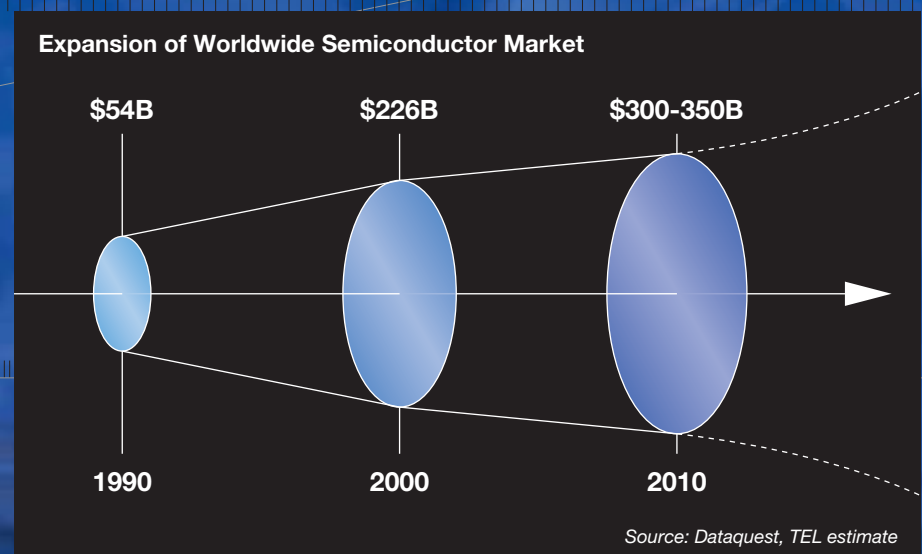


The Rapidly Expanding Scale and Scope of Semiconductor Applications

The world of the “invisible” future will consume a huge volume of semiconductor chips. Semiconductors will be embedded in everything, and large addressing space for memory and massively parallel processing with a numerous array of processors will realize intelligent functions. Demand for application-specific system on a chip (SOC) is already rapidly increasing for a broad range of market segments. We are headed into the “Semiconductor Big Bang” in both scale and scope of applications.



Nano-scale, High-speed, and Energy-saving Requirements

Miniaturization of integrated circuits is progressing toward the nano-scale. In the future, they will be invisibly embedded in everything, finally realizing ubiquitous computing. This growing demand for intelligent processing for high-speed execution of complicated, large-scale algorithms accelerates chip shrinkage and high-speed capability. But shrinkage and high-speed requirements create heat dissipation problems. In addition to these problems, lower energy consumption is required, especially for semiconductor chips that are used for mobile gears to achieve long hours of battery-powered outdoor usage. To solve these problems, we are challenged to introduce new technologies.

Every Product Demonstrates Key Process Innovations

Terminology

1. Lithography

This technique is used to transfer the circuit pattern from a photomask to the wafer's surface. A stepper-scanner is used to expose the pattern onto a photoresist-coated wafer. The exposed wafer is then developed to reveal the pattern.

