Tescan EXLO™

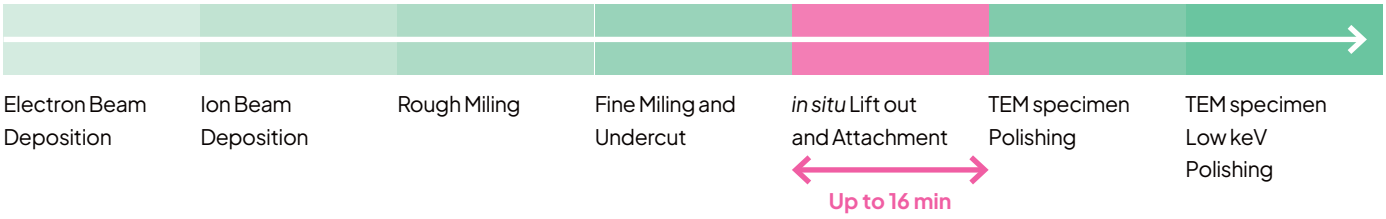
Maximize Throughput and Cut TEM Prep Costs with TESCAN *ex situ* Lift Out (EXLO)

Fast, reliable, and scalable *ex situ* lift-out for high-volume semiconductor and materials analysis workflows.

TESCAN EXLO™ combines precision handling with workflow flexibility by moving lamella transfer outside of the FIB-SEM. The EXLO 800 and EXLO 1200 platforms enable parallel FIB-SEM milling (with TESCAN FIB-SEM) and lift-out operations (with TESCAN EXLO™). This significantly boosts TEM specimen preparation throughput while reducing cost per lamella. Designed to support batch-prepared lamellae and a wide range of grid types, TESCAN EXLO™ makes high-throughput TEM sample preparation easier, faster, and more scalable.

Fully Automated TEM Prep Workflow:
Main Benefit is user Friendliness (unattended usage)

Total: "X" min



Fully Automated in Trench TEM Prep and
TESCAN EXLO: Main Benefit is **Speed Enhancement**

Total: ~ 0.8X min
(or better when > 1 specimen)

Figure1: Workflow comparison between fully automated in situ lift-out and TESCAN's automated sample preparation combined with TESCAN EXLO™ *ex situ* transfer. While in situ lift-out offers a fully automated and user-friendly workflow, transferring the lift-out step outside the FIB-SEM with TESCAN EXLO™ reduces the total time per sample by up to 20%. This results in a higher number of specimens prepared per day and a lower cost per specimen, making it an efficient alternative for high-throughput and cost-driven environments.

Key Benefits

Maximize Your TEM Sample Throughput

In conventional in situ workflows, FIB milling must pause during the lift-out step, creating idle periods that may limit TEM specimen throughput. TESCAN EXLO™ eliminates this bottleneck by decoupling lamellae manipulation from the FIB-SEM. This allows continuous milling of new lamellae while transfers are handled externally with TESCAN EXLO™. This parallelization enables labs to nearly double the number of lamellae produced within the same shift, without the need for additional FIB systems, boosting sample output while maintaining the high quality of FIB-SEM specimen preparation.

