FYZIKÁLNY ÚSTAV
Slovenskej akadémie vied

INSTITUTE OF PHYSICS
Slovak Academy of Sciences

Dúbravská cesta 9, 845 11 Bratislava, SR Tel.: (+421) 02 59410 501

LABORATORY REGULATIONS, NANOLAB

Everyone who works in a laboratory knows that there are certain rules and regulations to be followed to ensure safety of personnel, accuracy of experiments. In this document you can find the ground rules that all personnel of the Department of Multilayers and Nanostructures, IP SAS are obliged to follow in the laboratories of the QUTE pavilion. Since we have equipment in other SAS building, if it is not set by the other institute otherwise, adhere to the rules stated below.

List of laboratories at QUTE pavilion

- Chemical laboratory (fume hood, hot plates, chemical cabinets, spin coater – perovskite preparation-oriented lab)
- Trumpf laser and X-Ray lab (GIWAXS)
- Nanostar (GISAXS)
- Ion beam sputtering + in-situ ellipsometry + in-situ GISAXS
- Glove-box lab

List of laboratories in the NanoBIO building
1st floor

- Langmuir-Blodgett deposition + optical microscope + contact angle
- Battery testing lab
- Ellipsometry + UV-VIS + PL lab
- Confocal microscope + Imaging Ellipsometry

Ground floor

- X-Ray lab 1.
- X-Ray lab 2.
- Nanostar 2.
- CRM lab
- Scanning probe technologies (AFM, NanoFTIR)
- Profilometer lab
- Chemical laboratory (fume hoods, laminar flow box, hot plates, bath sonication, tip sonication, chemical cabinets, etc.)
- Batter prep. lab with GIWAXS integrated Ar glove-box

List of labs inside the SAS area

- Polymer Institute – Centrifuge + Glove-box + Zeta-sizer

1. General rules

1.1. Attendance table next to the building entrance

The magnetic table to signalize that you are inside the building is at the entrance of the NanoBio building. If you don't have your own magnet with your name, please use the ones labelled with visitor.

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1.2. Newcomers

If a new student (for Bc, Mgr or PhD project), or any short/long term guest or coworker arrives in our institutes, and you are responsible for his/her project, or closely working with her/him project, on the day of his/her first official workday, introduce him/her our laboratory regulations, introduce her/him to the practical part of the regulations (waste management, storage units, etc.). Let her/him read through the regulations, and collect her/his signature.

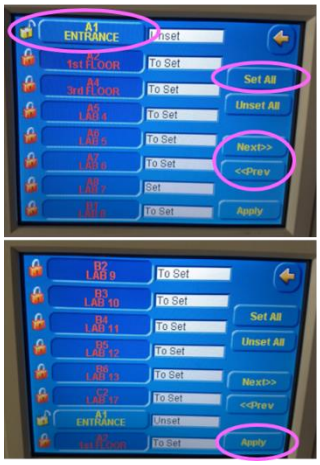
1.3. Building security QUTE

The building security is turned on for the night, and for the weekend. It is compulsory for the last person in our labs in the evening to turn on the security system. Follow these steps:

- If you do not have PIN code for the building, but your experimental work requires, ask your supervisor for one.

Click on the display, then click „Instant set“.

Enter your 6-digit PIN code, then press „ent“.



Click on individual options
or
click „Set all“ to set at once all of our laboratories and all of the 3rd floor offices. You wont be able to secure some of the laboratories that dont belong to our team, neither the 2nd floor offices (recognized upon the PIN code, but not displayed correctly).
Before securing the 3rd floor, make sure everybody left, otherwise secure only our laboratories (i.e. UNSET „A4“).
Use „Next“ and „Prev“ to navigate between rooms.

Important: Always leave the „A1 ENTRANCE“ UNSET!!!

Click „Apply“, you will hear a short sound signal.

1.4. Building security BioNano

There are 3 keys in use to access the Bio Nano building for the personnel of CEMEA and FU SAV OMN group. For colleagues from other institutes we provide the key for the main entrance. The security code for this building will be later updated.

