CCNS - Safety Refresher

Nov 2018
* The safety refresher are mandatory for ALL users

* Cleanroom access and instrument usage will be denied for users who:

  1. Have not attended a safety refresher
  2. Have not satisfactorily completed the quiz
Consumables – Substrates and More

Substrates

* Silicon wafers
* Pyrex wafers
* Fused silica wafers
* Glass slides
* Photomasks

General

* Lab wipes
* Swabs
* Pipettes
* Petri dishes

Photo-Resists & chemicals – to be used in CCNS facilities!!!
### Consumables - Chemicals

#### Solvents
- IPA
- Acetone
- NMP
- Ethanol
- Methanol

#### Acids
- Acetic acid
- Nitric acid
- Hydrochloric acid
- Phosphoric acid
- Hydrofluoric acid
- BOE
- Chrome etchant
- Titanium etchant
- Nickel etchant
- Aluminum etchant
- Gold etchant*

#### Photoresists
- AZ1505
- AZ1518
- AZ4562
- AZ5214
- SU-8 2000.5
- SU-8 3005
- SU-8 3050
- Lor 5A
- Lor 10B
- PMGI SF5
- PMGI SF9*
- ZEP
- PMMA
- ma-N

#### Developers
- AZ726
- AZ400K
- PGMEA
- MIBK
Preparing for cleanroom work

Familiarity with chemicals and processes

- Read the MSDS
- Perform literature searches
- Consult with staff members
- Have a work plan

Appropriate clothing

- Long, preferably loose fitting, pants
- Closed-toe shoes made of leather or plastic
- No wool or other shedding material
- No contact lenses
- No makeup
Preparing for cleanroom work

Bringing anything in? Is it permitted?

**Permitted**

* Water bottles (left in the gowning room only)
* Flash drives, phones, etc.
* Laminated paper or paper in nylon sleeves
* Tweezers and tools
* Wafers, other substrates

**Not permitted**

* Cardboard
* Regular paper
* Pencils, erasers
* Powders
* Any materials that tend to crumble
* Not sure? ASK FIRST!

Anything brought into cleanroom must be wiped with ethanol
Gowning in Engineering

Proper order:

0. Blue shoe covers

« Step on sticky mat «

1. Head cover
2. Face mask*
3. Coveralls
4. Booties
5. Gloves
6. Safety Glasses

The order of gowning prevents contamination!
Gowning in the Nano Center

Proper order:

0. Blue shoe covers

« Step on sticky mat «

1. Head cover
2. Face mask*
3. Coveralls
4. Gloves
5. Safety Glasses

The order of gowning prevents contamination!
Proper dress:

1. Lab coat
2. Gloves
3. Safety Glasses

Glove box specific:

1. Take off rings, bracelets, etc.
2. Put cotton gloves on top of latex gloves
Gloves

* Latex – always worn

* Nitrile – worn on top of latex for lithography and light chemical work

* Tri-polymer or rubber – worn on top of nitrile and latex when handling acids

Before leaving a chemicals room or before picking up a phone:

- Wash and dispose of or return outer layer of gloves
- Put on new gloves before continuing chemical work
Gloves

Types of gloves available

- Latex
- Nitrile
- Tri-polymer
- Rubber
Removing Gloves

Do not touch your skin with the outer side of the gloves

1. Pinch
2. Peel down
3. Pull off
4. Insert
5. Peel down
6. Pull off
1. Latex gloves
2. Nitrile gloves
3. Safety glasses
4. Apron
5. Tri-polymer gloves
6. Face shield

Check for holes and acid residues before using the apron and gloves
Removing Tri-Polymer Gloves

1. Rinse and dry rubber gloves
2. Take off first glove like a lady
3. Use 1st glove to take off 2nd glove
4. Check for holes and notify MNCF staff
Glasses

* Safety glasses must be worn at **ALL** times upon entering cleanrooms and other laboratories!

