MICRONOVA
Centre for Micro- and Nanotechnology

VTT

Aalto University

Handling of Chemicals

Obligations

Obligations of the employers

- Duty to be aware of the risks.
- Duty to select harmless chemicals.
- Duty to provide a safe working environment and necessary protective equipment and clothing.

Duties of the employees

- Use personal protective equipment and keep them in good condition.
- Inform employer about safety risks.

General Advice

Before you start to work with chemicals

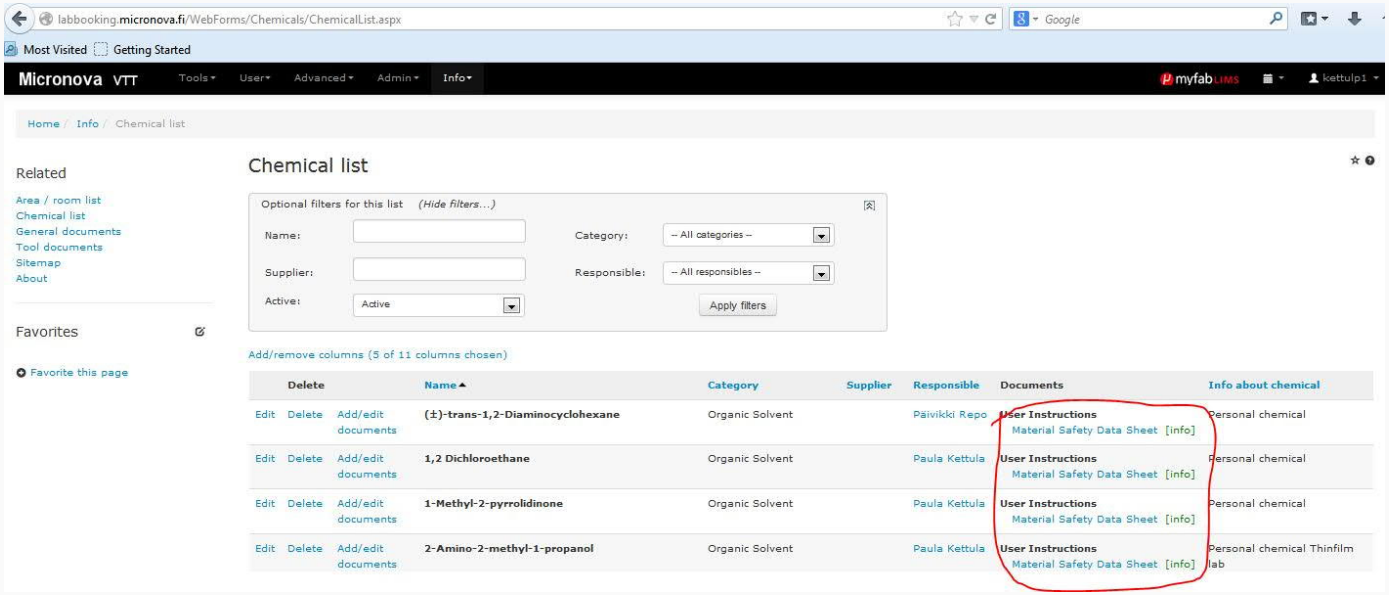
- Learn to recognize the possible dangers.
- Read the MSDS of the chemicals you will use.
- Seek training from an experienced operator.

- For safety reasons, working with chemicals that require wearing full protection and toxic gases after office hours (7:00 – 17:00) and during weekends is allowed only if there is another operator working in the cleanroom at the same time.

- Handle chemicals only in a fume hood or in a wet bench.

- Remember that there are special, separate working areas for solvents and acids.
  - When diluting acids: first water, then acid.
  - Don’t mix acids and solvents!
  - Sulphuric acid reacts vigorously with water.
  - Rinsing with DI water after processing
  - If you don't know, ask.

MSDS - Safety Data Sheet



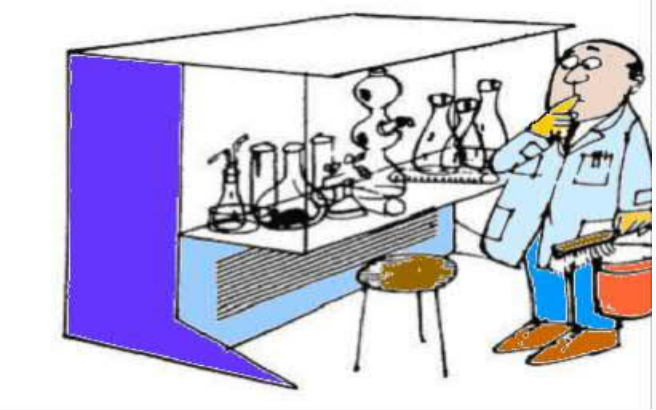
MSDS for all cleanroom and thin film lab chemicals are available in LIMS/Info/Chemical list

MSDS must be available also during power failures
→ paper copies are available next to the cleanroom entrance.

