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

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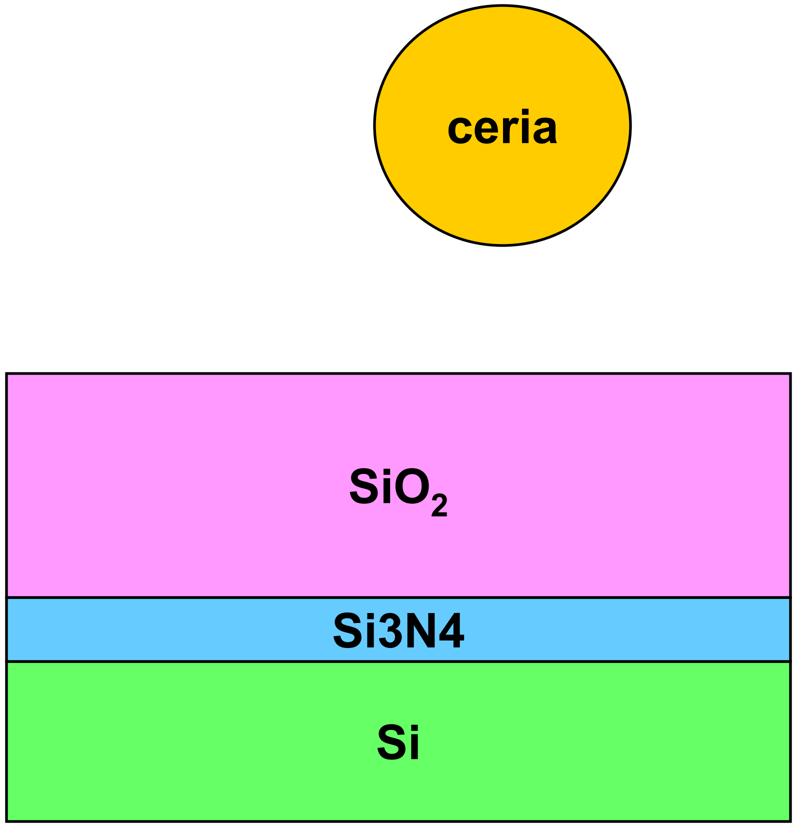
Dielectrics Polishing Needs: iDiel™6600 Solution Development

