CEITEC Nano User Manual

The intent of the CEITEC Nano User Manual is to ensure that an environment is created inside the core facility in which researchers can work together safely and productively while maintaining the integrity of the class 100 / 1.000 / 100.000 cleanroom environment and equipment.

Thus user manual will continuously adapt to changes to our facility as it evolves. We strongly encourage users to make us aware of how we can more effectively meet the goals of the facility. Please contact us at nano@ceitec.vutbr.cz with all your comments, questions and requests.

Staff Contact Information

Michal Urbánek, Ph.D.
Head of CEITEC Nano
Phone: +420 54114 9200
E-mail: michal.urbanek@ceitec.vutbr.cz
Office: C2.25

Ondřej Man, Ph.D.
Deputy Head Of CEITEC Nano
Phone: +420 54114 9747
E-mail: ondrej.man@ceitec.vutbr.cz
Office: A0.11a

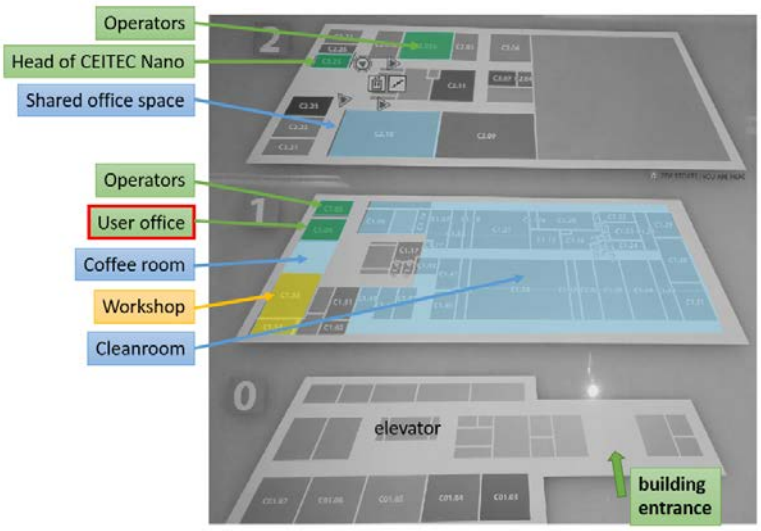
Richard Kolář
Core Facility Manager
Phone: +420 54114 9207
E-mail: richard.kolar@ceitec.vutbr.cz
Office: C1.04

Pavlína Zajícová
Core Facility Finance Manager
Phone: +420 54114 9205
E-mail: pavlina.zajicova@ceitec.vutbr.cz
Office: C1.04

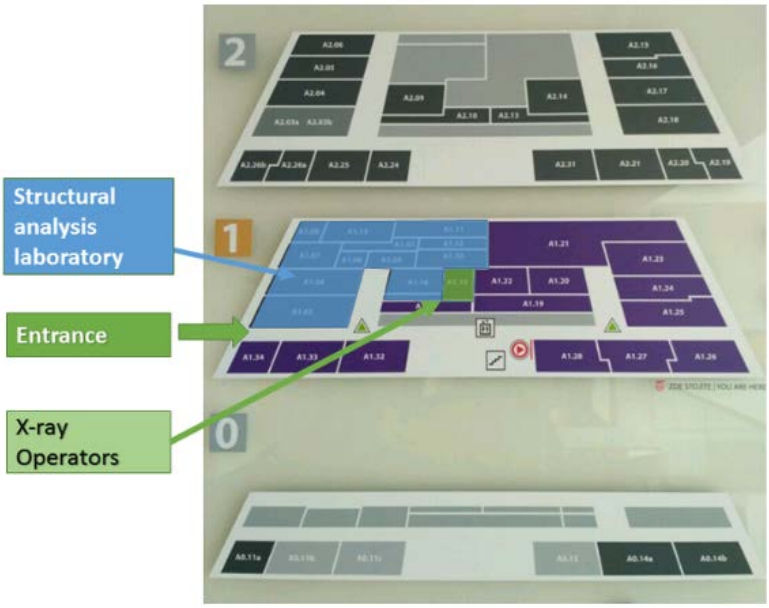
Helena Dolejšová
Core Facility Assistant
Phone: +420 54114 9206
E-mail: helena.dolejsova@ceitec.vutbr.cz
Office: C1.04

Table of Contents

Floorplan of the building “C” – Nanofabrication and Nanocharacterization



Floorplan of the building “A” – Structural Analysis Laboratory



1. Safety

The CEITEC Nano research infrastructure at CEITEC Brno University of Technology is committed to the highest possible safety standards. It is our goal to operate the facility in a manner that ensures that no unacceptable risks exist for all persons operating within the space. Safety is the responsibility of everyone. We require strict adherence to all applicable health and safety regulations, and will enforce these as necessary.

