



# **CMP MARKETS & VALUE CHAIN PERSPECTIVES**

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**A PRESENTATION FOR THE CMP USERS GROUP**

**JULY 17, 2007**

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**LINX CONSULTING**



# OUTLINE

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1. Introduction to Linx Consulting
2. Developments Impacting CMP
3. CMP Markets and Key Value Chain Components
4. Conclusions



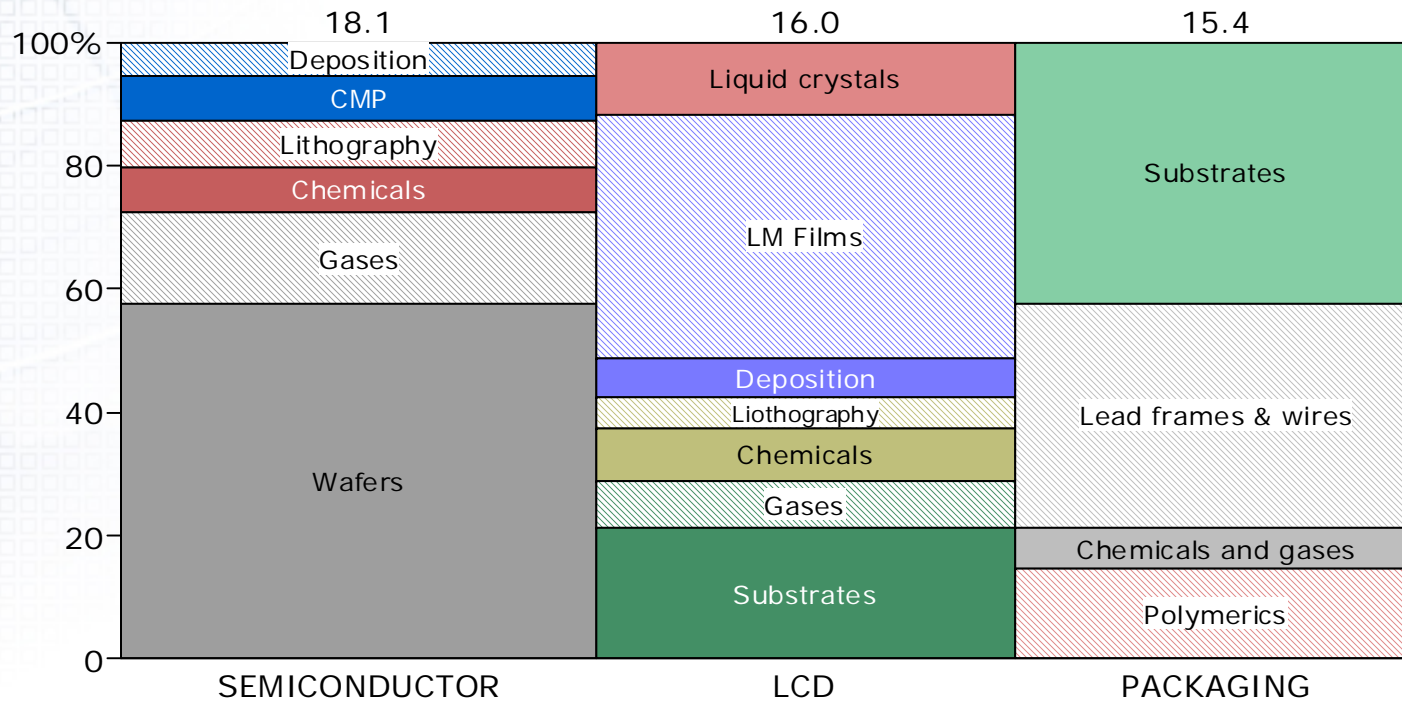
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# LINX CONSULTING



# LINX CONSULTING IS FOCUSED IN ELECTRONIC CHEMICALS AND MATERIALS

% TOTAL SEGMENT



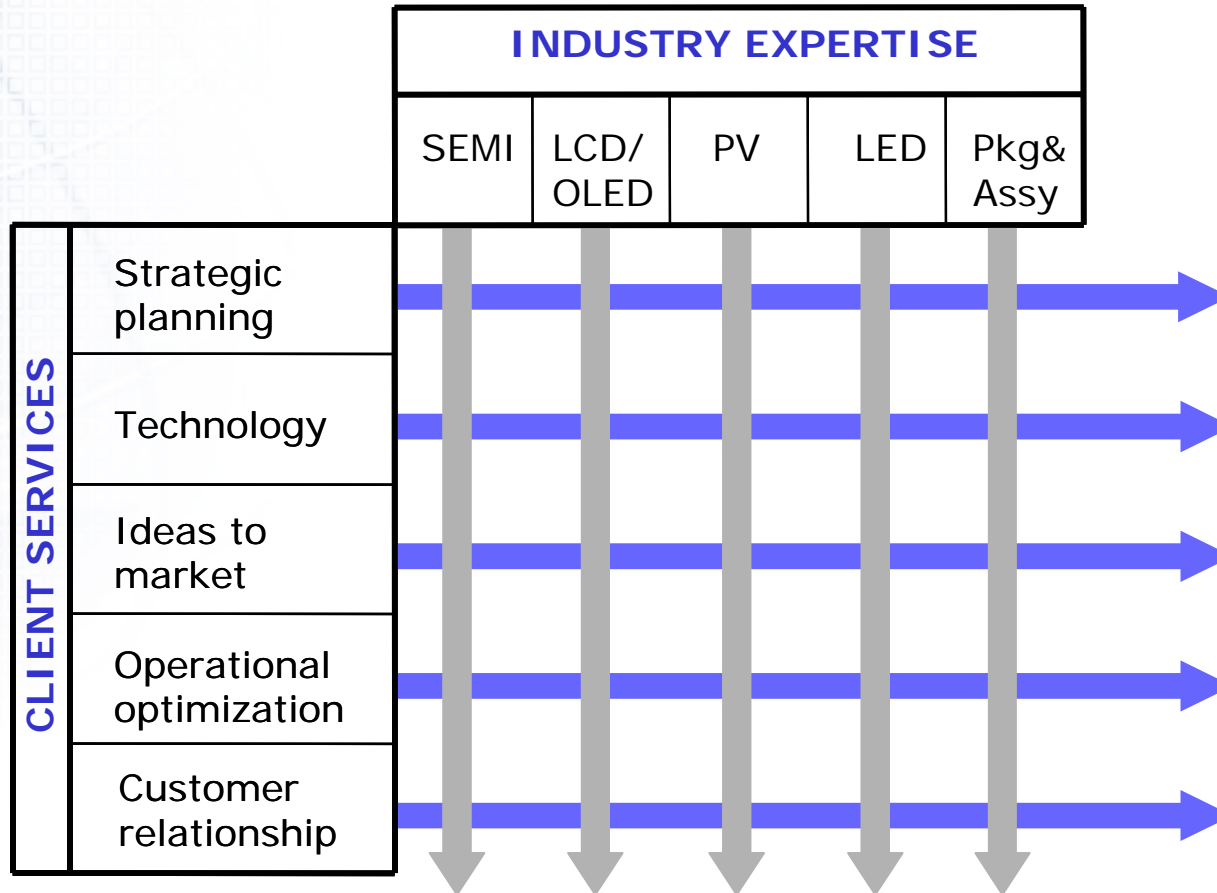
% TOTAL ELECTRONIC CHEMICALS

Notes:

1. Units are \$ billion
2. PCB chemicals and materials are estimated at \$10.5 billion
3. Compound semi including in semiconductor



# LINX JOINS INDUSTRY EXPERTISE WITH INSIGHTFUL SERVICE





# INDUSTRY ANALYSIS - SERVICES OFFERED

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## CURRENTLY AVAILABLE INDUSTRY ANALYSIS REPORTS

1. CMP Technologies and Markets to the 45 nm Node
2. Advanced Cleaning and Surface Preparation: Technologies and Markets
3. Opportunities in Imprint Lithography
4. Semiconductor Industry Direct Consumables Model
5. Specialty Abrasives in CMP
6. Advanced Patterning

## UPCOMING INDUSTRY ANALYSIS REPORTS

1. Advanced Thin Film Processes & Materials (in-process)
2. Electronic Materials in Photovoltaics (in-process)
3. CMP Technologies and Markets to the 32 nm Node
4. Advanced Cleaning and Surface Preparation to 32 nm Node