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1.5. Shared equipment and labs

Some of our laboratory equipment (for instance Confocal Raman) we share with groups from different institutes (Polymer Institute, Institute of Electrical Engineering). Colleagues from these institute are also required to follow the set of regulations written in this document.

1.6. Sample storage and labelling

Wherever you keep your samples, always label it correctly: date – name/initials – content. It is encouraged to have a box with your name on it, so you can keep the samples in one place. It also preferred to keep samples in laboratory shelves instead of your office. Keeping liquid or toxic samples in office is prohibited. Use the appropriate storage unit for it: chemical cabinet / fridge / freezer /glove box under N/Ar. Always consider whether the sample can be evaporating into the room or not. Unlabelled samples will be discarded.

If you see someone to forget a sample for instance beside the AFM (can happen to all of us), kindly let her/him know, so she/he can put it away.

Since the space is limited, check every month if there is some that you can already discard.

1.7. Respirator mask and lab coat

Use respirator mask whenever you see on the lab doors: Entry with Respirator only. This sign is on the door for the chemical lab and for the LB lab. On the other side of the sign sheet is written: safe entry. In this case you are safe to go inside without a respirator.

Use lab coat in chemical laboratory and also for other procedures that require chemical usage, for instance LB deposition.

Figure 1 - Entry with respirator only - chem. lab and LB lab sign.

1.8. Equipment reservations

The equipment reservation calendar is here: https://omnnas.ddns.net/Calendars/. If you need to create a new login, submit your request by e-mail to Dr. Halahovets. Since we share equipment with other research groups, it is crucial you plan your experiments ahead. You can reserve the fume hood as well, if you need space and time there for your experiment. Usually fume hood is not reserved for quick few minute

procedures, therefore check before you enter if someone in fact has a reservation. Do not disturb the experiments conducted there during the reservation period. If you finished your experiment with sonication probe, heating plate or spin coater, etc., do not leave the equipment inside the fume hood, remove so other have space where they can work as well. These equipments are stored on the table in front of the fume hood.

1.9. Cleaning

All glassware and instruments must be cleaned after a working session. Contaminants at the working environment must be promptly removed. Everyone must leave the working environment clean and clear of any possible sources of accidents. This includes to tidy up the workplace after measurement, putting away your samples and any non-reusable consumables (gloves, tissues). In case of AFM Multimode, it also means you need to clean the magnetic AFM holders. The only exception of this rules is, if you are working on same workstation for several consecutive days. If you empty a box of tissues or gloves, throw the box in the adequate waste bin.

Figure 2 - drying station for labware and the work table

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Figure 3 - an example how a working station should NOT look like after one's work is finished.

1.10. Waste separation

All sorts of waste have to be collected separately in the appropriate vessels. We have container on the 1st floor beside the entry door for plastic/paper/glass waste. These will be processed as communal waste. For laboratory waste separation see the **2.5 Lab waste separation.**

1.11. Wash bottles

Wash bottles of DI and IPA or Etoh are in almost every lab, labelled. The label contains the name of the lab as well. If you remove additional bottle from chem. lab, take it back later. Place the chem. lab wash bottles in the white boxes after your working session. Keep the table tidy.

1.12. Labware storage and consumables

New labware is stored in the corridor cabinets, the cabinets are labelled for ease of use. Since everyone can order consumables in out labs, it is recommended, that after you see that we are about to run out of gloves, tissues, or other consumables (pipette tips etc.), take it upon yourself and prepare an order. To do so, you can announce this by an e-mail to our colleagues, so that others may add some items. This would reduce the number of orders from the same company (usually merck, fisher), also reduce the money spent on delivery.

If you are not sure how to order consumables, there is a PDF on our server /_public/_PROTOCOLS named *howtopurchaseconsumables.pdf* for further information.

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2. Chemical laboratory-specific rules

You can find these posters both in English and Slovak Language in the chemical labs of our department.

