

## Hitachi High-Tech and ZEISS accelerate joint development framework for next-generation multi-beam inspection tools

Accelerating development of digitalized assets that help semiconductor device manufacturers improve yield in mass production and deploying them under HMAX Industry for Semiconductors

**Tokyo, September 30, 2026** – Hitachi High-Tech Corporation ("Hitachi High-Tech"), will enhance the development framework for next-generation multi-beam inspection tools in semiconductor manufacturing that is jointly developed with ZEISS Semiconductor Manufacturing Technology (SMT) (Germany, "ZEISS SMT"). This will accelerate the development of products that enable high-throughput inspections of small defects, which are expected to increase due to further semiconductor device scaling and the adoption of High-NA-EUV lithography\*<sup>1</sup>, at inspection speeds several dozen times faster than conventional inspection methods.

\*<sup>1</sup> High-NA-EUV lithography: Next-generation exposure technology for manufacturing advanced logic semiconductors of 2 nm or less

In the semiconductor manufacturing process, in order to manufacture high-quality devices, inspections for defects on wafers are conducted after circuit patterning steps using defect inspection tools, using e-beam tools with high sensitivity and optical inspection tools with superior high speeds. Hitachi High-Tech offers both e-beam and optical inspection tools and has been supporting numerous semiconductor device manufacturers for many years by providing in-line metrology and inspection tool for 300 mm wafers. By integrating these equipment platforms with the 91-beam multi-column technology\*<sup>2</sup> of ZEISS SMT, Hitachi High-Tech and ZEISS SMT have been working on the development of new in-line multi-beam inspection tools that can achieve both high sensitivity and high speed.

\*<sup>2</sup> MultiSEM by ZEISS SMT ([ZEISS SMT – MultiSEM Multi-Beam Electron Microscope](#))

High inspection performance in terms of speed and sensitivity will continue to be required for the mass production of advanced logic and memory devices in the future. In order to develop inspection tools that meet the requirements of next generation semiconductor devices manufacturing and to contribute to yield improvement in the mass production of many customers, it is essential to execute wide range of development quickly.

By further utilizing the resources of both companies through this development framework enhancement, high-throughput e-beam defect inspection tools with AI-assisted inspection algorithms can be developed rapidly, thereby contributing to innovation in the mass production of advanced semiconductors. Hitachi High-Tech will accelerate the development of high value-added digitalized assets that contribute to yield improvement, thereby supporting the delivery of HMAX Industry, which leverages Physical AI, and helping customers solve challenges and shorten time to market.

## Background

Although conventional optical defect inspection tools have a proven track record for inspection speeds in wafer inspection after each patterning process, as advanced semiconductor device manufacturers begin high volume manufacturing (HVM) of 2-nm node devices and adoption of High-NA-EUV lithography, it is difficult to stably inspect small defects around 10 nm. This bottleneck is expected to be one of the key challenges in ensuring high manufacturing yields and stable product quality for semiconductor devices.

Furthermore, single-beam defect inspection tools have been used in-line as an inspection method for limited application such as hotspots\*<sup>3</sup> inspection, but due to the increasing complexity of device structures and the increase in stochastic defects\*<sup>4</sup>, the numbers of inspection area and inspection layers have increased, making it difficult to secure the inspection speeds required for mass production lines.

\*3 Hotspot inspection: A method that focuses on patterns and layout areas that are prone to defects, which can easily affect yield and device operation

\*4 Stochastic defects: Defects caused by statistical variation of exposure/chemical reaction occurring in the advanced node and EUV lithography processes

Under these circumstances, multi-beam inspection tools are recognized as the only solution that can achieve both the inspection sensitivity and speed required by advanced semiconductor processes. Moreover, advanced semiconductor device manufacturers expect early adoption of multi-beam inspection tool, as the tools can also be applied for buried defect inspections and voltage contrast inspections\*<sup>5</sup>, which are quite difficult for optical inspection tools.

\*5 Voltage contrast (VC) inspection: An inspection method that detects open and short defects in the semiconductor device circuits based on electrical potential differences

## Collaboration with ZEISS

Hitachi High-Tech is promoting the development of multi-beam inspection tools in collaboration with ZEISS SMT, an industry leader in multi-beam column technology. Hitachi High-Tech has provided CD-SEMs with the top market share worldwide, and cultivated stable tool operation, high-precision stages, and AI-based image processing technologies over many years. Together with ZEISS' high-resolution and high-sensitivity multi-beam column technology, the two companies are able to develop e-beam defect inspection tools with excellent performance through synergistic effects. Currently, on-site evaluations using prototype tools have demonstrated the feasibility to inspect small defects that are difficult to detect with existing optical defect inspection tools at speeds several dozen times faster than single-beam inspection tool.

By strengthening the joint development framework, we will accelerate the multi-beam inspection tool development that can also meet the demands from semiconductor device manufacturers for increasingly sophisticated inspections. We will also leverage our customer network, which has the largest share of the global metrology tool market, and improve our presence through on-site evaluations of prototype tools through customer co-creation activities in a wide range of inspection domains. In doing so, we will proactively conduct inspections and demonstrations using mass production wafers targeted toward the acquisition of PORs (Process of Record), and will develop highly competitive products by accelerating development of new functionality our customers need.

## About Hitachi, Ltd.'s Connective Industries Sector

At Hitachi High-Tech, which belongs to the Industrial Solutions Business Unit of Hitachi, Ltd.'s Connective Industries (CI) Sector, we provide industrial solutions that maximize lifetime value for customers and transform industries globally, contributing to a prosperous society. We achieve this through the combination of strong products and HMAX Industry, a next-generation suite of solutions that combine data from an extensive installed base of digitalized assets with domain knowledge and advanced AI.

## Conference-related information

- [Surface pre-charging for mitigating imaging issues in multibeam SEM-based semiconductor device defect inspection \(SPIE 2025\)](#)
- [Self-supervised brightness and contrast correction for multibeam SEM defect inspection \(SPIE 2026\)](#)
- [Multibeam inspection tool development for detecting below 10 nm physical defects \(FCMN 2026\)](#)

## About ZEISS

<https://www.zeiss.com/corporate/en/home.html>

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## About Hitachi High-Tech

Hitachi High-Tech provides cutting-edge technologies, products and services to society and customers with its corporate vision of "Changing the World and Future with the Power of Knowledge" to contribute to a sustainable global environment, healthy, safe and secure lives, and the sustained development of science and industry. We manufacture and sell clinical analyzers, biotechnology products and radiation therapy systems in the healthcare field, semiconductor manufacturing and inspection equipment in the semiconductor field, as well as analytical systems and electron microscopes used in environmental fields and materials research. We are also engaged in a wide range of business areas globally, providing high added-value solutions in battery, communication infrastructure, railway inspection, digital and other industrial and social infrastructure fields. We provide solutions through a deeper understanding of the issues facing society and our customers to contribute to realizing a sustainable society. The company's consolidated revenues for FY2025 were approx. JPY 821.7 billion. For further information, visit <https://www.hitachi-hightech.com/global/en/>

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