



# EXpressLO™

## Product Data Sheet

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**EXpressLO™** is an *ex situ* lift out (EXLO) and manipulation solution used to **Pick&Place™** site-specific FIB prepared or other specimens for S/TEM or other analyses. The patented EXpressLO™ grid and method allows specimens to be manipulated to a new grid design that avoids a carbon or formvar film such that the specimens can be further FIB milled, broad beam ion milled, or plasma cleaned. **EXpressLO™** supports multiple FIB instruments, increases throughput, reduces FIB instrument time, allows for routine backside milling, and may be used for conventional and advanced TEM techniques such as EFTEM, electron holography, and high resolution S/TEM to be performed without adverse influences from a carbon/formvar or other film.

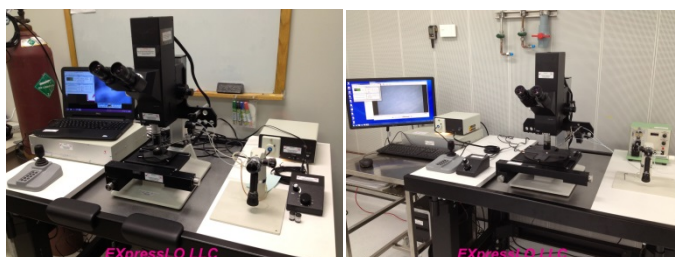
### Advantages and Benefits of EXpressLO™

- ✓ **EXpressLO™** supports multiple FIB instruments.
- ✓ **Pick&Place™** holder kit facilitates process.
- ✓ No expensive FIB time needed for lift out.
- ✓ Fast, easy to master, versatile, reproducible.
- ✓ Patented grid design and method.
- ✓ No carbon film needed.
- ✓ Re-thin EXLO specimens.
- ✓ Routine backside milling.
- ✓ Multi-user facility friendly.
- ✓ Supports multiple FIB instruments.
- ✓ Full systems and consumables available.

### EXpressLO™ Basic System

- ✓ **Light Optical Microscope:** Single objective parfocal microscope with 75-3000x motorized zoom magnification range, field of view from 1.8 mm x 2.4 mm – 0.045 mm x 0.060 mm, 10x oculars at constant 19 mm working distance, built-in ½" digital CCD camera and color monitor. Stand included. Computer included for color imaging display, digital and video image capture.

- ✓ **Hydraulic Micromanipulator:** 1 or 2 complete manipulators with tip maker and glass rods. 2 manipulators are recommended. Three-axis hanging joystick oil hydraulic micromanipulator with fine movement X = 10 mm, Y = 10 mm, Z = 10 mm. Full rotation of each knob provides X,Y,Z = 250 µm, minimum graduation = 2 µm. Joystick motion for maximum movement in XY plane = 0.002 mm. Tip maker includes a 1V heater with force puller for producing glass needles. Glass rods are 1 mm in diameter and 90 mm long. Hardware for incorporating manipulators onto microscope stand included.
- ✓ **6"x4" (150 mm x 100 mm) motorized stage:** Joystick driven and computer programmable software control and scripting for automation. X-Y travel = 75 mm/s at 0.5 µm resolution. Repeatability within +/- 2 µm. Uses same computer as microscope above.
- ✓ **Patented EXpressLO™ grids:** (100) 3mm Cu half grids.



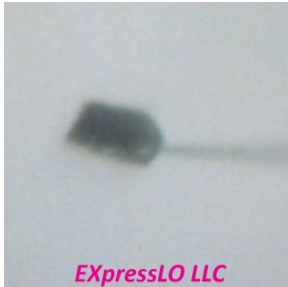
Fully installed 6"x4" motorized stage (left), and 8"x8" motorized stage (right) systems, both configured with 1 manipulator and vibration isolation table.