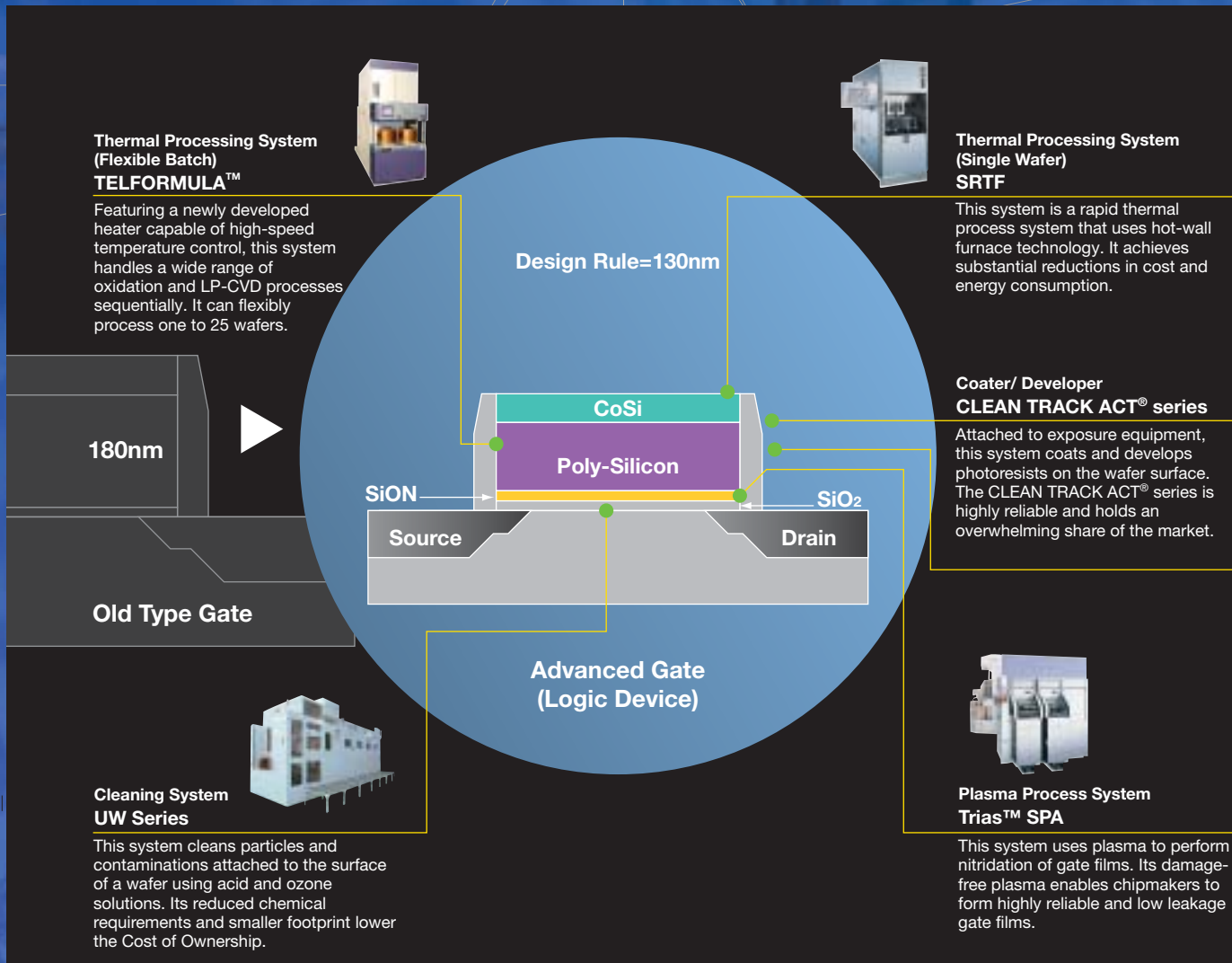
2. Low-k dielectric film

As design rules become finer and the space between interconnects becomes narrower, the speed of electrons traveling through interconnects is more easily affected by the amount of parasitic capacitance in the intermetal dielectric film, causing them to slow down. To solve this problem, it is effective to use low-k film.

Major changes are taking place in processes and materials for semiconductor manufacturing. To meet the technological challenges of greater scales of integration, higher speeds and lower energy consumption, the industry needs state-of-the-art technologies, such as lithography for finer geometries, low-resistance interconnect, low-k intermetal dielectric films, and ultra-thin gate dielectric films. TEL is committed to the development of these cutting-edge technologies, and providing its customers with "best-of-breed solutions" based on its proprietary technology and a world-class lineup of products.

