

NOVELLUS' COOLFILL CVD PROCESS ADVANCES TUNGSTEN FILL FOR SUB-32nm HIGH ASPECT RATIO STRUCTURES

San Jose, Calif. - April 16, 2009- As semiconductor devices scale to the 32nm technology node and beyond, shrinking contact and via dimensions make chemical vapor deposition (CVD) of tungsten more challenging. Increasing aspect ratios can lead to voids or large seams within device features, resulting in lower yields and decreased performance in microprocessor and memory chips. The International Technology Roadmap for Semiconductors (ITRS) calls for 32nm stacked capacitor DRAM contacts to have aspect ratios of greater than 20:1. Logic devices, though not as aggressive as DRAM, will still have challenges in maintaining low resistivity contacts as aspect ratios grow to more than 10:1. Void-free fill that meets the required electrical properties in aggressive features like these will be problematic using conventional CVD tungsten deposition techniques.

To address these challenges, Novellus (NASDAQ: NVLS) researchers have developed the CoolFill® CVD tungsten plug fill process using the ALTUS® CVD system with Multi-Station Sequential Deposition (MSSD) architecture. CoolFill is a reduced temperature (< 395 °C) CVD process that provides a larger process window for void-free tungsten fill by minimizing the mass transport effects responsible for void formation within a feature. CoolFill utilizes Novellus' advanced Pulsed Nucleation Layer (PNLxT) technology and the ALTUS MSSD architecture to simultaneously deposit nucleation and fill layers at different temperatures. While decreasing CVD temperature reduces the deposition rate and throughput on conventional CVD systems, Novellus' CoolFill technology mitigates this effect by combining lower temperature feature fill with higher temperature bulk fill. Multi-temperature processes are easily enabled using the ALTUS MSSD architecture without sacrificing productivity. Figure 1 shows how CoolFill CVD eliminates voids in a 32nm, 18:1 aspect ratio contact structure as compared to standard CVD.



Figure 1: Cross sectional TEM images comparing 32nm,18:1 aspect ratio contacts processed using Standard and CoolFill CVD.

"The CoolFill CVD process with PNLxT nucleation is a technology advancement that will extend tungsten to the 32nm technology node and beyond," said Michal Danek, senior director of technology for the Direct Metals business unit at Novellus. "CoolFill provides a larger process window to achieve void-free tungsten fill, thereby simplifying our customer's integration challenges as they scale their devices to the next generation technology node."

For more information on how CoolFill can extend your tungsten plug fill process to the 32nm node, go to <http://www.novellustechnews.com/cvd-tungsten/en/coolfill-tungsten-cvd.aspx>

About Novellus' ALTUS Tungsten Deposition Technology:

Introduced in 1991, ALTUS is the industry's tool of choice for tungsten deposition. The system provides leading productivity and technology for contact and local interconnect applications. The ALTUS Pulsed Nucleation Layer (PNL®) technology integrates a high-throughput atomic layer deposition (ALD) nucleation layer with a bulk chemical vapor deposition process. Novellus' Multi-Station Sequential Deposition (MSSD) architecture enables the nucleation layer and CVD fill to be performed sequentially on separate stations within the same ALTUS chamber. The integrated PNL and CVD approach produces benchmark productivity and production availability, resulting in the lowest-cost-of-ownership tungsten deposition solution in the industry.

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

<https://newsroom.lamresearch.com/2009-04-16-NOVELLUS-COOLFILL-CVD-PROCESS-ADVANCES-TUNGSTEN-FILL-FOR-SUB-32nm-HIGH-ASPECT-RATIO-STRUCTURES>