VERSUM MATERIALS’ ENHANCED PORTFOLIO OF OFFERINGS TO THE CMP MARKET PROVIDES AN INTEGRATED SOLUTION TO OUR CUSTOMERS IN THE IC SEGMENT.

**COPPER CMP SLURRIES**
- High removal rates for high throughput
- Low within wafer polish non-uniformity
- Low across wafer and within die Cu line dishing
- Very low abrasive concentration
- Supports low defectivity
- Supports high selectivity to barrier films
- Highly-concentrated slurries for optimal cost-of-ownership

**BARRIER CMP SLURRIES**
- Highly tunable performance to match desired removal rates and selectivity requirements
- Low defects and improved typography control due to better particle technology, minimized large particle counts, proprietary surfactant technology and improved corrosion protection technology

**TUNGSTEN CMP SLURRIES**
- Proprietary solid state catalyst technology
- Colloidal silica-based products as opposed to competitive fumed silica-based products
- Inherently lower erosion and defect performance
- Low cost-of-ownership products
- Wide applicability in:
  - Advanced memory and logic applications due to superb erosion and defect performance vs. competitive products
  - Foundry, memory and legacy applications due to our excellent cost-of-ownership.

**ADVANCED OXIDE AND STI CMP SLURRIES**
- Lowest trench oxide loss (dishing), nitride loss and within die (loss over various feature sizes) post polishing thickness ranges in the industry
- Tailored and refined particle characteristics (both for calcined and colloidal particle-based products) yielding low defectivity and optimal CMP performance
- Concentrated and low solids at point of use products for desirable cost-of-ownership
- Consistent and dependable performance

**COBALT CMP SLURRIES AND CLEANS**
- Bulk Co slurries:
  - High and tunable Co removal rates
  - High selectivity of Co vs. barrier or dielectric films
  - Low corrosion for high yields
- Co barrier slurries:
  - Highly tunable to meet individual customer removal rate and selectivity targets
  - Low defectivity and improved topographical control
- Post-Co CMP cleans:
  - Tuned to work with our Co bulk and barrier slurries

**POST-CMP CLEANING PRODUCTS**
- Worldwide leader in providing post-CMP chemistry since 1998, providing technically advanced, highly concentrated materials that reduce cost-of-ownership.
- Our formulations are optimized for use with our slurry portfolio, designed with understanding from slurry and clean chemistries.
- Cleans for a range of CMP applications:
  - BEOL Cu and Barrier
  - MOL Metals (Tungsten, Cobalt, Al HKMG)
  - FEOL STI and Advanced Oxides
INTEGRATED CMP AND pCMP PRODUCT OFFERINGS

Scaling and new materials at advanced nodes requires continued innovation in chemical additive and abrasive chemistry to meet performance and COO requirements.

<table>
<thead>
<tr>
<th>CMP Slurries</th>
<th>FEOL Dielectrics STI, ILD, Oxides</th>
<th>MOL MG &amp; Contacts W, Co and Al</th>
<th>BEOL Interconnect Cu Bulk/Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduced defectivity • High selectivity (nitride, oxides, and poly) • Low oxide dishing</td>
<td>• Dishing Improvements • Low defectivity • Removal rate tuning</td>
<td>• Low defectivity • Optimized COO • Tunable • Compatible with new metals (Co/Ru)</td>
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</tbody>
</table>

Key CMP Attributes

Proprietary Clean STI 2950 (buff): Ceria DP 1036

• Ceria nano particle removal • Reduced defect • Inc. PVA brush life

CP72B: W and Al HKMG CP98D: W Co7900: Co

• Corrosion control • Metal contamination • Reduced particle defect

CP72B: Cu CP98D: Cu/Co DP1002: Cu/Co/Ru

• Corrosion control • Organic residue removal • Reduced particle defect

CMP DISTRIBUTION EQUIPMENT

Our FlowMaster® range of CMP slurry feed, blend and distribution modules have the ability to support multiple slurry tools while reducing your total equipment cost-of-ownership. Our proprietary PolyFlow® equipment design provides significant benefits in product delivery consistency and reliability.

WORLDWIDE HEADQUARTERS

For more information, please contact us at:

VERSUM MATERIALS, LLC
VERSUMMATERIALS.COM

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