- 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



Initial Wafer Surface

<u>Mohs Hardness</u>

6.0

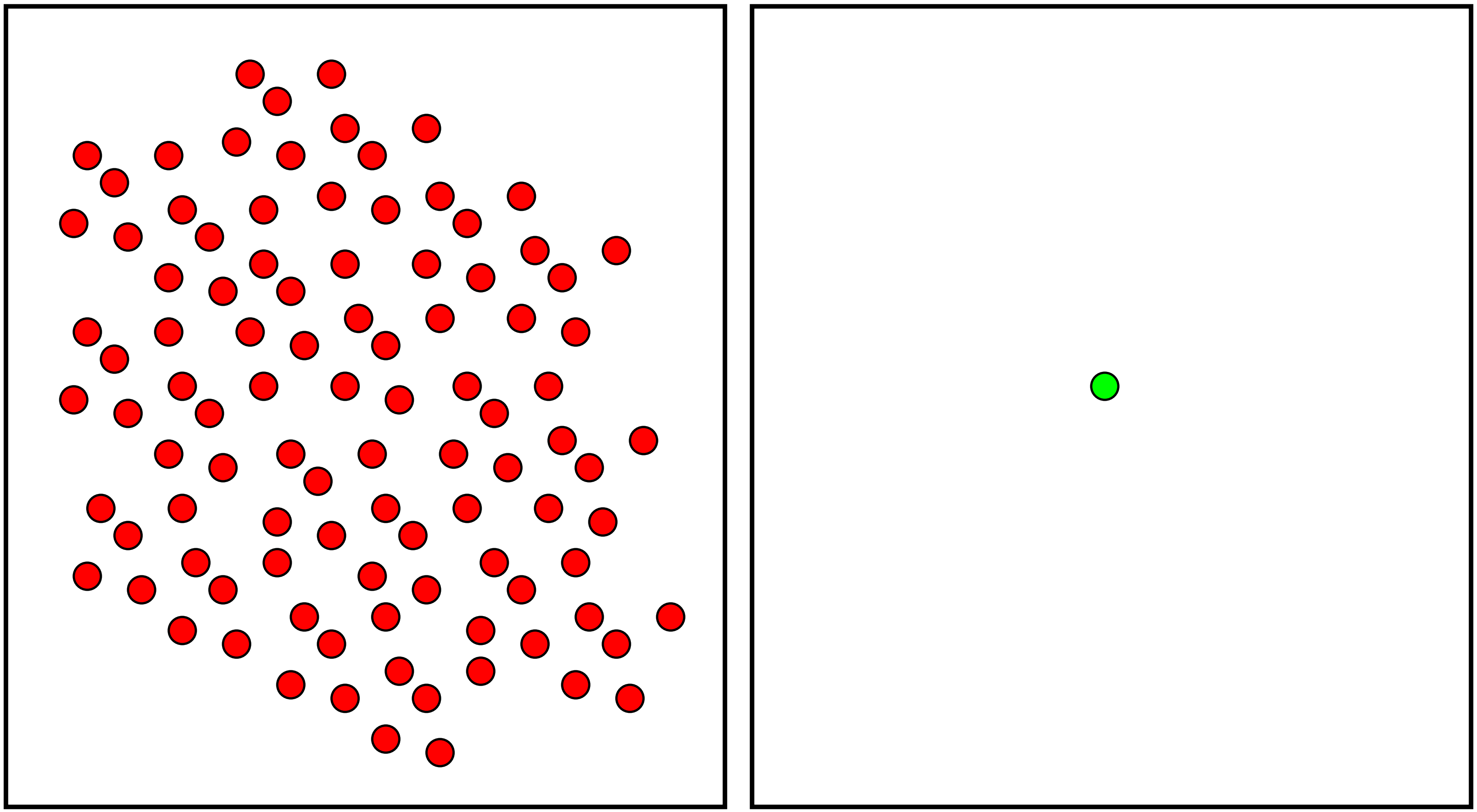
6.5 – 7.0

9.0

Ceria Is A Much More Efficient Abrasive

Silica System

Ceria System



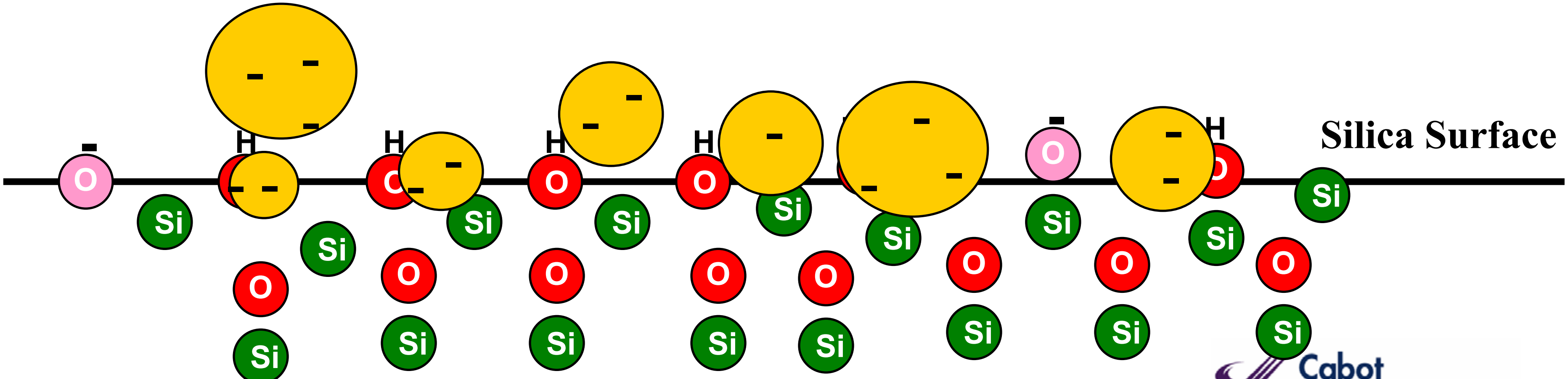
Ceria vs. Silica Polishing Mechanisms

