Challenges for CMP Consumable Suppliers

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The Challenge of Chip Technology

Smaller dimensions and larger wafers

- CMP process requirements are more demanding
- Innovative wafer states, structures, and materials are required
  - Drives new CMP applications
  - Each new CMP process must robustly meet requirements
  - Added chip complexity leads to divergent requirements
- Investment is required years in advance
Outline

CMP Challenges:

• Tighter performance requirements
  – Epic® D100 Pad / Tungsten

• Customized solutions
  – Poly/Nitride/Oxide Platform

• New applications / materials
  – Ruthenium

• Q&A
Tighter Performance Requirements
“Big 4” CMP Requirements by Application

**Wafer Yield**
- Cu M1-M5 loss -13% / yr
- With Lower Variation

**Defectivity**
- Density -25% / yr
- Size -13% / yr
- Eliminates Impurities and Variation

**Productivity**
- Step Function versus Past
- Driving CoO and also CoC

**CoO/CoC**
- Customization Consistency / CI

**Support**
- Full Support Supply Assurance
Improved Erosion with Epic® D100 Pad and WIN W7300

Erosion (Å/min)

Baseline with W7300
D100 with W7300
w/ W2000

D100 with W2000
Baseline with W7300
D100 with W7300

Pattern Density (%)
Better Defectivity Performance

Total Defect Counts on MIT 854 Mask Patterned Wafers

D100 pad shows improvement in total defect counts compared to baseline.
Improved CoO for Customers

Extended Run* on D100 Window Pad (W2000 1:1 diluted with 2.4% H₂O₂)

* From experiments which simulate the production polishing process with long conditioning process.
Customized Solutions
Platform Development—Optimization of Tunability

Barrier (Ta/TaN)

Low K

Down Force Tunable

Copper

Independently Chemically Tunable

200 Å/m  800 Å/m  1500 Å/m  3500 Å/m

Chemically & Down Force Tunable

TEOS

1000 Å/m

800 Å/m

200 Å/m  800 Å/m  1500 Å/m  2500 Å/m

Down Force Tunable

Hard

Politex

Tuned to Customer-Specific Incoming Topography
New Applications and Materials
The Future CMP Alphabet

Aluminum

Cu

Ta/TaN

Ru

GST

SiO$_2$

TiN

CDO

Noble Metals

HfO$_2$

SiO$_2$/SiN

CuMn

BPSG
iCue® B9000 Slurry (Platform) Tunable Selectivity

Process comparable to DF/TS=1.5psi/120rpm on Mirra

B9000 Ru and Ta Slurry (Platform) with H₂O₂ as an oxidizer and selected chemistries:

• Safe (will not form toxic RuO₄)
• Colloidally stable
• Applicable to Ru and Cu with no galvanic corrosion
• Tunable for Cu / Ru / Ta barrier selectivity with knobs identified and understood

* Ru removal rate is dependent on the deposition process (between 350-500 Å/min)

i-Cue® B9000 platform shows good Ru RR and tunable Cu/Ru/Ta selectivity
Summary

• Current Challenges for CMP Suppliers are:
  – Tighter Performance Requires, and CoO
  – Customized Solutions
  – Development for a variety of new materials

• We hope to work together with our customers to meet these challenges
Perfecting the Surfaces of Tomorrow™