Applied Materials Announces Breakthrough Copper Chip Manufacturing Solution With Advanced Electroplating System

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Millennia(TM) Electra(TM) ECP Solves Copper Electroplating Production

Challenges with Industry's First Automated Chemical Management

Technology, Unique Chemistry, High-Throughput Design

Applied Materials, Inc., the world's leading supplier of copper manufacturing equipment to the semiconductor industry, today announced its Millennia Electra ECP (ElectroChemical Plating) system. This next-generation system has been specifically designed for the volume manufacturing of high-speed copper-based semiconductor chips featuring breakthrough innovations in chemical management technology, chemistry and equipment architecture.

"The new Millennia ECP system takes electroplating technology out of the development phase and into the high-volume manufacturing arena," said Dr. Ashok Sinha, president of Applied Materials' Metal Deposition Product Business Group. "This unique product employs several industry 'firsts' that solve key process challenges and provide customers with the reliable, production-worthy capability required in fab lines. We are very pleased with the response we've had from customers about our Millennia ECP system who are impressed by the new level of performance it will provide for manufacturing interconnects with copper."

Commitments have already been received for multiple Millennia ECP systems from customers in the United States, Europe and Japan. These systems are expected to begin shipping later this year. Dataquest, a market research firm, estimates that the market for copper deposition equipment, which includes barrier/seed and electroplating systems, will have a compound annual growth rate of 37 percent over the next four years (1999-2003).

As part of Applied Materials' "Electra" copper product line, the Millennia ECP system joins Applied Materials' Mirra(R) Cu CMP system, also announced today, and Endura(R) Barrier and Seed system to provide customers with a Total Solutions(TM) approach to their copper interconnect manufacturing requirements. The Endura Barrier and Seed system, introduced in December 1997, is being used by 19 of the industry's top chipmakers engaged in copper development and commercialization.

"Several innovations make the Millennia ECP the most production-ready electroplating tool available," said Dr. Dan Carl, general manager of Applied Materials' Copper Division. "The system's advanced, closed-loop chemical management system automatically ensures consistent plating performance and repeatable results. The proprietary low-acid electrolyte chemistry used in the Millennia enables uniform, void-free copper fill of the interconnect structures. And for optimum equipment efficiency, we've packaged these and other unique features in a new high-throughput, high efficiency architecture."

Productivity has been a major issue confronting the use of conventional electroplating systems as full manufacturing tools, since significant time had to be spent in manually controlling the process chemistry and performing off-line chemical sampling and analysis. The Millennia ECP system solves these problems by introducing the industry's first completely automated chemical management technology.

The Millennia ECP's computer-controlled, closed-loop chemical management system continuously analyzes and automatically controls the electrolyte and additive chemistries to specified levels. It is capable of keeping the solution to within parts-per-million accuracy at all times, enabling precise, repeatable results wafer after wafer. This constant chemical control allows for fast re-start and re-qualification after system shutdown, using far fewer test wafers than other systems.

Overcoming traditional problems with variable film quality and fill uniformity in existing systems, Applied Materials has developed a proprietary low-conductivity, low-acid electrolyte chemistry. This innovative process chemistry enables exceptional film uniformity without the need for complex wafer rotation schemes and allows void-free, gap-filling under a wide range of conditions. In addition to being easy to dispose of without hazardous waste handling, the low-acid chemistry avoids the rapid corrosion of the copper seed layer that can result in wafer-to-wafer variations.

"To meet the aggressive requirements of volume-production manufacturing, we've incorporated many of the reliability and throughput design concepts from our Endura(R) and Producer(TM) platforms in the Millennia system," noted Avi Tepman, vice president of systems engineering in Applied Materials' Metal Deposition Product Business Group. "The Millennia maintains separate wet and dry processing areas that are each serviced by dedicated robots to minimize copper contamination and increase productivity. Critical to this scheme is a highly reliable wet-wafer robot, field-proven on other Applied Materials' systems, that enables the fast, simultaneous electroplating of four wafers.

"Designed for exceptional throughput, the Millennia ECP has two twin-cell electroplating modules, serviced by a dual-blade wafer handler. The

system's unique platform can be expanded with a third twin-cell process module for additional capacity or for other future technologies. Both 200mm and 300mm wafers can be accommodated on the Millennia platform with no change in footprint."

Copper contamination, an issue with currently available systems, is addressed in the Millennia with a post-plating clean module located in the wet processing area of the system. Two spin-rinse-dry cells clean the electrolyte from the front and back sides of the wafers and then dries them. The wafers are then sent to the dry area of the system, thus reducing particles and minimizing potential copper contamination to the fab.

Applied Materials is the only company that offers products for all of the key process steps required for dual damascene copper interconnect fabrication. Leveraging this range of technologies, the company also offers the Copper Interconnect Equipment Set Solution(TM) (ESS(TM)). Launched in late 1998, the Copper Interconnect ESS provides customers with the equipment, integrated process technology and guaranteed electrical results for manufacturing dual damascene structures. The Millenia ECP is available as both a standalone system and as part of the Copper Interconnect ESS.

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 www.appliedmaterials.com.

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CONTACT: Applied Materials, Inc.
Connie Duncan, 408/563-6209 (editorial/media)
Carolyn Schwartz, 408/748-5227 (financial community)

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