- 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

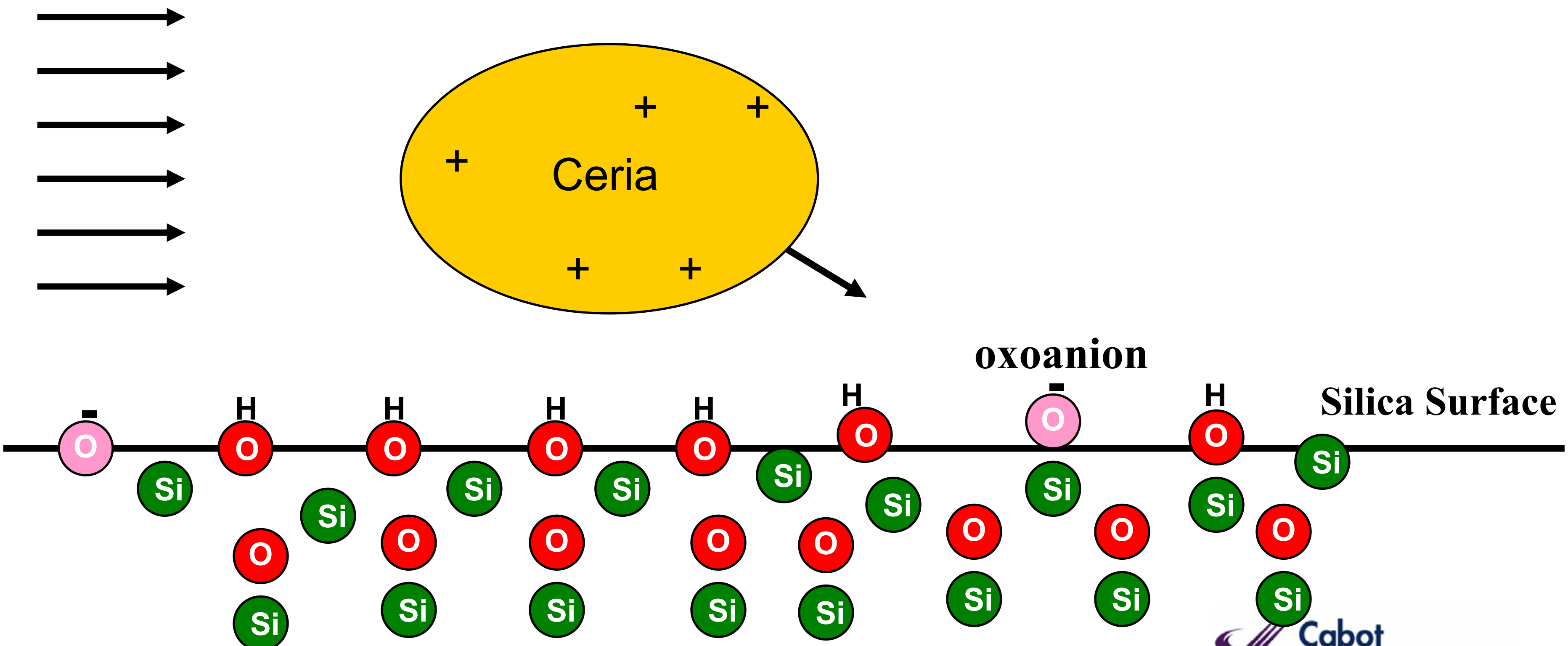
Mechanical Abrasion Oriented

- **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



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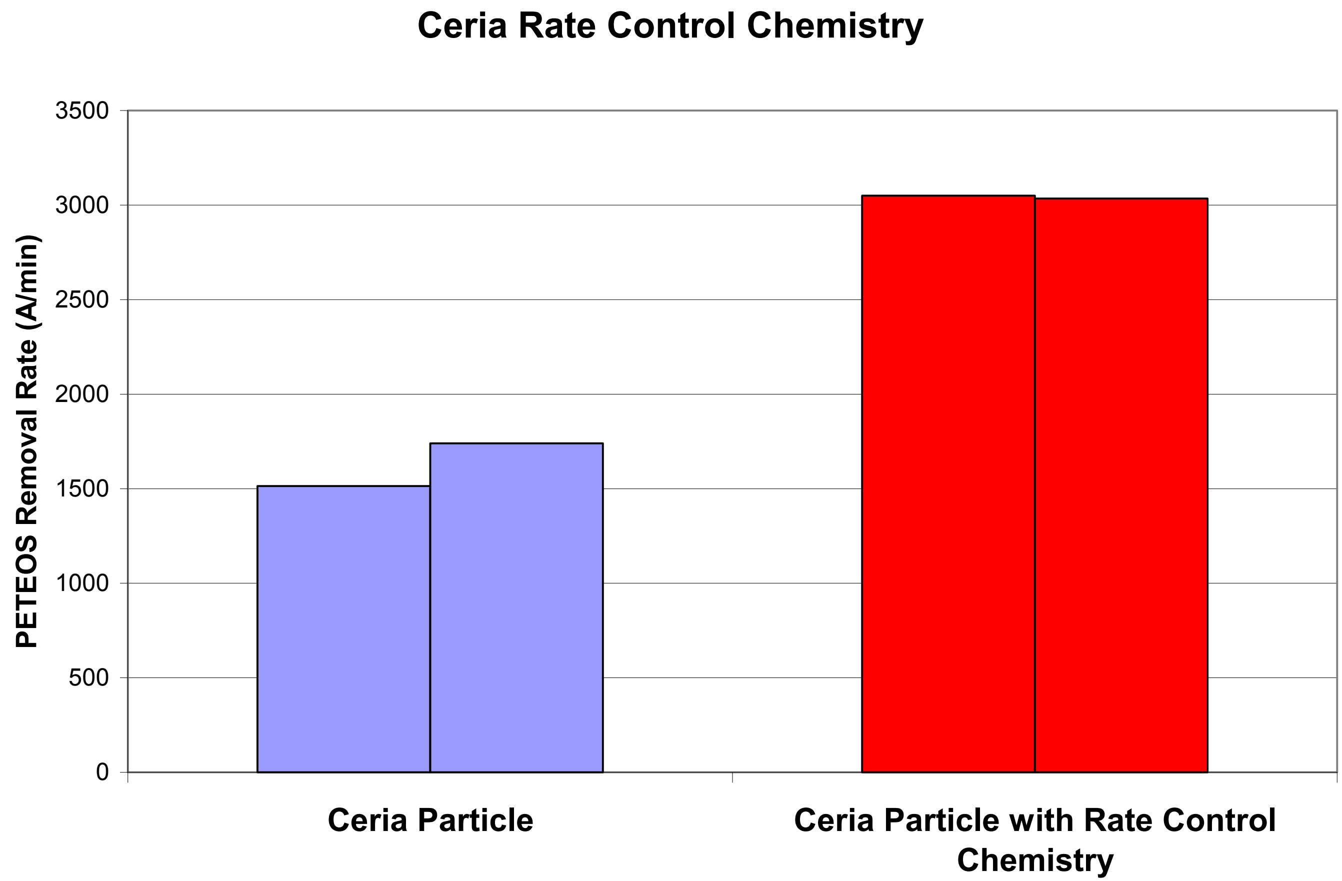
High Efficiency Rate Acceleration Chemistry



Higher Oxide Removal Rate with a Host of Rate Acceleration Molecules in Ceria Slurry

Most Consistent Removal Rate with Chemistry Oriented Slurry

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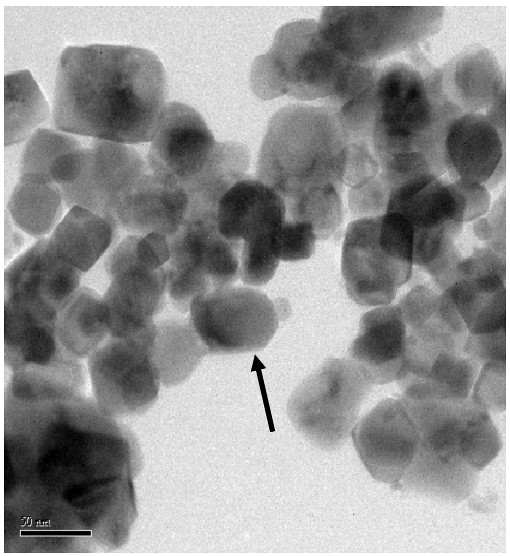
Impact of Abrasive Morphology on Defectivity

