

Thermo Fisher: 40 years of semiconductor analysis innovation

History

With more than four decades innovating physical and electrical analysis solutions for the electronics industry, Thermo Fisher Scientific is one of the world's premier providers of ultra-high-resolution tools for imaging and analysis at the nanoscale.

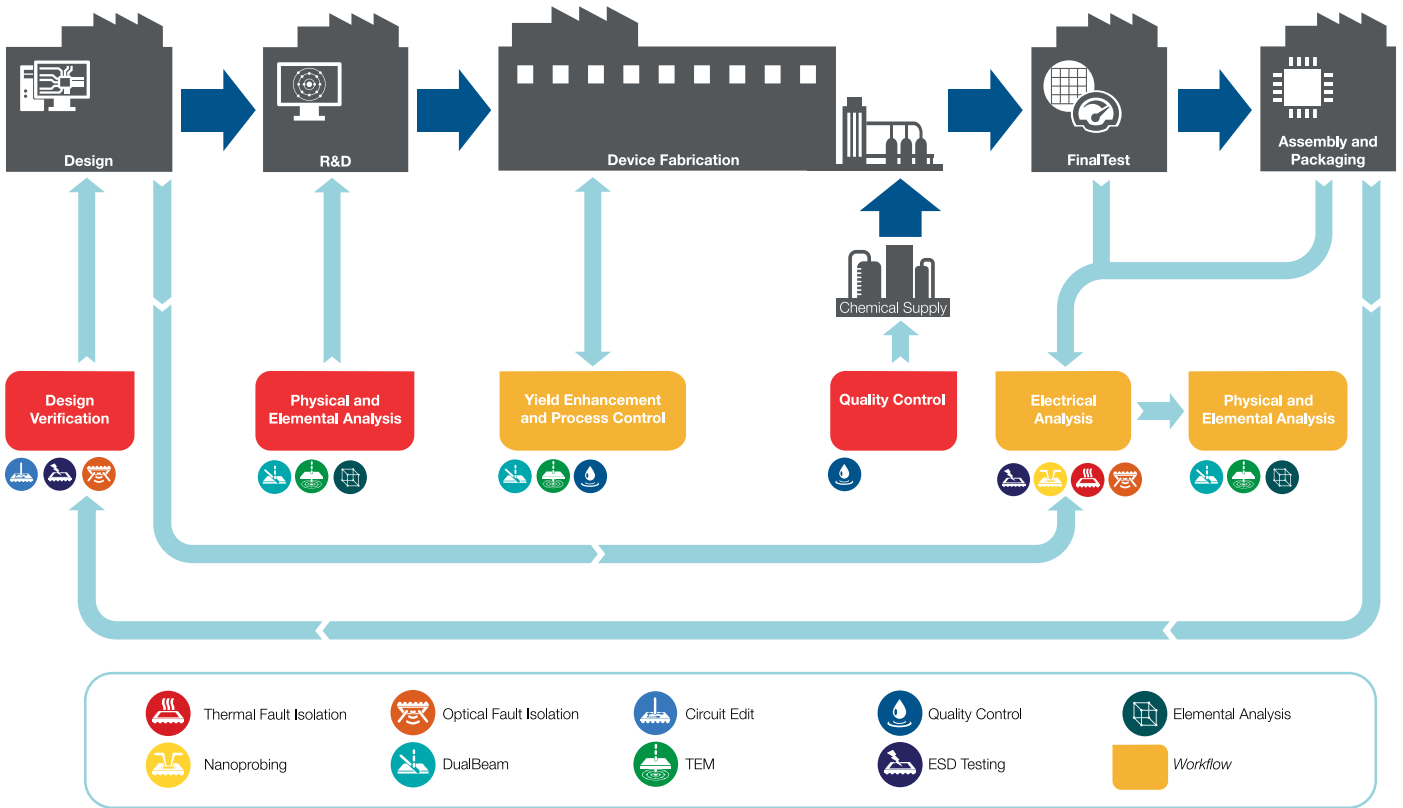
In 2016, Thermo Fisher acquired FEI company, a leading electron microscopy organization in the semiconductor market, where FEI's nanocharacterization and nanoprototyping tools support the developments of small, complex devices. Through the acquisition, Thermo Fisher also acquired FEI's DualBeam systems and the world's most powerful, commercially available transmission electron microscope (TEM) – both pioneering technologies developed by FEI.

