



Applied Materials Pushes the Boundaries of the Transistor with Atomic Scale Manufacturing Technology

July 12, 2011

- **At 22nm, the heart of the transistor gate - its dielectric film stack - must be atomically engineered**
- **Challenge: Forming atomically thin film stacks with clean, precisely-controlled interfaces**
- **Solution: Performing multiple process steps, including advanced high-k ALD technology, entirely under vacuum**

SANTA CLARA, Calif., July 12, 2011 - Applied Materials, Inc. today launched its [Applied Centura® Integrated Gate Stack™](#) system for creating the critical gate dielectric structures in 22nm logic chips. This system is the only tool available that can process the entire [high-k](#) multilayer stack in a single vacuum environment, thus preserving the integrity of its critical film interfaces. This capability is vital to maximizing transistor speed and minimizing power consumption in leading-edge microprocessor and graphics chips.

As logic chips scale down to the 22nm node and beyond, the heart of the transistor [gate](#) structure, its [dielectric](#) film stack, is becoming so thin that it must be atomically engineered. To meet this challenge, the Integrated [Gate Stack](#) system features Applied's advanced atomic layer deposition ([ALD](#)) technology, which builds ultra-thin, hafnium-based layers less than 2nm in thickness - about one hundred thousandth the width of a human hair - a fraction of a monolayer at a time, with unmatched uniformity across the wafer.

More importantly, as these films become thinner, the interfaces between adjacent layers become more crucial. The new Integrated Gate Stack system fabricates the entire gate dielectric gate stack - involving typically four process steps - entirely under vacuum. This unique approach avoids contamination of the interfaces from exposure to ambient air which can degrade transistor performance. Applied's researchers have found that eliminating air exposure during processing offers a significant performance boost: mobility in the transistor can improve by up to 10% and switching voltage variability between transistors can be reduced by up to 40%, enabling the manufacture of faster, higher-value chips.

"Tomorrow's nanoscale transistors require incredible precision because films just a few atoms thick will determine device performance," said Steve Ghanayem, group vice president and general manager of the Metal Deposition, Front End and ALD Products division at Applied Materials. "By combining multiple adjacent processing steps on our world-class Centura platform, we can simplify customers' process flows and help them achieve high production yields of their next-generation logic chips."

"There is a tremendous increase in chip complexity as we move to the 20nm era and one of the biggest changes is at the transistor level where we are seeing a complete redesign of this important building block for electronic devices. Our customers saw the benefit of Applied's [Metal Gate Stack](#) solution and worked with us on the same integrated approach for the dielectric gate stack," said Dr. Randhir Thakur, executive vice president and general manager of the Silicon Systems Group at Applied Materials. "The new Centura Integrated Gate Stack system is the latest of several innovative systems Applied has launched in recent months, all designed to enable our customers to transition their cutting-edge transistor designs from the lab to high volume manufacturing."

Applied Materials will showcase its Centura Integrated Gate Stack technology at Semicon West in San Francisco from July 12-14. For more information, visit www.appliedmaterials.com/events/semicon-west-2011.

Applied Materials, Inc. (Nasdaq:AMAT) is the global leader in providing innovative equipment, services and software to enable the manufacture of advanced semiconductor, flat panel display and solar photovoltaic products. Our technologies help make innovations like smartphones, flat screen TVs and solar panels more affordable and accessible to consumers and businesses around the world. At Applied Materials, we turn today's innovations into the industries of tomorrow. Learn more at www.appliedmaterials.com.

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[The Applied Centura Integrated Gate Stack system.](#)

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