

## **Intel Receives the SEMI Award for a Process and Technology Integration Breakthrough — the High-k Solution**

SEMI

3 — SEMI today announced that team members at Intel Corporation — Mark Bohr, Robert Chau, Suman Datta, Mark Doczy, Brian Doyle, Tahir Ghani, Jack Kavalieros, Matthew Metz, and Kaizad Mistry — are recipients of the 2012 SEMI Award for North America. The Intel team was honored for their contribution to the first development, integration and introduction of a successful high-k dielectric and metal electrode gate stack for CMOS IC production, first implemented at the 45nm node in 2007. Dr. Robert Chau accepted the SEMI Award on behalf of his team during a banquet at the 2013 SEMI Industry Strategy Symposium (ISS) yesterday in Half Moon Bay, Calif.

The successful introduction of a high-k/metal gate structure in commercial IC devices, aided by support from SEMI member companies with development of appropriate materials, processes and production tools, was a critically important milestone and continues to be in use throughout the IC industry for advanced planar and finFET-like CMOS transistors.

Team members include:

- Mark Bohr, senior fellow and director of Process Architecture and Integration, Logic Technology Development, Intel
- Robert Chau, senior fellow and director of Transistor Research and Nanotechnology, Components Research, Intel
- Suman Datta, professor, Electrical Engineering, Pennsylvania State University\*
- Mark Doczy, senior engineer in Advanced Transistor and Nanotechnology Group, Components Research, Intel
- Brian Doyle, principal engineer in Advanced Transistor and Nanotechnology Group, Components Research, Intel
- Tahir Ghani, fellow and director of Transistor Technology and Integration, Logic Technology Development, Intel
- Jack Kavalieros, principal engineer in Advanced Transistor and Nanotechnology Group, Components Research, Intel
- Matthew Metz, senior engineer in Advanced Transistor and Nanotechnology Group, Components Research, Intel
- Kaizad Mistry, vice president and director of Logic Technology Integration, Logic Technology Development, Intel

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\*Formerly with Intel Corp.

To keep on the Moore's Law curve, transistor size had to be cut in half every 24 months. However, one critical part of the transistor could not shrink anymore — the thin layer of silicon dioxide (SiO<sub>2</sub>) insulation that electrically isolates the transistor's gate from the channel through which current flows when the transistor is on. That insulating layer has shrunk with each new generation, but gate leakage currents increased with each shrink. By 2007, these leakage currents were becoming too large and the thickness could no longer decrease. Intel and other chipmakers could not shave off even a fraction of a nanometer more. Without a significant innovation, the semiconductor industry faced the end of the Moore's Law era. The team's development, integration and introduction of a successful high-k dielectric and metal electrode gate stack for CMOS IC production — first implemented at the 45nm node in 2007 — allowed the industry to perpetuate Moore's Law. The decrease in power, decrease in size and increase in performance enabled by this innovation changed the future of the IC industry.

"The invention of the high-k plus metal gate transistors was an important breakthrough," said Denny McGuirk, president and CEO of SEMI. "The Intel team pioneered a new era of transistor design based on novel device architecture and advanced materials development."

"Against all odds, the Intel team tackled a problem that threatened Moore's Law, and succeeded," said Bill Bottoms, chairman of the SEMI Award Advisory Committee. "The oxide layer was so thin that individual atoms of thickness had to be counted, so the industry was at a crossroads. The Intel team identified a gate dielectric material as a replacement for SiO<sub>2</sub> that reduced gate leakage and moved the industry forward."

The SEMI Award was established in 1979 to recognize outstanding technical achievement and meritorious contribution in the areas of Semiconductor Materials, Wafer Fabrication, Assembly and Packaging, Process Control, Test and Inspection, Robotics and Automation, Quality Enhancement, and Process Integration.

The award is the highest honor conferred by SEMI. It is open to individuals or teams from industry or academia whose specific accomplishments have broad commercial impact and widespread technical significance for the entire semiconductor industry. Nominations are accepted from individuals of North American-based member companies of SEMI. Past award recipients include Walter Benzing and Mike McNealy, Ken Levy, Jean Hoerni, Dan Maydan, Robert Akins and Igor Khandros, among others.

## **About SEMI**

SEMI is the global industry association serving the nano- and microelectronics manufacturing supply chains. Our 2,000 SEMI member companies are the engine of the future, enabling smarter, faster and more economical products that improve our lives. Since 1970, SEMI has been committed to helping members grow more profitably, create new markets and meet common industry challenges. SEMI maintains offices in Beijing, Bengaluru, Berlin, Brussels, Grenoble, Hsinchu, Moscow, San Jose, Seoul, Shanghai, Singapore, Tokyo, and Washington, D.C. For more

information, visit [www.semi.org](http://www.semi.org) [1].

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## Links:

[1] <http://www.semi.org/>

[2] <http://www.semi.org/en/node/mailto:dgeiger@semi.org>