# CMP - 32 nm NODE – REPORT CONTENTS

1. **EXECUTIVE SUMMARY**
  - Growth in CMP Operations
  - Growth in Slurries and Pads
  - Suppliers
  - Regional distribution of polishes
2. **METHODOLOGY**
3. **BACKGROUND AND MODEL DRIVERS**
4. **CMP APPLICATIONS**
  - Aspects covered for each of the following applications:*
    - *Challenges*
    - *Typical POR*
    - *Consumables*
    - *Key IP*
    - *Activities of leading users*
    - *Markets (65 nm and above)*
  - Bulk Copper 65, 45 & 32nm
  - ECMP technology
  - Copper end point 65, 45 & 32nm
  - Copper barrier 65, 45 & 32nm
  - Tungsten 65, 45 & 32nm
  - STI 65, 45 & 32nm
  - Oxide 65, 45 & 32nm
  - Emerging applications
5. **CMP TOOLS & EMERGING TECHNOLOGIES**
  - Leading tools/platforms
  - Tool supplier characterization
  - Impact of new technologies
  - Consumable selection
6. **MARKET ASSESSMENT AND FORECASTS**
  - Total consumables market
  - Slurries
  - Pads
  - CMP operation forecasts
  - CMP by applications
  - CMP by device segment
7. **SUPPLIER ASSESSMENT**
  - Leading suppliers
  - Slurry suppliers
  - Pad suppliers
  - Conditioner suppliers
8. **BUSINESS ANALYSIS AND OPPORTUNITIES**
  - CMP consumables
  - Customer considerations
  - Influence of tool producers
  - Sustainability of suppliers
  - Interviewee comments

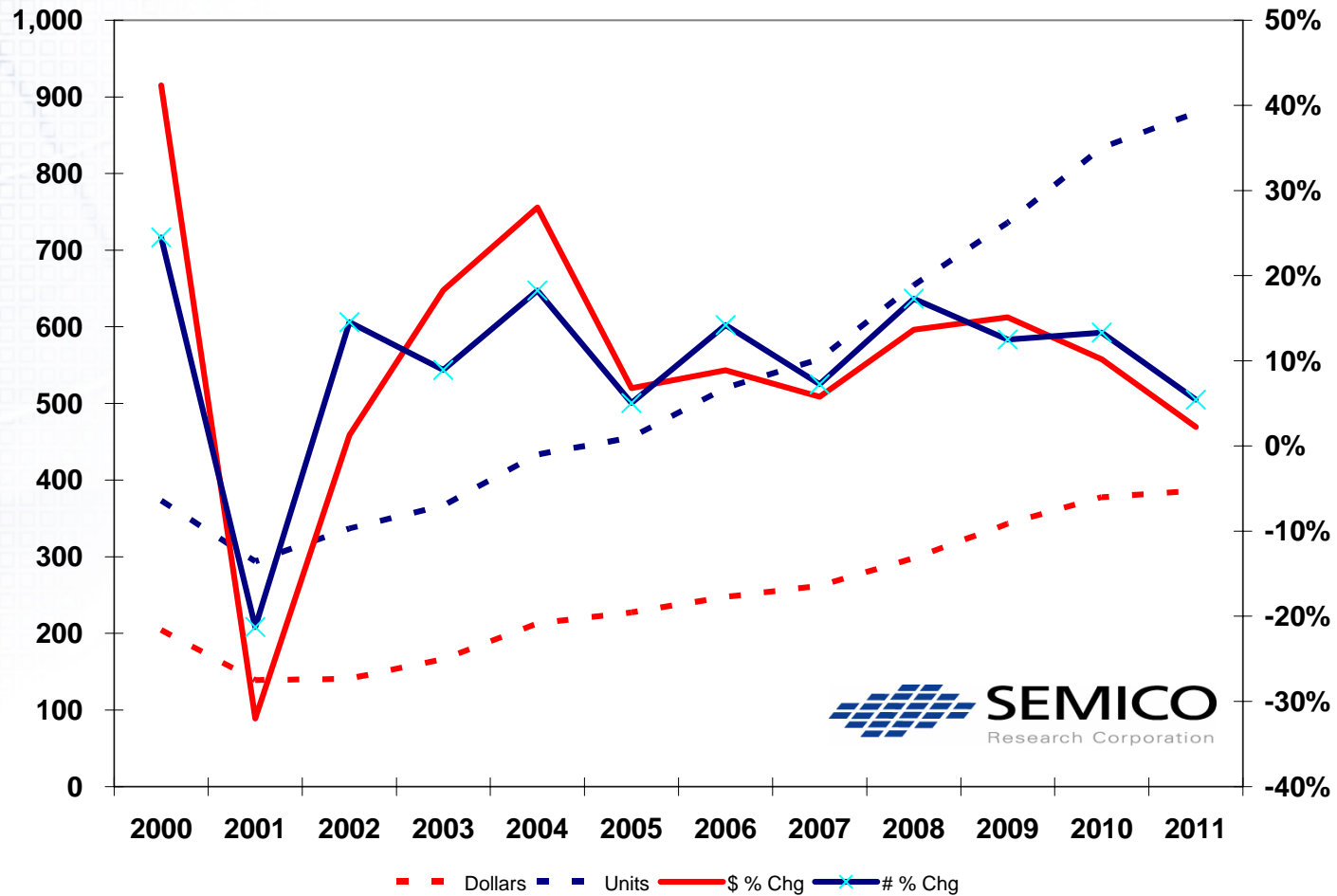


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## **DEVELOPMENTS IMPACTING CMP**