Today, a more connected, more autonomous, and smarter world is translating into a huge demand for semiconductors in everything from cars to cellphones to refrigerators. The confluence of artificial intelligence, cloud, connectivity and intelligent edge are driving continued innovation in semiconductor to meet consumer's needs. However, shrinking geometries, new materials, and novel 3D architectures make these continual improvements increasingly more challenging. Thermo Fisher provides the broadest portfolio of semiconductor metrology, characterization and fault analysis instruments to accelerate pathfinding and development, maximize yields, and ensure the production of high-quality devices that meet current and future industry demands.

What we do

Thermo Fisher's next-generation products focus on advanced analytical capabilities for failure analysis, yield learning, and process control. These solutions increase productivity in semiconductor fabs and by providing insight and data to improve product quality and yield in the manufacturing of 3D NAND, logic, DRAM, analog and display devices.

Yield is affected at every stage in the process—from design to final assembly and packaging. Thermo Fisher's electron microscopes and analytical instrumentation help control process steps and analyze the wafer environment throughout semi-conductor manufacturing to ensure the highest yield possible:



Who we work with

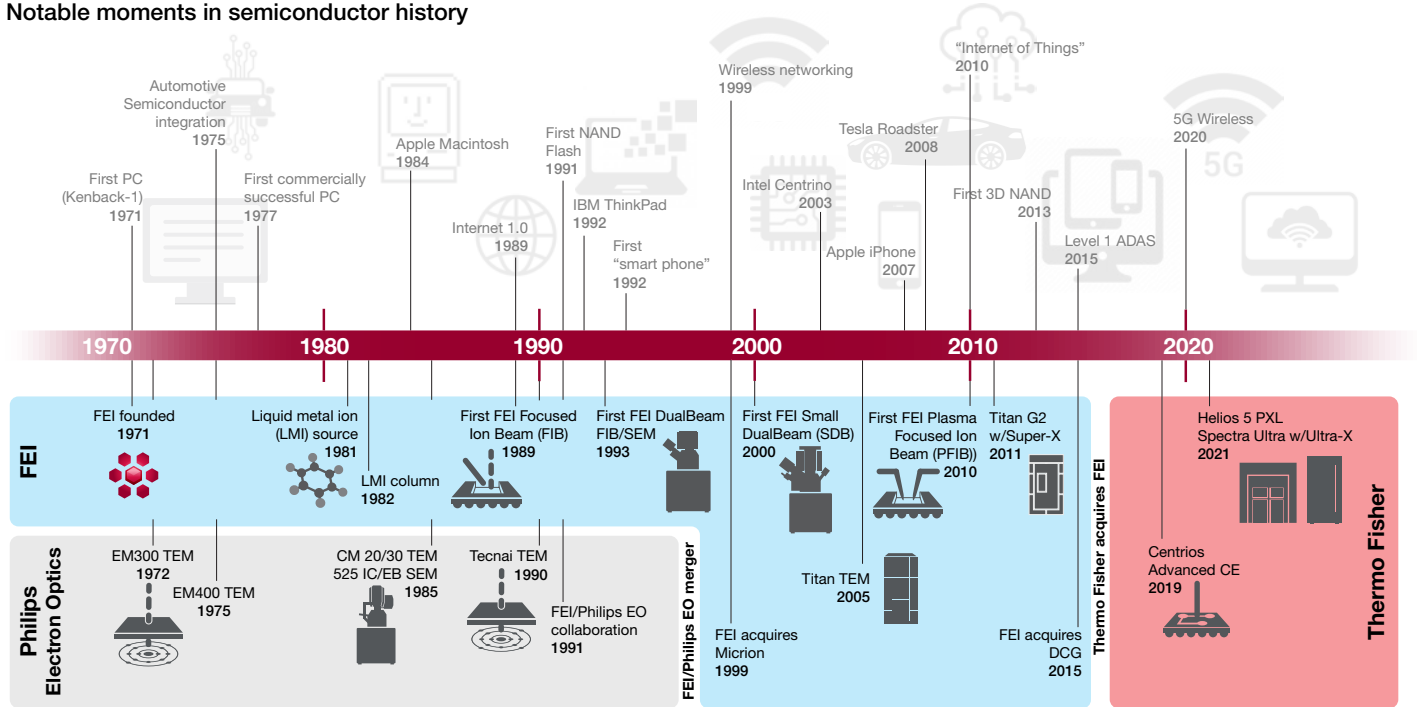
- All of the top semiconductor manufacturers worldwide use Thermo Fisher instruments, and our tools are used in numerous research, service lab and industrial applications worldwide.
- Preferred supplier of EFA, PFA and metrology solutions with leading memory and logic integrated device manufacturers and foundries.