1.1 Internal User Safety Requirements

1.1.1 Each user must schedule and attend a general safety orientation (about 2.5 hours) with CEITEC Nano staff.

1.1.2 Each user must read the CEITEC Nano User Manual and complete the exam (accessible through the website – http://nano.ceitec.cz).

1.1.3 Each user must have their faculty sponsor sign the CEITEC Nano User Agreement (accessible through the website – http://nano.ceitec.cz).

1.1.4 We invoke the buddy system for working inside the CEITEC Nano. No one is permitted to work alone inside the facility of nanofabrication. At any given time, at least two users (not visitors) must be present. The facility is open 24/day, 7 days/week, except for planned shut-downs, which will be announced one month prior.

1.1.5 The lights should remain switched on all the time. No window blocking is allowed, except justified reasons (e.g. optical lab.) CEITEC Nano staff and all other users must be able to check the inside of the cleanroom from the cleanroom corridor.

1.2 Resources

1) Phone numbers:

a) Fire/Police/Emergency Land Line: 1-1-2
b) CEITEC Safety Coordinator: Denisa Sigmundová (+420) 54114 9618

2) Material Safety Data Sheets (MSDS):

MSDS of all materials used in CEITEC Nano laboratories should be available at http://nano.ceitec.cz/msds/

2. General Emergency Procedures

The CEITEC Nano core facility environment contains many potential hazards, posed primarily by the chemicals used.

Important: *It is each user's responsibility to read through the MSDS sheets associated with the chemicals they plan to use and to familiarize themselves with their potential hazards prior to using them. MSDS of all chemicals provided by CEITEC Nano can be found on the CEITEC Nano webpage under the trainings section.*

2.1 Chemical Spill on Personnel

Follow these general guidelines regarding chemical spills on personnel:

In case of significant, general external exposure, immediately use a safety shower located in the rooms C1.31 (chemical processes), C1.40 (service room), C1.48 and C1.49 (chemicals storage). Remove clothing while under the shower and flush for at least 15 minutes. Seek medical attention as soon as possible.

In case of localized external exposure (small area of contact such as on an extremity (e.g. hand) a DI spray gun, DI tap, or even a dump rinse module at a fume hood, may serve if these are the closest sources of water. Flush the affected areas with water for at least 15 minutes. Seek medical attention if necessary.

If the chemical is hydrofluoric acid (HF) or another fluoride-ion containing solution (BOE, PAD etch), you must act immediately as fluorine ions will quickly penetrate skin to damage tissue underneath. Strong acid concentrations (over 50%) cause immediate, severe, burning pain and a whitish discoloration of the skin which usually proceeds to blister formation. In contrast, the effects of more dilute solutions may be delayed. The latency period for symptoms (redness, swelling, and blistering) to appear after exposure to aqueous HF solutions in the 20-50% range may be up to eight hours. Solutions less than 20% may not produce symptoms for up to twenty-four hours. The origin of the fluoride ions penetration is the acid attack. If the acid is not remove thoroughly, then it keeps destroying the corneal epithelium or the epidermis, and thus it facilitates deeper tissular destruction by the fluoride ions. Fluoride ion from HF forms a strong bond to Ca2 + in bones. It reaches to bones and leaches calcium (hypocalcemia) from bones and may tie up calcium in nerve cell. This disruption of nerve condition can be life threatening when disrupting a heart function. Systemic hypocalcemia should be considered a risk whenever the body surface area of skin burns from concentrated HF exceed 25 in2 (160 cm2), or about the size of the palm of your hand. Concentrated HF burns can be fatal if only 2% of the body surface area is exposed. If contact with HF (or related solution) is suspected, treat the incident as an HF exposure. Calcium gluconate gel is used as an antidote for HF exposure to skin. Tubes of calcium gluconate are located in the first aid kit in the lab, along with instructions on its use. Calcium gluconate is for external use only and must not be used for chemical exposure to eyes. Although, calcium gluconate mainly acts on chelation of fluoride ions, it has only a limited action on the acid (does not neutralize the H+ irritating ions). Besides calcium gluconate, there is a universal product for rinsing the HF affected body area, called HEXAFLUORINE. It has a multiple action mechanism: such as sweeping effect (like water), hypertonicity (unlike water – make HF to come out of the tissues and stops its penetration), chelation of F- and absorption of H+. There are 3 bottles of

HEXAFLUORINE (á 500 ml) placed in a plastic box just beside the fume hood. Additionally, 1 bottle with HEXAFLUORINE will be placed on the way from the laboratory to the locker rooms. Ocular extender is available on each bottle for better eyes rinsing. There is no other storage place for HEXAFLUORINE, so please use these four bottles for rinsing the affected skin area as they are determined for it and not only for eyes rinsing.

