

## Research and Development

Today, technology is not only increasingly advanced but also changing rapidly. Consequently, R&D operations have to be more flexible to anticipate the market needs and more aggressive to meet the challenge of new unknown technologies as well.

In order to enhance both early starts and the streamlining of the R&D process, Tokyo Electron has introduced a new structure in R&D operations, consisting of three stages: product development (D), research (R), and the feasibility study (FS). Executives of each division can make a decision to implement FS projects speedily and a committee consisting of technology executives discusses whether each project can move on to the next stage as needed.

In the semiconductor production equipment sector, Tokyo Electron is accelerating development not only of equipment but also of processes by joining the Albany Nanotechnology Project, which is supported by the state government of New York. Moreover, the Company has formed collaborations with International SEMATECH and imec of Belgium, focusing on identifying potential demand at an early stage.

We are aiming to create new businesses through FS. The research area is not limited to Si (Silicon) integrated circuits, but is expanding to compound semiconductors such as SiC (Silicon Carbide) and also organic semiconductors for display. The research activity in this new area has already grown to be a major part of the corporate R&D division activities.

Nowadays, even cutting-edge technology easily diffuses across national borders, thereby making the competition become more intensive. Continuous R&D effort is of the essence to produce a “winning” product. Tokyo Electron is pursuing new technological advances incessantly and eyeing “the world of nanometer”.

### Pushing the Boundaries of SPE Technology

The limitation of scaling has been the hottest topic in the semiconductor industry for years. Although the semiconductor industry has faced technological crises several times in its history, innovative technology has always overcome such difficulties. Tokyo Electron is leading the way with cutting-edge technology for the continuous growth of the semiconductor and equipment industries.

In finer pattern delineation, Tokyo Electron has developed new double patterning technology enabling half pitch 13nm line & space. This is the finest pattern which has been fabricated using a commercial exposure tool.

In addition to this double patterning process, Tokyo Electron is also developing a novel clean track system for EUV lithography for the coming 10 nm generation.

A critical issue with scaling is “fluctuation” of transistor performance such as the threshold voltage and drain current. Excess energy in thermal and plasma processes can cause damage, leading to “transistor performance fluctuation”. To minimize the energy applied to a wafer is essential to suppress the fluctuation in the manufacturing process. Based on this understanding, Tokyo Electron has commercialized a novel dry etch system using RLSA plasma which enables damage-free etching with low energy and high electron density.

In addition to finer pattern delineation, new functional materials are indispensable to increase packing density. Tokyo Electron supplies High-k / metal gates for logic devices, novel dielectric film and electrodes for DRAM capacitor. Furthermore, CVD of phase change material and resistive material have also been developed by the R&D division for the emerging memory devices.

3D (three dimensional) is a novel approach to accomplish higher packing density as well as a higher chip performance. Not only 3D memory cell stack but also 3D chip stack technology has been attracting much attention for many years. In the 3D memory cell stack area, Tokyo Electron is preparing deep hole etching at high rates together with its metal filling technology. In the 3D chip stack area, the Company is also a top tool supplier, and has commercialized high rate TSV (Through Silicon Via) etch system and developing a low temperature insulator deposition system.

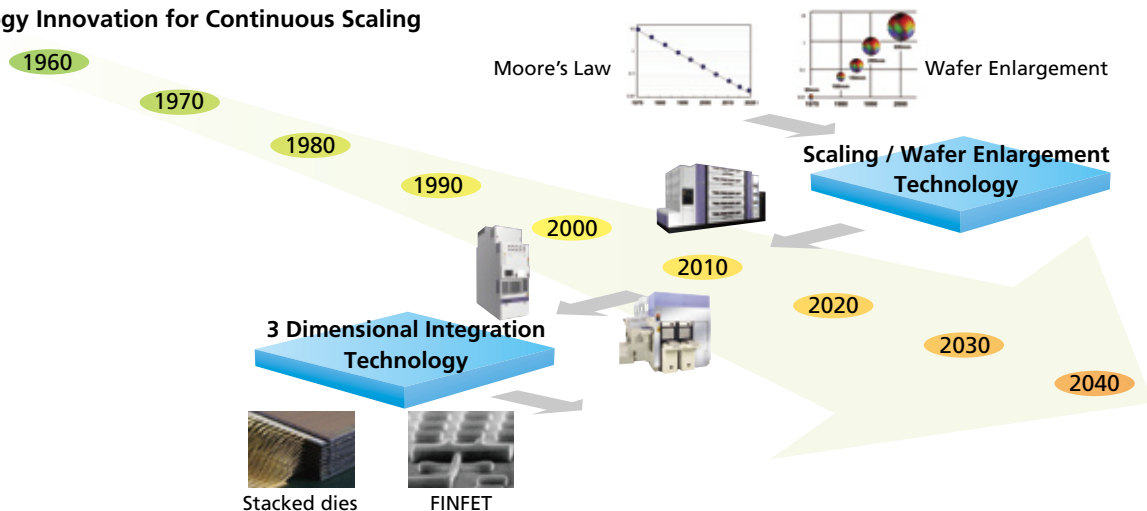
### Working on Environment and Energy-related Issues

Tokyo Electron is also working on global environment and energy related issues.