To Lower Defect Count

Rounded Edge and Corner

Narrow Particle Size Distribution

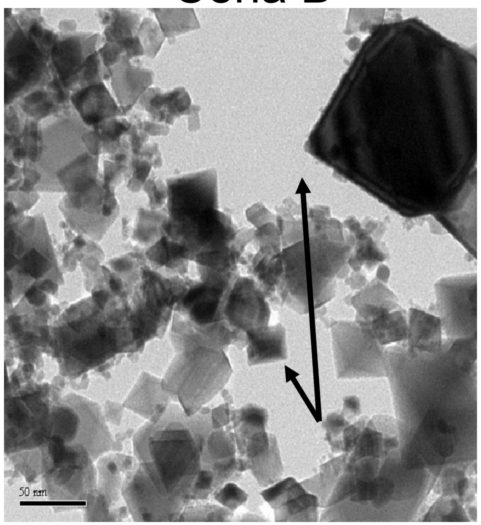
Ceria A



Scale = 50 nm

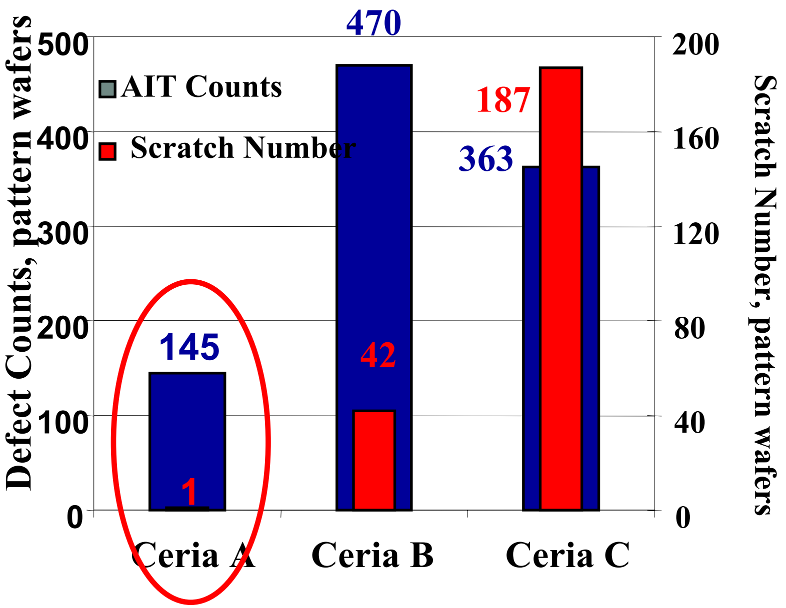
Small, uniform particles with rounded edges

Ceria B



Scale = 50 nm

Large, uncontrolled particles with sharp edges



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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

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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

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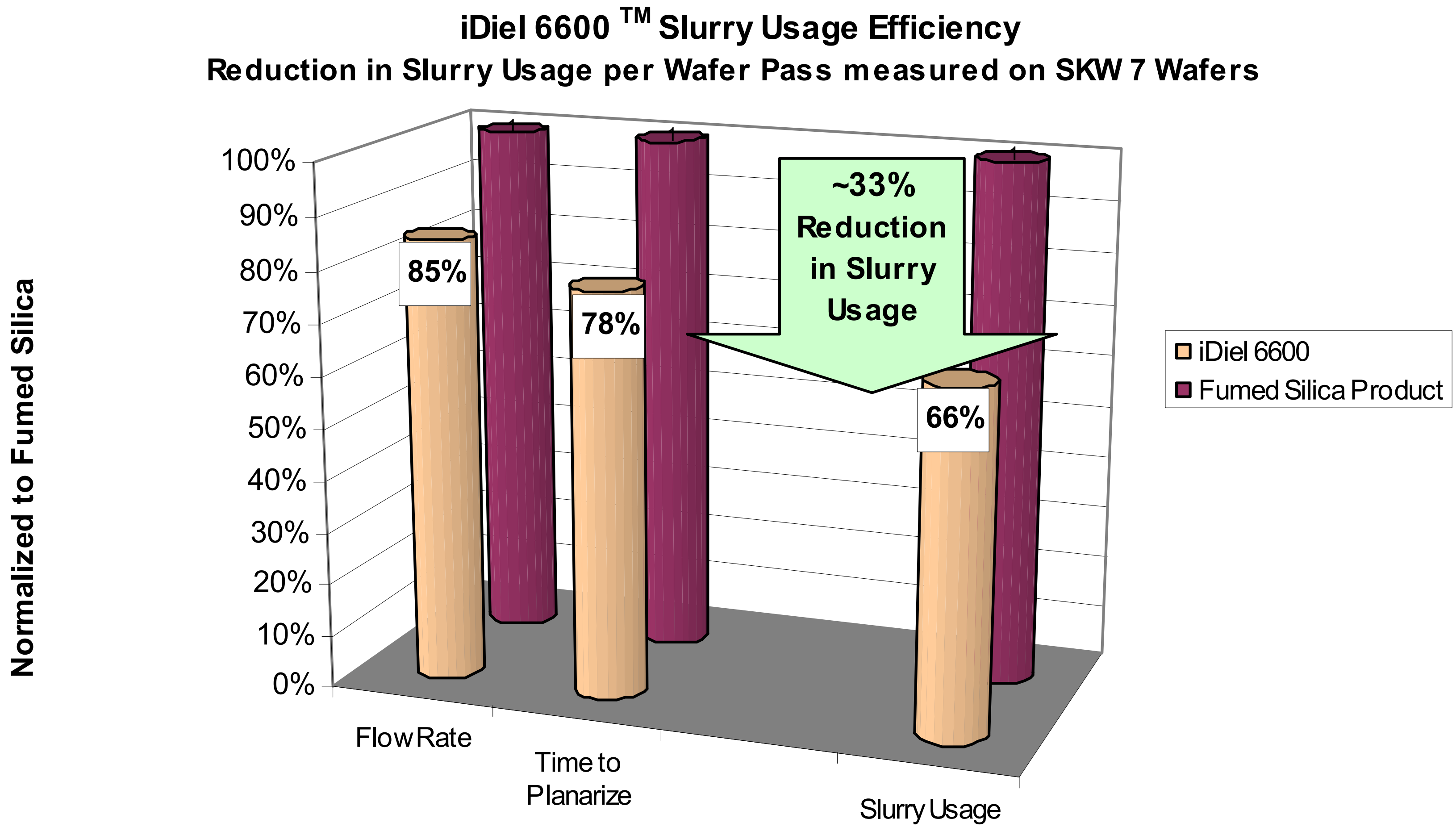
iDiel™ 6600 Low Cost of Consumable

