



## Applied Materials Announces New Ti/TiN CVD System to Enable Low Cost, High Speed DRAMs

November 23, 1998

**SANTA CLARA, Calif.--(BUSINESS WIRE)--Nov. 23, 1998--**

Production-Ready CVD Ti/TiN Liner/Barrier Technology Using  
TiCl<sub>4</sub> Chemistry Aimed at High Aspect Ratio Contact  
Metallization for 256Mb DRAM Generation and Beyond

Applied Materials Inc., the leading global supplier of Chemical Vapor Deposition (CVD) systems to the semiconductor industry, introduces the CVD Ti/TiN Centura. Using titanium chloride (TiCl<sub>4</sub>) source chemistry, the system deposits titanium (Ti) and titanium nitride (TiN) liner/barrier layers in very advanced DRAM contact structures for 256Mb, 0.18-micron generation devices and beyond. The system's TiCl<sub>4</sub> TiN process is also ideally-suited for depositing the top electrode of gigabit-level capacitor structures in applications with Ta<sub>2</sub>O<sub>5</sub> (tantalum pentoxide) dielectrics.

"Customers have been very impressed by the production worthiness of this new generation Ti/TiN technology for their latest DRAM designs. The CVD Ti/TiN Centura provides a new capability to effectively fill deep, narrow contact holes, enabling the reduction of contact size and making faster, cheaper memory chips possible," noted Dr. Ashok K. Sinha, president of Applied Materials' Metal Deposition Product Business Group. "This system is a tremendous achievement in advanced metal CVD technology that further strengthens Applied Materials' industry-leading position in metal deposition."

Multiple Ti/TiN Centura systems are already in use by customers; commitments for additional systems have already been received from semiconductor manufacturers in North America, Japan, Korea and Taiwan. Market researcher Dataquest, estimates the 1998 market for Ti/TiN deposition, including CVD and PVD technologies, to exceed \$370 million. The CVD Ti/TiN process is part of the metal CVD market, which is estimated by Dataquest at \$717 million in 1998 and forecast to grow to \$1.55 billion by 2003.

"Integrating the CVD titanium and titanium nitride process steps on a single platform allows our customers to easily build a complete, high performance liner/barrier structure in a unified process flow with exceptional throughput," noted Russell Ellwanger, chief technical officer of Applied Materials' Metal Deposition Product Business Group. "The enhanced productivity of the systems' TiCl<sub>4</sub> TiN chamber will also enable our customers' implementation of next-generation tantalum pentoxide capacitor structures."

The CVD Ti/TiN Centura provides chipmakers with a simplified, sequentially integrated process using Applied Materials' proprietary chamber technologies. In fabricating the contact structure, a robust layer of CVD TiCl<sub>4</sub> Ti is first deposited using the company's Ti-xZ Plasma Enhanced CVD chamber. During deposition, the Ti film at the bottom of the contact is completely silicided (forming TiSi<sub>2</sub>) in-situ

-- thus providing a very low resistivity film and eliminating the need for a post-deposition anneal step. For the barrier layer, a very thin, conformal layer of TiCl<sub>4</sub> TiN film is then deposited using a thermal process in the company's CVD TiN-xZ chamber. This barrier layer ensures device integrity by preventing the diffusion of the metal fill into other areas of the device. The TiCl<sub>4</sub>-based Ti/TiN processes have been demonstrated to be effective in contact structures with aspect ratios as high as 15:1.

System throughput of the integrated CVD Ti/TiN Centura is excellent at 35 wafers per hour. Customers opting for a stand-alone CVD Ti or CVD TiN system with a four-chamber configuration can process more than 70 wafers per hour. Marathon runs have validated the performance of the CVD chambers, showing production-proven manufacturability with excellent process stability and particle performance.

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>.