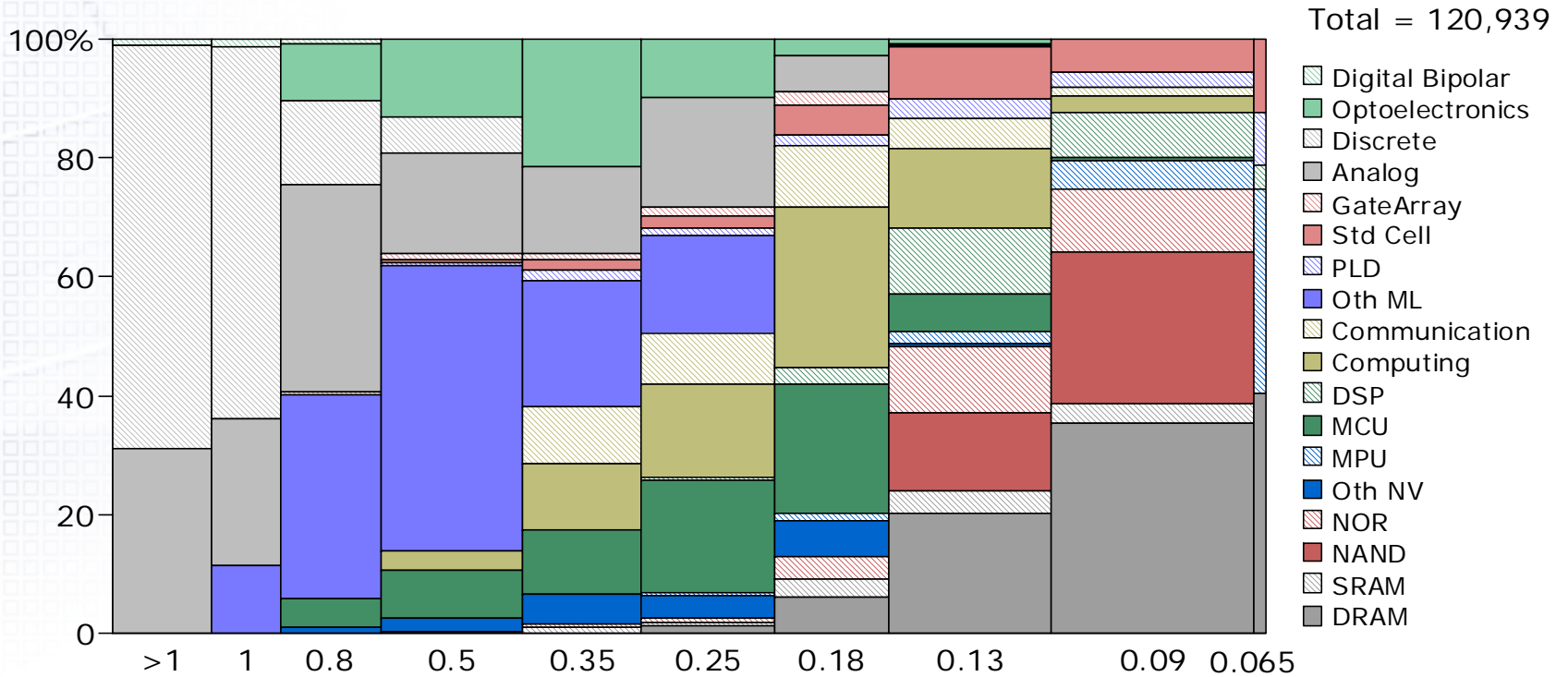


# SEMICONDUCTOR INDUSTRY GROWTH



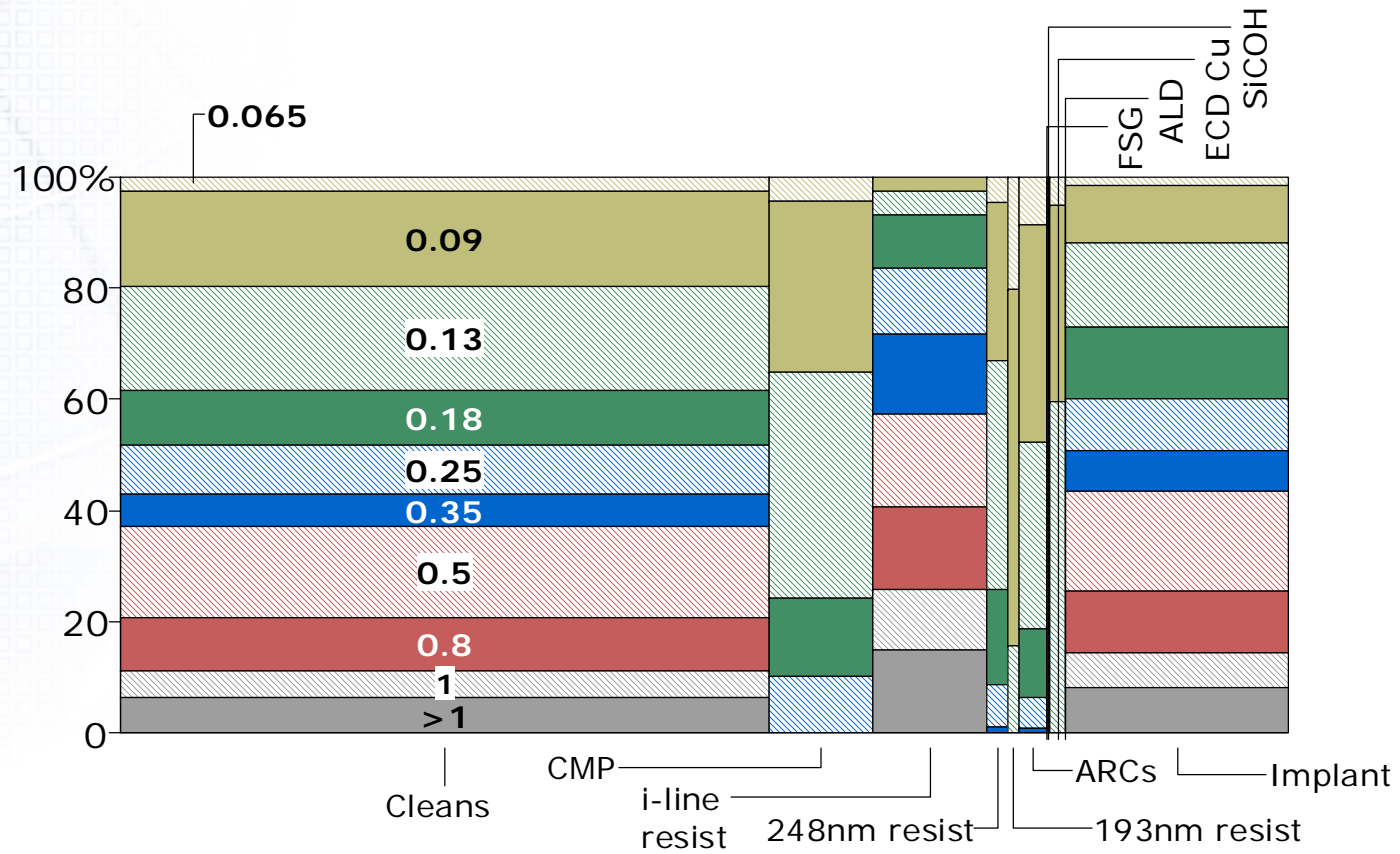


# WAFER STARTS - 2006



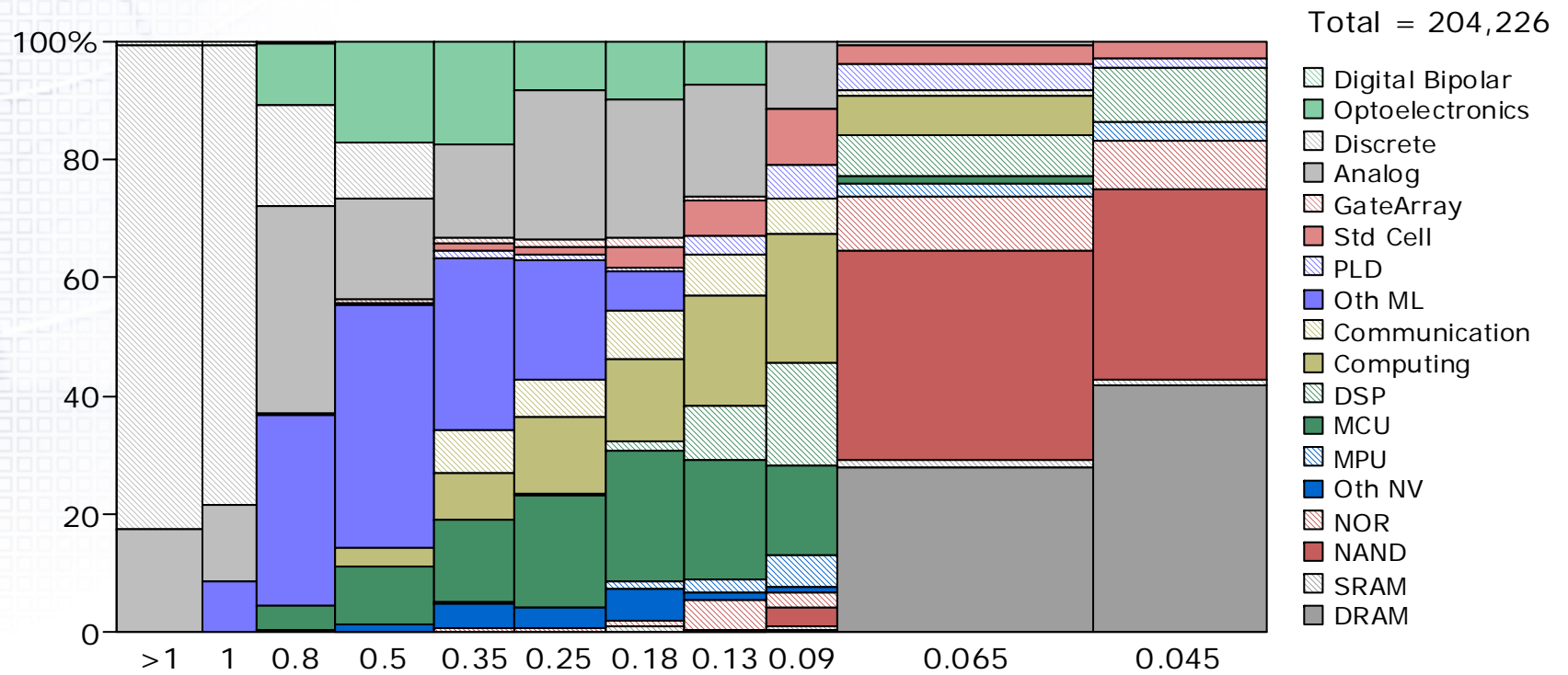


