



**CORE STATUS:** new users must complete 2 trouble-free training sessions and pass the Core driver's test to work independently during Core sessions.

**FLEX STATUS:** core users must complete 3 additional trouble-free sessions, and demonstrate responsibility for maintaining the microscope in best working condition to work during Flex sessions.

**To reserve** a FIB session, go to [www/ncem.lbl.gov](http://www/ncem.lbl.gov), click on "Microscope Scheduling", use proposal number and password to log in. You may only sign up for 2 Core sessions and 2 Flex session at a time. **To cancel** a session, email your request to the technical staff in charge of the microscope.

## CORE LICENSE TEST

### **Safety**

- Understand emergency shutdown procedure
- Know emergency contact numbers
- Understand long milling session should be avoided.

### **Load specimen**

- Wear gloves
- Mount specimen on holder
- Open nitrogen gas valve
- Vent the chamber
- Insert the holder and tighten gently.
- Check sample height!**
- Push door handle and press "Pump"
- Close nitrogen gas valve
- Check if vacuum in  $10E-5$  mbar range in 5 minutes.

### **Start beam**

- Wait until vacuum  $< 5 \times 10E-5$  mbar
- Select SED detector
- Press "Beam On"
- Wait until ion beam current is stabilized, record V/I value
- If the ion source needs heating, notify NCEM staff

### **Eucentric height and basic alignment**

- Start continuous e-beam imaging
- Press shift-F9 to set focus to eucentric height
- Search for area and raise stage up until interested feature are in focus
- Use "Stage"- "Align X/Y" to orientate the feature
- Center one feature on screen by double click on it, tilt sample to 10 degree, then use Z control to center the feature.
- Repeat at higher magnification ( $>1.5K$ )
- Repeat with 52 degree sample tilt
- Back to 0 degree tilt and finely focus on the feature
- Press OK on pop-up window
- Check stigmatism and lens alignment

### **Making ion beam and e-beam coincident**

- Tilt sample to 52 degree
- Magnification couple checked
- Choose ion beam aperture 30pA
- Start ion beam live imaging, adjust contrast/brightness, focus
- Use image shift X and Y to center the same feature which had been centered in e-beam image.



**CORE LICENSE TEST (CONTINUED)**

**Milling**

- Change to a desired beam current
- Go to area of interest
- Adjust focus and astigmatism at the magnification
- Draw a pattern, start milling

**Shutting down**

- Press Beam Off
- Press off HT button
- Select Stage Initialization, wait until stage stop moving
- Open Nitrogen gas valve
- Press Vent
- Remove holder properly.
- Press door handle and press Pump.
- Close nitrogen gas valve
- Log in source live time and V/I, and any problem.

**Name** \_\_\_\_\_

**Date** \_\_\_\_\_ **Proposal #** \_\_\_\_\_

**Pass** \_\_\_ **Fail** \_\_\_



## FLEX LICENSE

### **Pt deposition with ion beam or e beam**

- Heat Pt source
- Find area of interest, adjust eucentric height.
- Take one ion beam (or e beam) image, draw a box for depositing area.
- Choose materials file as Pt.mtr
- For ion beam deposition, choose beam current by  $2 \times \text{Area}(\text{square of microns})$ . For e-beam deposition choose spot size 5-7.
- Re-adjust contrast/brightness, and refocus
- Insert Pt needle
- Take one image, adjust deposition box position.
- Start deposition and check progress by taking one e beam or ion beam image
- Turn off Pt source and wait at least 10 minutes before venting

### **Insulator deposition using ion beam**

- Purge insulator source if the source has not been used for several days
- Follow same procedure as Pt deposition, but use 1 pA/square micron

### **Omniprobe lift-out**

- Find area of interest, adjust eucentric height
- Adjust e beam/ion beam coincident.
- Tilt stage to 52 degree and cut trenches on each side of interested area.
- Tilt stage to 10 degree and cut out the window with one side attaching to the wall.
- Tilt stage to 52 degree, choose 10 pA current
- Lower stage Z for about 1 mm
- Insert the Omniprobe, bring it to the center with both beams
- Insert Pt needle
- Raise stage slowly, use both beam images to bring the side of the sample to the needle until they touch.
- Draw a deposition box and weld with 10pA current
- Cut the sample free
- Lower the stage to lift out the sample
- Retract the Omniprobe with Z control first, then retract it completely
- Find the TEM grid and adjust eucentric height
- Tilt the stage to 52 degree
- Lower stage Z for about 1 mm
- Insert the Omniprobe, bring it to the center with both beams
- Insert Pt needle
- Raise stage slowly, use both beam images to bring the grid bar to the side of the sample until they touch.
- Weld the sample and cut the needle free
- Lower the stage, retract the Omniprobe and Pt needle
- Thin the sample with ion beam until desired thickness reached

### **Low Energy Ar Ion Source**

- Open Ar gas cylinder main valve.
- Use e-beam to set sample to eucentric height, and align sample to Ar beam as necessary.
- Switch on Ion Gun Control Unit. Wait gun pressure meter reading  $< 0.5$  mTorr.
- Set emission knob to 100 uA, switch Beam "On". Wait for 5 minutes.
- Set emission to 1mA and 10 mA, wait 5 minutes at each step.
- Switch Beam "Off". Wait gun pressure meter reading  $< 0.5$  mTorr.
- Open Ar gas leak valve CCW slowly until gun pressure is 7.0 mTorr.
- Choose condenser setting. A is preferred.



**FLEX LICENSE TEST** (CONTINUED)

- Turn up ion energy to desire value, such as 1000 eV.
- Dial in corresponding Focus value and Centering X/Y values.
- Switch Beam "On". Ion beam is energized.
- Switch Beam "Off" when desired time is reached. Turn down ion energy. Use e-beam to check milling process.
- To shutting down the ion gun, set emission knob to 100uA. Check beam is "Off" and ion energy knob is turned fully CCW.
- Switch off Control Unit.
- Wait 10 minutes for the filament to cool down before venting the chamber. Turn off Ar gas leak valve (CW about 1 turn).

**Name** \_\_\_\_\_

**Date** \_\_\_\_\_ **Proposal #** \_\_\_\_\_

**Pass** \_\_\_\_\_ **Fail** \_\_\_\_\_