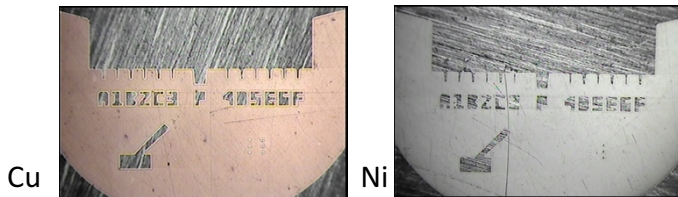
Fully installed 12"x12" system configured with 2 manipulators and vibration isolation table.



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*Pick of a specimen attached to a glass probe.*



Patented **EXpressLO™** Cu or Ni half grid with 13 specimen positions: 1 large P slot, 2 small numbered, 6 intermediate lettered slot openings.

### Optional Items

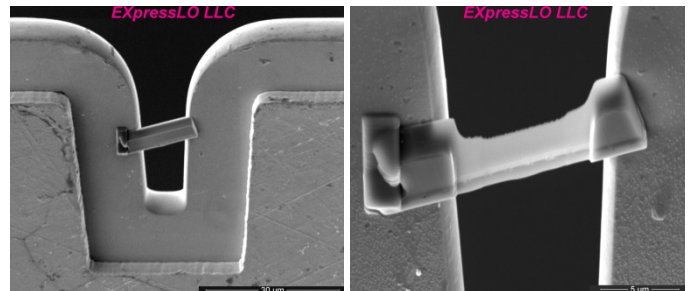
- ✓ **8"x8" (200 mm) motorized stage:** Replaces 6"x4" stage above.
- ✓ **12"x12" (300 mm) motorized stage:** Replaces 6"x4" stage above.
- ✓ **Vibration isolation table (for 6"x4" or 8"x8" stages):** 30" x 48" x 29" including (2) sliding shelves, front and rear support bars (48"), 2 arm rests, 4 casters. Maximum 100 psi nitrogen or air needed.
- ✓ **Vibration isolation table (for 12"x12" stage):** 36" x 60" x 29" including (2) sliding shelves, front and rear support bars (60"), 2 arm rest pads, 4 casters. Maximum 100 psi nitrogen or air needed.

### ✓ **System Requirements**

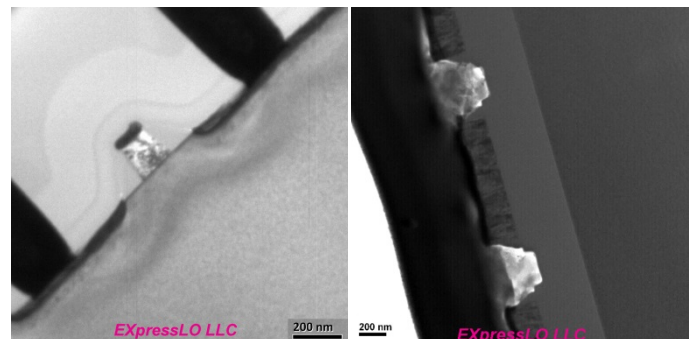
- Power Requirements: 110 VAC
- Desk/table (if air table not ordered)
- 100 psi nitrogen or air (for optional vibration isolation table)

### ✓ **References:**

- [1] Introduction to FIB, eds. Giannuzzi & Stevie Springer (2005).
- [2] Giannuzzi, Microsc. Microanal. 18, 2012, 632.
- [3] Giannuzzi, ISTFA 2012, ASM Int. 388.
- [4] Giannuzzi, Microsc. Microanal. 19, 2013, 906.
- [5] U.S. Patents 8,740,209 and 8,789,826.
- [6] Giannuzzi et al., Microsc. Microanal. 21, 2015, 1034.
- [7] [www.YouTube.com/LAGiannuzzi/videos](http://www.YouTube.com/LAGiannuzzi/videos).



*Backside FIB milled specimen after EXpressLO™ lift out.*



*TEM images of backside FIB milled specimens using EXpressLO™ with no curtaining artifacts.*