Clean Ways of Working

- When you use beakers or other chemical vessels, label them clearly. Mark the name of the chemical, date and your own name.
- Rinse empty chemical bottles with DI water and after draining put them in the bottle bin (in the grey area).
- You must ensure that the working areas, equipment and vessels are clean after your work.
- If you find unmarked vessels containing unknown liquids, inform Aalto Nanofab's Cleanroom Engineer immediately.

Content:	
Name:	Date:



Standard chemicals

HYDROGEN PEROXIDE 30% WEIGHT VLSI -17606- (2,5 L)
NITRIC ACID MIN. 69 % VLSI PUR -17512- (2,5 L)
ORTHO-PHOSPHORIC ACID MIN 85 % VLSI -17644 (2,5 L)
SULFURIC ACID 95-97 % VLSI -17611- (2,5 L)
TMAH ULSI (5 L)
AZ 5214 E (5 L)
AZ 351 B DEVELOPER (5 L)
AZ 726 MIF DEVELOPER (5 L)
2-PROPANOL VLSI PUR -17604- (2,5 L)
ACETIC ACID MIN. 99,8 % MOS PUR -17926- (2,5 L)
ACETONE VLSI PUR -17617- (5 L)
AMM. FLUOR. ETCH. MIXT. AF 90-10 VLSI 17672- (5 L)
AMMONIA SOLUTION MIN. 25 % VLSI -17605- (5 L)
ETCHING MIX. PWS 80-16-4 MODIFIED -17531- (5 L)
HMDS PURANAL (2,5 L)
HYDROCHLORIC ACID MIN 37 % VLSI PUR -17610- (2,5L)
HYDROFLUORIC ACID 50 % VLSI PUR -17602- (2,5 L)
MMA 8.5 MAA EL11
950 PMMA Series resist in Anisole
MIBK
Anisole
Technistrip Ni555
AZ15nXT (450 CPS) Photoresist

Nanofab personnel ensure that all standard chemicals are available in the cleanroom.

New Chemicals

- Only approved chemicals can be used in the cleanroom. For using a new chemical you need permission from Aalto Nanofab's Cleanroom Engineer (Päivikki Repo; deputy Antti Peltonen).

- e-mail your request and the material safety data sheet of the chemical to Aalto Nanofab's Cleanroom Engineer.

- Cleanroom Engineer checks that the chemical is suitable for the cleanroom. If there are no contamination risks and the chemical is safe to use in the cleanroom you will get permission to use the chemical. You purchase the chemical yourself.

Chemical Safety - General

- Always use personal protective equipment as instructed.
- Handle chemicals only in the wet benches or in the fume hoods.
- Acids and solvents have different fume hoods and wet benches because there are dedicated air exhausts and waste chemical drains for acids and solvents.
- If you notice a problem with water, exhausts, gases or electricity contact Nanofab person on-call immediately. See the number below!
- During alarms follow the instructions given in Micronova Safety Code.
- If you don´t know, ask!

  Nanofab person on-call (0) 040 5274 840

Personal Protective Equipment

Protective equipment must be used when handling chemicals!

There are two levels of protection:

Light Protection and Full Protection.

Light Protection: Use with solvents and resists.

- Goggles (or face shield)
- Thin gloves (double gloves for messy work, for instance resist work)

Full Protection: Use with acids and bases.

- Faceshield
- Acid recistant apron
- Chemical gloves

Remember: Acetone and IPA and <u>all resists</u> are also chemicals!

Gloves

- You always have to use gloves in the cleanroom.
- When you are handling chemicals use thick chemical cloves on the usual cleanroom gloves.
- If you are working with small substrates and the chemical gloves are too thick, use double gloves.
- Use double gloves during messy tasks, such as resist work in the lithography.

Chemicals – Names and Labelling

Use the correct chemical - always check the name on the bottle!

