

TEM Lift-out Tools for FIB prepared Lamellas

The FIB lift-out technique allows TEM lamellas to be extracted from bulk material, which saves a lot of sample pre-thinning time and is very successful in the preparation of site specific cross sections and planar samples. TEM sample preparation can be automated by using scripts and macros however the best accuracy is achieved if the milling is under manual control with direct SEM observation (keep in mind that an automated process is a blind process).

In a first step the sample is milled and polished from the front side under continuous SEM control until the detail of interest is visible. In the second step the sample is rotated by 180° and the back of the sample is milled and polished under continuous SEM control until the desired thickness is achieved. The TEM sample preparation module is used to pick up TEM lamellas and transfer them to a suitable TEM grid. The TEM lamella cut out of a bulky specimen has a size of approximately 12 µm x 6 µm with a thickness of about 100 nm. A skilled operator achieves success rates of about 90%.

TEM Lift-out Tool 1

Optical Zoom Microscope

A high resolution optical zoom microscope system with 75x to 3000x video zoom range. The working distance is constant at 19mm through the entire zoom range. The large working distance is beneficial for picking up the TEM lamella unhindered by geometrical limitations. The infinity corrected objective with a NA of 0.45 gives a superior image quality that allows fast and easy navigation to localise the lamella. The motorised zoom and the illumination are both controlled by a remote controller to keep mechanical vibrations at the probe tip to a minimum.

Large Specimen Stage

The large 200 x 200 mm stage enables positioning of bulky samples up to 8" wafers to speed up the transfer process. The optical microscope is equipped with a 10 times binocular head and a high resolution video system with colour camera and monitor including automatic brightness and contrast control.

High Precision Micromanipulator

One high precision 3-axes hanging joystick type oil hydraulic micromanipulator to transfer the lamella. The rounded hanging joystick configuration requires a constant driving force, thanks to improved springs in the drive unit. Changing over from left to right hand usage is a simple matter of adjusting the two settings screws.

Glass Tip Maker

An electrical tip maker to produce new clean glass tips for picking up TEM samples.

Technical Data of Zoom Microscope

Infinity corrected objective	10 x
Working distance	19 mm
NA	0.45
Visual magnification	75 x - 3000 x
Visual field of view	3.2 - 0.08 mm
Video field of view	1.8 x 2.4 - 0.045 x 0.060 mm

Technical Data of Micromanipulators

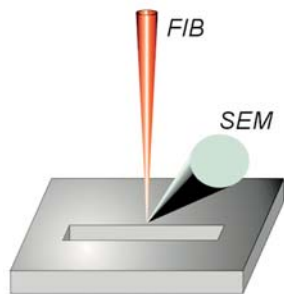
Movement range of manipulator	10 mm for X, Y, Z axis
Full rotation of knob	250 µm (40 revolutions)
Minimum resolution	2.5 µm
Joystick operation	2 mm (for movement in X, Y axis)

TEM Lift-out Tool 2

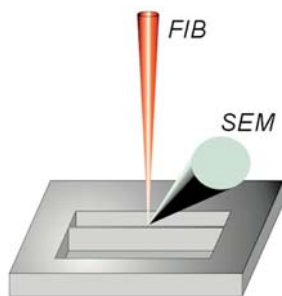
Same as Lift-out Tool 1 but with two hydraulic micromanipulators for a higher success rate.



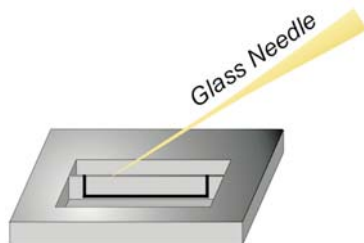
Fig. 1: TEM Lift-out Tool 1



FIB milling and polishing of front side of TEM lamella



Sample is rotated 180° and the back is milled and polished



Pick up of TEM lamella with Lift-out Tool

Fig. 2: TEM lamella preparation procedure

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