

Vacuum Capsule for cryo-electron tomography

Transfer your cryo-lamellae safe and free from contamination

Cryo-electron tomography (cryo-ET) is an increasingly popular imaging technique in cell and structural biology, as it allows proteins to be studied in their cellular, spatial context at resolutions that far exceed the limits of light microscopy.

Cryo-focused ion beam (cryo-FIB) technology is a vital component of cryo-electron tomography, as it enables the preparation of the electron-transparent samples necessary for cryo-transmission electron microscopy (cryo-TEM). To this end, instruments like the Thermo Scientific™ Arctis™ Cryo-Plasma FIB can be used to prepare very precise, thin subcellular regions, known as *in-situ* cryo-lamellae, from vitrified cellular samples.

Once prepared in the cryo-FIB, lamellae must be transferred to a cryo-TEM for imaging. During this process, it is critical to avoid ice particle contamination on the freshly prepared sample surface, as ice particles can complicate or even completely prevent the acquisition of tomographic data. This type of contamination primarily occurs during unloading and transfer into the cryo-TEM carrier, at which time the sample comes into contact with liquid nitrogen. To eliminate this source of contamination and increase the yield of the tomography workflow, Thermo Fisher Scientific is introducing the specially designed Thermo Scientific™ Vacuum Capsule, which allows Autoloader specimen cassettes to be transferred under vacuum from the Arctis Cryo-Plasma FIB to cryo-TEMs such as the Thermo Scientific™ Krios™ or Glacios™ Cryo-TEM.

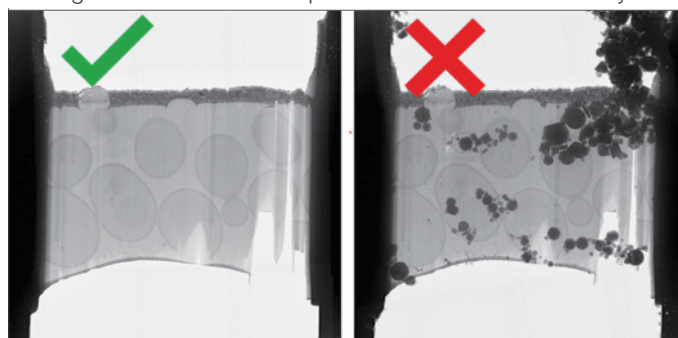
Key features

Optimized lamellae for cryo-electron tomography. Maximizes the available lamella area for imaging and makes data acquisition more reliable and robust.

Prevents ice contamination. Ensures that lamellae created with a cryo-FIB can be transferred to a cryo-TEM without surface contamination.

Compatible with Autoloader systems. Existing instruments equipped with an Autoloader can be retrofitted to be compatible with both standard capsules and the Vacuum Capsule.

Easy and safe sample transfer. The Vacuum Capsule securely contains samples, allowing the safe transfer of biological materials that require certain levels of biosafety.



Cryo-lamella after transfer with the Vacuum Capsule (left) and the same lamella after transfer with a standard capsule using liquid nitrogen (right). Transfer with the Vacuum Capsule completely avoids the ice contamination which is clearly visible on the cryo-lamella on the right.

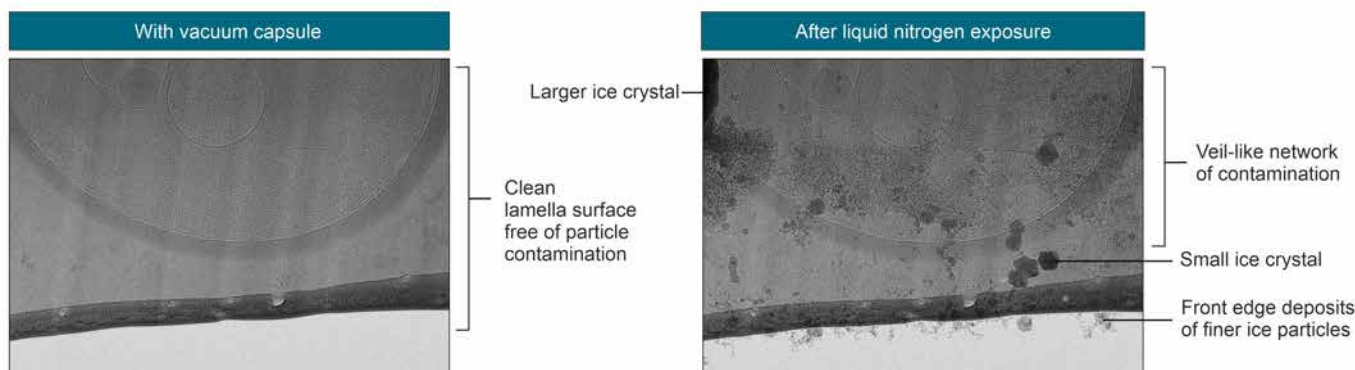


Figure 1. Contamination-free transfer with the Vacuum Capsule. The same lamella is first shown being transferred under vacuum and then after exposure to liquid nitrogen.