# UNIT OPERATIONS - 2006



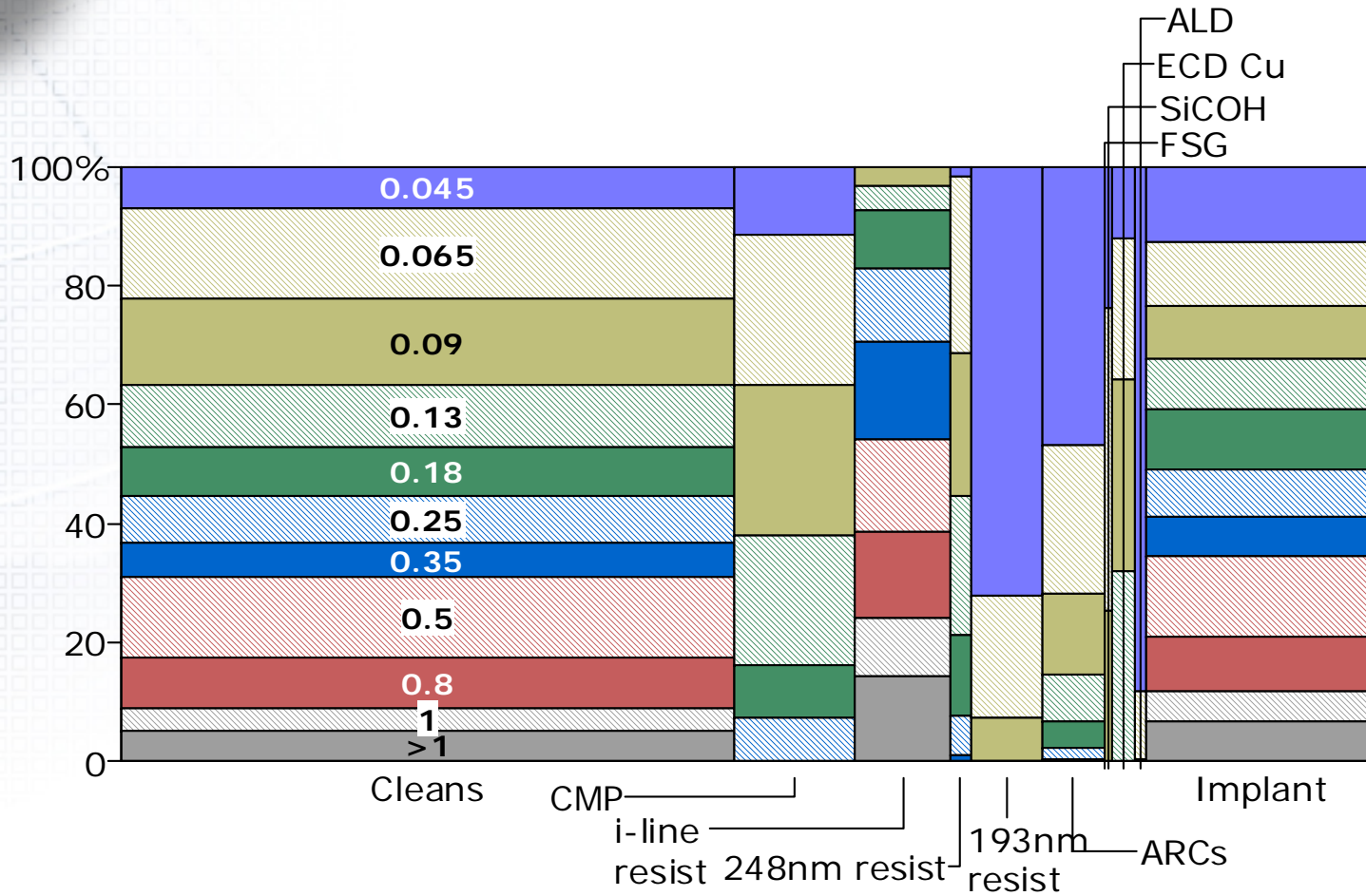


# WAFER STARTS – 2010



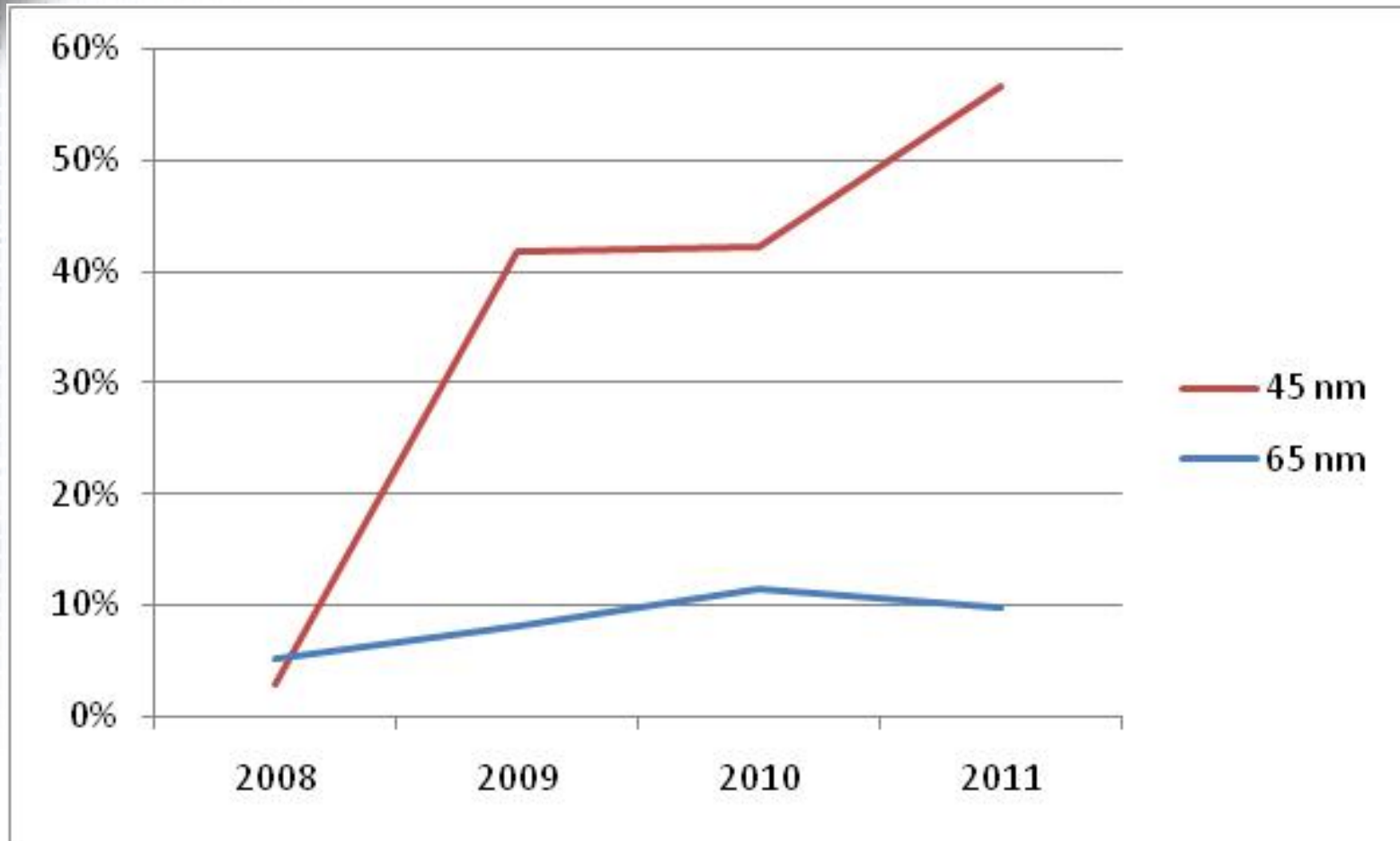


# UNIT OPERATIONS - 2010





## MEMORY – TOTAL % OF COPPER POLISHES



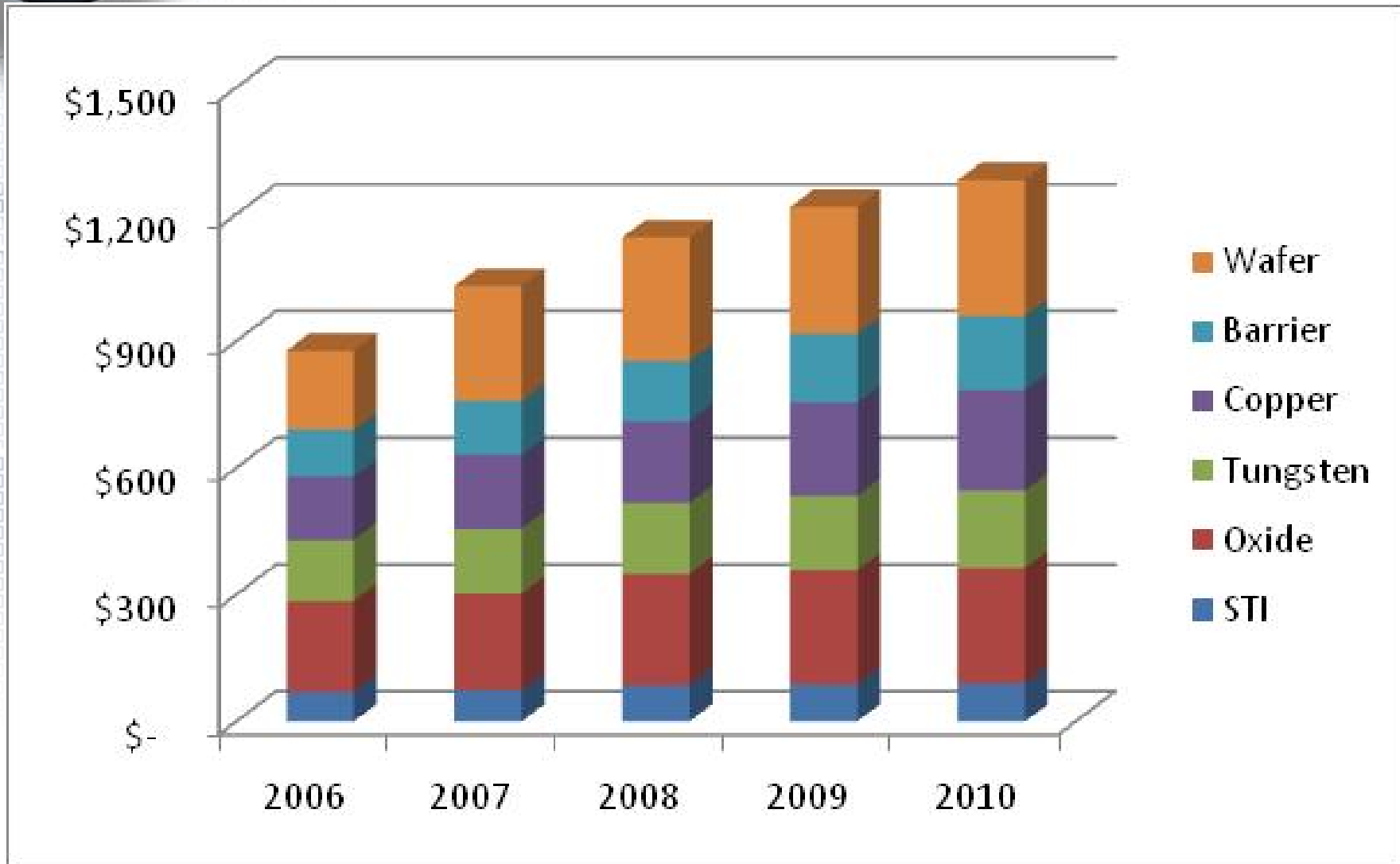


