

MSE 460 TEM Lab 1: TEM Lab Preparation

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Aims: The aim of this first lab is to prepare you for TEM labs. This lab covers

- Basic safety issues
- NUcore login system
- Sample preparation techniques (overview)

I. Basic safety issues

Safety education is mandatory for all TEM users. Only those who receive safety training and sign the liability agreement can use EPIC facilities. Please do not touch or use anything in EPIC if you do not know the consequence of your actions. You should ask EPIC staff first if you are not sure about the consequence of your actions.

What You Should Know Before an Emergency Occurs

1. KNOW the established emergency procedures for this building and work area.
2. KNOW two means of egress from your area.
3. KNOW the locations of fire alarm pull stations.
4. KNOW the locations of portable fire extinguishers and how to use them.
5. KNOW the location of EPIC Safety Desk Book and how to find information in it.
6. KNOW the location of Materials Safety Data Sheets (MSDSs) and how to read it.
7. KNOW the location of the nearest first aid kit and know how to use it.

What You Should Read Before Using EPIC Facility

1. NU Emergency Response (<https://www.northwestern.edu/emergency-management/>)
2. NUANCE Emergency Response Procedures (<http://www.nuance.northwestern.edu/about/emergency.html>).
3. NU Safety Plan (<http://www.northwestern.edu/research-safety/index.htm>).
4. NU Chemical and Biological Safety in Laboratories (CBSL) (<http://www.northwestern.edu/research-safety/biosafe/index.htm>, <http://www.northwestern.edu/research-safety/chem/index.htm>).
5. NU Hazard Communication Program (<https://www.northwestern.edu/risk/environmental-health-safety/facility-safety/hazard-communication.html>).
6. NU radiation safety (<https://researchsafety.northwestern.edu/safety-information/radiation-safety-handbook.html>)
7. Tech building Safety Plan (<https://www.mccormick.northwestern.edu/documents/faculty-staff-resources/emergency/tech-ford-evacuation-guidelines-brochure-template.pdf>).
8. EPIC Facility Rules.

- Please read and understand departmental safety plan (posted on an EPIC notice board). Know what users should do if an emergency occurs, Know users' responsibility and Tech building emergency evacuation plan.
- Please read and understand EPIC facility rules (posted on an EPIC board).
- No SMOKING, FOOD, or DRINK AT ANY TIME in EPIC labs
- Please read and understand TEM safety rules (shown below):

Safety in TEM

TEMs are complicated high voltage facilities. You need to treat them cautiously while using them. You MUST NOT touch anything you do not know. You should always ask staff if you are not confident to use the function of related facilities. Before using TEMs, you must get a safety training and sign a form to release and waives any and all claims whatsoever against Northwestern University, its trustees, officers, employees and agents from any liability or any loss, cost, damage, expense, injury or death arising from or in any manner connected with or related to your use of the facilities and equipment.

TEMs:

Your personal safety:

- a) *High voltage: Stay away from the high voltage generator and cables to avoid electric shock. The voltage is 200,000 V (compared to a normal voltage of 120 V for your home appliances)*
- b) *Radiation: Radiation is shielded in TEMs and is within the safe limit if the facilities are used properly.*
- c) *Liquid nitrogen: You must not leave when you are getting LN2 from the big tank. You must deal with LN2 carefully: avoid injury by LN2 when you hook the cold finger Dewar on TEMs and avoid falling off from the stand when you pour LN2 into the cold trap.*
- d) *Eye protection: Try to use a weaker beam if possible and avoid damage to your eyes*

TEM safety:

- a) *Rules for TEM: Read and follow the operation instruction carefully, especially the notes.*
- b) *Vacuum: Make sure that vacuum is always good; Follow rules when you load/unload specimen. Objective aperture must be out when loading/unloading samples.*
- c) *Liquid nitrogen: Fill cold trap/figure with LN2 at the beginning of your experiment and top up them every two hours during your session*
- d) *Filament: Do not over-saturate the filament.*
- e) *Make sure that your sample is set at the eucentric height when loading the Obj aperture into the column. Do not change the sample holder height when the Obj aperture is in the column. Never adjust the height of the Obj aperture.*
- f) *If you are not confident of the consequences resulted from your action, please ask staff before your action.*

The form you need to sign (posted on the board):

I certify that I am trained on safety for the use of the TEM facilities. I sign below to release and waives any and all claims whatsoever against Northwestern University, its trustees, officers, employees and agents from any liability or any loss, cost, damage, expense, injury or death arising from or in any manner connected with or related to your use of the facilities and equipment.

<i>Department</i>	<i>Advisor</i>	<i>Name</i>	<i>Signature</i>	<i>Date</i>

II. NUcore login system

Know how to reserve, cancel and log in/out TEM sessions. You may do it by using any internet-connected computer.

III. Introduction to sample preparation equipment

- Cutting: wheel saw, wire saw, ultrasonic cutters...
- Polishing: mechanical polishing, electro-chemical polishing...
- Dimpling
- Ion milling: PIPS, IBT
- Microtome