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

↓ $ for Transportation / Logistics + ↓ 33% Reduction in Slurry Usage per Wafer = ↓ CoC

iDiel™ 6600 Low Cost of Consumable



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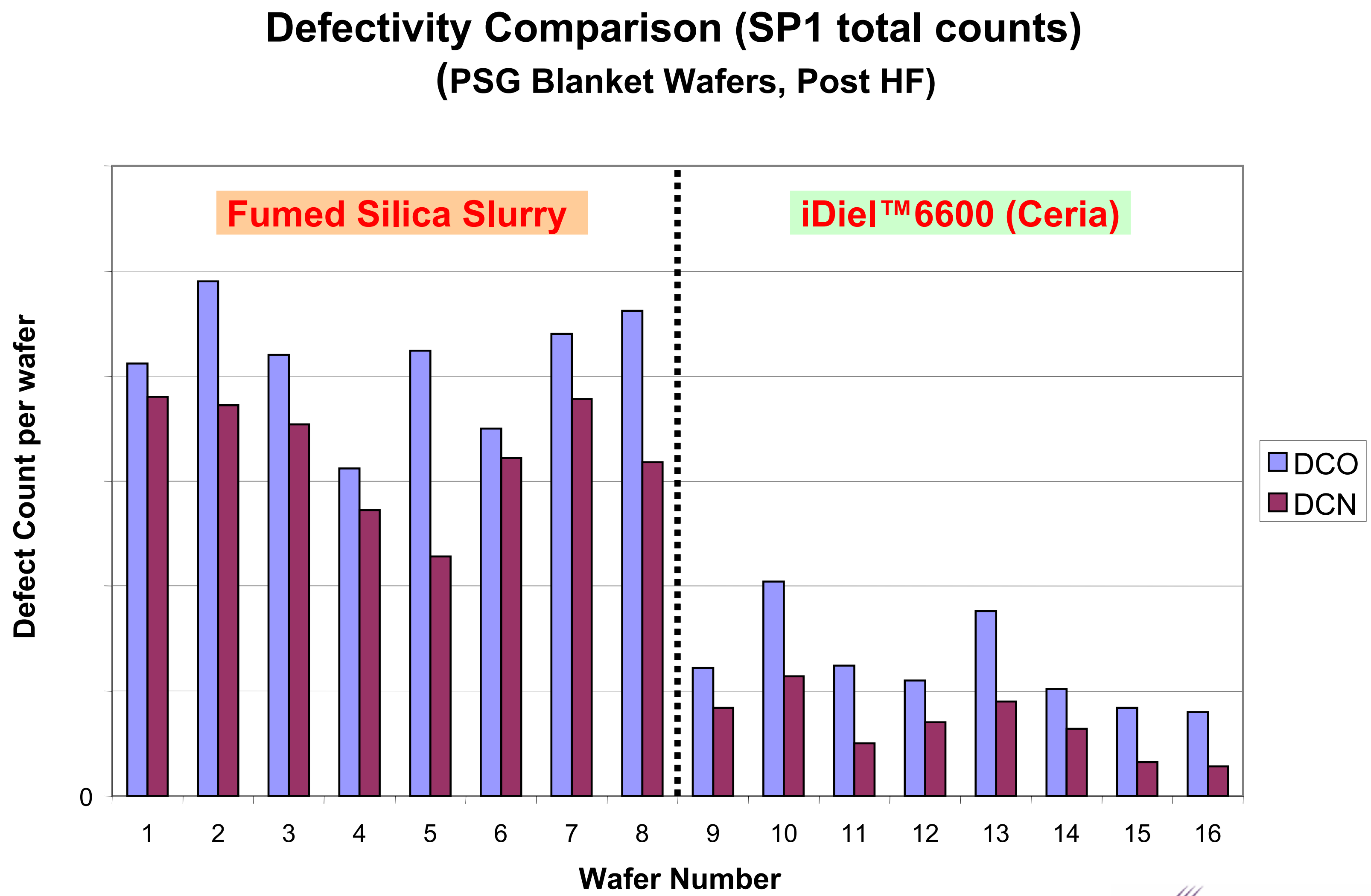
Defectivity Reduction with iDiel™6600



