

Safety Presentations

Updated April 29 2019

Electrochemistry Lab (323B)

- **NO** etching
- High-speed centrifuge (up to 10,000 rpm)

General Lab (324C)

- Etching (all hoods)
- Traditional centrifuge
(15, 50, 250 mL tubes)

Synthesis Lab (327B)

- Etching (left hoods only!)
- Traditional centrifuge with large container
(15 mL, 50 mL, 150 mL, 1 L tubes)

Electrochemistry Lab (323B)

Equipment

- Hotplates, with and without temperature control
- High speed centrifuge (15 mL and 50 mL centrifuge tubes)



Experiments

- **NO** etching
- Preparing polymer and polymer composite solutions
- Solvent exchange
- TMAOH intercalation
- Interfacial assembly
- Anything that's not etching

Chemicals

- Acids
- Bases
- Solvents
- Oxidizers
- Toxics/poisons

Waste storage

- Under hood



General Lab (324C)

Equipment

- Hotplates, with and without temperature control
- Traditional centrifuge (15, 50, and 250 mL tubes)



Chemicals

- Used for etching - HF, HCl, H₂SO₄

Experiments

- Etching (HF, HF-producing solutions)

Waste storage

- Under hood



Synthesis Lab (327B)

Equipment

- Hotplates, with and without temperature control
- Traditional centrifuge, equipped with containers for large centrifuge tubes (15, 50, 150 mL and 1 L)
- Reactor

Chemicals

- Used for synthesis and delamination
- HF, HCl
- LiCl, LiF

Experiments

- Etching (HF, HF-producing solutions) – left hoods only!

Waste storage

- Under hood

High Hazard PPE

“PERSONAL PROTECTIVE EQUIPMENT (PPE) WORN IN HIGH HAZARD AREAS”

EYE PROTECTION

Face shield provides additional protection against toxic chemicals
Must be worn when working with HF



Used for high-UV or laser applications

FLAME RESISTANT LAB COAT

Should be worn when working with flammable chemicals

RUBBER APRON

Must be worn when working with HF

RUBBER GLOVES

Must be worn when working with HF

WRIST GUARDS

Must be worn when working with HF

CLOSED-TOE SHOES



RESPIRATOR

Protects against chemical vapors and particulates

Training prior to use is required

CHEMICAL RESISTANT SHOE COVERS

EMPLOYEES MUST BE TRAINED ON HOW TO SELECT, PROPERLY WEAR, CARE FOR, CLEAN, AND MAINTAIN PPE. INFORM SUPERVISOR OF NEED TO REPAIR OR REPLACE PPE. CONTAMINATED PPE MAY BE A HAZARDOUS WASTE, AND SHOULD NEVER BE TAKEN HOME.

Minimum Lab PPE

PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR THE LABORATORY WORKER

EYE PROTECTION

Goggles must always be worn in lab
Regular prescription glasses do not provide same protection

GLOVES

Provides protection from chemicals

Choose correct gloves for the application

Replace gloves if they are contaminated

Do not wear gloves outside of lab (cross-contamination)

INSULATED CRYOGEN



LEATHER



ALUMINIZED



METAL MESH



HAIR CARE

Long hair should be tied back

LAB COAT

Protects against minor spills and splashes

Ensure material is suitable for chemicals you work with

This needs replaced when contaminated by chemicals

LONG PANTS

Must always be worn in lab, no exceptions!

CLOSED-TOE SHOES

Must always be worn in lab, no exceptions!

ST, PROPERLY WEAR, CARE FOR, CLEAN, AND MAINTAIN PPE. : NEED TO REPAIR OR REPLACE PPE. OUS WASTE, AND SHOULD NEVER BE TAKEN HOME.



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A.J. Drexel Nanomaterials Institute

Spill Kit Types and Locations

General Purpose Spill Kit



For all *non-Hydrofluoric Acid (HF)* spills

Locations:

Room 327B – Above centrifuge
Room 324 – Above balances
Room 324C – Shelves by left fume hood

HF specific First Aid Kit



Only for treating HF burns

DO NOT attempt to clean up any HF spill
Call EH&S immediately
215.895.2222

Locations:

