

*Press Release*

**NOVELLUS' ULTRA LOW DIELECTRIC CONSTANT MATERIALS  
ENABLE 32nm DEVICE INTEGRATION**

*New Dense ULK Materials More Reliable, Easier to  
Integrate than Porous Alternatives*

San Jose, Calif. – June 18, 2009 – Novellus (NASDAQ: NVLS) has developed Dense ultra low dielectric constant (ULK) films that provide more reliable device integration compared to porous ULK alternatives. These films are deposited using a novel, single precursor that offers a five percent lower effective dielectric constant (k-effective) when combined with Novellus' diffusion barrier layers for typical 32nm device structures.

The integration of ULK materials into a damascene interconnect scheme poses numerous challenges associated with wet clean, chemical mechanical planarization (CMP) and plasma etch. Conventional ULK films are porous in nature and are deposited using two chemicals that include a porogen and a structure former. The porogen is subsequently removed with an ultra-violet thermal processing (UVTP) step. The matrix of interconnected pores created by the UVTP treatment results in a lower dielectric constant, but causes the porous films to be highly susceptible to solvent and moisture absorption. Extra integration steps, such as a thermal bake-out or deposition of a capping layer, are required to retain the integrity of the film. These additional process steps add manufacturing complexity and cost. In contrast, UVTP of Dense ULK films results in increased mechanical strength through the cross-linking of bonds. Figure 1 compares solvent penetration through Dense ULK and the competing porous ULK films. As shown in the figure, the solvent diffusion coefficient is approximately 5 to 6 times lower in Novellus' Dense ULK film with a dielectric constant of 2.55.

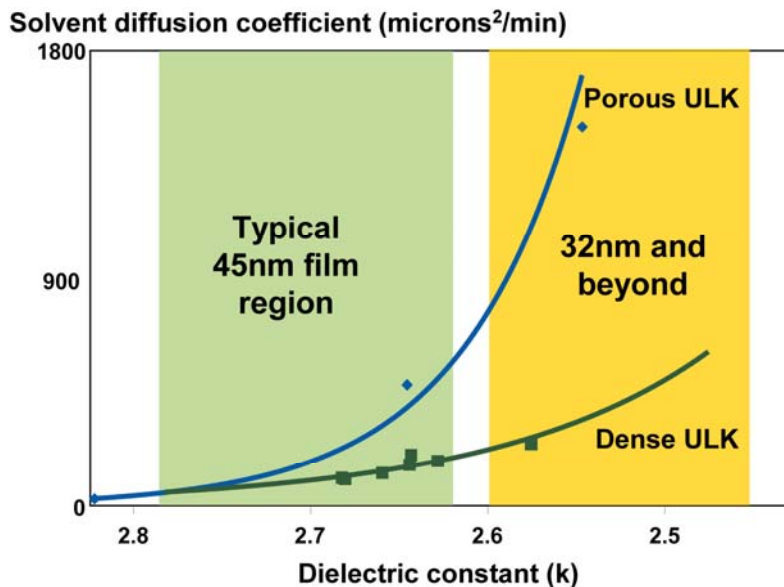


Figure 1: Comparison of solvent diffusion in Novellus Dense ULK and porous ULK materials as a function of dielectric constant.

Cross-section pictures showing the trench etch profiles of porous and Dense ULK materials (post-UVTP) are shown in Figure 2. Vertically etched structures can be easily obtained when patterning Novellus' Dense ULK film - a direct result of the chemical homogeneity throughout the layer. For the tight line-to-line spacing employed at 32nm, the improved patterning capability translates into higher breakdown voltage and lower leakage currents. Void formation in porous ULK, also seen in Figure 2, illustrates the need for control of the queue-time between the CMP and dielectric diffusion barrier process steps. Strict queue-time control is not required for Novellus' less-permeable, Dense ULK films.

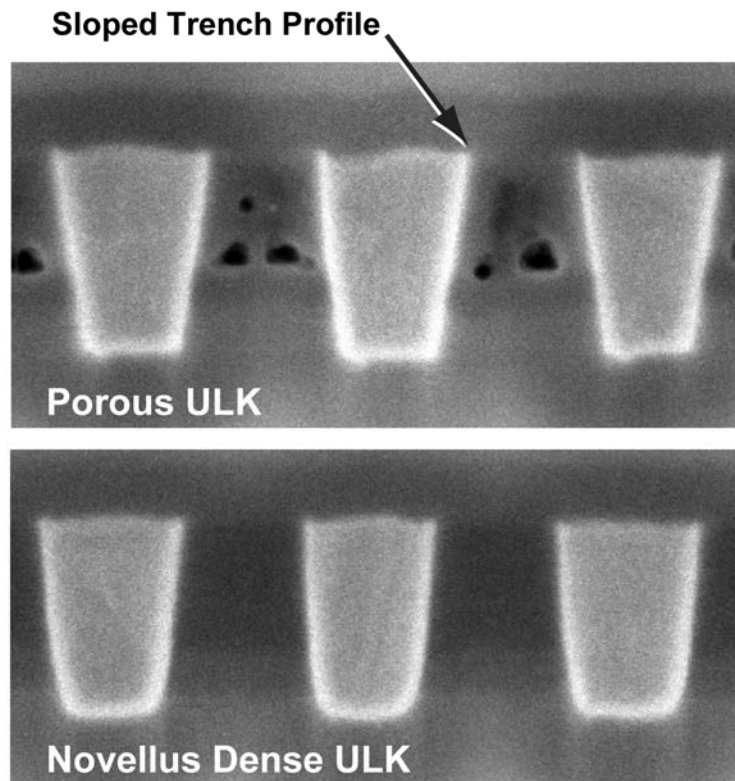


Figure 2: Comparison of etch profiles of Novellus Dense ULK and porous ULK showing relatively vertical etch profiles with dense ULK materials. Queue time effects manifesting as voids are also seen in the porous ULK materials.

“Novellus Dense ULK films enable five percent lower k-effective than porous ULK films without adding complexity to the integration sequence”, said Andy Antonelli, technology manager at Novellus' PECVD business unit. “These Dense ULK materials have been designed to enable a reliable, manufacturable solution that is compatible with wet clean, CMP and etch modules”.

For more information regarding the use of Dense ULK materials, go to [www.novellustechnews.com](http://www.novellustechnews.com).

**About Novellus' PECVD Technology:**

For high-volume manufacturing applications at 45nm and beyond, Novellus' advanced low-k, ILD, IMD, and dielectric diffusion barrier films offer the lowest k-effective, superior RC control, and an easily integrated low-cost dielectric solution.

**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](http://www.novellus.com)

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