Tescan FemtoChisel

The Intelligent Multi–Wavelength Laser System for Advanced Microelectronics Inspection

One Platform. Any Material. Pristine Results.

Semiconductor devices are increasingly built from heterogeneous material stacks — silicon, metals, glass, polymers, ceramics, and fragile organics — each with unique optical and thermal properties. Traditional sample preparation struggles with this complexity. FemtoChisel solves it.

For years, lasers were dismissed as rough micromachining tools — fast but messy, leaving surfaces that always required heavy post-processing.

Tescan FemtoChisel changes the paradigm.

It combines femtosecond precision machining with wavelength selectivity, Intelligent Multi-gas Processing, advanced laser energy modulation in time and space and 3D surface monitoring for pristine, analysis-ready cross-sections at high throughput.

Intelligent Fast Seamless Failure Analysis and Sample Preparation Workflow

FemtoChisel—while useful as a stand-alone micromachining tool—is best used as part of an integrated workflow for semiconductor and microelectronics inspection. In this workflow, micro-CT, FemtoChisel, and TESCAN Plasma FIB-SEM work together to accelerate failure analysis and sample preparation for next-generation devices, including advanced packaging. The process begins with non-destructive inspection by micro-CT, followed by FemtoChisel laser processing to rapidly access targeted regions deep within complex material stacks. FemtoChisel's multi-resolution correlative machine vision can learn from CT or optical imaging to enable accurate navigation and targeting across the workflow, and processed regions of interest with their coordinates are transferred seamlessly to the Plasma FIB-SEM for immediate final polishing without tedious re-navigation. High-resolution imaging for root-cause analysis is then completed in the FIB-SEM. Similarly, FemtoChisel can alternatively accelerate site-specific TEM sample preparation for the most detailed inspection in dedicated STEM..

Past Workflow

Traditional Laser-FIB-SEM Workflow Processing steps

Identifying Region of Interest, registration and Targeting	**Bulk Laser Machining**	**Rough FIB-SEM Polishing** (needed to reveal structures under debris)	**FIB-SEM Final Polishing and/or Imagining Using FIB-SEM**

FemtoChisel Workflow

FemtoChisel Workflow Processing Time

Intelligent Correlative ROI Targeting & Machine Vision	**Fast, high quality FemtoChisel machining with Intelligent multigas processing** (minimal Debris, Visible sub-surface structures)	**FIB-SEM Final Polishing and/or Imagining Using FIB-SEM**

Tescan FemtoChisel

It's the first system where speed, quality, and correlation converge — accelerating Inspection, failure analysis and targeted internal access, and lowering cost-per-sample while handling the most heterogeneous materials in todays and tomorrow's microelectronics.

The applications of FemtoChisel are diverse in today's microelectronics analysis ecosystem. From Inspection and high throughput FA in packaged devices and mobile displays (X-sectioning, die extraction, resampling, chip decapsulation, whole Printed circuit board delayering) to backside substrate thinning, In Trench TEM lamella preparation and die-level reverse engineering.

Key Benefits

Boosting lab Productivity and reducing time-to-sample and cost-per-sample with >90% Worfklow time saving: Large Scale X-sectioning and Delayering of heterogeneous materials thanks to true femtosecond Laser processing being up to 2000× faster than Plasma FIB and up to 10000× than Ga FIB: Ga FIB for trenching and rough milling.

Heterogeneous materials No longer an issue Combination of unprecedented laser fluence regimes and software selectable multi-wavelength operation makes FemtoChisel Material agnostic.

Pristine surfaces with minimal/no debris and redeposition and heat affected zone: proprietary intelligent multi-gas processing, laser protective layer and advanced laser beam time and space modulation artifact-free cross sections for direct final FIB final polishing and ultra-high-resolution imaging across the entire surface

The most precise, intuitive and correlative Multi-resolution Targeting system assisted by Machine Vision: FemtoChisel intelligently navigates to region on interest by bringing image from ANY CT, Optical or SEM image

Nanometer-level endpoint precision using integrated confocal height sensor with single digit nm resolution and high-resolution machine vision for in-process depth monitoring enabling all-in-plane features of interest

Scale to wafer-level thanks to high-repeatability long-range multi-axis stage system FemtoChisel covers entire packages and substrates: further compatible with Tescan large chamber FIB-SEM

Prepare large volume (cubic mm scale) samples or access deeply buried Regions of Interest quickly and efficiently – even in non-conductive hard materials (glass, polymers, ceramics) – with the faster material removal rates of the laser and Plasma FIB combined

Easy future upgrade path and customization as well as advanced recepie development supported by Modular system architecture with a full digital twin technology.