Room 327B – by etching reactor computer



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Gas Tank Safety

Never modify, force, lubricate, or tamper with cylinder valves

Use a cylinder dolly to transport tanks



Cap gas tanks when not in use

Always secure gas tanks with a chain or strap

Confirm the type of gas prior to use

Ensure the area you are working is properly ventilated

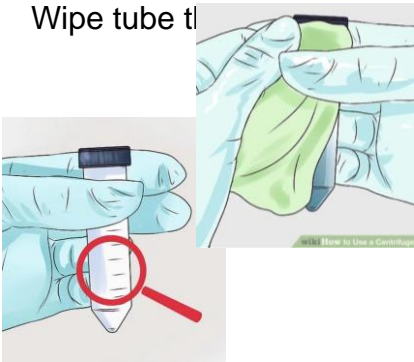
Centrifuge – safety and usage

Max fill level 10% of total volume to avoid spilling during



Inspect tube for cracks and defects

Wipe tube top



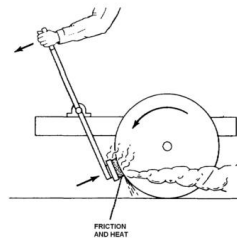
Use RCF instead of RPM
RPM settings different from one instrument to the next

RPM – Revolutions per minute
RCF – Relative centrifugal field

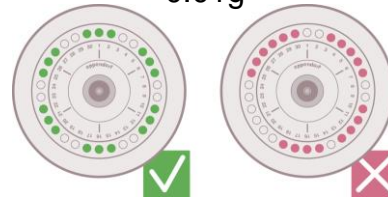
$$RCF = 11.2 \times R \times \left(\frac{RPM}{1000}\right)^2$$

Fast acceleration and deceleration leads to wear and tear

Always set to the lowest setting on the instrument



Proper tube placement
Place items symmetrically
Weight counterbalance to 0.01g



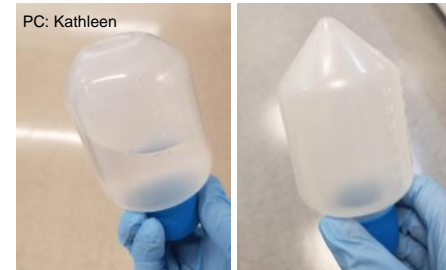
Clean inside housing after every cycle to remove sprayed liquid



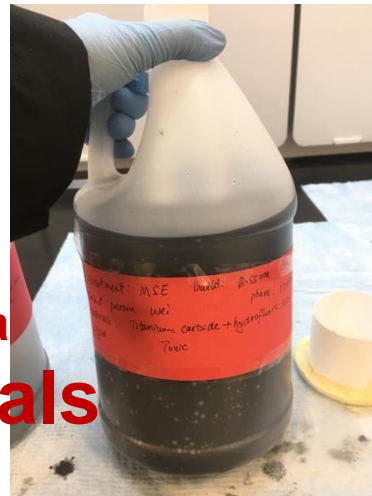
Centrifuges heats up during operation
Requires periodic breaks and cooling