Follow these specific procedures in case of HF skin exposure:

1. IMMEDIATELY rinse the affected body area with cold running water (shower if available). Be careful to wash the acid away from all parts of your body, especially finger/toe nails where acid can get trapped.
2. While rinsing, remove all contaminated clothing as well as jewelry that could trap HF.
3. Continue rinsing with water and the most affected areas with HEXAFLUORINE (3x500 ml is available beside the fume hood)
4. Continue rinsing with water for 5 minutes. Speed and thoroughness in washing off the acid is essential.
5. Never take pain medication for HF burns. Decreased pain is the best indication that treatment is effective.
6. Call a colleague for help.
7. Obtain Calcium Gluconate gel (available inside the first aid kit in the lab).
8. Puncture the tube using the inverted tube cap. Apply gel over the entire affected area.
9. Using gloves, gently massage the gel into the skin. Take the gel with you and continue to apply fresh gel repeatedly. Note: Calcium gluconate gel should not be used until after complete (at least 5 minutes) washing of the skin with water and HEXAFLUORINE. After the pain has subsided, the calcium gluconate gel should be rubbed-in for 30 minutes at 3 or 4 hour intervals. If the skin burns are deep or extensive, calcium gluconate gel, 2.5%, should be massaged into the skin for 3 to 4 days, 4 to 6 times daily.
10. Elevate burned extremities, if possible.
11. Go immediately to a local emergency medical provider.
12. Tell them you have Hydrofluoric Acid on you.
13. Continue to apply fresh gel (and gently massage it in) while waiting to be treated.
14. Following treatment, the injury must be reported to CEITEC Nano staff. Incident record form will be filled at the User Office C1.04.

In case of exposure of the eyes (corrosives are especially serious!), flush immediately, either with an eyewash bottle or with the built-in eyewash shower in the wet process lab. If using an eyewash bottle first, continue with flushing at the eyewash shower when the bottle is emptied. There are 3 HEXAFLUORINE eyewash bottles (á 500 ml) beside the fume hood for the HF injuries and 1 DIPHOTERINE eyewash bottle intended for neutralizing other acids and bases injuring the eyes. Apply these flushing solutions at the first time, afterwards you may continue with the normal saline solution flushing which is placed in the same plastic box as HEXAFLUORINE and DIPHOTERINE. Eyes should be rolled up and down, and side to side, continuously, to allow clean water to flush behind the eyeball. The eyeballs sit rather loosely in their sockets, a splashed chemical can work its way around the eye to damage the optic nerve. Flush both eyes with water for at least 15 minutes. Both eyes should be held open with the thumb and forefinger. While the victim is at the eyewash, someone else should be calling the doctor (call 155) for further instructions. Upon any exposure to corrosives, the victim should be taken to the emergency center for evaluation and treatment. In addition to the eye wash equipment inside, eye wash stations are also located in the corridor surrounding the cleanroom. You may use these eye wash stations in case of any trouble with the eye wash equipment inside the

cleanroom, or if you need additional flushing after the eye wash stations inside the cleanroom are emptied. Chemicals in the facility of the hazard class "corrosive" include primarily:

1. The following acids and their mixtures -- sulfuric (H2SO4), nitric (HNO3), acetic (CH3COOH), hydrofluoric (HF), buffered oxide etchants (BOE -- pre-mixed ammonium fluoride and hydrofluoric acid).
2. The following bases and their mixtures -- potassium hydroxide (KOH), tetramethyl ammonium hydroxide (TMAH).

Follow these specific procedures in case of HF eye exposure:

1. Immediately wash the eyes with large quantities of of HEXAFLUORINE (3 bottles are available just beside the fume hood including the ocular extenders.
2. Use ice packs.
3. Call immediately medical emergency (155). The ice packs should be used until medical facility is reached.
4. Note: No oils or ointments should be used. Inflammation may be decreased by the use of corticosteroid solutions for ophthalmic use. An eye specialist should be consulted immediately.
5. Following treatment, the injury must be reported to CEITEC Nano staff.

Follow these specific procedures in case of HF inhalation:

1. Immediately move affected person to fresh air and call 155 for medical assistance.
2. Keep victim warm, comfortable and quiet.
3. If breathing has stopped, begin CPR at once. Make sure mouth and throat are free of foreign material.
4. 100% oxygen (10 to 12 L/min flow rate) should be administered as soon as possible by a trained individual.
5. A nebulized solution of 2.5% calcium gluconate may be administered with oxygen by inhalation.
6. Do not give stimulants unless instructed to do so by a physician.
7. The victim should be examined by a doctor and held for observation for at least 24 hours. The reason is that inhalation of HF fumes may cause swelling in the respiratory tract up to 24 hours after exposure. A person who has inhaled HF vapors may require prophylactic oxygen treatment. Vapor exposure can cause skin and mucous membrane burns and damage to pulmonary tissue. Vapor burns to the skin are treated the same as liquid HF burns.