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## **CMP MARKETS AND VALUE CHAIN**



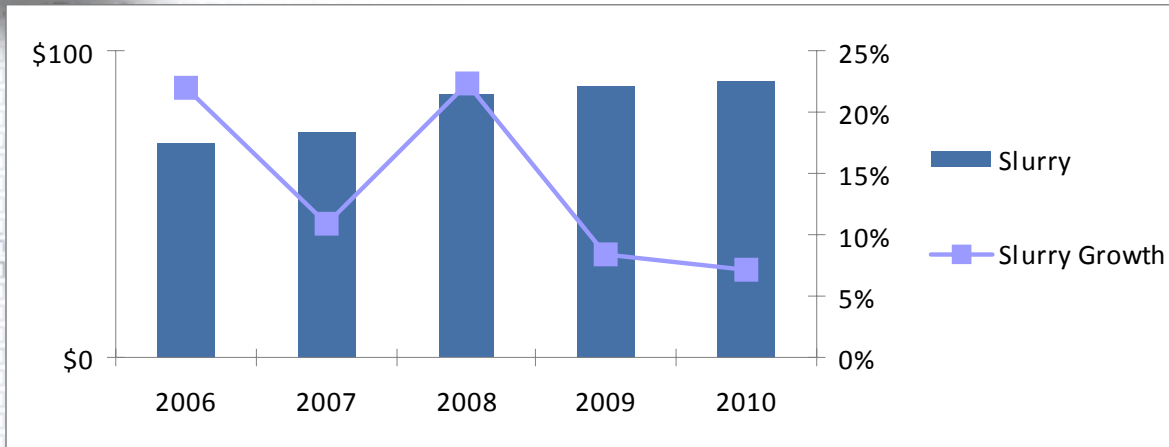
## SLURRY MARKETS - \$875 MILLION IN 2006