Tubes may deform from force and heat



Do not cap it



Chemicals
Presentation by Mykola
Spilled chemicals
Presentation by Tyler

Chemical Compatibility

Chemical Class & Examples:	Incompatible Classes of Chemicals and Examples:
Acids (inorganic): Nitric acid, sulfuric acid, hydrochloric acid, hydrofluoric acid, perchloric acid	Bases: sodium hydroxide Other: potassium cyanide
Acids (organic): Acetic acid, ethanoic acid, phenol	Bases: potassium hydroxide, sodium hydroxide Other: potassium cyanide Oxidizing agents: hydrogen peroxide, nitric acid, perchloric acid, potassium hypochlorite, potassium perchlorate
Alkali Metals: Sodium, lithium, potassium	Chlorinated hydrocarbons: Chloroform Halogens: iodine Other: carbon dioxide, water
Bases (caustic): Potassium hydroxide, sodium hydroxide	Acids (organic): acetic acid, ethanoic acid, phenol Acids (inorganic): nitric acid, sulfuric acid, hydrochloric acid, hydrofluoric acid, perchloric acid Flammable solvents (hydrocarbons): acetone, acetonitrile (ACN), benzene, ethanol, diethyl ether, isopropanol, methanol, methyl ethyl ketone, tetrahydrofuran (THF)
Chlorinated hydrocarbons: Carbon tetrachloride, methylene chloride, chloroform	Alkali Metals: sodium, lithium, potassium Bases: sodium hydroxide Other: mixture of acetone and base
Combustibles liquids and solids: Diesel, vacuum oil, grease	Oxidizing agents: hydrogen peroxide, nitric acid, perchloric acid, potassium hypochlorite, potassium perchlorate
Hydrocarbons (flammable solvents): Acetone, acetonitrile (ACN), alcohols, benzene, diethyl ether, methanol, methyl ethyl ketone, tetrahydrofuran (THF)	Bases (caustic): potassium hydroxide, sodium hydroxide Oxidizing agents: hydrogen peroxide, nitric acid, perchloric acid, potassium hypochlorite, potassium perchlorate
Halogenated hydrocarbons: Carbon tetrachloride, chloroform, methylene chloride	Alkali Metals: sodium, lithium, potassium Bases: sodium hydroxide, potassium hydroxide Metal: aluminum, manganese Oxidizing agents: nitric acid Other: plastics, rubber
Halogens: Fluorine, chlorine, bromine, iodine	Flammable solvents: acetone, acetonitrile (ACN), benzene, ethanol, diethyl ether, isopropanol, methanol, methyl ethyl ketone, tetrahydrofuran (THF)
Metals: aluminum, copper, gold, iron, mercury, silver, zinc	Acids (organic): acetic acid Bases (caustic): potassium hydroxide, sodium hydroxide Oxidizing agents: nitric acid Other: sodium azide
Oxidizing agents: Oxygen, chlorine, hydrogen peroxide, nitric acid, perchloric acid, potassium hypochlorite, potassium perchlorate	Acids (organic): acetic acid Combustible liquids and solids: oils and grease Flammable solvents: Acetone, alcohols



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Walk-in fume-hood safety

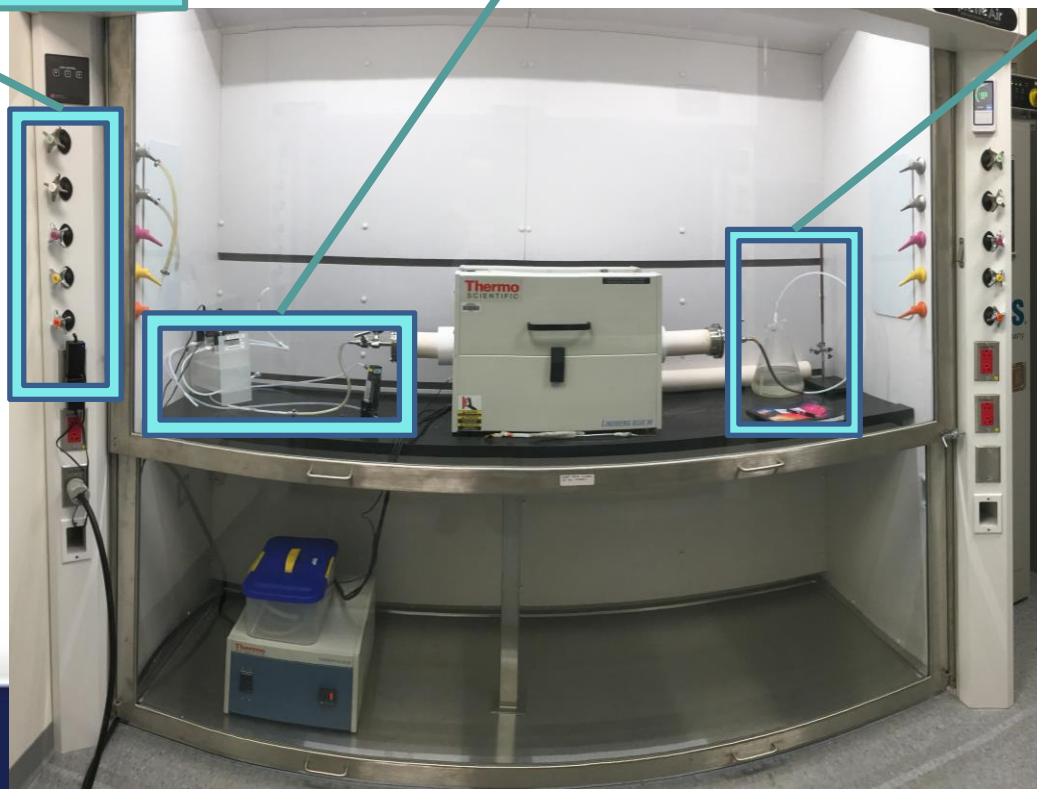


- After you have attached tubing to your furnace, but before opening the gas tanks in the cabinets, ensure that the gas line you want to use is the only valve of that gas that is open (turned counter-clockwise).
- Check **all the other** lines of that gas in the room and make sure they are closed (turned clockwise, all the way).
- I.e.: if you are using NH_3 , open your line by turning the appropriate NH_3 knob counter-clockwise, but make sure the other **three** NH_3 lines are closed (unless somebody else is using it, then more than one line can be open).