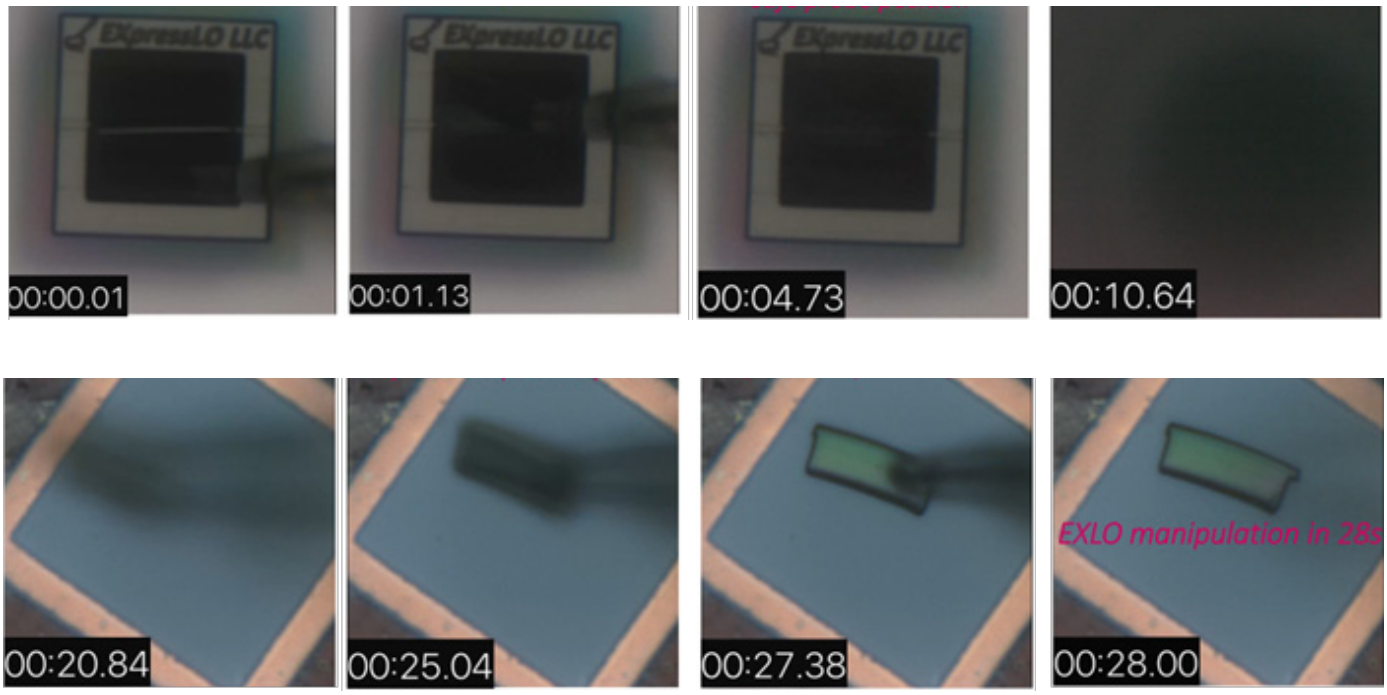


Figure 2: Time-lapse images showing *ex situ* TEM specimen lift-out using TESCAN EXLO™, completed in just 28 seconds. Timestamps are displayed in mm:ss.ms format. This result, obtained on a test sample, demonstrates that an experienced operator can consistently transfer lamellae from trench to grid in under a minute, enabling safe, fast, and reproducible manipulation.

Lower Cost per TEM Specimen

FIB-SEM systems represent a significant capital and operational investment. By relocating lamella manipulation outside the FIB chamber, TESCAN EXLO™ significantly reduces the time each sample occupies the system. This optimization not only increases FIB availability for continuous milling but also allows lamella transfer to be performed by less specialized staff. The result is a substantial reduction in per-sample costs, enabling more efficient use of both equipment and personnel.

