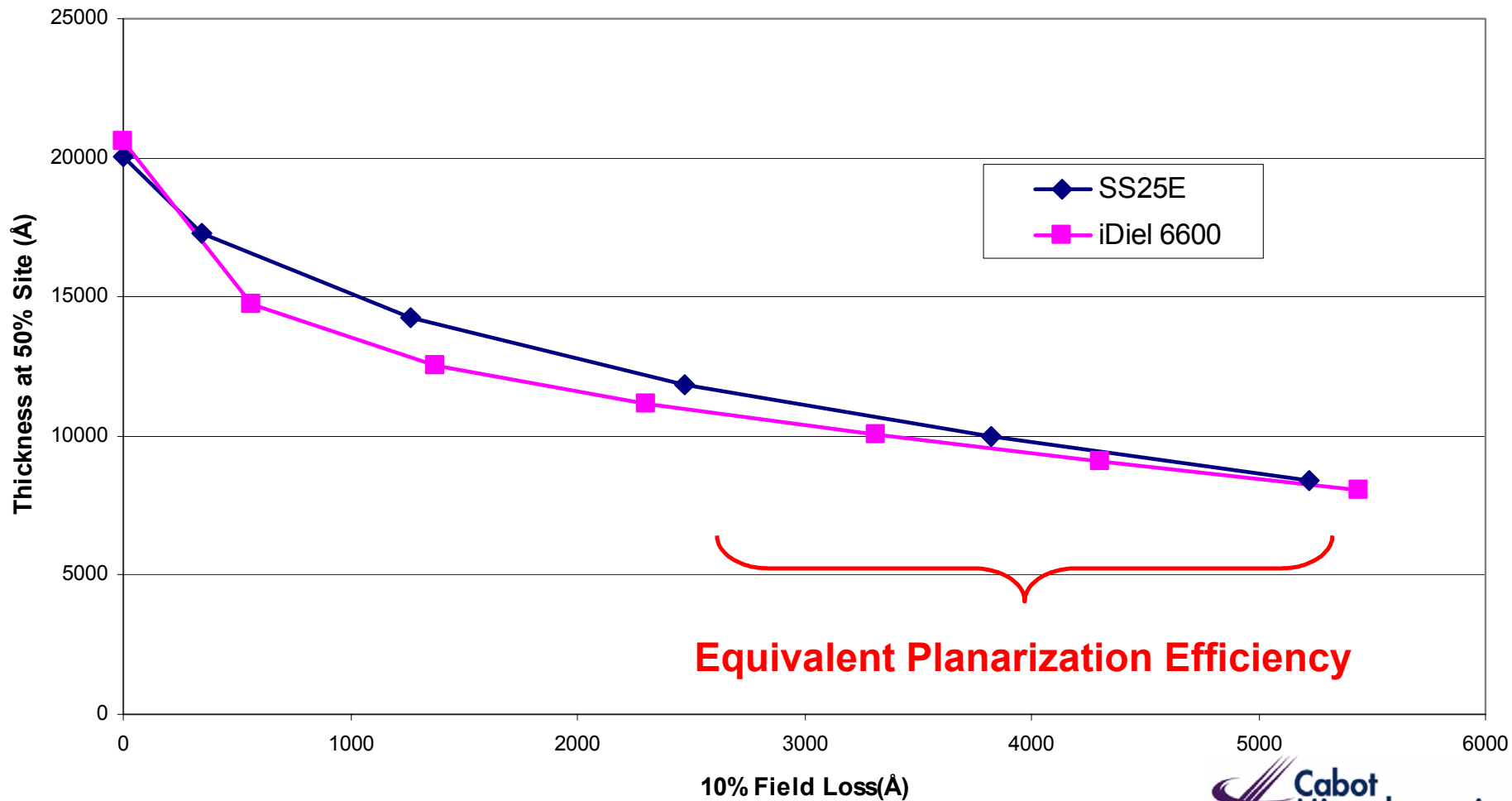
Customer Validation of Microscratch Reduction