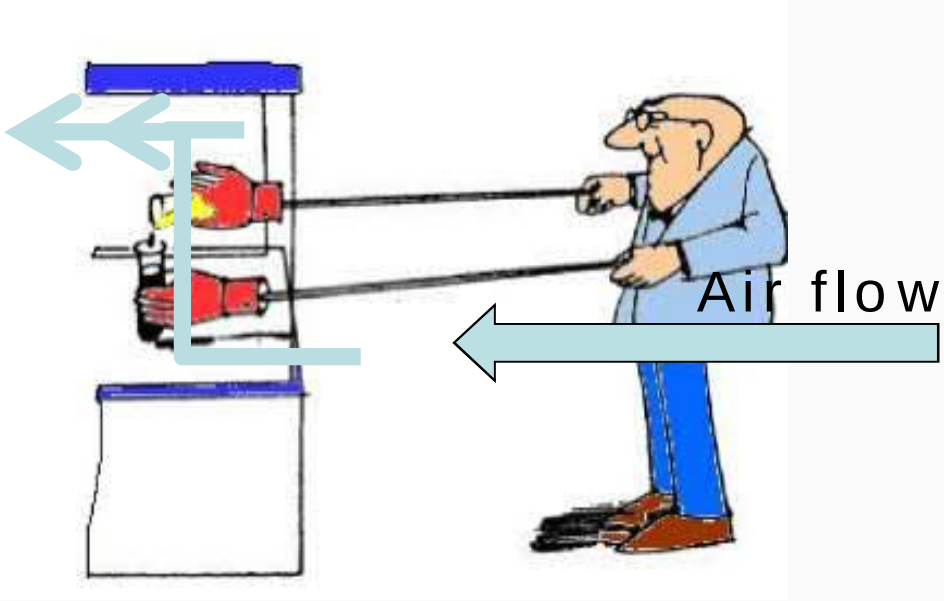
Read the whole name! We have many chemicals beginning with the same word like:

- Ammonium solution
- Ammonium fuoride
- Ammonium fluoride etchant
- Hydrochloric acid
- Hydrofluoric acid

- Check every bottle!

- For your own and others' safety: Always label the chemical vessels you are using - including DIW vessels!

Use of Fumehoods



User Manual for Fume Hood

1. When starting check that fume hoods ventilation works properly.
2. Always keep the front door as low as you can.
3. Do not use fume hood as a storage.
4. Place all equipment and tools as far in the fume hood as you can.
5. Do not bend over in to the fume hood while working.
6. Close the front door when you are done with your work.
7. If fume hoods ventilation stops, close the front door and report about the dysfunction to person-on-call.

Drains

- We have 3 types of drains in the cleanroom:
  - Neutralisation drain (”Normal” acids and bases)
  - HF drain (Hydrofluoric acid and any other mixture containing fluoride)
  - Solvent drain (IPA, Acetone, MIBK, PGMEA)

- Chlorinated solvents: do not pour them down the drain; they must be collected separately
- If a forbidden chemical ends up in any of these drains, the Nanofab person on-call must be informed immediately. He will arrange for appropriate measures.
- The temperature of the solutions led into the drains must not exceed +50°C.

Chemical Spills on the Floor

- If you spill chemical on the floor, absorb it with absorber tissues located in the service corridor area.
- If chemical seeps under the raised floor, immediately contact the person on-call.
- Mark the contaminated area to prevent others from stepping into the spill.
- If the chemical is very fuming make an alarm using the chemical alarm button and call the Rescue Team.

First Aid in Chemical Accident

Undress and use the emergency shower.
At least 5 minutes.

Use eye wash if necessary.

First Aid in HF Accident

Calsiumgluconat eye drops

In case of accident...

1. **ASK FOR HELP TO GUIDE YOU**
   - **Phone Call On Duty +358 40 527 4840**
   - **Phone 112 to get further instructions**
2. Flush your eyes at least for 5 minutes
3. Avoid damaging the unhurt eye with contaminated flushing water
4. Take one bottle from the row
5. Twist the cap guard away
6. Cut the cap with scissors, if it is needed
7. Bend your head to get easy access for the drops
   - Ask for help, if it is available
   - Draw the lower eyelid, look upwards and put several drops to the eye
   - Add more if is needed
8. Go with guide to the emergency duty or place guided by 112
   Address: HUS Silmä-korvasairaala
   Haartmaninkatu 4C
   00290 Helsinki
   Phone: 09 4711
9. Take along Calsiumgluconat eyedrops and gel tubes
   Take along HF material safety data sheet from M2 cleanroom hallway

Rub exposed skin with Calcium gluconate gel. Seek medical help.