Follow these specific procedures in case of HF ingestion:

1. Do not induce vomiting. Never give anything by mouth to an unconscious person.
2. Have the victim drink large amounts of room temperature water as quickly as possible to dilute the acid.
3. Call 155 for medical assistance.
4. Have the victim drink several glasses of milk or several ounces of milk of magnesia, Mylanta, Maalox or similar products, or eat up to 30 Tums, Caltrate or other antacid tablets. The calcium or magnesium in these substances may act as an antidote. Avoid administering bicarbonates at all costs, the carbon dioxide byproduct could severely injure the victim.
5. Proceed to a physician for appropriate follow-up and/or treatment.

2.2 Chemical Spill

A number of chemicals are present in the CEITEC Nano core facility that pose a potential for serious injury, major equipment damage or even death. It is necessary to know how to react quickly and properly in response to any spill to avoid possibly serious consequences. The following procedures are only intended as general guidelines. Always use common sense when handling a particular situation.

a) If you are in the facility during normal business hours, notify CEITEC Nano staff immediately. Place a sign near the spill before leaving the area to contact CEITEC Nano staff so that other users are aware. If you are in the facility during off hours, notify another person in the lab that there is chemical spill and that you plan to clean it up.

b) If the chemical spill is very large and you feel you cannot handle it, alert others to its presence and evacuate the cleanroom. Notify CEITEC Nano staff, if possible.

c) A spill response kit can be found in the lab. They are plainly marked and contain the following items:

- Acid neutralizer
- Base neutralizer
- HF acid neutralizer
- pH test paper
- Two pair of acid resistant gloves
- Two pair of vapor-resistant goggles
- Scrapers
- Large scoop / brush
- Large sponges
- Trash bags

d) Retrieve the spill response kit:

- If the chemical is an acid or a base, put on acid gloves and goggles before attempting to clean up the spill.
- Isolate the area around the spill.
- Select the proper equipment for the spill. Select the proper neutralizer for the chemical (note: solvents do not require a neutralizer).

e) Clean the spill:

- Apply the appropriate neutralizer on the chemical spill. Be sure to cover the entire spill.
- Watch the color of the spill as you add neutralizer (Note that the spill can get hot during neutralization): Use pH paper to verify that a pH of 7 has been achieved, indicating complete neutralization.
- Once the spill has cooled, place the absorbent sponges on the spill until all of the liquid is absorbed.
- In case of a solvent spill, do not attempt to neutralize. Soak up the chemical as quickly as possible to reduce damage to the floor. Do not use water on the floor until the chemical has been soaked up.
- Clean up: Do not remove your safety equipment until you are completely finished. There may still be some active chemical on the floor. When the spill has been completely absorbed, place the absorbent sponges in a double trash bag. Place the bag in one of the fume hoods and contact CEITEC Nano staff to its presence. If glass is involved, place the glass

in a separate sharps container and label it as “SHARPS” along with the name of the chemical the glass contained.

- Wipe down the entire spill with a mop and DI water. When finished, place the mop head in a fume hood sink and rinse it thoroughly with DI water.

f) Inform CEITEC Nano staff and complete an incident report form.

Liquid Nitrogen Safety

Liquid Nitrogen (LN2) It is extremely cold: 77.3K = -196C = -320F at atmospheric pressure. This can cause severe frost bite. On vaporization it expands by a factor of 700; one liter of liquid nitrogen becomes 700 liters of nitrogen gas. This can cause explosion of a sealed container, or it can displace oxygen in the room and cause suffocation without warning.

Precautions when handling liquid nitrogen

1. Treat liquid nitrogen and any object cooled with liquid nitrogen with respect.
2. Take care not to allow liquid nitrogen to be trapped in clothing near the skin. Use of apron is recommended.
3. When working with LN2 wear **closed toe shoes** and **long pants**, **safety glasses** or a face shield and **gloves**. Gloves should be loose fitting, so they could be thrown off if liquid were to pour inside them.
4. Use only approved unsealed containers. Never pour it into a coffee thermos. Never seal it in any container (it will explode).
5. Never dip a hollow tube into liquid nitrogen; it may spurt liquid.
6. Never use in a small poorly ventilated room, and never dispose of liquid nitrogen by pouring it on the floor. It could displace enough oxygen to cause suffocation. Nitrogen gas is colorless and odorless--the cloud that forms when you pour liquid nitrogen is condensed water vapor from the air, not nitrogen gas.
7. Do not store liquid nitrogen for long periods in an uncovered container (on the other hand, never totally seal a container). Because the boiling point of oxygen, 90.1K, is above that of nitrogen, oxygen can condense from the air into the liquid nitrogen. If the air over the nitrogen circulates, this liquid oxygen can build up to levels which may cause violent reactions with organic materials; even materials which are ordinarily nonflammable. For example, a severe clothing fire could result from ignition in the presence of liquid oxygen.