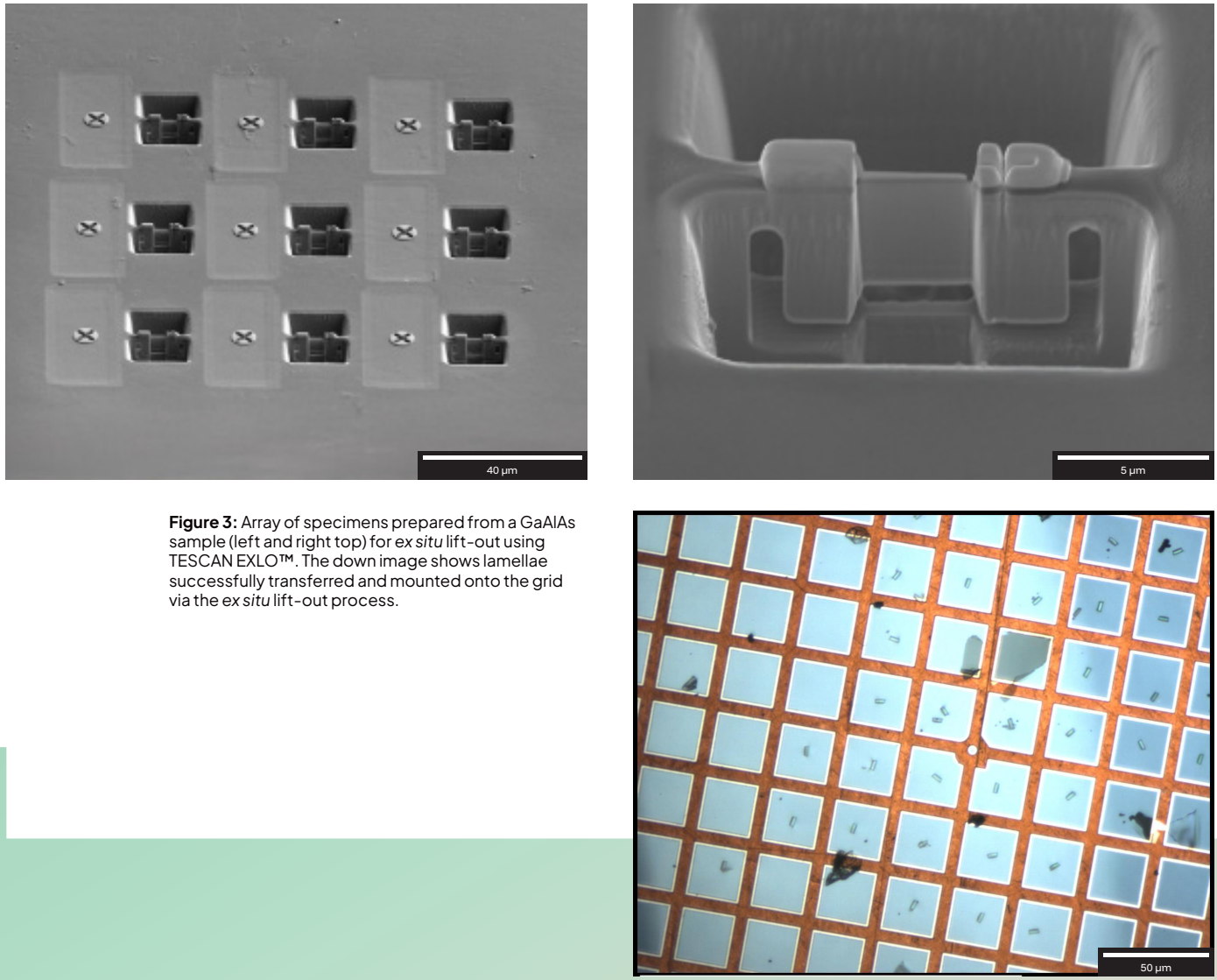


Figure 3: Array of specimens prepared from a GaAlAs sample (left and right top) for *ex situ* lift-out using TESCAN EXLO™. The down image shows lamellae successfully transferred and mounted onto the grid via the *ex situ* lift-out process.

