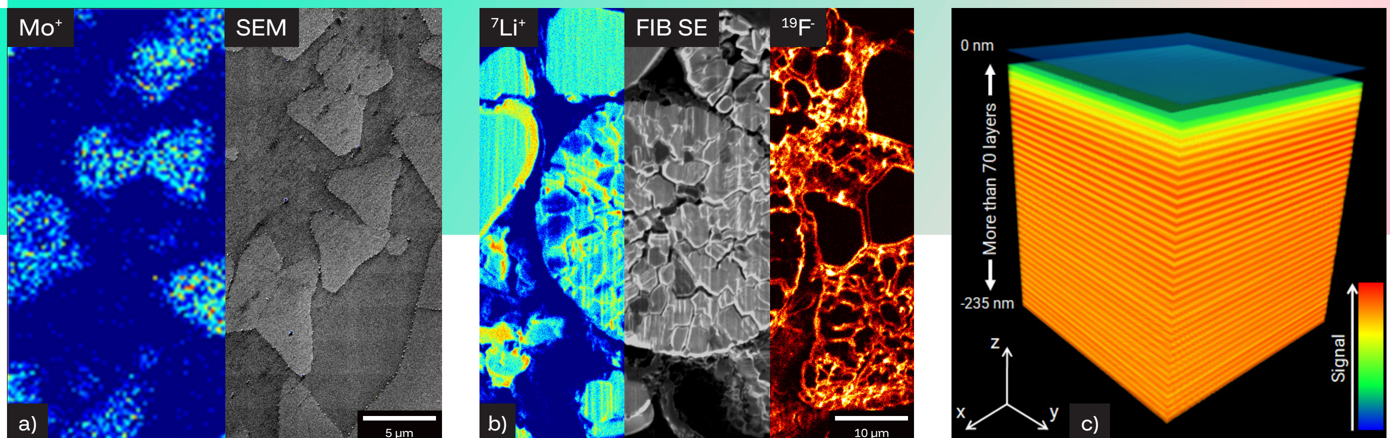
Tescan FIB-SEM integrated ToF-SIMS for Materials Science

Expand your analytical capabilities to include characterizing the lightest chemical elements and the chemistry of samples at the nanoscale.

Tescan's solution for secondary ion mass spectrometry (SIMS) integrates an orthogonal Time-of-Flight SIMS (ToF-SIMS) analyzer on a standard FIB-SEM system. The ToF-SIMS technique, which uses FIB to generate ionized particles, enables high-spatial and high-depth resolution 3D chemical characterization of solid materials. In contrast to the commonly used Energy Dispersive X-Ray Spectroscopy (EDS), ToF-SIMS is very sensitive to lithium, making it an especially valuable technique for lithium-ion battery research within energy storage technologies development. ToF-SIMS as the nanoanalytical method is also very important in the fields of novel (nano)materials development, nuclear research, geology, semiconductors, and for the study of contaminants or impurities from the material production process.



ToF-SIMS chemical mapping of MoS_2 monolayer flakes **(a)**, distribution of Li, F in NMC lithium-ion battery cross section **(b)**, 3D visualization of Ga distribution in multilayer system (superlattice) with layer thicknesses of 3 nm **(c)**

Key benefits

Expand your micro and nanoanalytical capabilities for a comprehensive study of all elements—even hydrogen—present in metals, polymers, and natural materials using surface-sensitive ToF-SIMS integrated with FIB-SEM.

Visualize nanoscale distribution of Li, C, and F in lithium-based battery anode, cathode, and separator components and interfaces, even at the lowest concentration (from ppm range) with the excellent light element sensitivity of ToF-SIMS combined with the superior resolution of FIB.

Study the chemical state of materials at the molecular level with the ability to distinguish not only elements but also molecules, molecule fragments, and clusters.

Characterize the chemistry of nuclear energy research materials using simultaneous detection of elements and isotopes for isotope ratio evaluation.

Analyze the chemical composition of nanostructures including nanoparticles, nanowires, precipitates in metals, grain boundaries, etc. using the outstanding high-spatial resolution of the Orage™ Ga FIB column.

Evaluate the overall quality of micro- and nano-multilayer systems (superlattices, optical materials, photo/electronic devices) and identify inner defects within thin film coatings by combining depth profiling with 3D elemental visualization.

Navigate safely and precisely to locate features of interest at the nanoscale using non-destructive, high-resolution SEM imaging with its wide range of detection capabilities and intuitive Wide Field navigation.

Perform sub-surface elemental, molecular, and isotopic materials characterization by applying ToF-SIMS analysis to a FIB-prepared cross section or lamella surface, without breaking the chamber vacuum.

Carry out comprehensive nano and micro-characterization for all materials classes and correlate the data by combining ToF-SIMS with other analytical capabilities (SEM, EDS, Raman spectroscopy, etc.) within the same FIB-SEM system.

Obtain optimum ToF-SIMS results even from charging and non-conductive samples (glass-based, polymers, minerals, etc.) using electron beam scanning or an optional flood gun for localized charge compensation.

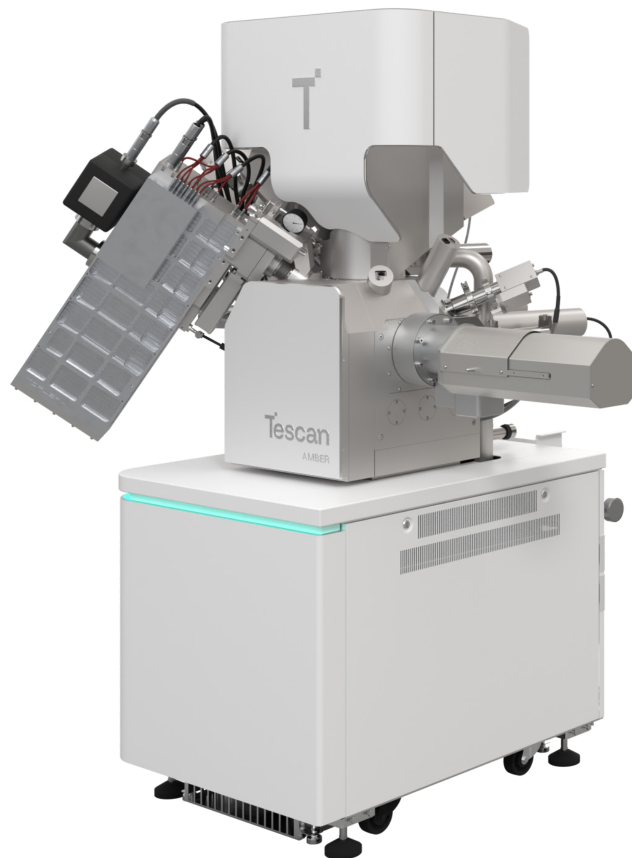
Enhance the ToF-SIMS signal significantly through utilization of selected gas chemistries delivered by the gas injection system (GIS) during analysis.

Obtain the best ToF-SIMS results, even from beam-sensitive, liquid-based, vacuum-sensitive, and volatile materials by cooling or heating the samples during analysis.

Connect sample topography changes with their ToF-SIMS data by correlating the FIB SE image with every ToF-SIMS frame.

Maximize instrument usage and efficiency by analyzing data on a separate PC with the included, standalone ToF-SIMS data processing software module.

Select the ToF-SIMS hardware and FIB system platform that meets the requirements for your intended field of application to achieve the optimum spatial resolution, surface sensitivity, and molecule fragmentation level*.



*Consult a local sales representative for the identification of optimum ToF-SIMS hardware and FIB-SEM platform for your application.