Institute of Physics SAS, Dúbravská cesta 9, 845 11 Bratislava

Department of Multilayers and Nanostructures

LABORATORY SAFETY RULES

- Food, drink, and smoking are strictly prohibited in the laboratory.
- Always wear protective gloves when handling chemicals. Corrosive and harmful substances must be handled inside a fume hood.
- When working with poisons and other harmful chemicals, avoid contact with skin, mucous membranes, respiratory organs, and the digestive system.
- Any work with substances that produce fumes, irritants, odors, or toxic gases or vapors must be conducted in a fume hood with adequate ventilation.
- Always wear eye and face protection when working with alkali metals, hydrides, organometallic compounds, and strong oxidizing agents.
- Work with chemicals that may harm human health must be carried out in a fume hood with adequate ventilation. Ensure that exposure levels do not exceed the maximum permissible concentration.
- Handle chemicals with care and pay attention to the hazard pictograms on the labels.

flammable oxidizing toxic corrosive explosive irritating, sensitizing dangerous for environment carcinogen, mutagenicity, reproductive and specific toxicity gases under pressure

- Every sample must be clearly labeled with the name, date, chemical compound, and solvent.
- Keep your work area clean and free of chemicals.
- When transferring or pouring poisons and corrosive substances, containers must be placed securely to prevent spills or breakage.
- Substances that release heat when dissolved must be dissolved in small portions while cooling.
- When heating flammable liquids in heating baths, use a bath liquid that is miscible with the flammable liquid.
- Prevent bumping when heating flammable liquids in flasks by using boiling chips or boiling glass tubes.
- Do not use water or alcohol to cool reaction vessels containing alkali metals, hydrides, or organometallics.
- Before working with alkali metals, hydrides, organometallic compounds, or strong oxidizing agents, prepare appropriate firefighting equipment according to the emergency procedures.
- Immediately rinse acid or base spills with plenty of water and neutralize with sodium bicarbonate powder, followed by another rinse with water.
- Do not use sawdust, textiles, or other organic materials to clean up spills of nitric acid or strong oxidizing mixtures (e.g., chromic acid).
- Immediately turn off electrical power and allow the spilled flammable liquid to be absorbed by a suitable porous material (e.g., sand). Ventilate the laboratory (not into the hallway).
- Immediately turn off gas appliances and electrical power, restrict access to unauthorized personnel, and ensure good ventilation (not into the hallway). Absorb the spilled liquid with a suitable porous material and dispose of it safely.
- Chemical substances that can spontaneously ignite (e.g., sodium, potassium) or filter paper saturated with flammable liquids must not be disposed of in regular waste bins.
- Do not dispose of solid waste in sinks.

Inappropriate combinations of chemical factors leading to spontaneous combustion

acetic acid	chromic acid, nitric acid, compounds containing -OH, ethylene glycol, perchloric acid, peroxides and permanganate
acetone	concentrated solutions of nitric acid and sulphuric acid
alkali metals	carbon dioxide, carbon chloride
ammonium nitrate	acids, powdered metals, flammable liquids, nitrites, chlorates, easily decomposable organic substances or flammables
chlorates	ammonium salts, acids, powdered metals, sulphur
chlorine	ammonia, acetylene, butadiene, butane and other petroleum gases, hydrogen, sodium carbide, turpentine, benzene, easily reconcilable metals
hydrazine	hydrogen peroxide, nitric acid, oxidizing agents
hydrocarbons	fluorine, chlorine, bromine, chromic acid, hydrogen peroxide
hydrogen peroxide	copper, chromium, iron, most metals and their salts, flammable liquids and materials, aniline, nitromethane, cotton, wool, wood dust, coal
nitric acid	acetic acid, acetone, alcohol, aniline, chromic acid, hydrogen sulphide, flammable liquids and gases, paper, cardboard, rags
organic peroxides	acids, do not rub and keep refrigerated
potassium chlorate	acids
potassium perchlorate	acids
potassium permanganate	Glycerol, ethylene glycol, benaldehyde, sulphuric acid