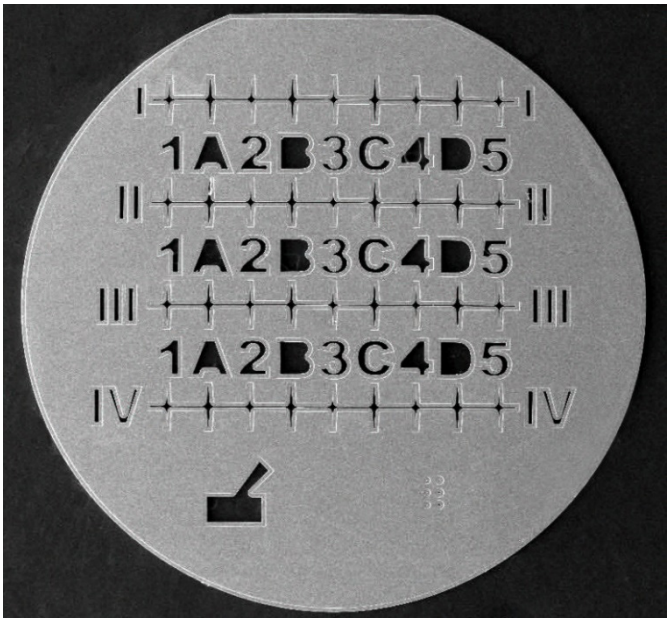
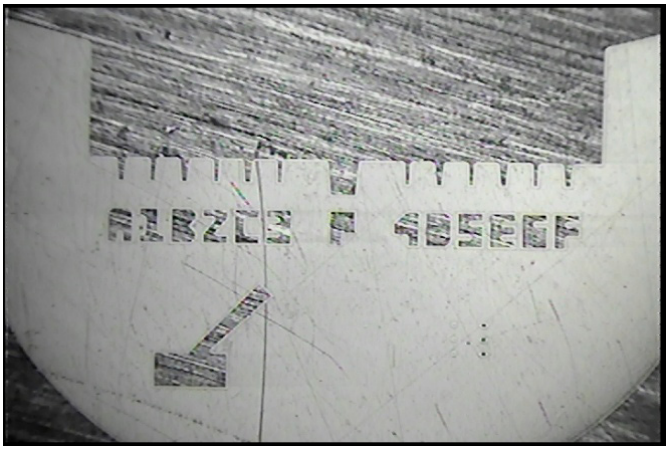
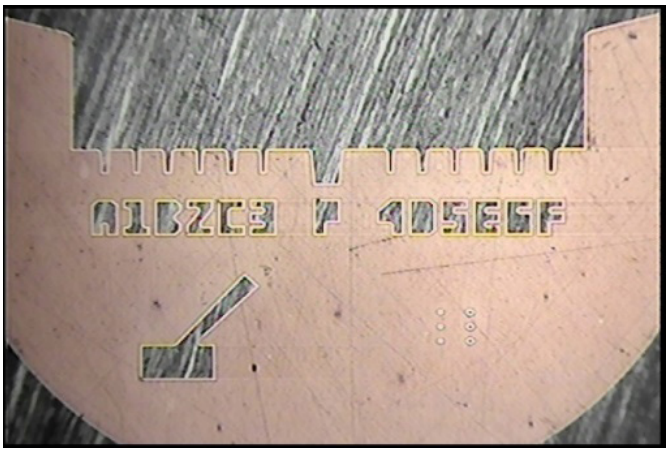


Figure 4: TESCAN slotted grid (left) designed for TESCAN EXLO™ workflows, alongside standard nickel (Ni) and copper (Cu) grids compatible with the TESCAN EXLO™ solution. The grid designs support both standard and inverted lamella configurations for flexible TEM sample preparation.





Optimized Grid Solutions for High-Quality TEM Preparation

TESCAN's slotted grids are engineered specifically for efficient and reproducible lamella mounting during *ex situ* lift-out. Available in standard copper (Cu), nickel (Ni), and advanced nanocrystalline diamond (NCD) materials, these grids support both standard and inverted (backside) lamella configurations.

The slotted design ensures secure lamella placement and excellent mechanical stability during transfer and downstream thinning. NCD grids are ideal for analytical TEM workflows, minimizing background signal and X-ray interference for more accurate EDS analysis.

TESCAN EXLO™ platforms are fully compatible with all grid types, offering flexible adaptation to diverse materials, device structures, and analytical requirements.

Train New Operators with Ease

TESCAN EXLO™ is designed for intuitive operation, eliminating the complexity often associated with advanced sample preparation systems. With joystick navigation and live optical imaging, new users can become proficient in just a few hours. This short learning curve reduces training time, minimizes operator fatigue during long shifts, and improves overall lab efficiency, making high-throughput TEM sample preparation accessible to a wider range of users.

Expand Sample Versatility — Ideal for Sensitive Materials and Nanostructures

TESCAN EXLO™ enables precise manipulation and transfer of a broad range of materials beyond standard semiconductor lamellae. It is particularly well-suited for handling delicate nanostructures such as nanoparticles, nanowires, and thin films that are sensitive to prolonged FIB exposure. By relocating the transfer step outside of the FIB chamber, TESCAN EXLO™ minimizes the risk of FIB exposure damage. This expands laboratory capabilities, making TESCAN EXLO™ a tool for materials science, nanotechnology, and advanced lift-out workflows.