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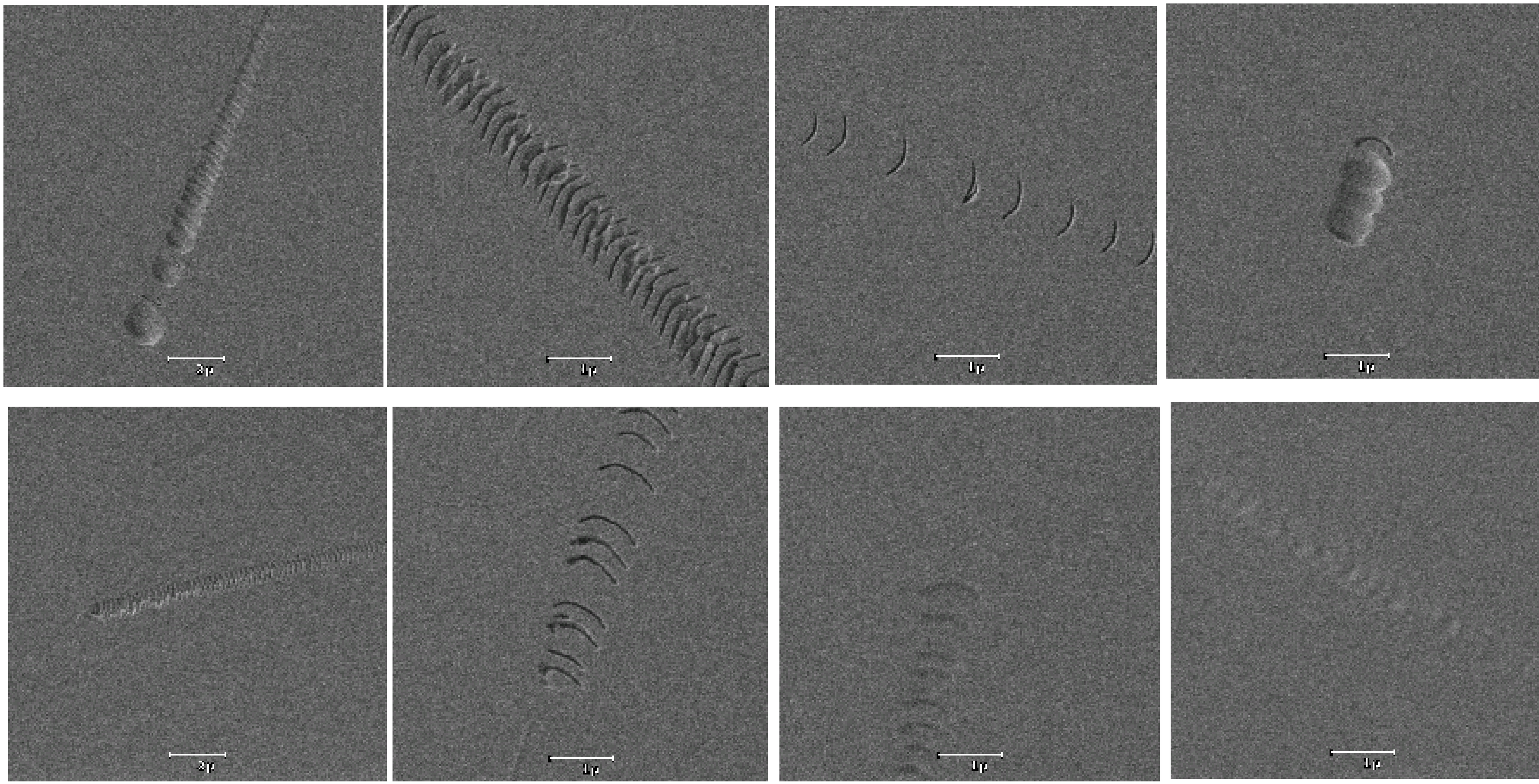
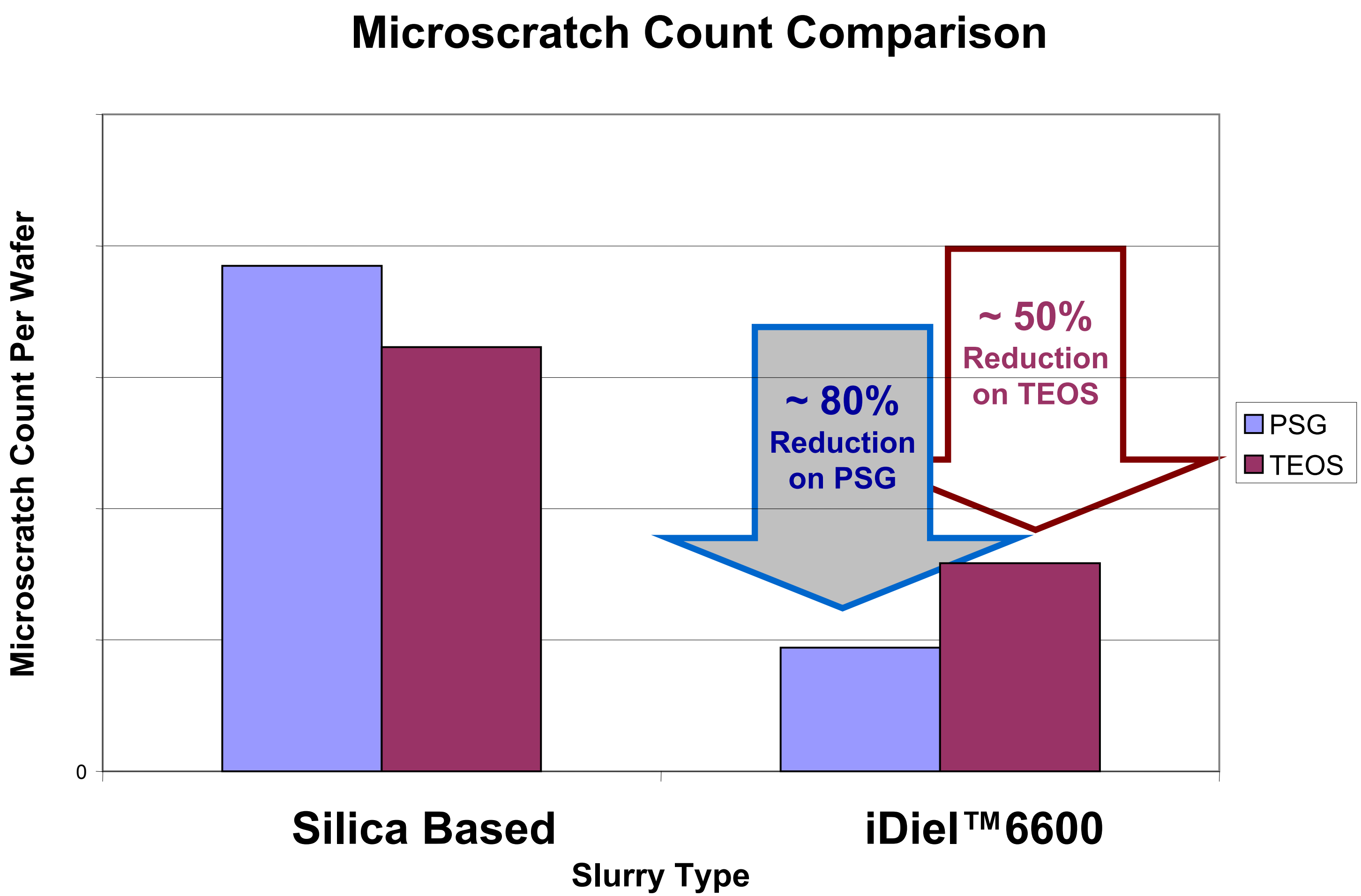
Example of Defect Classification by SEMVison Class#25 : general micro-scratch



