

News Release

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Hitachi High-Technologies to Launch Advanced High Voltage CD-SEM “CV6300 Series”

—Deep holes and trench bottom measurements for 96 layers and beyond 3D-NAND flash memory manufacturing. Precise overlay measurements of device patterns. —

Tokyo, Japan, July 2, 2019, Hitachi High-Technologies Corporation (TSE:8036, Hitachi High-Tech) announced today that it will launch sales for the Advanced High Voltage CD-SEM “CV6300 Series”. CV6300 is the successor of the CV5000 Series, and enables measurements of high aspect ratio*1 deep holes and trench bottom dimensions to control the manufacturing of 96 layers or higher 3D-NAND flash memory*2, as well as high-speed and high-precision overlay*3 measurements. The CV6300 Series will contribute to productivity improvements in semiconductor device manufacturing.



Advanced High Voltage CD-SEM “CV6300 Series” (Image)

In addition to the miniaturization that has been improving the performance of semiconductor devices, there has been accelerated progress to make the device structures three-dimensional. For 3D-NAND state-of-the-art flash memory device, memory capacity is being expanded by stacking multiple memory cells vertically, and multi-layering technology is advanced from the current 64 layers structure to 96 layers or 128 layers. To control the size and shape of memory cells in the manufacturing process, it is necessary to precisely measure the bottom dimensions of memory holes and slits (trenches), which have become deeper due to the increased multi-layering. For the manufacturing of DRAM*4 and logic devices, there are requests for more accurate alignment between upper and lower device patterns alongside the advances in miniaturization. For this reason, high-precision fast overlay measurements at many points across the device are becoming a necessity.

The newly-developed CV6300 Series is the world's first*5 advanced in-line measurement system that realized a 45kV acceleration voltage. The maximum acceleration voltage of the irradiating electron beam (primary electron beam) has been increased from 30kV in the previous CV5000 Series to 45kV, with a significant increase of the signal amount of the reflected electrons (BSE*6) generated by the interaction of the primary electron beam and the test sample. This allows to achieve a high-resolution high-quality imaging, and enables highly accurate measurements of deep holes and trench bottom dimensions. In addition, by improving the precision of adjustments and stability of the primary electron beam, Hitachi High-Tech has achieved precision improvement in dimensions and overlay measurements, as well as a reduction of measurement variation among systems. Furthermore, due to the adoption of new wafer stage and optimization of dimension measurement sequencing*7, measurement throughput has been improved by about 25% compared to the previous model.

Hitachi High-Tech will strive to meet customers needs in dimensions measurements and defect inspection for the development and mass production of semiconductor devices by supplying electron beam based products such as traditional CD-SEM, High voltage CV6300 Series, and wafer inspection systems based on optical technologies. Hitachi High-Tech will continue to provide innovative solutions for upcoming technology challenges. In parallel, Hitachi High-Tech will contribute to cutting-edge technologies by pursuing and creating new value in collaboration with its customers.

- *1 High-aspect ratio: Indicates high values for the ratio of depth and width for the pattern formed on the wafer. The higher the value, the more difficult it is to process and measure.
- *2 3D-NAND flash memory: One type of non-volatile memory.
- *3 Overlay: The alignment of circuit patterns for many layers formed on the wafer.
- *4 DRAM (Dynamic Random Access Memory): A kind of volatile memory.
- *5 According to company research.
- *6 BSE (Backscattered electron): Reflected electron or backscattered electron.
- *7 Measurement sequencing: A series of operations such as setting the conditions, processing steps, etc. for dimensional measurement.

【Main Specifications】

Wafer size	Φ300 mm (SEMI standard V notched wafer)
Acceleration voltage of electron beam	15 kV~45 kV (in 5 kV increment)
Image capturing function	Simultaneous image capturing by three detectors Image composition function
Measurement function	CD measurements, Overlay measurements
Auto-loader	Three FOUPs*8- random access compatibly

*8 FOUP (Front-Opening Unified Pod): A standard front-opening cassette integrated transport and storage container used in semiconductor plants

【Main Features】

■ High-precision, high-speed overlay and dimensions measurements for deep holes and trenches

Enhancing measurement capabilities described below compared to the CV5000 Series by utilizing newly developed electron guns and corresponding electron optics to achieve maximum acceleration voltage of 45kV, improvements of detection systems for SE*9 and BSE generated from deep holes and trenches by angle and energy, and enhancement of system noise resistance.

- (1) High-precision and high-throughput overlay measurements in circuit pattern areas by using electron beam.
- (2) Expanded applications for overlay measurements through selection of a suitable voltage from wide range of acceleration voltage conditions.
- (3) Bottom dimensions measurements and incline measurements of deep holes and trenches in 3D-NAND flash memory with 96-layers or more.

■ Stable operation and low CoO*10

Realized stable operation and low CoO by adopting Hitachi High-Tech's proven platform for vacuum control and wafer transfer system.

*9 SE (Secondary Electron): Electron generated from inelastic scattering in a test material upon being irradiated by an electron beam.

*10 CoO (Cost of Ownership): The total cost necessary for installation, operation and management of facilities, equipment, and other hardware.

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