Dielectric Film and Gate Electrode Formation

The transistors used in large scale integrations (LSIs) comprise an electrode and dielectric film stacked on silicon, and a source and drain into which impurities are doped. In a high-speed logic chip, the main problem that arises is the delay in the electric signal, particularly in the gate section. To try and minimize or eliminate this problem, development efforts are focusing on further miniaturization of the transistor itself, the use of low-resistance gate electrodes, formation of ultra-thin gate dielectric film, and discovery of materials and processes to support even thinner film formation.



3. Making thinner gate dielectric film

Based on the scaling law, if the gate length and width and its dielectric film thickness are made smaller and thinner, the electric current, voltage, signal delay time, and other performance specifications of a transistor will improve.

Copper Interconnect and Intermetal Dielectric Film Formation

The most advanced chips exhibit a high degree of integration, with tens of millions of transistors on a single chip. Interconnect is highly miniaturized and the space between interconnects is minimal. Consequently, the signal delay in the electric circuitry cannot be neglected. To combat this problem, the aluminum interconnect and SiO₂ dielectric film are being replaced with copper interconnect and low-k dielectric materials in the latest processes. With logic chips in particular, multilayer circuitry is an essential technology, and the industry is actively developing technologies for interconnect integration.

CU ECMD

NuTool™ 2000 (Product of NuTool Inc., U.S.A.)

A copper electroplating system that utilizes special proprietary technology to greatly reduce the amount of polishing required after copper film deposition.



SOD Coater

CLEAN TRACK ACT® series

This system deposits low-k intermetal dielectric films using the spin-on coating method. The system is expected to make great inroads into the intermetal dielectric film market, beginning with the 100nm generation.



Plasma Etch System

Telius™

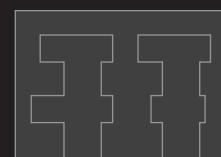
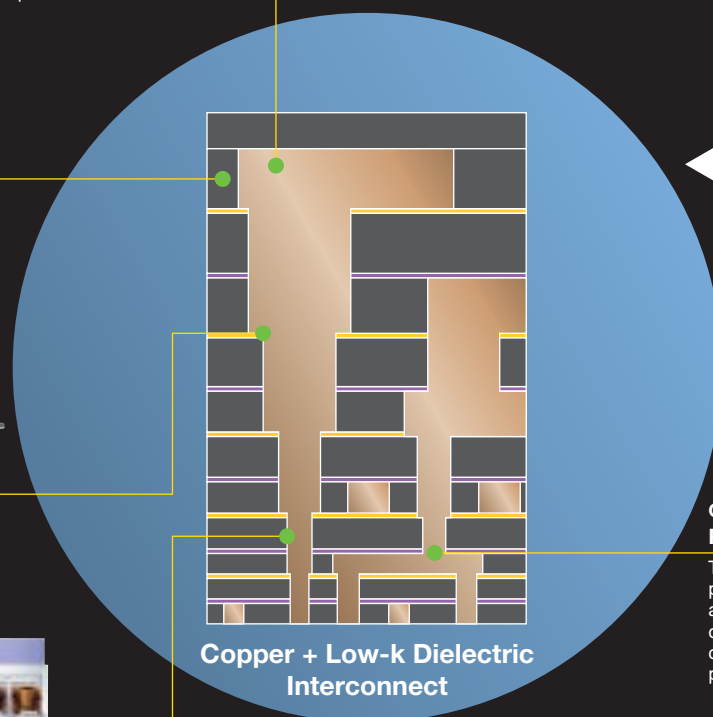
A plasma etch system for dielectric films that demonstrates superior capabilities for high-end applications, such as deep trench and self align contact etching.



Single Wafer CVD System

Trias™

Using heat and plasma, this system forms metal films or barrier films. This system claims the highest share of the market for DRAM applications.



Aluminum + SiO₂ Interconnect



Cleaning System

PR Series

The system removes post-etching polymers using chemical reactions and spray technology. The unique double slide chamber achieves high cleaning performance and shortened process times.