- Double-check that all tubing is securely connected.
- It is best to wrap joints where tubing meets knobs with either parafilm or Teflon tape to prevent leaking
- When connecting one type of tubing to another type, it is best to use a metal clamp to fasten them together.

- Unless your gas reaction requires a specific exhaust medium, it is standard to place tubing coming out of the furnace in a beaker of water.
- This allows you to observe the flow rate and also neutralizes the gas.

- **KEEP THE SASHES CLOSED!** Only open the sash when you are moving your sample, then close it to prevent gas from seeping out into the lab.



- Before turning on gases, check necessary instructions for the walk-in fume hoods.
- First, before opening gas tank, make sure that the appropriate path in the cabinet's manifold is open for the gas you want to use.
- If you want a gas to be introduced to the fume hoods, the path from the tank to the tube in the top left of the gas cabinet should have the appropriate lines.
- If an open path toward the top center tube is made, gas will be exhausted out of the Bossone building (you typically do not want this, unless you are trying to completely deplete a tank).

- Lastly, observe the regulators to see that the amount of gas in the tank is sufficient (right meter) and the left meter, which controls the flow rate out of the tank is at a low but non-zero value.
- This can be adjusted by turning the central black and white knob to 'increase' or 'decrease' the flow
- Check that the open/close valve is open.
- Check that your gas is flowing in the beaker in the fume hood

- Secondly, you can open the gas tank by turning the top valve counter-clockwise.
- For some tanks, this will require a wrench.

- When you are done with your gas treatment, close the tank knob only
- Adjusting and closing the regulator valves is typically not necessary. Gas may flow for a few minutes after you close the tank, but this is normal and should take a few minutes to dissipate.
- For certain gases like ammonia and chlorine, you should run argon through these lines for a few minutes afterward.
- CLOSE THE KNOB YOU USED ON THE FUME HOOD

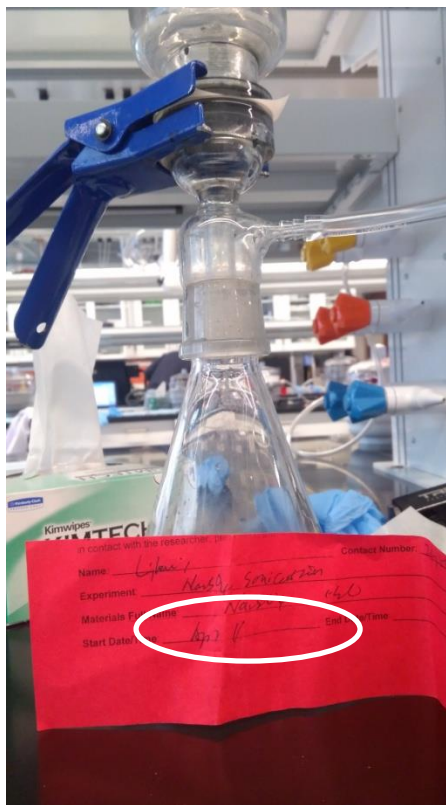


Safety - Labeling

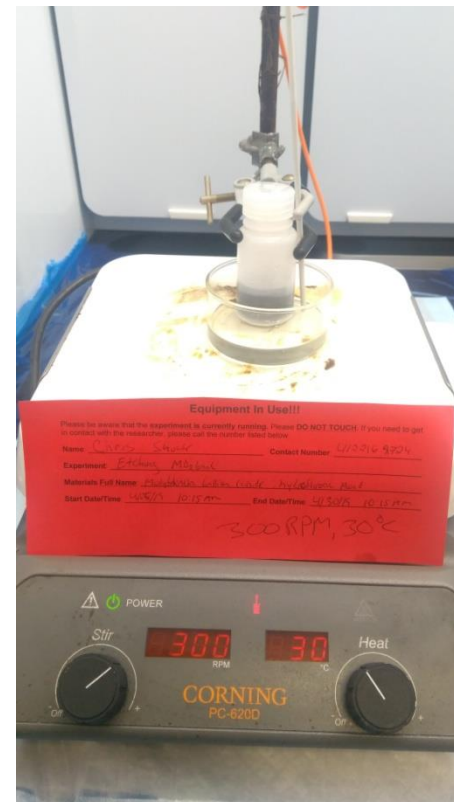
Full chemical names
Experiment conditions
Time and dates