First Aid

Suffocation: If person seems to become dizzy or looses conciousness while working with liquid nitrogen, move to a well-ventilated area immediately. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Call a physician. Keep warm and at rest.

Frost bite: If exposed to liquid or cold gas, restore tissue to normal body temperature, 98.6F (37C), followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Call a physician. Rapid warming of the affected part is best achieved by using water at 42°C. Under no circumstances should the water be over 44°C, nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke, nor drink alcohol.

2.3 Emergency power shut-down

Emergency power shutdown switch for the whole lab is located at the ground floor of the C building, next to the entrance lobby.

2.4 Emergency Evacuation Procedures:

Some emergency situations will require evacuation from the building. If evacuation is necessary please proceed to the nearest emergency exit and exit the building. If you are inside the cleanroom proceed to the nearest emergency exit and do not stop to remove your cleanroom garments. Follow the green arrows and gather at the parking lot in front of CEITEC administrative building (building S).

Toxic Gas Leak

Several toxic gasses are used in the CEITEC Nano facility. These gasses are kept in gas cabinets designed to contain leaks that might occur from the cylinders. However, it is possible that there may be a leak associated with equipment that employs these toxic gases or the gas lines running between the gas cabinets and the equipment. This would result in a release of toxic gas into the breathing space of the lab. PLEASE SEE SECTION 3 FOR INFORMATION ABOUT THE TOXIC GAS MONITORING SYSTEM AND EMERGENCY PROCEDURES.

Fire

In case of fire, evacuate the cleanroom and building immediately through the nearest emergency exits without de-gowning. Do not try to extinguish any fire in a fume hood. The burning polypropylene material will not be extinguishable and the resulting smoke is highly toxic.

3. Access Procedures

Users can use the CEITEC Nano research infrastructure in the following ways:

3.1 Access for academic users

Preferred way how to use the equipment in CEITEC Nano research infrastructure for academic users is self-service access. The instruments running costs is 100% payed from CEITEC Nano project, only administration and training fee is paid by user.

Full access to CEITEC Nano via booking system	CZK
User fee for new and regular users	30 000/year
User fee for short-term users, only if no training required	300/hour

Self-service users gain full independent access to all CEITEC Nano labs and access to all instruments via booking system. Authorization to work on individual instruments is required and can be obtained after proper training.

1. Register via Perun website – https://idm.ics.muni.cz/fed/registrar/?vo=CEITEC&group=NANO
2. Print the CEITEC Nano User fee agreement published on CEITEC Nano website and sign it. If you have a faculty advisor and/or sponsor have them sign it as well. Bring the agreement to the user office or scan and email it to nano@ceitec.vutbr.cz.
3. Thoroughly study the CEITEC Nano Policies and Procedures document, then pass the exam.
    - Log in to your CEITEC Nano user account, click on the CEITEC Nano Policies and Procedures Exam.
    - Wait to receive an email (this can take up to 3 days) which shows your score and whether or not you passed the exam.
    - If you did not pass the exam, you can Correct and resubmit the exam at the CEITEC Nano Policies and Procedures Exam page.
4. Contact CEITEC Nano User Office to schedule laboratory safety excursion. CEITEC Nano User Office can be reached via email nano@ceitec.vutbr.cz or by phone 54114 9207.
    a. Full CEITEC Nano excursion – 2 hrs.
    b. Nanofabrication laboratory – 45 min.
    c. Nanocharacterization laboratory – 30 min.
    d. Structural analysis laboratory – 30 min.
5. After you have completed all of the access requirements, you can start with the trainings for individual equipment.

3.2 Access for Commercial Users

Please contact us at nano@ceitec.vutbr.cz to discuss your individual needs and pricing.

4. Prior to Entering the CEITEC Nano Research Infrastructure

4.1 Concept of the Cleanroom

A Class 100 cleanroom is defined as having less than 100 particles of 0.5 micron or greater in size within a cubic foot of air (equivalent to ISO 5). A Class 1000 cleanroom is defined as having less than 1000 particles of 0.5 micron or greater in size within a cubic foot of air (equivalent to ISO 6). Similarly, a Class 100.000 cleanroom has less than 100.000 particles 0.5 micron or greater in size within a cubic foot of air (equivalent to ISO 8). This level of cleanliness is necessary to maintain the reproducibility of newly developed state-of-the-art electronic device processes. To reach this level of cleanliness, the transfer of particle and chemical contaminations must be eliminated wherever it is found. Hair and skin from people are the greatest possible sources of airborne particles within the cleanroom and thus must be covered at all times with proper cleanroom garments. Many common materials also shed particles into the air at all times and are not allowed in the cleanroom.