* The **ONLY** exception is when using a microscope

* Dark UV protective glasses are found near mask aligners and evaporators
Cleanroom hazards

- Chemicals
- Electricity
- Extreme temperatures
- UV and laser radiation
- High and low pressure
- Machinery
Cleanroom hazards

* Multiuser lab/equipment:
  * Non standard processes
  * R&D tools

* Students:
  * work fast
  * non-experienced

more hazards & down time
Minimizing risks

Chemicals

* Working alone on benches is forbidden! (New Regulation!!!)
* Read the MSDS
* Keep solvents and acids separate
* AAA: Always Add Acid to water
  (for piranha: add $\text{H}_2\text{SO}_4$ to $\text{H}_2\text{O}_2$)
* Wear apron, face shield and tri-polymer or rubber gloves when handling acids
* Always work with a cleanroom certified buddy after normal hours (18:00-08:00)
Minimizing risks

Chemicals

* Keep work area clean and organized
* Do not block fume hood intake holes
* If you need to leave the chemicals unattended, label the chemicals by: Date, chemical name, your name, your phone number
* Work at least 15 cm inside the fume hood
* Use litmus paper, don’t assume its water
Minimizing risks

Chemicals

* Repeatedly check gloves for contamination
* Remove gloves before opening doors, answering phones
* Do not use phone while working with chemicals
* Do not place phone or other personal belongings in the fume hood
* Replace gloves before continuing chemical work
* Do not touch skin with gloved hands
Minimizing risks

Hotplates

* You must be present when heating chemicals
* Never leave the cleanroom with chemicals on a hotplate
* Do not heat solvents with boiling points lower than 60 °C (140°F) – e.g. acetone
* A switched off hotplate might still be hot!
* Turn it off (or down to room temp) when finished
* Always check that glassware is free of cracks and chips before placing on a hotplate
Minimizing risks

High and Low Pressure

**High pressure sources:**
- Load locks and vacuum chambers after venting
- CPD

**Issue:** violent decompression

**Solution:**
1. Open lock closure before venting
2. After extracting sample from load lock, pump lock to $10^{-2}$ Torr, stop lock pump and open lock closure before leaving the system

**Low pressure sources:**
- Vacuum chambers under vacuum

**Issue:** pinch points

**Solution:** keep hands away from pinch points
Minimizing risks

Machinery

Sources of pinch points:
* Loadlocks
* Vacuum chambers
* Nanoimprinter

Issue: pinch points

Solution: keep hands away from pinch points
Extreme Temperatures

Sources of extreme temperatures:

* Hotplates
* Ovens
* PECVD
* ALD
* LN$_2$

Minimizing risks:

* Turn hotplates and ovens off after use
* Use timers when possible
* Wait until 50$^\circ$C to open PECVD chamber
* Wear insulating gloves and goggles when dispensing LN$_2$
Minimizing risks

UV radiation

Sources of UV radiation:
* Mask aligners
* Evaporators
* Plasma etchers

Minimizing risks:
* Use proper glasses when viewing evaporator crucible
* Turn around during exposures
* Inform users around you of exposure
Minimizing risks

Laser radiation

Sources of laser radiation:
* ELAS femtosecond laser micromachining system
* Heidelberg DWL-FS66 laser writer

Minimizing risks:
* Both machines have interlocks that cut off laser if door is open
* Both machines are class 1 lasers under normal operating conditions
* Only certified superusers and company technicians are allowed to open the system exposing the optical elements
Call security at x8222 or x5555 03-640
Emergency response

Chemicals – Eyes

* **Time is critical!**

* Flush with water using eyewash for AT LEAST 15 MINUTES

* Inform those around you and the cleanroom staff of your situation

* Seek medical care as soon as possible!

Call security at x8222 or X5555
Eye wash and showers

Engineering cleanroom

Lithography Room

Chemicals Room

Call security at x8222 or X5555
Emergency response

Eye wash and showers

Nano Center

Portable eyewash

Across from Cleanroom Hallway

Call security at x8222 or X5555
Emergency response

Eye wash and showers

301

Call security at x8222 or X5555
Emergency response

Chemicals – Skin

* **Time is critical!**

* If your clothing has been exposed, first take off clothes then use shower

* Wash the area immediately for **15 MINUTES** in the nearest faucet or eyewash

* For larger exposures, take off clothes and use shower

* Inform those around you and the cleanroom staff of your situation

* Seek medical care as soon as possible!

**Reminder:**
The cleanroom suits do **NOT** protect you from chemical spills

Call security at x8222 or X5555
Chemicals – HF

* Exposure to concentrations <20% may not cause any sensations or feelings initially
* Visible signs of HF exposure may not appear until the next day
* Extreme pain may occur without corresponding external signs
* High concentrations (49%) will cause an immediate, painful response
* HF will absorb through the skin and muscle until it reaches bone where it will begin react with and decalcify the bone
* Exposures of 2% of body area can decrease calcium levels in the body effecting heart function to the point of death

Call security at x8222 or X5555
Emergency response

HF treatment kits

Engineering

Nano Center

301

Call security at x8222 or X5555
Emergency response

HF treatment kits

HF treatment kit contents:

- Calcium gluconate cream
- Hexafluorine eye rinse
- MSDS
- HF burn management review article

Call security at x8222 or X5555
Chemicals – HF – Skin

* **Time is critical!**

* Wash the area immediately for **15 MINUTES** in the nearest faucet or eyewash

* Apply generous amount of calcium gluconate cream to exposed area, take the cream with you

* Inform those around you of the exposure

* Have a friend inform the hospital of the situation, go to the hospital with the **MSDS** and **HF burn management review article**

* At the hospital, the doctor may inject calcium gluconate solution into the affected area

Call security at x8222 or X5555
Emergency response

Chemicals – HF - Eyes

* **Time is critical!**
* Immediately rinse with hexafluorine eyewash
* Continue wash for at least 5 **MINUTES**
* Inform those around you of the exposure
* Continue to rinse in eye wash until leaving for hospital
* Have a friend inform the hospital of the situation
* Go to the hospital with the MSDS and **HF burn management review article**

Call security at x8222 or X5555
**Emergency response**

**Electrical shock**

**Dos**

* Switch off the main switch
* Break the contact between electrical source and the injured using rescue hook
* Call for help! Cleanroom staff and security
* If breathing and heartbeat has stopped begin C.P.R (if you are trained)

**Don'ts**

* Don't touch the patient directly
* Don't go near the area if high voltage is suspected

Call security at x8222 or X5555
Emergency response

Electrical shock

EMO (emergency off button/switch)

Nano Center

e-Beam

Engineering

Call security at x8222 or X5555
Defibrillators can be found throughout every building in the case of sudden cardiac arrest. Once turned on, the defibrillator will instruct you in what to do.

Call security at x8222 or X5555
Emergency response

Chemical Spills

* Always notify MNCF staff

* In case of liquid spills inside the fume hood, clean with wet lab wipe or chemical sleeve

* In the case of small liquid spills outside the fume hood, inform all users and mark the area, put on gas mask and clean with wet lab wipe or chemical sleeve

* In the case of large spills (>0.5 liters) or any amount of HF inform all users and leave immediately without degowning

* After all liquid has been absorbed, wash the area with water

* Spills in hard to reach places, or HCl, should be absorbed with granules like Chemizorb

* All materials should be disposed of in two plastic bags (one within the other), and placed in the fume hood.

Call security at x8222 or X5555
Fire

* In the event of a small fire that does not pose any danger to you, use a fire extinguisher to extinguish the fire at the source.

* There are fire extinguishers in every room and the extinguishers are suitable for use with chemicals.

* To extinguish a chemical fire, stand ~3 m away and aim the extinguisher at the top of the fire.

**If the situation endangers your health or life:**

- Do not degown
- Leave the area immediately through the nearest exit

Call security at x8222 or X5555
Emergency response

Alarms

* Fire
* Dangerous gases (PECVD – Eng; ALD – Nano)
* Hood fume suction fault – Nano

* Tzeva adom – find closest shelter

Call security at x8222 or X5555
Habits and Best Practices

Contamination

* Skin should never touch any surface in the cleanroom
* Never touch skin with gloved hands
* Frequently check gloves for contamination
* Dispose of nitrile gloves before leaving chemical rooms or answering phones
* Handle all chucks, crucibles, etc. with double gloves
* Throw vacuum grease swabs away after use
* Don’t use carbon tape in evaporator (if you must, clean the sample holder after use!)
Habits and Best Practices

Waste Disposal

* After use, dispose of all chemicals in proper waste bottles
* Do not close waste bottle with cap before it is full
* Chemicals that are not water soluble (e.g. PGMEA) should be rinsed with IPA followed by water. Repeat rinse
* Empty chemical bottle used for waste should be rinsed fully three times before use

Do not fill bottles past this point!
Habits and Best Practices

Waste Disposal

* Empty chemical bottles used for waste should be rinsed fully three times before use.
Habits and Best Practices

Sharps Waste Disposal

**ALL** glass, silicon, blades, broken glassware, etc. must be disposed of in orange or red sharps waste receptacles.

Do not dispose of **ANY** other garbage in the sharps waste.
Habits and Best Practices

* Always be considerate
* The cleanroom is a public laboratory
* Leave the work areas as clean or cleaner than you found them

Presentation available at: http://nano.tau.ac.il/mncf/index.php/msds
New Waste Disposal Procedure

* For NANO Building users

* Wait for an email regarding waste disposal date

* Make a list of your waste chemicals

* Bring the list and the chemicals
Thank you for your attention!