Providing Further Value as a Leading Supplier

As personal digital electronics and an array of new products become popular in markets, semiconductor demand will progressively shift to products with short life cycles. Because diversification of IC applications is proceeding simultaneously, chipmakers are anticipated to increasingly specialize in design and increase their reliance on equipment suppliers for semiconductor manufacturing processes. Foundries are also expected to expand their commissioning of equipment suppliers for advanced processes for the designs created by fabless makers.

As Chipmakers Orient “What to Make,” Tool Suppliers Must Come Up with “How to Make It.”

During the dawning of the age of semiconductors, the equipment suppliers’ only role was providing hardware. However, opportunities have increased for equipment suppliers to contribute a new type of value-added content, in the form of expertise. Equipment suppliers can offer the total process recipe, and supply integrated solutions for multiple adjoining processes, or supply the systems that can self-optimize the processes with fewer manual operations. Leveraging its expansive product lineup and world-class R&D capabilities, TEL is concentrating on providing further added value to its customers.

Broadening Spectrum of the Role of Semiconductor Equipment Suppliers

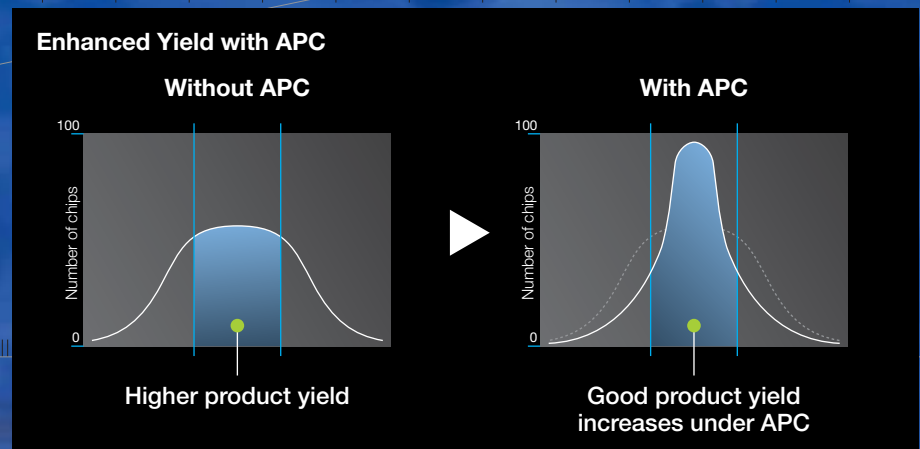
FAB Management				
Manufacturing Technology				○
Process Control				●
Process Integration			●	●
Process Recipe		●	●	●
Production Tool Manufacturing	●	●	●	●
	1970s	1980s	1990s	2000s

Advanced Process Control

Advanced process control (APC) is the automation of process control functions performed in individual systems or between systems to keep process stability and higher yield stability. So far, this function has been mainly achieved through the intervention of people in production lines by monitoring the quality of the product or checking whether mistakes have occurred.

Why Yield Management is Important

Semiconductor manufacturing utilizes state-of-the-art technologies in the fields of physics and chemistry. However, due to its technological complexities, there is no guarantee that every chip will be perfect. Since the proportion of good to bad product is a question of survival for chipmakers, increasing yield is one of the most important issues for them from cost and speed-of-launch perspectives. Because APC contributes in lowering chipmakers' production costs, it will be one of the chief factors in differentiating semiconductor production equipment in the near future.



TEL's Integrated Metrology Software — a Solution for APC

In February 2001, TEL purchased Timbre Technologies Inc., of the United States, acquiring its Optical Digital Profilometry™ metrology software. Compared with conventional SEM, ODP™ greatly reduces the time to measure critical dimensions, cross sectional profile and film thickness. In our R&D efforts, we have vigorous programs under way to develop APC technologies at the equipment level, incorporating this technology into our greatest area of strength, lithography processes (Etch and Clean Track) for process monitoring.