Normal air contains hundreds of thousands of particles per cubic foot, to prevent these particles from entering the cleanroom the pressure inside the cleanroom is kept higher than outside by constantly pumping filtered air into the cleanroom. This results in a constant flow of particle free air from inside to outside of the cleanroom through all openings such as between doors and doorsills and through fume hood and gas cabinet exhausts. This airflow pattern keeps all outside air and particles from entering. But even with this pressure differential we cannot commonly open the majority of the doors that lead into the cleanroom. By opening even one door the air balancing for the entire lab is compromised which allows the possibility of outside air - and particles - to enter. This compromises the entire cleanroom and jeopardizes particle sensitive processing in progress inside the lab. Thus, as cleanroom users, you may only use the main entry door and the subsequent air locks leading into the cleanroom to enter and exit under normal circumstances. All other doors to the cleanroom are emergency exits and are to be used only in the event of an emergency.

Even with a constant flow of filtered air from inside the cleanroom to the outside world, particles can still find their way into the space within the cleanroom. The strategy implemented to keep any particles within the cleanroom space from interfering with ongoing experiments push the particles downward. This is done by forcing filtered air into the room from above and pulling air out from below. With a constant downward flow of particle free air the resulting laminar flow around all objects in the room gives any dislodged particle only one option: down and out. But even with all the equipment used to keep the airborne particle count low, maintaining such a high level of cleanliness requires that the users strictly adhere to protocol, especially the gowning procedures outlined in this document.

It is important for each user to understand that their individual commitment to this protocol ultimately determines the success or failure of the facility.

All of the elaborate equipment installed to provide a microscopically clean and controlled atmosphere would be to no avail if our users do not believe in and help enforce these policies. We also understand that users are a tremendous resource for new ideas. With this in mind, we strongly encourage our users to recommend changes that may make the facility safer, cleaner, easier to use, or less expensive to maintain. Contact us at nano@ceitec.vutbr.cz with your questions, comments and recommendations. When in the cleanroom, please be aware of your knowledge limitations. It is extremely important that you ask a CEITEC Nano staff or experience user for help if you are unsure about the operation of these facilities.

4.2 Materials Prohibited Inside the Cleanroom

Materials that are fibrous or likely to degrade in normal use and create particulate are not allowed in the cleanroom. Materials with textured surfaces that can trap particles and cannot be cleaned are also not acceptable. Less obvious materials are polymers that outgas and release organic contaminants. Please consult CEITEC Nano staff if you are not sure. All items that are brought into the cleanroom must be wiped with the provided isopropyl alcohol/DI water solution prior to entry. The items must be brought into and out of the cleanroom via dedicated load-lock windows located in the gowning room. The following list of materials provides some examples of prohibited materials:

- Food or drinks
- Make-Up
- Paper (only cleanroom paper is permitted)
- Wood
- Fabrics and woven materials
- Fiberglass
- Soft plastics and elastomers that are easily abraded
- Pencils, Ballpoint pens (the ink can cake, dry, and flake); only cleanroom approved writing materials are permitted)
- Erasers
- Powders
- Foam materials including some tool handles
- Solutions or suspensions that will dry out to leave powders or particulates
- Most PVC materials
- Devices with hidden surfaces that cannot be cleaned
- Any materials that can easily shred or aerosolizes to become a source of particulate

Taking any materials in and out of the cleanroom should be avoided whenever possible. There is storage space available in the cleanroom for users' tools and personal supplies. Once brought into the cleanroom, these tools and supplies should remain inside as long as they are needed in the cleanroom. When you are finished with your work at CEITEC Nano, please remember to remove any items that you have brought in.

4.3 Card Access System

The CEITEC Nano facility is equipped with a card system, which limits access to authorized users. Users must use a valid access card, in order to be able to enter the facility.

Note: *The access card is strictly for your own personal use. Please do not admit anyone other than yourself into the facility for any reason other than an emergency. Should you need to admit another person into the facility due to an emergency, both the authorized user and the person who was given access to the facility must notify CEITEC Nano staff. Please see section 10 for visitor policy.*

Please understand that we will enforce all lab rules and that any breach of these rules can result in nullification of your access privileges.

4.4 Locker Policy

A number of lockers and a coat rack are available to CEITEC Nano users in rooms C1.06 (men) and C1.14 (women). These lockers are intended for temporary use for cleanroom users. Users may store items that cannot be brought into the cleanroom space during their time inside the cleanroom. **Storage of chemicals is not permitted under any circumstances.**

4.5 PC room for CEITEC Nano users

A PC room for CEITEC Nano users is located in the room C2.10. CEITEC Nano users can use their cleanroom access card to enter to this room and use any of the 16 available desks on the first-come first serve basis.

5. Cleanroom Gowning Procedure

The cleanroom garments are picked up for laundering once per week. Each week on laundry pick up day the used garments are taken down for cleaning and the previously cleaned garments are delivered, cleaned and packaged.