Intuitive Joystick and Control Interface

Simplifies navigation and manipulation; designed for ease of use by both novice and experienced operators.

Motorized X/Y/Z/R Stage

Enables precise and programmable specimen and grid positioning for repeatable, accurate manipulation.

Optional Vacuum-Assisted Transfer Tool (Aspirato™)

Hollow glass probe with controlled vacuum ensures safe, contactless pickup and placement of fragile samples.

Technology Behind TESCAN EXLO™

Engineered for speed, precision, and reproducibility, TESCAN EXLO™ features a motorized X/Y/Z/R stage for precise specimen positioning and alignment. A high-resolution optical microscope with live zoom provides real-time monitoring throughout the transfer process. For even greater control, the optional vacuum-assisted Aspirato™ hollow glass probe enables safe, contactless pickup and placement of lamellae, minimizing mechanical stress and contamination risk.

TESCAN EXLO 800 supports wafers up to 200 mm, while the EXLO 1200 extends capacity up to 300 mm. Both platforms feature intuitive joystick controls for simplified operation across all skill levels. Additionally, the EXLO 1200 includes an air-damped workstation to eliminate vibrations, ensuring stable, controlled manipulation even for the most fragile or beam-sensitive samples.

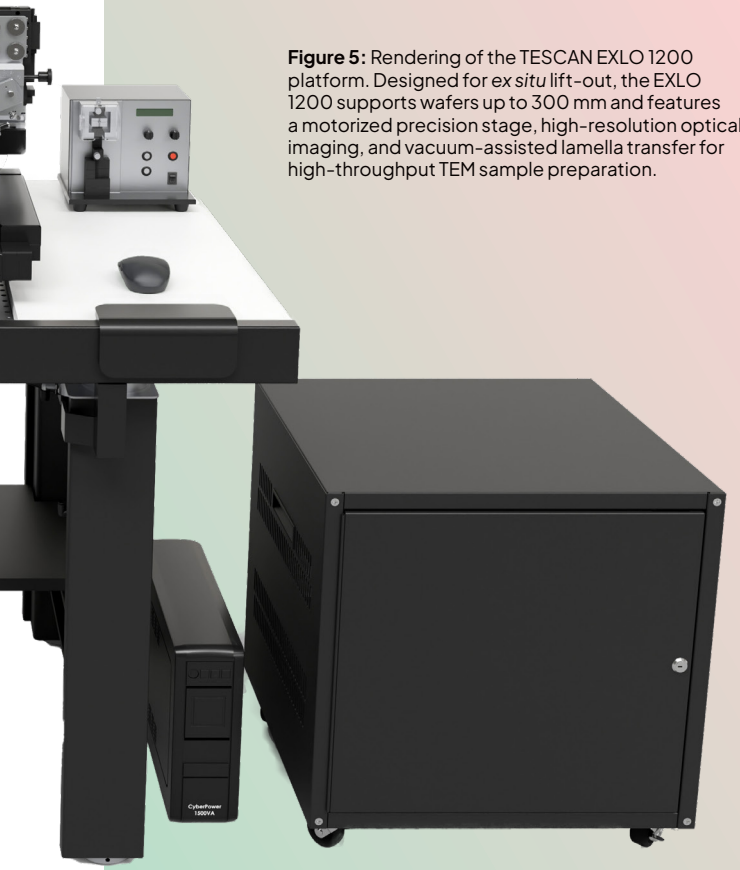


Figure 5: Rendering of the TESCAN EXLO 1200 platform. Designed for *ex situ* lift-out, the EXLO 1200 supports wafers up to 300 mm and features a motorized precision stage, high-resolution optical imaging, and vacuum-assisted lamella transfer for high-throughput TEM sample preparation.