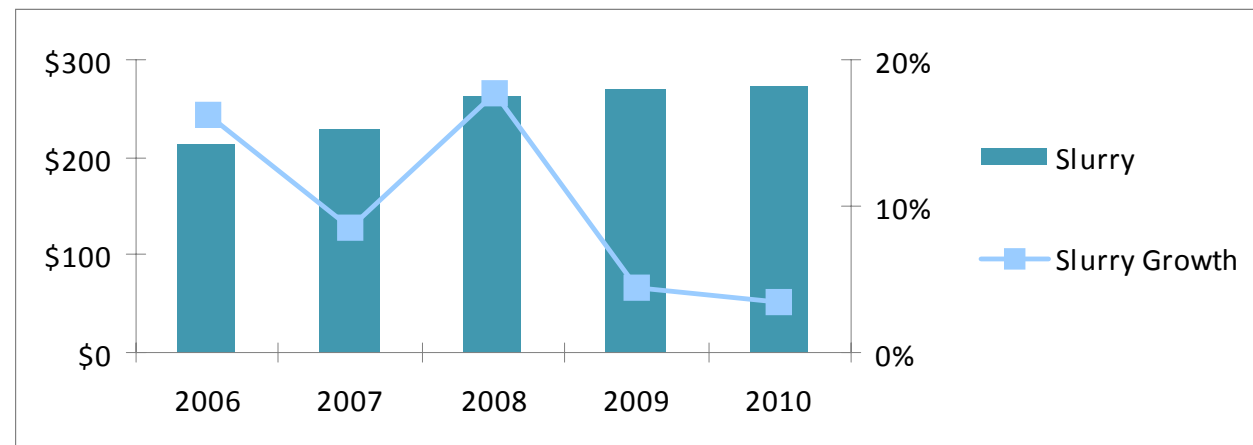


# STI AND OXIDE MARKETS

## STI



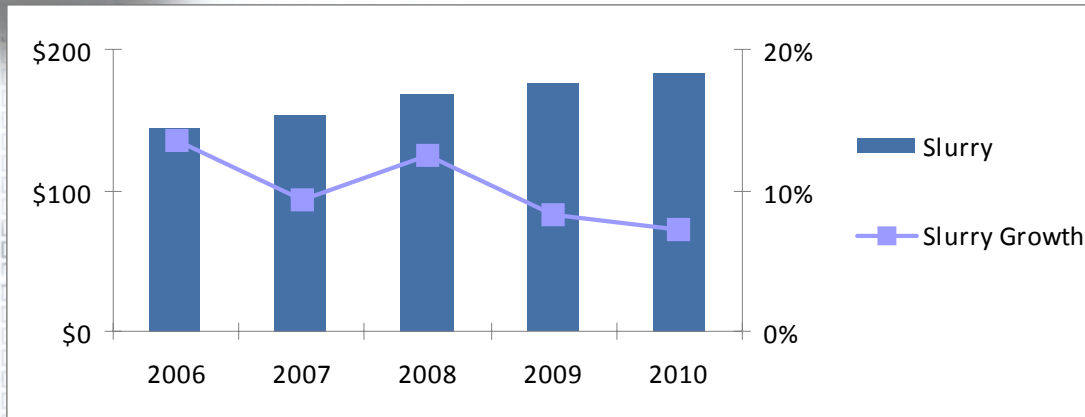
## OXIDE



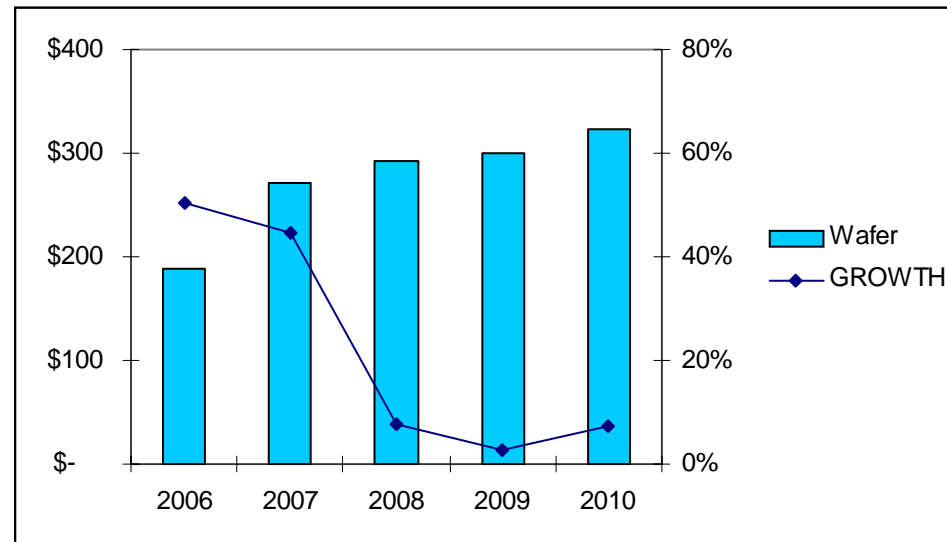


# TUNGSTEN AND WAFER POLISH MARKETS

## TUNGSTEN



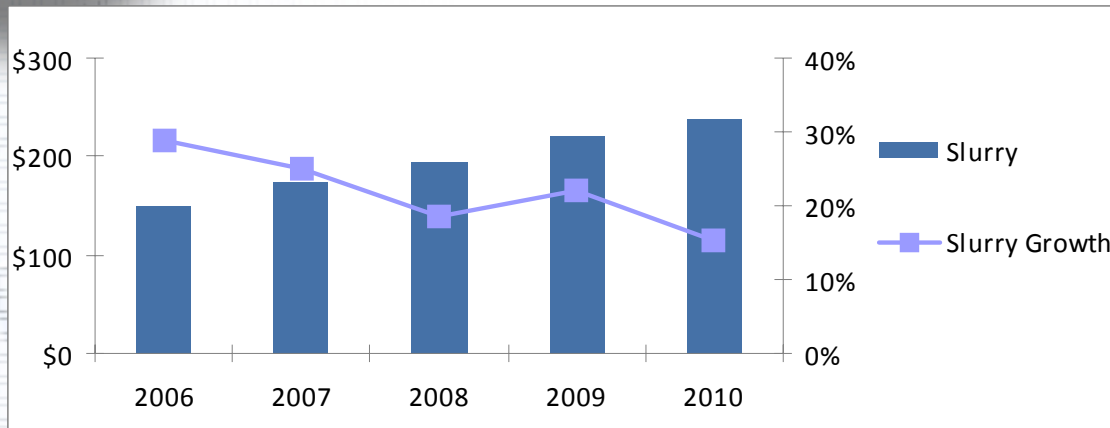
## WAFER POLISHING



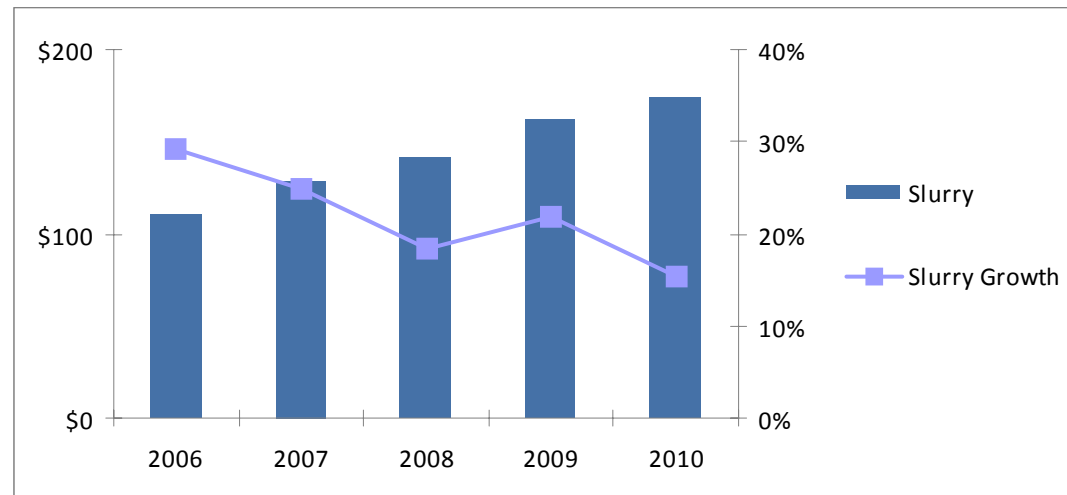


# COPPER AND BARRIER MARKETS

## COPPER

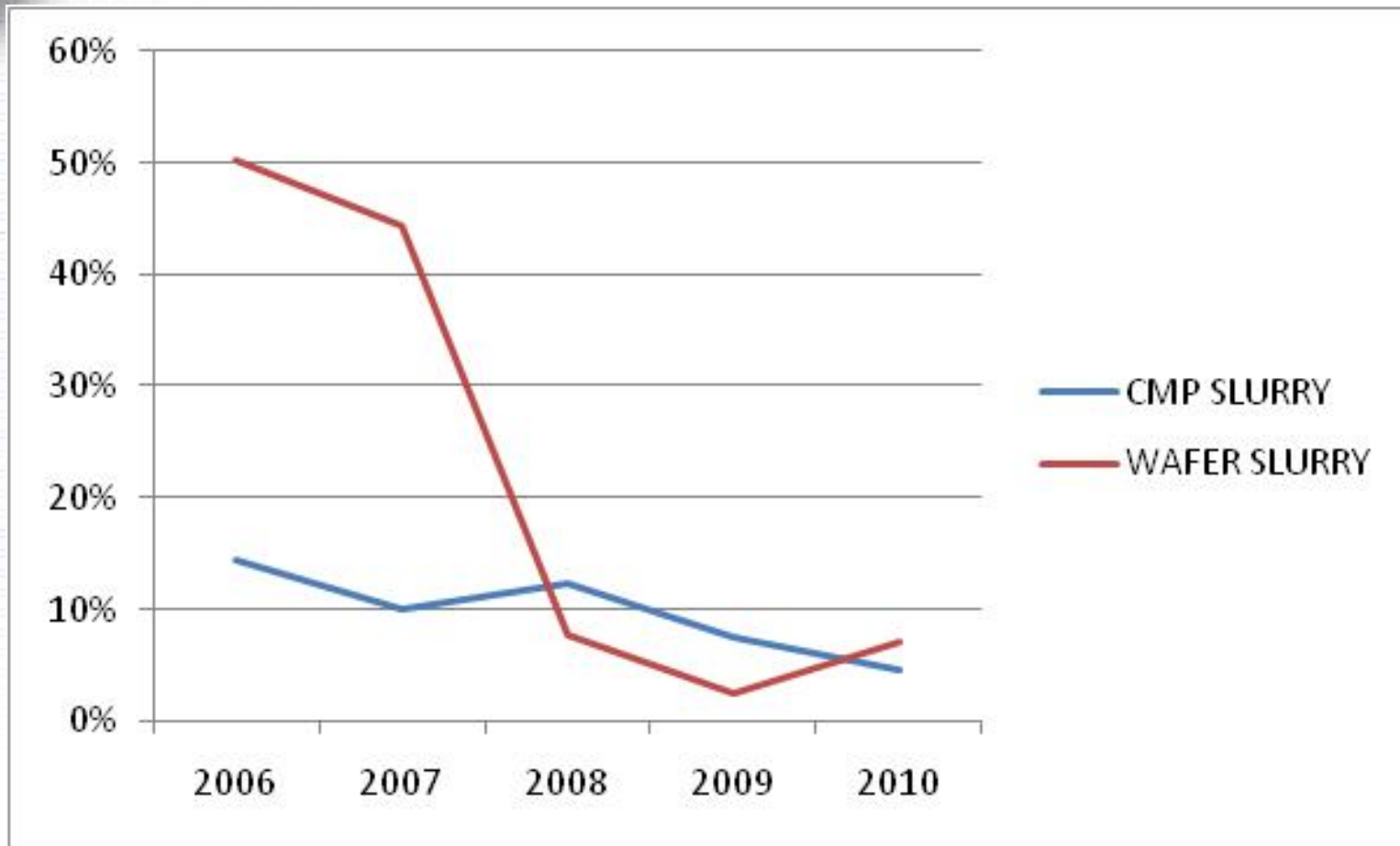


## BARRIER



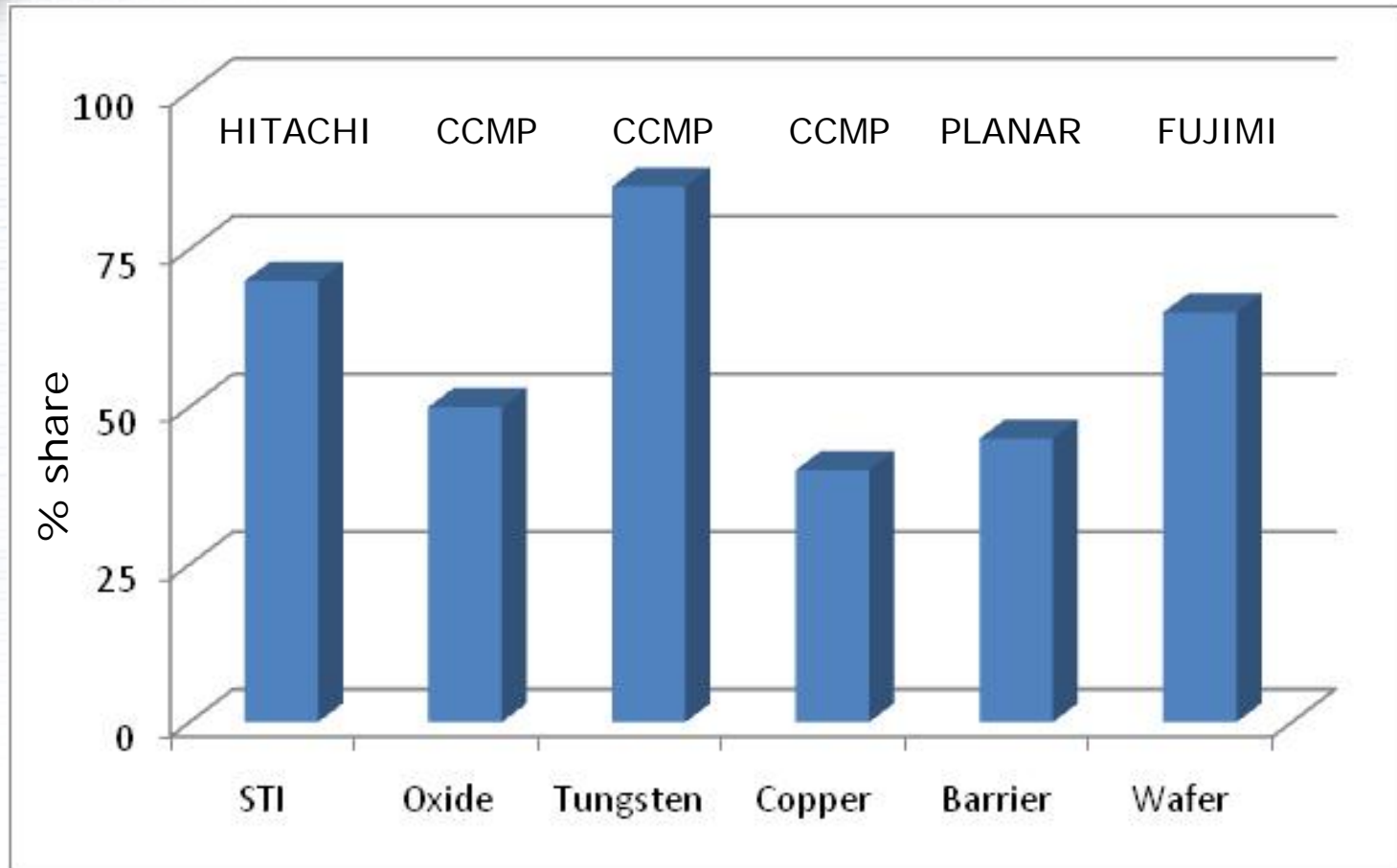


## SLURRIES – AAGR(%) 2006 TO 2010



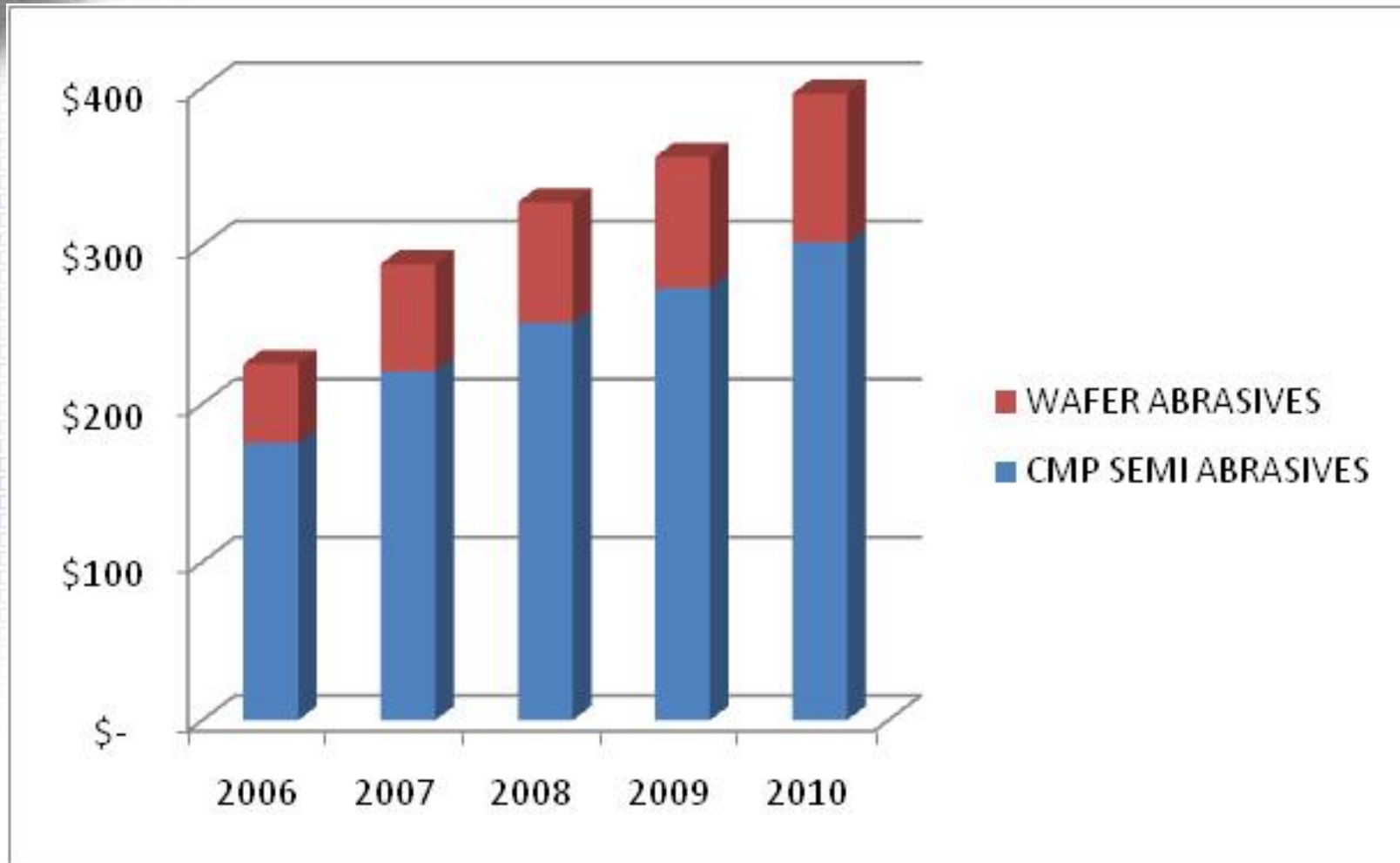


