

Features: Technological Innovation in Pursuit of Growth

Feature 1: Product Development

Increasing Business Opportunities through Production Equipment Innovation



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Until recently, PCs drove the semiconductor market, but in the past year mobile devices such as smartphones and tablets have come to the fore. Their considerable growth is also expected to trigger demand for servers and storage for the cloud services. The year was a historic turning point that changed the future course of the industry.

The higher speed and lower power consumption demanded of semiconductor devices have become more important than ever. Development is advancing in an extremely wide variety of semiconductor process technologies, including patterning technology centered on conventional lithography, 3D structures, materials and packaging. In close collaboration with its customers, Tokyo Electron is conducting advanced technological development in these and other core areas.

Demand is rising for equipment that realizes low damage and high selectivity, especially in 3D structure devices, which are gaining momentum as they shrink below 20nm. Tokyo Electron is meeting these needs with proprietary *RLSA™* etching technology, dry cleaning technology, and wet cleaning technology acquired with FSI International last year that eliminates the need for ashing. These are garnering high levels of interest and tool evaluations

from customers. In memory chips, 3D structures are expected to be employed in NAND flash memory. In these structures, Tokyo Electron is attracting attention for its deep silicon etch technology, used in DRAM trench processes. Also garnering interest is our wafer bonding technology used in bonders/debonders, in the area of advanced packaging technologies.

Improving equipment productivity is an important task as the number of wafer process steps increases. Tokyo Electron's new *NT333™* ALD system, *CLEAN TRACK™ LITHIUS Pro™ Z* coater/developer, *CELLESTA™ -i* single wafer cleaning system and nearly all of the Company's products used in wafer processes feature productivity that is 1.5 to 2 times higher than previous generations. Furthermore, we are advancing development of new products for the 450mm wafer generation.

Moving forward, the product cycle of advanced electronics will continue to shorten, and speed will be increasingly important in the development of production equipment. Tokyo Electron will meet the needs of the era through alliances with customers, consortia and universities, and by offering production equipment for next-generation technology before anyone else.

Aiming for sales expansion through product development in response to new technologies



ALD System
NT333™

Semi-batch ALD system employing a concept different from existing ALD processes, realizing high-quality nano-scale deposition while maintaining high productivity.



Coater/Developer
CLEAN TRACK™ LITHIUS Pro™ Z

The latest coater/developer model, with increased through-put and enhanced defect reduction for further miniaturization



Plasma Etch System
Tactras™ RLSA™ Etch

Silicon plasma etch system characterized by low damage and high selectivity, with excellent 3D structure transistor formation process performance

Feature 2: Research and Development

Boldly Advancing Innovative Technological Development

The semiconductor technology is facing two serious bottlenecks: miniaturization and power consumption. To realize continuous growth, we must create innovative technologies that overcome these bottlenecks.

In order to continue scaling semiconductors, Tokyo Electron is developing technologies for EUV* lithography, a promising next-generation technology, with consortia around the world. Also, Tokyo Electron has superior multiple patterning technology using etching combined with unique film deposition, achieving 11nm line patterns. Single digit nm lines are now in sight. In addition, Tokyo Electron is developing DSA** technology which makes circuit patterns by using chemical reactions, without exposure and development. Through these efforts, Tokyo Electron is pursuing a full range of technological development aimed at further miniaturization.

Technologies that solve the problem of power consumption will make use of new semiconductor materials to reduce operating voltage and to reduce standby power by introducing nonvolatile memory to replace DRAM and SRAM.

Research into germanium (Ge) and indium gallium arsenide (InGaAs) as new semiconductor materials with high carrier mobility is advancing. Integrating these different types of semiconductors on silicon substrates will mean a great upheaval, equivalent to restarting the development of silicon semiconductor device production processes. To face this change, Tokyo Electron is developing manufacturing technology based on bold ideas that transcend conventional wisdom.

MRAM is currently the only candidate

for nonvolatile memory to replace today's standard forms of working memory. The key to realizing highly integrated magnetic memory lies in magnetic materials and production technology to integrate them. In order to pursue development of manufacturing technology optimized for these materials, we are accelerating development via joint research with world leader Tohoku University.

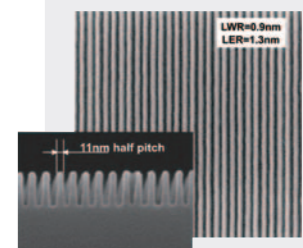
Tokyo Electron is also tackling environmental and energy-related problems in order to realize a more sustainable society. The Company is actively engaging in development of thin-film silicon photovoltaic panels to provide green energy and OLED panel production technology, which is expected to achieve commercial viability and promises high luminosity and low power consumption.

In these and other areas, Tokyo Electron continues to boldly advance innovative technological development of rapidly changing, cutting edge technology.

* EUV: extreme ultraviolet
** DSA: directed self-assembly



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11nm line pattern realized with multiple patterning technology



Tohoku University Center for Innovative Integrated Electronic Systems, Research and Development Building, completed April 2013

Tokyo Electron is taking part in the research and development program conducted by Tohoku University Center for Innovative Integrated Electronic Systems, with the aim of quickly establishing production equipment technology for MRAM (magnetoresistive random access memory), which is attracting attention as a next-generation memory device.