Waste disposal

Only the following may be poured down the sink:

- Residues of poisons that are completely miscible with water, and only in quantities that do not exceed the maximum permissible concentration in water reservoirs according to the relevant regulations.
- Sufficiently diluted solvents (1:10) that are completely miscible with water (acetone, ethanol, methanol, isopropanol) in quantities not exceeding 0.5 liters (per single disposal) and diluted aqueous solutions of acids and hydroxides (at least 1:30).

The following may not be poured down the drain:

- Solvents that are not completely miscible with water; poisons, explosives, acids, and hydroxides above the specified concentration, and substances that release toxic or irritating gases when mixed with water, acids, or alkalis.

Waste solvents (xylene, toluene), after complete removal of residues of self-igniting substances and after neutralization, must be collected in designated containers (halogenated and non-halogenated separately). There must be sufficient free space above the liquid level in the containers.

Reaction waste, which due to the nature and concentration of hazardous chemicals may not be poured down the laboratory drain, must be collected according to the instructions of the employee in charge of working with hazardous chemicals into designated containers and, after filling, handed over for disposal.

Residues of alkali metals, alkali metal hydrides, and solutions of organometallic compounds after reactions or solvent drying must be disposed of immediately.

- Alkali metals must be disposed of in a fume hood with 96% ethanol; disposal of potassium with ethanol must be carried out in an inert gas atmosphere.

Containers for general waste must not contain substances that may cause fire or spontaneous combustion.

- Broken glass and waste with sharp edges must be placed in a separate container.
- Waste contaminated with oils (textiles, sawdust) or flammable substances must be placed in closed metal containers, which must be emptied daily and their contents disposed of in an appropriate place.
- Non-toxic solid waste may be disposed of with municipal waste.

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2.1. Chemicals

Before ordering and/or using a chemical make sure you are aware of its toxicity and potential harm that it can cause. Read the chemical safety information. Look into the storage conditions. If you are not sure consult your supervisor whether we have permission to store the given chemical in our laboratory conditions.

2.2. Lab door

Keep the chemical lab door closed at all times. When necessary use the sign on the door: ENTRY with Respirator mask, anyways leave the sheet on the SAFE ENTRY side.

2.3. Manipulation with pipettes

If you are not used to work with pipette ask your consultant or supervisor. If you do know, then do it properly. For reference there are several how to-s on YouTube.

- Preparation: Hold the instrument in a nearly vertical position. Depress the plunger smoothly to the first stop position.
- Aspiration: Immerse the pipette tip in the liquid. Allow the plunger to move up smoothly to the rest position. Wait one second so that all the liquid has time to move up into the tip.
- Dispense: Place the pipette tip at an angle (10° to 45°) against the inside wall of the receiving vessel. Depress the plunger smoothly to the first stop position.
- Purge: Wait one second, then depress the plunger to the second stop position. This purge stroke removes any remaining sample from the tip.
- Home: Allow the plunger to move up to the rest position
- Remove pipette tip.
- FYI: To obtain greater uniformity and precision of dispensing, it is better to provide identical contact surfaces for all aliquots. This is done by pre-rinsing with the same liquid as the one dispensed. For pre-rinsing, aspirate with the tip, and then dispense back into the original reservoir or to waste. Pre-rinse again when adjusting the volume.

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Figure 4 - an example of contaminated pipette.

2.4. Storage of chemicals

Primarily, we use the chemical cabinets for chemical storage. It is preferred to store the chemicals in the original packaging, if this is not applicable then label the bottles correctly: date of expiration, material, name of the person who prepared it. The expired or unlabelled flasks in the chemical cabinet (yellow) should be removed. If you stumble upon expired chemicals, pour them in the waste containers. Orient yourself according the labelling.