## LEADING SLURRY SUPPLIERS - CONCENTRATION





## VALUE CHAIN – ABRASIVES - \$225M IN 2006



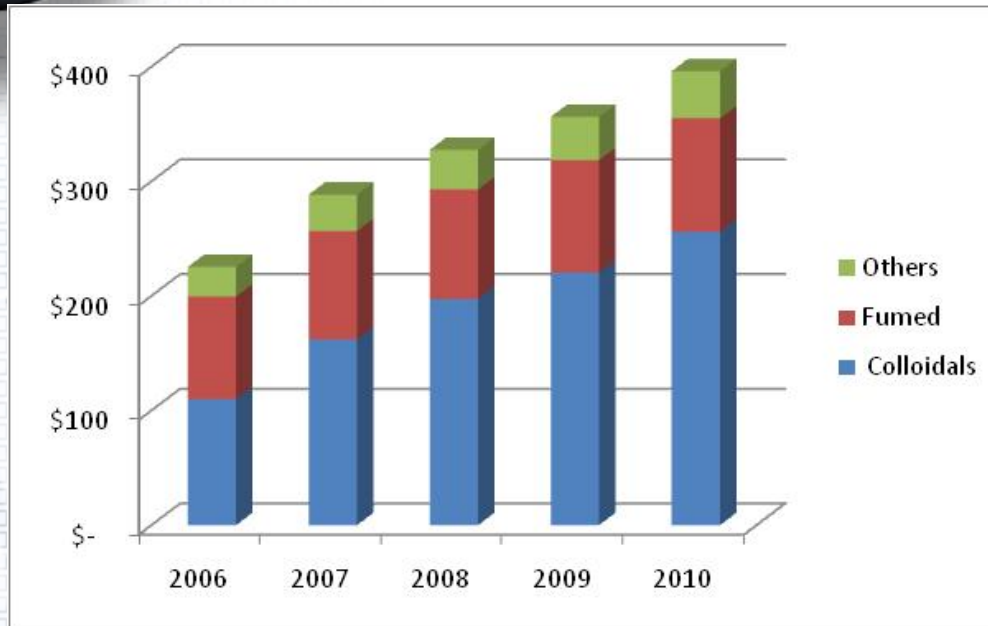


# CHANGES IN ABRASIVES MIX

APPLICATION	CMP ABRASIVES EMPLOYED			COMMENTS
	CURRENT NODES IN PRODUCTION	65 NM	45 NM	
OXIDE	FS CS		FS CS Ceria	FS will slow down after 45 nm
TUNGSTEN	FS	FS CS HPCS	FS CS HPCS	FS will slow down after 45 nm
STI	Ceria			FA likely for advanced logic
BULK COPPER	Alumina CSI		CSI HPCS	ECMP not seen as likely to impact forecasts
BARRIER	FS CS HPCS		CS HPCS	HPFS slow down at 45 nm
FINAL WAFER POLISH	HPCS			HPCS will remain dominant material due to purity
STOCK POLISH	CS			No major changes



