Tokyo Electron and Novellus Systems Announce Breakthrough Results and Collaboration on Copper Process Technology for 2Xnm and Beyond

TOKYO, Japan and SAN JOSE, Calif. - December 1, 2008 - Tokyo Electron Ltd. (TEL) and Novellus Systems, Inc. (NASDAQ: NVLS) are pleased to announce the availability of an integrated copper interconnect solution for the 2Xnm generation and beyond. This integrated metallization scheme is the result of a joint program established between the two companies for the continuous advancement of copper interconnect technology.

The co-developed process employs an ionized PVD TaN or Ti barrier capped with an ultra-thin CVD Ruthenium (Ru) liner. This barrier and Ru liner is then coupled with a proprietary copper wet seed process (eliminating the PVD Cu seed process) and a copper electrochemical deposition process, which yields fully-filled fine features at the 2Xnm node without the issues associated with PVD liners and seeds.

Breakthrough results with this new metallization scheme are enabled by two key process steps. The first key process in the scheme is a Ruthenium liner layer deposited by a CVD process using the TEL Trias Tandem™ system. The CVD Ru process offers exceptional feature conformality and resistivity in aggressive damascene features at thicknesses of less than or equal to 2nm (20Angstroms). The proprietary CVD Ru process and hardware provides excellent productivity and very efficient use of the Ru precursor. In mass production, the consumable cost for the CVD Ru process (including pre-clean and barrier processes) will be the most attractive among all available options. This level of consumable cost is not achievable with PVD Ru or ALD Ru.

The second key process step in the new metallization scheme is a wet copper seed process called DirectSeed™ which is deposited in the Novellus SABRE® Extreme™ electrochemical deposition tool. DirectSeed from Novellus is a proprietary technology for depositing a smooth, conformal Cu seed layer with thicknesses of less than or equal to 3nm (30Angstroms) directly on the CVD Ru substrate. The DirectSeed process eliminates the need for a PVD Cu seed layer and eliminates the processing challenges with PVD including step coverage, overhang and feature shadowing. The industry-leading SABRE Extreme Electrofill™ process is also used to deliver perfectly-filled Cu features at the 2Xnm node.

According to Go Okubo, vice president and general manager for the Single Wafer Deposition Business Unit, Tokyo Electron Ltd, "The achievement of our collaboration is a breakthrough in terms of realizing two long-awaited technological advancements. One is the establishment of the innovative integration technology, which assures copper fill at 2Xnm and beyond, and opens new prospects for reducing line resistance. The other is the substantial reduction of the process steps without sacrificing the benefit of low CoC, which will contribute to maximizing our customers' profit. Achieving this technological breakthrough came by combining the expertise from TEL and Novellus. We will pursue our relationship to further improve copper interconnect technology."

According to Tim Archer, executive vice president for Electrofill and PECVD business units at Novellus Systems, "TEL and Novellus have joined development forces to offer an exciting, attractive alternative to the traditional PVD / Electrofill approach for 2Xnm and beyond. The combination of the TEL CVD Ru liner and the Novellus Sabre DirectSeed™ copper wet seed and Sabre Extreme Electrofill offer an extension of copper fill to the finest features while improving the cost per wafer as well. The partnership of TEL and Novellus also offers our customers tremendous leverage by reducing or eliminating the development and integration time and cost that follows the selection of individual processes."

About SABRE Extreme:
Building on the success of the SABRE NExT system, the SABRE Extreme is targeted for the 3X and 2X technology nodes. SABRE Extreme features an improved plating cell incorporating an advanced fluid management system and current distribution technology, improving yield, on-wafer performance and reducing cost-of-consumables. SABRE Extreme runs the most advanced Electrofill™ chemistry, key to providing superior copper filling capability on extremely narrow high-aspect-ratio features.

About Novellus:
Novellus Systems, Inc. (Nasdaq: NVLS) is a leading provider of advanced process equipment for the global semiconductor industry. The company's products deliver value to customers by providing innovative technology backed by trusted productivity. An S&P 500 company, Novellus is headquartered in San Jose, Calif. with subsidiary offices across the globe. For more information, please visit www.novellus.com.

About Trias Tandem:
Trias Tandem is a product of Trias series featuring worldwide field-proven productivity and reliability. It is a high vacuum apparatus capable of accommodating PVD and CVD modules for copper interconnect process. Trias Tandem with iPVD module and CVD Ru module developed by TEL is capable for 3X and 2X technology nodes.

About Tokyo Electron Ltd:
Tokyo Electron Ltd, established in 1963, is a leading supplier of innovative semiconductor and FPD production equipment worldwide. In Japan, TEL also distributes computer network related products and electronic components of global leading suppliers. To support this diverse product base, TEL is strategically located around the world. TEL is a publicly held company listed on the Tokyo Stock Exchange. For more information, please visit http://www.tel.com/eng/.

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