After each laundry cycle if you are regular user, you should find your labelled hanger in the box next to the packaged garments. Take a clean coat/coverall from the shelf and when you are leaving the cleanroom, hang it on your labelled hanger and on "Personal" coat-stand. This will be your personal coat/coverall for the week.

Each laundry day the coats/coveralls and hangers are removed from coat-stands and the process starts over.

In addition to the labelled hangers on "Personal" coat-stand you will see a coat-stand labelled as "Shared". If you are entering the cleanroom only one time during the week and do not plan to return, please use a garment from the "Shared" coat-stand. If you do not find your size in the shared section, you may obtain a new garment and hang it on an unlabeled hanger on "Shared" coat-stand.

DO NOT USE NEW GARMENTS EACH TIME YOU ENTER THE CLEANROOM! In an effort to keep costs low, our inventory is kept at a minimum level. We cannot allow one time use of our garments.

Entering the Cleanroom

Figure 1: Entrance path to the cleanroom.

A. Entry area

1. **Using access card, open and enter locker room (C1.06 – men, C1.14 – women)**.

1. **Remove all unnecessary clothes**. Use lockers to store items that cannot be brought into the cleanroom.
2. **Put on cleanroom shoes or shoe covers**. Get a pair of shoes from the rack or pair of shoe covers from the labelled dispenser. Only flat or very low-heeled shoes may be worn. **No sandals or open-toed shoes are permitted**.
3. Exit the changing room into the clean room corridor. **Step on tacky mat**. Take at least 6 steps, 3 for each foot.
4. Proceed to gowning area via room C1.19a. (see red arrows in figure 1).

The gowning procedure is then different for nanocharacterization laboratory and for nanofabrication laboratory:

5.1 Class 100.000 (Nanocharacterization)

The gowning area for Nanocharacterization laboratory is located in the FILTER I, room C1.15.

1. Step on tacky mat. Take at least 4 steps on the tack mat, 2 for each foot.
2. **Wipe down all materials**. Note that some materials may be damaged by isopropyl alcohol, so you may need to use DI water instead from the squeeze bottle provided. Moisten a cleanroom wipe with isopropyl alcohol. Wipe all surfaces of materials you will be bringing into the cleanroom. Wipe the length of the wiper cloth and then fold over. Repeat folding and get new wipes as necessary. Dispose of IPA wipes in Red Flammables can. ALL wipes with ANY amount of isopropyl alcohol MUST be disposed of in the red flammables waste can to contain the fire hazard. Put all materials into a load-lock window.
3. Take a coat/overall from your labelled hanger. Pick up the coat/overall from the shelf if this is the first visit after laundry cycle. Alternatively, pick-up a coat from “Shared” hanger.
4. You may want to put on a cap. Caps are located in a marked bin next to the coat hangers.
5. Enter the cleanroom.

Exiting the Cleanroom class 100.000

1. Put all materials into the load-lock window.
2. Exit the cleanroom, proceed to room C1.15.
3. Remove the coat and put it on the appropriate hanger.
4. Remove the cap and throw it into dispense bin.
5. Gather all materials from the load-lock window.
6. Proceed to the changing rooms **(C1.06 – men, C1.14 – women)**, put off the shoes or remove shoe covers. Pick up your clothes and other stuff and exit the gowning room.

5.2 Class 100 / 1.000 (Nanofabrication)

The gowning area for Nanofabrication facility is located in the FILTER II, room C1.16 and has benches arranged in a way that divides the area into two parts. In order to proceed from the gowning area to

the cleanroom, you will need to step over the benches. Please do so only in accordance with the procedure described below.