High-Resolution Optical Microscope

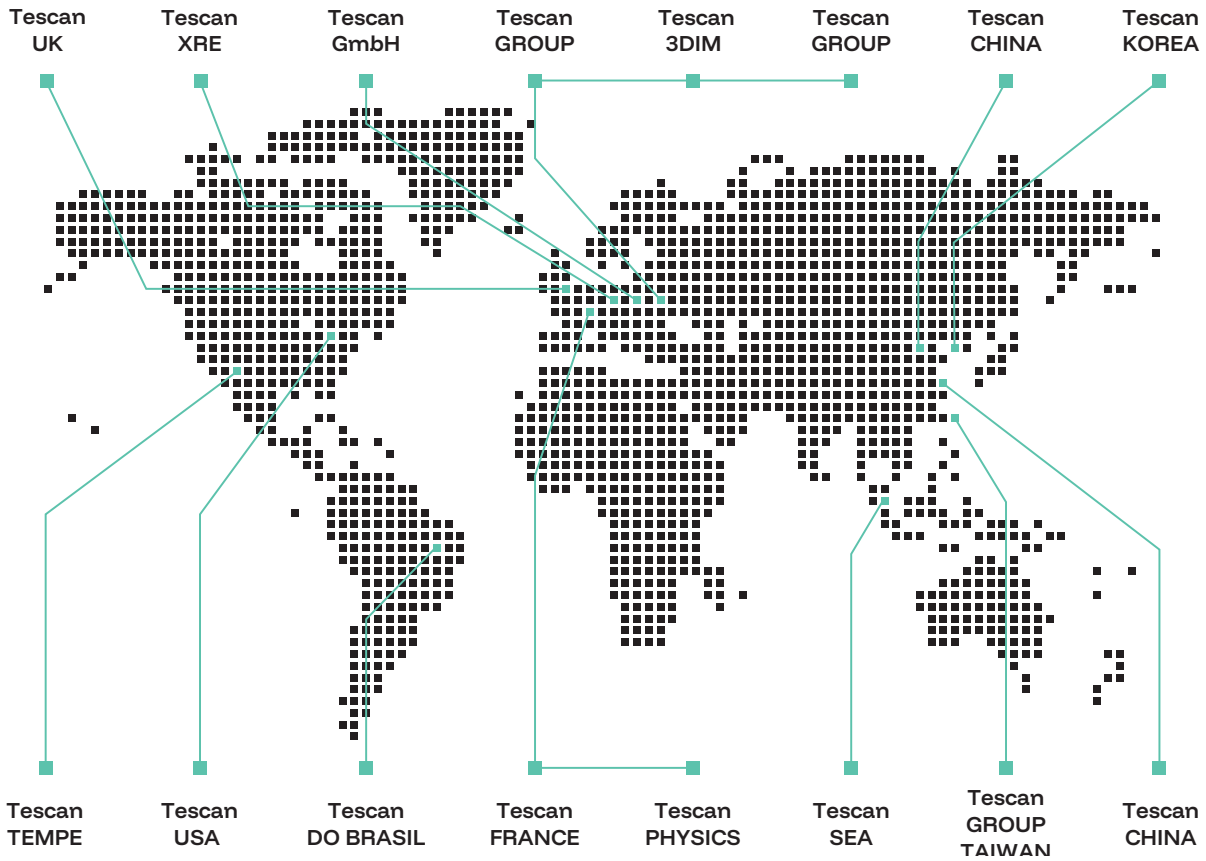
Provides live imaging with variable zoom for real-time monitoring and alignment during lift-out and transfer.

Wafer Support Platform

Accommodates wafer samples up to 200 mm (EXLO 800) or 300 mm (EXLO 1200), ensuring secure handling of wafers, grids, and custom carriers.

Workstation with Air-Damped Table

Reduces vibrations, ensuring mechanical stability for precise specimen handling.



Tescan Family Around the World

Tescan enables nanoscale investigation and analysis within the geosciences, materials science, life sciences and semiconductor industries. The company has a 30-year history of developing innovative electron microscopy, micro-computed tomography, and related software solutions for customers in research and industry worldwide. As a result, Tescan has earned a leading position in micro- and nanotechnology.

For more information visit: www.tescan.com.

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