2.5. Lab waste separation

NEW!!! Now we have waste containers also in the chemical lab at BioNano, which are placed under the fume hoods, labelled as usual.

Battery waste – under and besides the fume hood, as labelled in the Battery prep lab.

The two big waste containers under the table are for non-chlorinated and chlorinated waste. They are labelled NON-CL and CL. Please dispose of waste according to the labelling. It is our laboratory practice to collect the waste liquid into one-liter bottles on the table. There are 3 different labels: NON-CL, CL, PSK. The PSK stands for perovskites. If the NON-CL and CL bottles are full, pour into the corresponding big waste containers under table, rather than take one more 1l bottle.

Everything contaminated with perovskite solutions (glassware, plasticware) is collected separately, if you have such waste please consult with your superviser. In case of any other glassware that is not reusable after washing, after washed out it can be thrown in communal glass waste bins, since it is highly recyclable. Put the washed non-reusable Teflon caps into general waste. When washing non-reusable labware, if the last washing step is IPA or ethanol, etc., let the residue evaporate in the fume hood, then throw it in the glass waste bin.

2.6. Washing reusable labware

After removing the solution from reusable labware (into the appropriate chemical waste vessel, if necessary, rinse with acetone and pour into appropriate waste container), follow these general rules:

- Wash labware as quickly as possible after use
- If cleaning is not possible immediately, soak glassware in water
- Soak labware in detergent and gently wash with cloth, sponge or brush, if necessary, use sonication bath
- For glassware that is exceptionally dirty, a cleaning powder with a mild abrasive action will give more satisfactory results
- Rinse with IPA/ethanol (generally it is suggested to rinse always with polar and non-polar solvents to remove all possible contaminants)
- Rinse with DI water
- Leave to dry

Please consider that some nanoparticle solutions are exceptionally hard to clean, be thorough.

2.7. Fume hood - QUTE

The sash of the fume hood should always be closed as far as possible. If not working in the fume hood leave it on setting 1.

When working in the fume hood, the waste separation for the liquid is the same: CL and NON-CL bottles are there. There are glass containers for glass waste and for plastic waste. The plastic waste are the pipette tips and syringes without the needle. These are there to let the residues of chemicals to evaporate in the fume hood. The container for glass is for glass (glass micropipettes), not for Teflon caps, and certainly not for liquid samples in glass bottles. Put the needles in a separate bin for the needles. After using a needle, put back the plastic cap on it, then throw it in the separate bin.

2.8. Labels on chemicals

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All containers of chemicals must be labelled correctly, including the wash bottles. The container label must include the date of preparation, the person who made the solution, and the name of the chemical, resp. content. If you prepare aliquots, the labelling should be the same.

2.9. Sink

Containers with food, coffee mugs, bowls, plates have no place in the chemical laboratory. For drinking water please use the tap in the PhD student room or in the kitchen, 2nd floor. The sponge in the chem. lab is for cleaning laboratory glassware, not for food containers. The drain in the chemical room can be potentially contaminated with highly toxic material and organic solvents.

2.10. Fridge

If you need to put something in the fridge, please use your dedicated box or shelf. Unmarked flasks will be removed from the fridge immediately. The best is to label them by writing your name/initials, date and content. Do not put inside flasks/beakers without lids. Do not leave flasks in between boxes, as they can fell down/out upon manipulating with the boxes or opening the door (already happened before). Flasks placed like this will be removed from the fridge immediately, despite being labeled. Do not use the labeled storage compartments for anything other than indicated on the label. The right side of the upper shelf is reserved for dialysis experiments. Please leave it empty. Do not encourage colleagues from other departments to leave their samples in our fridge. They should contact us first and agree on using one of our dedicated boxes/shelves. The inside of the fridge will be cleaned regularly, but do not hesitate to inform Dr. Annušová if you notice any contamination. Do not leave your samples/chemicals there for eternity. The space is limited.

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Figure 5 - Forgotten beakers near the drain. Overpacked fridge with non-labelled and forgotten samples. Do not replicate!