The first of the Company's initiatives is concerned with the photovoltaic (PV) cell. For the Si thin film PV cell, which has a high growth potential, we are developing equipment with high productivity for Si thin film by leveraging semiconductor and FPD production equipment technology. Moreover, we are conducting research and development activities on new PV cell equipment with high efficiency and low cost.

Our second contribution is energy saving through power electronics. The SiC device is expected to become a revolutionary technology, a once-in-decades innovation. A key technology in the

### Technology Innovation for Continuous Scaling



SiC power device is epitaxial growth on SiC substrates. We have developed an SiC epi tool that forms epitaxial layers with superior quality as well as high productivity. This equipment will be launched in 2010.

### Exploring New Fields

Tokyo Electron is meeting the challenge of moving into new fields by leveraging semiconductor and FPD manufacturing equipment technology. The Company has formed collaborations with universities and venture companies that possess complementary technology

to enhance new technology development. These collaborations are not limited to domestic universities but are spreading to universities and research institutes in foreign countries.

Furthermore, Tokyo Electron takes part in research programs organized by overseas consortia to identify new and promising technology for the future of semiconductors.

In 2006, the Company established TEL Venture Capital, Inc., headquartered in Silicon Valley, for investigating new technology. TEL Venture Capital has already made investments in several venture companies that possess promising technology.

## Intellectual Property

Tokyo Electron understands that it is vital to protect the intellectual property rights of independently developed proprietary technologies and products to ensure the smooth growth of businesses. The integration of our intellectual property strategy with our technological and product strategies is thus important to realizing the maximum benefits expected.

The needs of device manufacturers, our customers, have been diversifying, and they are also increasingly emphasizing reliable process performance and higher productivity from production equipment. Consequently, the role of equipment manufacturers such as Tokyo Electron in developing semiconductor/FPD/ photovoltaic cell manufacturing technology is increasing. Within this context, Tokyo Electron strives to bolster the protection of its intellectual property by actively filing patent applications for equipment recipes, software technologies, process management technologies for various types of manufacturing equipment, and other technologies.

### Contribution of License-related Activities

In building and implementing our intellectual property rights strategy, we do not view intellectual property rights obtained for proprietary products and developed technologies as a source of income from licensing to other companies. Rather, we view this as a method of differentiating our own products and bolstering our competitive advantages.

Technologies in Tokyo Electron's business fields are becoming increasingly advanced and complicated. To effectively develop new products incorporating leading-edge technologies, and bring them to market as quickly as possible, it is essential to utilize all available intellectual properties. From this viewpoint, Tokyo Electron not only respects the intellectual property rights of others, just as we do our own, but also makes effective use of them through obtaining licenses.

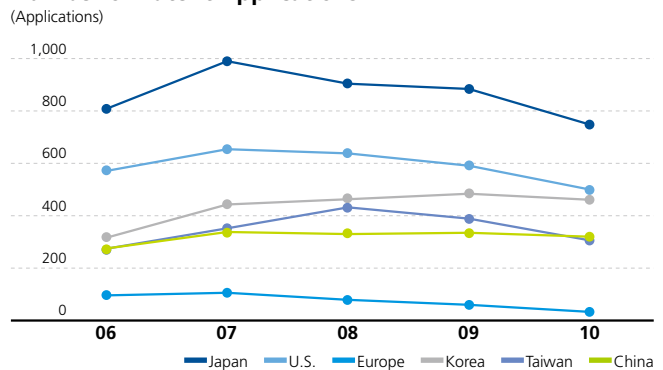
### Status of Intellectual Property Application

The graph in this section shows the number of patent applications filed by Tokyo Electron as of March 31, 2010. In addition to filing applications for core technologies vital to our strategies in each business division, we vigorously promote the development of a patent portfolio that encompasses the technologies that support our core technologies. Tokyo Electron's patent portfolio has been highly acclaimed, including as shown by being ranked No. 1 in semiconductor production equipment operations in the Patent Power Scorecards published in IEEE Spectrum in January 2010.

We are also optimizing our number of patent filings in step with market and competitor trends in our business fields. In particular, our number of patent applications filed in Korea and China continues to rise. These filings reflect Korea and China's growing importance in our recent business strategies, as well as our patent strategies in response to the rapid increase in filings from Korean semiconductor and FPD production equipment manufacturers. Most notably in Korea, Tokyo Electron is ranked 4th among foreign companies in the number of patent applications filed (447 applications in the year 2009), according to results announced by the Korean Intellectual Property Office.

As of March 31, 2010, Tokyo Electron held 3,396 patents in Japan and 8,298 patents overseas. As part of proper asset management, we periodically assess Tokyo Electron's patent portfolio, ensuring we have an optimum inventory in line with the status of sales in each business and country, and with the filing trends of competitors.

### Number of Patent Applications



### Ranking of U.S. Patents in 2009

Semiconductor Production Equipment Manufacturing

Rank	Company, Country	Adjusted Pipeline Power
1	Tokyo Electron Ltd., Japan	792
2	KLA-Tencor Corporation, U.S.	536
3	Disco Corporation, Japan	322
4	FormFactor Inc., U.S.	312
5	Applied Materials Inc., U.S.	266

Source: IEEE Spectrum/January, 2010