Microscratch Count Comparison



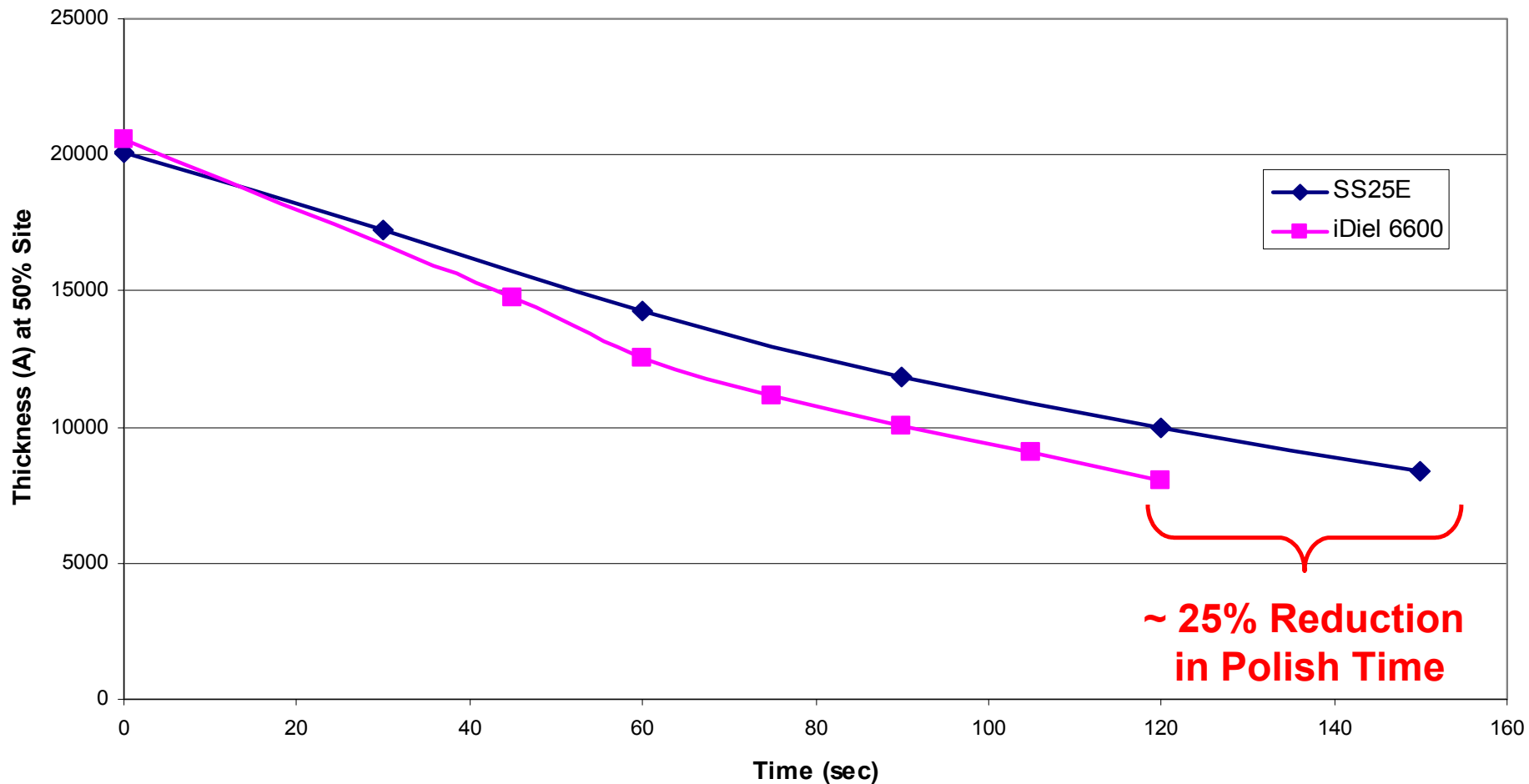
Planarization Efficiency of iDiel™ 6600 vs. SS25E® on MIT Pattern

Oxide Thickness at 50% Pattern vs. 10% Field Loss
Mirra, 2-platen process, IC1000/Suba-IV3/3/3.5/100/118



iDiel™ 6600 Removal Rate On MIT Pattern

iDiel™ 6600: Thickness of "UP AREA" vs Time
Mirra, 2-platen process, IC1000/Suba-IV3/3/3.5/100/118



**~ 25% Reduction
in Polish Time**

Summary

- Innovation Can Drive CoC Reduction
- Unique Ceria Abrasive Properties Key To Achieving Metrics
 - High Efficiency Abrasive
 - Chemically Enhanced Mechanism
 - Low Defects
 - Low CoC