✘ No labeling



❖ Improper labeling



✓ labeling

Conflict Resolution and Mentorship

Updated April 29, 2019

Just ask yourself

- We are just creatures motivated by our wants and needs
- What do I want?
- What do they want?
- For relationships, we want to feel respected, heard, understood and valued

Relationships

- Respected: I want to feel that my feelings being considered and that I am shown courtesy that I think I deserve
- Heard – I want to feel that I am given equal and quality time and attention
- Understood – I want to feel that my ideas and contributions are given thorough and careful consideration
- Valued – I want to feel that I am an essential and integral part of the team and that my contributions matter

Interpersonal conflict resolution

- (Usually) do not talk to Yury, Mykola, Babak first
- Tell the person the actions that you had problems with and how their actions made you feel
- Be more comfortable with confronting each other. I know, easier said than done. Feign confidence if you need to, express how you feel, use “I” statements, provide evidence to give support and tangibility to your feelings, be considerate, hear their side, exhaust the discussion until a mutually agreed upon resolution is reached, follow up (positively or negatively)

A conflict example

Example: Mark is setting up an etch and he is careless with the pipette that he is using for HCl.

- **“Hey Mark, I noticed that when you finished with the HCl, you placed your pipette in the hood and didn’t wipe up where it was placed. It might have not left any residue, (predicting and acknowledging their stance), but it still scares me (how it makes you feel) (saying that it is dangerous may come off as patronizing). Would you mind disposing of it right away instead of placing it down (ask instead of telling)?”**
- ***Next time you see him etching***
- **“Hey Mark, I know it’s a little more effort, but I appreciate you doing that!”**
- ***If not***
- **“Hey Mark, we agreed on you disposing of your pipettes and aren’t adhering to the agreement.”**
- **Then you can go to leadership and tell them your account.**

An accountability example

Let's say your solution spills and sprays the inside of the centrifuge

- You can: Clean up your centrifuge tubes and quickly wipe up the centrifuge wall and hope no one notices.
- Benefits: Avoided admitting fault and slight embarrassment
- You can: Send an email. “Hey all, my cap came loose and splashed the inside of the centrifuge. It will be down for the 30 minutes while I clean it. If you use it after me and see any spots that I may have missed, please let me know and I will be sure to clean it up. Thanks for your understanding!”
- Benefits: Built trust, established your integrity, demonstrated your responsibility

Social Psychology

- Assume people are trying to follow the rules and speak as though you are holding them to a preestablished standard
- People are more likely to uphold an expectation than to rise above and beyond what they see as the passable minimum
- We are social creatures: People are more likely to follow the rules if they believe everyone else is also following the rules
- People are more likely to disregard the rules if they believe everyone else is disregarding the rules

DNI-ALL@LISTS.DREXEL.EDU

How to format an email:

- Positive, Negative, Positive
- “Hello all, I have noticed that everyone is doing a fantastic job keeping their benches and lab spaces clean. Unfortunately, the cleaning of glassware has not been given the same care. Please be mindful to clean the glassware after use and I appreciate your efforts in doing so!”

Conclusion

- We are most productive and happy when we are comfortable in our environment
- We want to trust and be trusted by our peers
- We want to feel respected, heard, understood, and valued in our relationships

Introducing a new member to the lab

Before anything else: BioRAFT safety training, submit headshot photo and phone number, go over DNI group website information. Describe how ordering, chemical inventories, waste, lab organization, log books, FACES, subgroups, etc. works.

M – **Model** the correct behavior, support mentee/new researcher's **Mission**.

E – **Evaluate** knowledge or previous experience. Go over project expectations, lead mentee towards related literature (***know the way***)

N – **Navigate** the project and give lab specific training through tutorials (***go the way***)
Have mentee perform Risk Assessments (with original schematics and protocols)

T – **Trust** the new lab member. Allow experiments when the researcher feels comfortable, smooth, and understands all aspects of the protocol(s)

O – **Offer** feedback. Supervise all preliminary experiments, give advice, and correct things that may lead to bad habits or safety violations (***show the way – correct and incorrect***)

R – **Review and Reflect**. Be involved in their progress!