Thermo Fisher supplies semiconductor capital equipment globally, with years of committed investments in local expertise and technology advancements.

Over 40 years of semiconductor heritage

Notable moments in semiconductor history



Milestones by decade

• 1980s: Developing FIB and SEM technologies

- First Liquid Metal Ion (LMI) beam column invented and added to a scanning electron microscopy (SEM) system
- The LMI beam column was a breakthrough as it provided a way to make a small-focused ion beam. With this, semiconductor manufacturers could image and machine at a sub-micron scale which facilitated mask repair and circuit editing to support rapid prototyping

• 1990s: Commercializing its instruments

- First DualBeam SEM developed
- The DualBeam combined a FIB and a SEM (scanning electron microscope) in one instrument. This provided semiconductor manufacturers with the ability to slice (mill) and view (image) semiconductor sample. Prior to this, manufacturers used two instruments, one with FIB capabilities which increased time-to-data.

• 2000s: Expanding SEM applications

- Driven by the continued innovation and adoption of desktop computing, Thermo Fisher introduced the first Small DualBeam.

- Where previous instruments were designed to handle semiconductor wafers, the SDB, was more affordable, which lent itself to adoption in universities, research labs and fabless semiconductor companies.


• 2010s: Incorporating data automation capabilities

- Introduced the Plasma FIB (PFIB), which enables higher throughput milling for large volume characterization
- The PFIB provided faster milling, which increased semiconductor manufacturers ability to process larger sample volumes. With each process node, the number of samples requiring analysis has and continues to increase.
- Produced dedicated workflow solutions that enable high performance yield characterization for the data storage and semiconductor markets

• 2020s: Evolving to create application-level instruments

- Going forward, demand for semiconductors is expected to grow exponentially as new applications incorporate semiconductors to deliver new capabilities. Robotics, smart cities, Industry 4.0, autonomous and electric vehicles are just some of the applications that continue to drive customer demands for semiconductors with higher performance, energy efficiency and increase reliability.

Solutions for Semiconductor for Metrology, Characterization and Analysis

Localization				Preparation			Analysis		
<p>Thermal Fault Isolation Non-destructive electrical fault localization on chips, packages or boards</p>	<p>Optical Fault Isolation Electrical fault localization and circuit timing analysis</p>	<p>Nano probing Precise localization of electrical faults in transistors or interconnects</p>	<p>Circuit Analysis Rapid prototyping of design modifications</p>	<p>Plasma FIB Large area sample preparation & analysis</p>	<p>Lab Dual Beam FIB/SEM Advanced cross section and TEM sample preparation workflows</p>	<p>Wafer Dual Beam FIB/SEM Semi-automated defect analysis & metrology tool</p>	<p>ESD Verifies that products can withstand electrostatic discharge events</p>	<p>FIB/SEM Automated tool for surface and cross section analysis</p>	<p>S/TEM Atomic resolution analysis</p>
									

To deliver products that meet these performance demands, failure analysis, metrology and characterization will take on a greater role in supporting product development, yield learnings and quality control. Shrinking dimensions, complex 3D structures and new materials continue to introduce new challenges for semiconductor manufacturers. To support the evolving needs of the semiconductor industry, Thermo Fisher Scientific's commitment to our customers include:

- Ongoing investment in innovative, industry leading solutions to meet evolving metrology and failure analysis needs. This includes product development, application support and service support infrastructure to assist customers in accelerating their own innovation and productivity.

- Comprehensive electrical fault analysis, physical fault analysis and localization workflows, and industry leading software for wafer, bare die or fully packaged chips to root cause complex device defects.
- Investments in local resources to support customer's design verification, electrical, physical and elemental analysis, yield enhancement, process improvement and quality control analysis needs.

Learn more at thermofisher.com/em-semiconductors