Applied Materials Introduces Enabling Polysilicon CMP Process for Next-Generation Devices

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New Mirra Polysilicon CMP Process Targets Manufacturing
Challenges of Sub-0.18 Micron Transistors

Applied Materials, Inc. (Nasdaq:AMAT), the leading supplier of CMP (chemical mechanical polishing) systems to the semiconductor industry, today introduced a production-worthy polysilicon (poly) CMP process to enable high-performance sub-0.18 micron capacitor and transistor device designs.

The proprietary Mirra(R) Polysilicon CMP process, already accepted at a number of advanced logic and DRAM fabs, provides the industry with a precise technology for forming polysilicon capacitor, gate and contact device structures.

"Our Mirra Polysilicon CMP process is an attractive solution for sub-0.18 micron device designs because of its ability to precisely planarize polysilicon films," said Chris Smith, vice president and general manager of Applied Materials' CMP division.

"As a relatively new CMP application, advanced chipmakers have had to use internally developed poly CMP processes. To enable the mainstream implementation of this advanced technology, we have leveraged the proven advantages of our Mirra CMP system to develop the industry's first turnkey polysilicon CMP process."

Market researcher Dataquest forecasts the market for CMP polysilicon applications will grow from $28 million in 1999 to $107 million by 2003, representing a compounded annual growth rate of 40 percent over the four year period. Based on customer information, Applied Materials estimates that poly CMP can be used in up to four layers of some advanced DRAM devices. Applications for polysilicon CMP technology are expected to increase because they enable the formation of scaled-down capacitor and transistor gate structures as well as polysilicon contact plugs.

Mirra Polysilicon CMP is a two-slurry, multi-step process that provides customers with repeatable removal uniformity across the wafer, low defect counts for high device yield and minimal dopant loss to ensure device performance and high yield. Enabling this superior process performance is a production-proven system with capabilities that are unique to the Mirra system and critical to poly CMP.

The Mirra's flexible three platen design is ideally suited for addressing key issues of removal non-uniformity, defects and dopant loss. First, to achieve consistent uniformity, a non-selective slurry removes the layer of cap oxide that grows on the poly surface. This "oxide breakthrough" polish step is followed by bulk removal of the poly layer using a different high-removal rate, high-selectivity (polysilicon:oxide) slurry until the endpoint is reached. The process continues using a non-selective slurry for overpolishing, to minimize dishing which could diminish device performance. Once polishing is complete, a separate step cleans and re-oxidizes the polysilicon surface to limit dopant loss. By allowing sequential multi-step processing, the Mirra maintains high throughput.

The Mirra's Titan Head(TM) polishers enable a low pressure process that is a major factor in the uniform, consistent removal rate exhibited by the Mirra Polysilicon CMP process. Combining this low pressure processing capability with a non-selective slurry for overpolish and an advanced CMP rinse solution also offers excellent defect performance for high yielding results. A complete, fully automated dry-in/dry-out post-CMP cleaning process using the Mirra Mesa(TM) integrated CMP solution contributes to tight particle control.

The Mirra's In Situ Rate Monitor (ISRM(TM)) endpoint technology repeatably controls overpolishing to minimize erosion and dishing effects. It accurately identifies the point at which the polysilicon has been completely removed to end polishing, thereby limiting the loss of polysilicon in the plug, contacts and trenches. Given the accuracy of ISRM endpointing, the need for a typical sacrificial nitride stop layer can be eliminated, offering a simplified and potentially lower cost production process.

Applied Materials, Inc. is a Fortune 500 global growth company and the world's largest supplier of wafer fabrication systems and services to the global semiconductor industry. Applied Materials is traded on the Nasdaq National Market System under the symbol "AMAT." Applied Materials' web site is http://www.appliedmaterials.com.

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