Customer Validation of Microscratch Reduction



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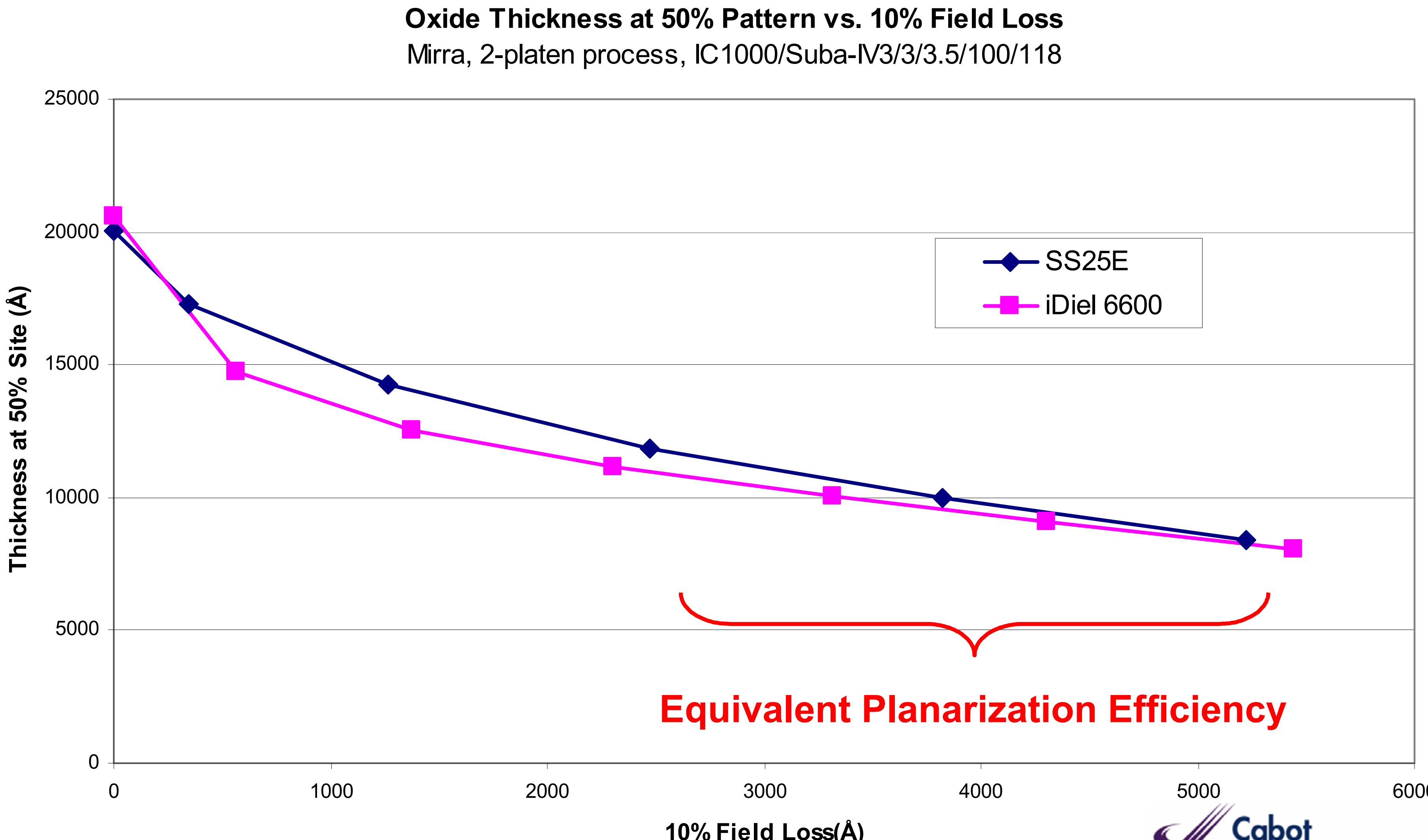
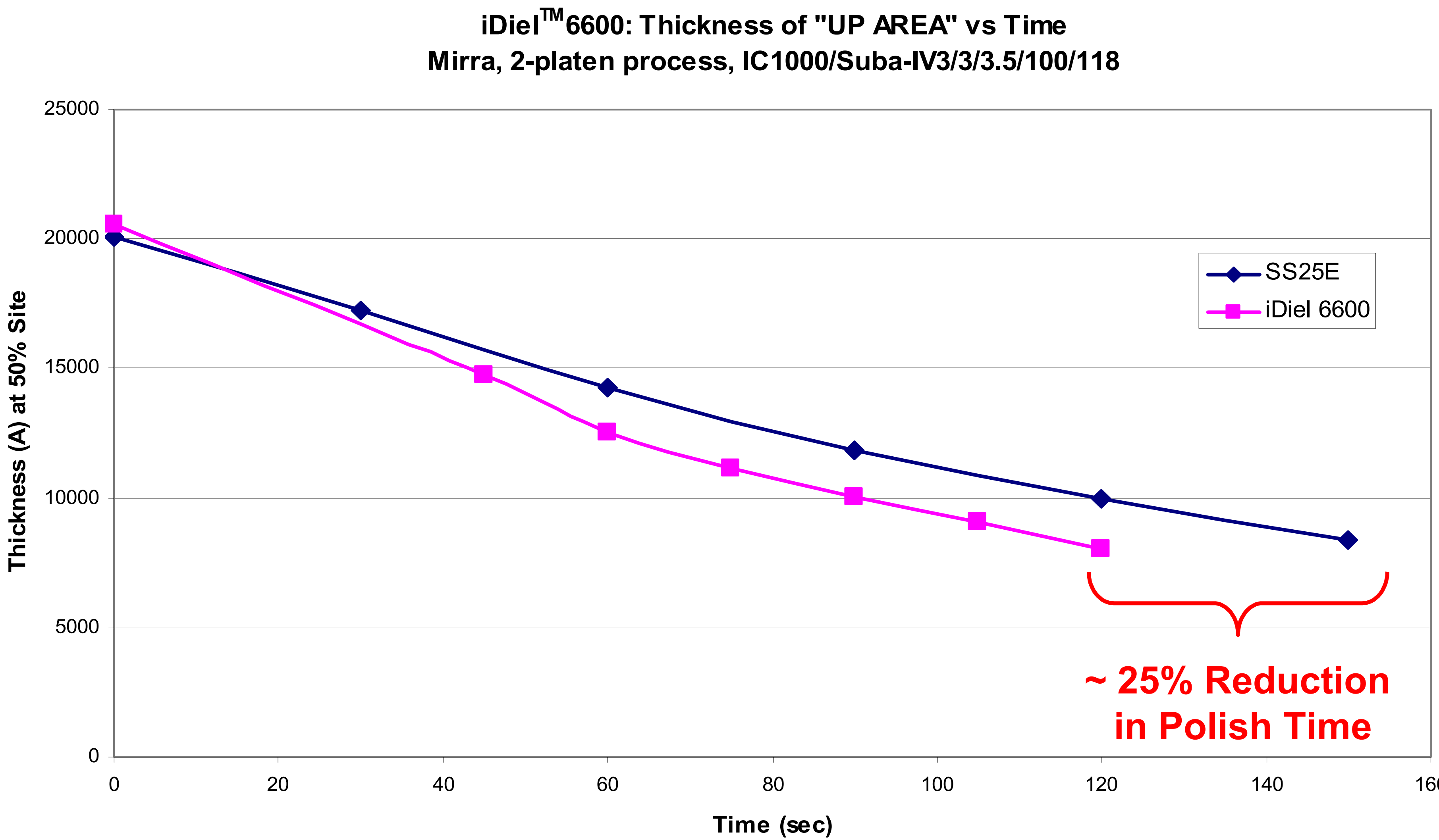
Planarization Efficiency of iDiel™6600 vs. SS25E® on MIT Pattern



iDiel™6600 Removal Rate On MIT Pattern



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Summary

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