Contamination

- Particles
- Metals
- Organic compounds

Sources of Particles

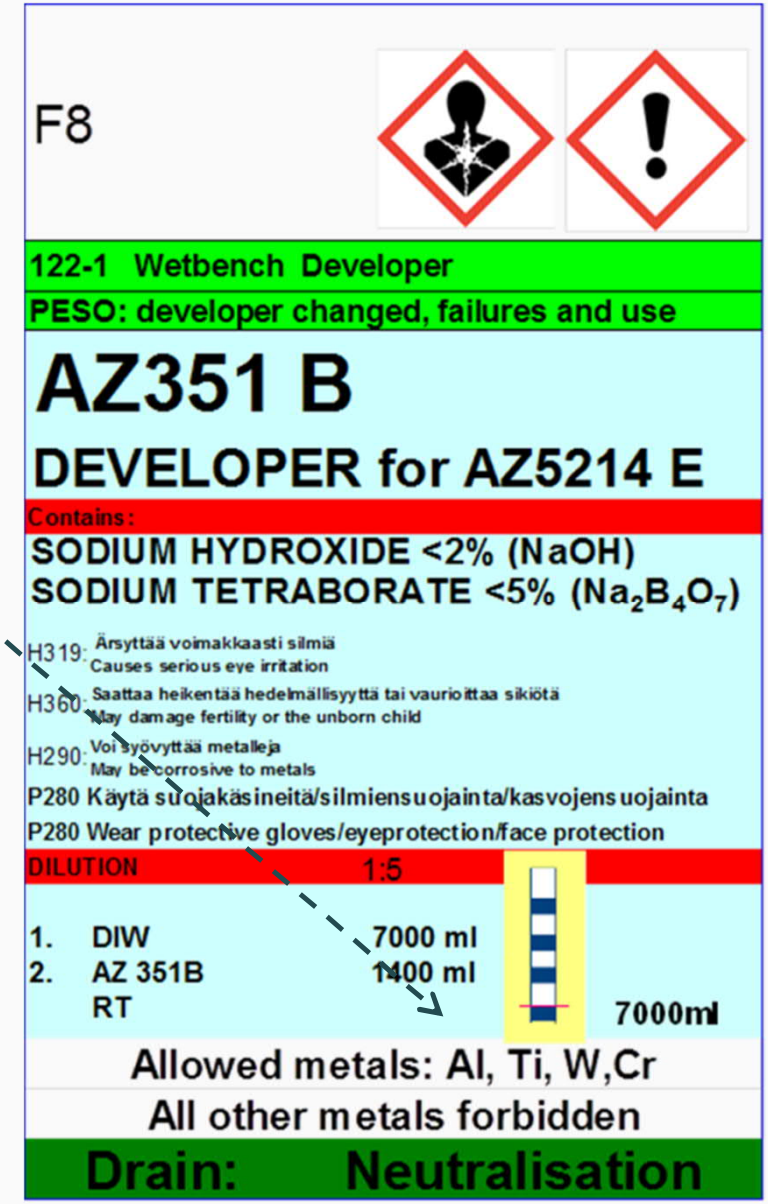
- Operators (40-90% of the contamination)
  - People generate particles in the form of skin flakes, lint, cosmetics and respiratory emissions
- Materials (substrates like silicon and glass)
- Substrate handling
- Tools and containers (e.g. quartz boats and tubes)
- Gases
- Chemicals (there can be unwanted reactions)
- Processes
- Maintenance work

Metal Contamination

- Many metals can seriously degrade the operation of processed devices. (e.g. Au, Ag, Pt, Cu, Ti, Fe, Ni…)
- For this reason processing tools have restrictions on the metals that are allowed on your samples.
- Removal of trace metals is a major reason for wafer cleaning prior to sensitive processes.
- There are numerous sources of metals even though materials like Teflon, SiC and quartz are often used in equipment and wafer handling tools.
  - structural parts of equipment (e.g. ion implanter or sputter shutter blades)
  - piping for gases and liquids
  - tweezers and jigs
  - chemicals (some photoresist developers have NaOH as an essential constituent)
  - sweat (esp. sodium)
  - Plastic containers, plastic vessels

Metal Contamination

- Several type of metals are used in our cleanroom processing. Metal etching as well as developing of metallised substrates is allowed only in the cleanroom bay F12
- Some metals are allowed to be developed and etched in the tanks of Lithography bay F8.
- Follow the instructions given on the signs above the tanks.
- Only the metals shown in the labels are allowed.



Sources of organic contamination

- Solvent vapors (e.g. lithography processes HMDS priming and resist baking).
- Wafer boxes (plasticizers).
- Etch and deposition gases.
- Vacuum pump oils.
- Equipment O-rings (Vacuum grease is forbidden).
- Cleanroom construction materials (avoid silicone containing materials).

Avoid Contamination

To avoid spreading contamination in the cleanroom good working habits are essential.

- Keep your gloves clean. Change them if needed.
- Remove chemical gloves before using computer etc!
- If you bring samples into the cleanroom, make sure they are cleaned prior to processing.
- Check restrictions for the tool or workstation you are using. Don’t process forbidden materials!
- Beware of metal tweezers!
- Be sure to mount your sample correctly on a carrier prior to processing.

  Generally the use of tape and glues are forbidden!
- If you make a mistake, promptly notify Nanofab personnel or the Main User of the tool.

By following the rules you can help us maintain a clean cleanroom.

Welcome to work in the Micronova Cleanroom!

Aalto University

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