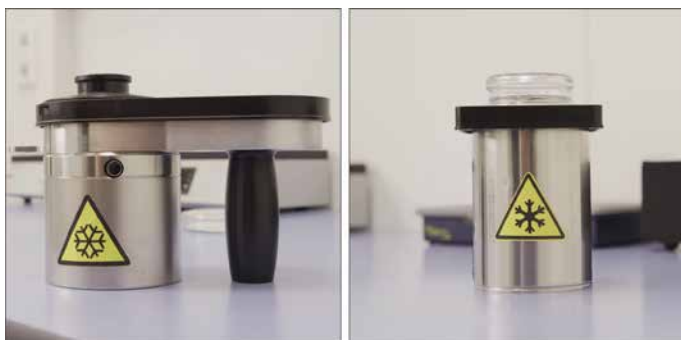


Figure 2. Vacuum Capsule (left) and standard capsule (right).

The Vacuum Capsule can be used to transfer up to 12 grids containing freshly prepared cryo-lamellae without contamination. Vacuum transfer is made possible by a new, customized Autoloader system that is compatible with both standard capsules (without vacuum) as well as the new Vacuum Capsules. This enables flexible loading and transfer of various cryo-FIB samples.

The Vacuum Capsule allows cryo-lamellae to be transferred without coming into contact with liquid nitrogen or a nitrogen gas atmosphere. This helps to prevent contaminants, such as fine ice particles, from adhering to the lamella surface and interfering with or preventing image acquisition in the cryo-

TEM. The resulting cleaner lamellae offer more surface area for tomographic data acquisition. In addition, the Vacuum Capsule provides secure sample transfer within an enclosed environment, enabling the analysis of samples in laboratories that operate at certain biosafety levels.

Conclusions

The Thermo Scientific Vacuum Capsule addresses the complexities and challenges of the cryo-tomography workflow by introducing an innovative solution for cryogenic sample transfer. The vacuum transfer system improves the efficiency of tomographic image acquisition and ensures the safety of your valuable samples.

Compatibility and upgradability

The Thermo Scientific Vacuum Capsule is available as an option on all new Krios Cryo-TEM, Glacios Cryo-TEM, and Arctis Cryo-Plasma FIB systems. After a hardware compatibility check, the vacuum transfer system can also be retrofitted onto most existing Arctis and cryo-TEM systems for a seamless integration into your cryo-tomography workflows.

The Vacuum Capsule requires an Autoloader system to be present on both the cryo-TEM and cryo-FIB.

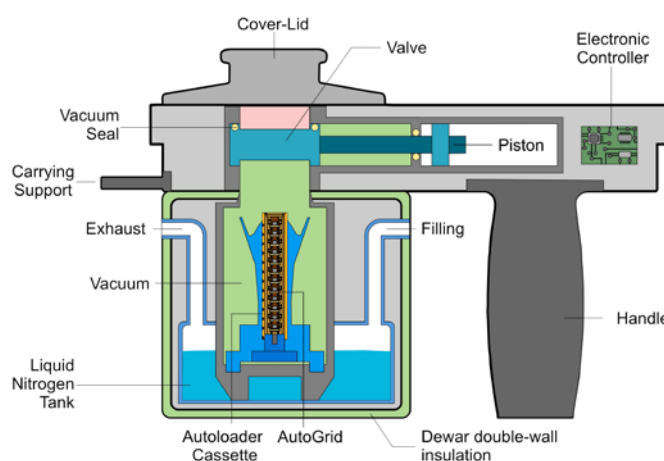
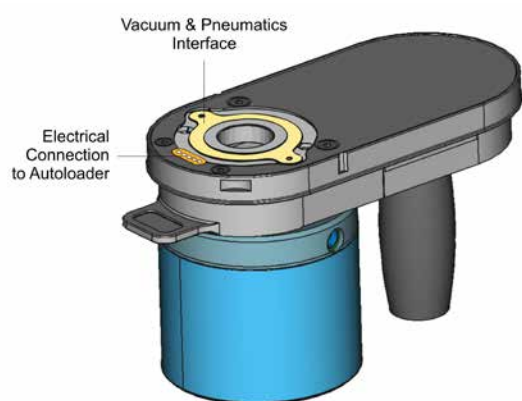


Figure 3. Vacuum Capsule design. Vitrified cryo-lamella samples are stored in an autoloader cassette and kept under vacuum during transfer from cryo-FIB to cryo-TEM.

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