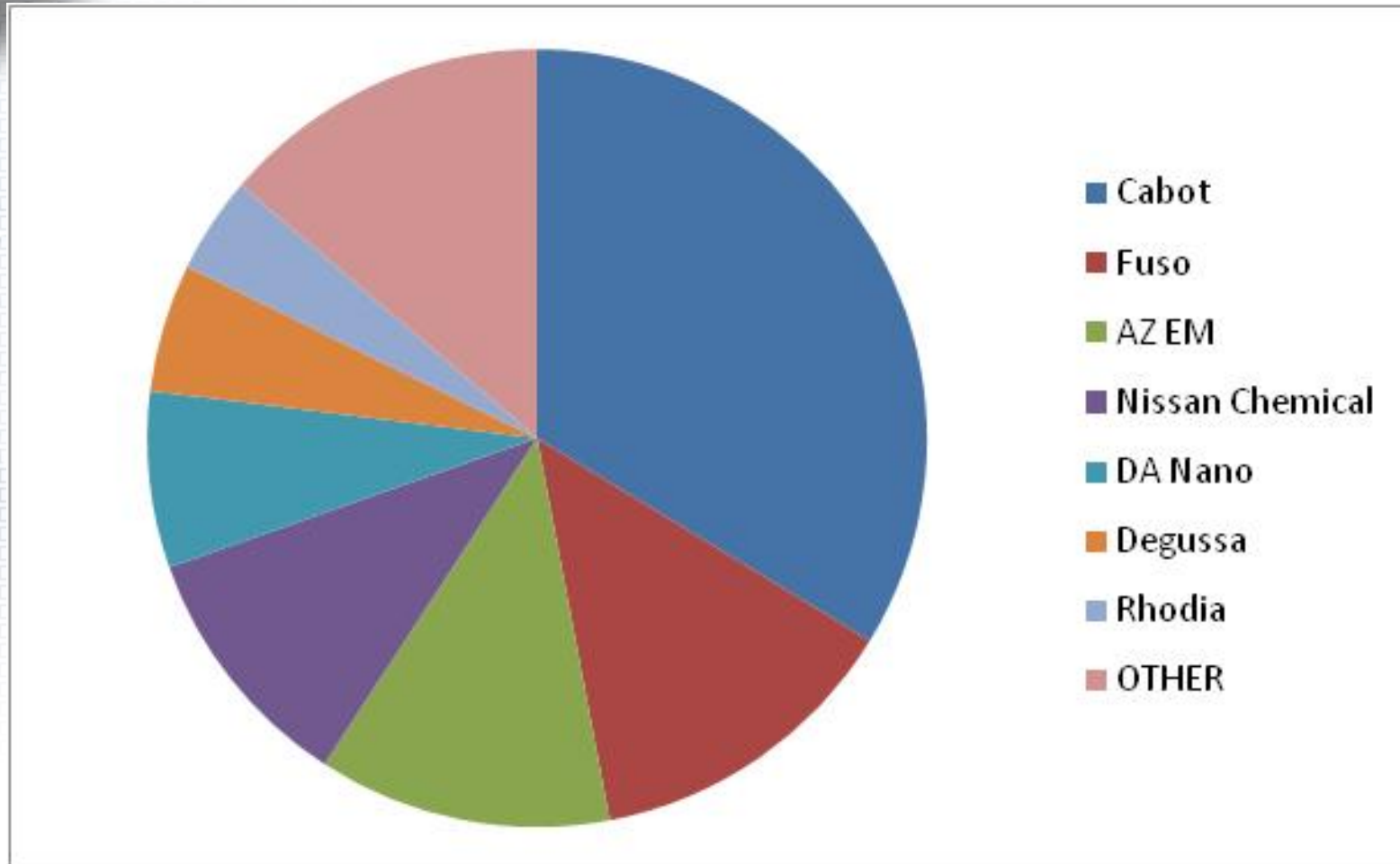
# ABRASIVES MARKET, 2006 - 2010



Abrasive type	CAGR (%), 2006 – 2010
Colloidals	23.5
Fumed	2.5
Others	12.4

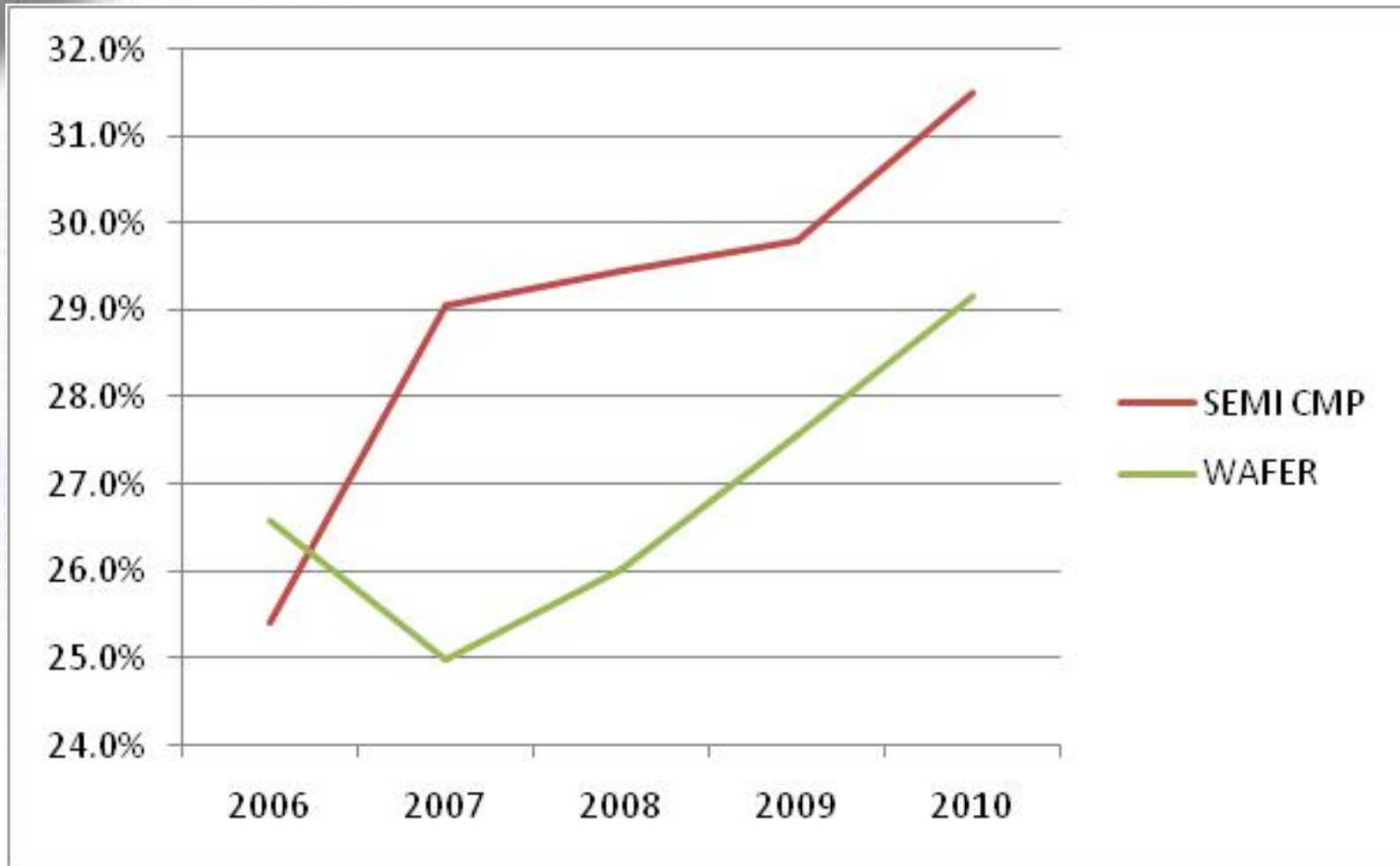


## LEADING ABRASIVES SUPPLIERS (%)





## RATIO OF ABRASIVES TO SLURRY (\$ BASIS)





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## CONCLUSIONS



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- Increased proportion of wafer starts are for DRAM and NAND -> new slurry demand drivers
- Change in abrasives mix from more commodity to more engineered products may lead to increases in slurry prices
- The chemo effect will continue to remain of critical importance, however, slurry producers with an integrated position in or preferred access to engineered abrasives may become advantaged
- Limited influence of emerging technologies on slurry demand
  - ECMP, fixed abrasives and novel barriers
- DRAM AND NAND conversion to copper complete at 45 nm – drives copper growth and limits future growth in oxide and tungsten
- Conversion to 300 mm slows down growth of wafer polishing