1. Step on tacky mat. Take at least 4 steps on the tack mat, 2 for each foot.
2. Put on pair of gloves. Touch ONLY the cuffs of the gloves. Do NOT touch the palms or fingers of the gloves with bare hands. Oils and particulates from your skin adhere to the gloves and subsequently contaminate everything you touch. Get a pair of gloves from one of the labelled dispenser bins. Pull on the first glove holding it only by the cuff. Pull on the second glove making sure that the first glove does not touch your skin.
3. **Wipe down all materials**. Note that some materials may be damaged by isopropyl alcohol, so you may need to use DI water instead from the squeeze bottle provided. Moisten a cleanroom wipe with isopropyl alcohol. Wipe all surfaces of materials you will be bringing into the cleanroom. Wipe the length of the wiper cloth and then fold over. Repeat folding and get new wipes as necessary. Dispose of IPA wipes in Red Flammables can. ALL wipes with ANY amount of isopropyl alcohol MUST be disposed of in the red flammables waste can to contain the fire hazard. Put all materials into a load-lock window.
4. Select your hanger number. Pick up the garments from the shelf if this is the first visit after laundry cycle. Alternatively, pick-up garments from "Shared" hanger.
5. Put on hood. Align the hood so that your face will be at the opening. Pull the hood over your head.
6. Put on coveralls. DO NOT let your coveralls touch the floor because contamination from the floor will then be brought into the cleanroom on your coveralls. Always inspect your coverall for signs of contamination or wear. Hold the sleeves so that the coveralls do not touch the floor. Find a comfortable sitting position, but DO NOT allow your feet to cross the bench at this time. Put one leg in the leg of the coveralls and pull up to your ankle. Put your other leg in the leg of the coveralls and pull up to your ankle. Stand and pull the upper half of the coveralls up to your arms. Put your arms through the sleeves. Pull the coveralls up over your shoulders. Pull the zipper up halfway. Tuck in hood. Tuck the front and rear flaps of the hood under the coveralls. Pull up the zipper of your coveralls all the way.
7. Put on boots. DO NOT place your boots on the floor because contamination from the floor will get on the sides of the boots and be carried into the cleanroom. NEVER stand in boots on the gowning rack side of the benches. Note that boots fit either foot. Get your boots and put them on the bench. Find a comfortable sitting position, but DO NOT allow your feet to cross the bench at this time. Raise one foot and pull on a boot, then rest this foot on top of the bench. Pull over the boot over the coverall's leg until your foot is snugly in the bottom of the boot (This will help to trap any particles falling down the coverall leg inside the boot). Swing your booted foot onto the other side of the bench. Clip the buckle and tighten the strap. Repeat with the second foot.
8. Check proper gowning fit in mirror. Is your hood tucked in, front and back?
9. Put on second pair of gloves. NOTE: the palms and fingers of the second pair of gloves should not touch the first pair of gloves. Pull on a glove holding it only by the cuff. Pull the glove cuff up over the coverall cuff as far as it will go. Repeat with the other hand. If necessary, pull up the glove fingers for a snug, comfortable fit. While in the cleanroom, keep your hands away from your face. Oils from your face can be transferred to the gloves and subsequently to the cleanroom equipment or your samples.
10. Enter the air lock C1.16a.
11. Enter the cleanroom.

Exiting the cleanroom class 100/1.000

1. Put all materials you want to remove from the cleanroom into the load-lock window.
2. **Enter the gowning area from inside the cleanroom**.
3. **Remove boots.** DO NOT place your boots on the floor because contamination from the floor will get on the sides of the boots and be carried into the cleanroom. NEVER stand in boots on the gowning rack side of the benches. Find a comfortable sitting position on the bench, keeping your booted feet on the cleanroom side of the bench. Swing the first foot onto the top of the bench. Slide the boot off your foot and place onto the bench so that it will not be knocked onto the floor. Swing your foot to the garment rack side of the bench. Repeat with the other foot.
4. **Remove the outer gloves.** Discard them in the trash container.
5. **Remove Coveralls.** DO NOT let your coveralls touch the floor because contamination from the floor will then be brought into the cleanroom on your coveralls. Find a comfortable standing position. Pull the zipper down. Roll the coveralls from your shoulders. Pull out your arms from the sleeves and hold the sleeves and zipper so that the coveralls do not touch the floor. Roll the coveralls below your waist and hold the sleeves and zipper so that the coveralls do not touch the floor. Sit down and remove one leg from the coveralls while holding and gathering the coveralls so they do not touch the floor. Repeat with the other leg.
6. **Soiled Garment?** If you have worn your garment for more than approximately 24 hours or it has become soiled, the garment should be laundered. Place garments into the appropriate containers.
7. **Hang up coveralls.** Avoid touching the coveralls with your clothes or bare skin. Hold the coveralls by the shoulders and lift them so they do not touch the floor. Hang them on your assigned hanger. Close the zipper.
8. **Remove and hang up hood.** Pull the hood over your head. Secure the hood to the coverall by fastening the snap at the top of the hood to one of the snaps on the collar of the coverall.
9. Store the boots. Place the soles of your boots together. Roll the tops of the boots around the soles. Place your boots inside a leg of your coveralls and connect the snaps on the outside of the pant legs so that the shoe covers will not fall out.
10. Gather all materials from the load-lock window.
11. Proceed to the changing rooms **(C1.06 – men, C1.14 – women)**, put off the shoes or remove shoe covers. Pick up your clothes and other stuff and exit the gowning room.

6. Using the Fume Hoods

The fume hoods allow users to handle materials that generate hazardous vapors by containing and venting these vapors out of the breathing space of the lab. The fume hood is the only place that hazardous chemicals should be handled in open containers. Each hood is clearly labeled as to what chemicals may be used in each hood. The stainless steel fume hoods are for the use of flammable chemicals since the steel will not burn. However; we cannot use acids and bases in the stainless steel hoods because, over time, these chemicals will corrode the metal. For this reason, we must use the polypropylene fume hoods for acids and bases. Use of the wrong type of chemical in a given fume hood presents a serious safety hazard for all users in the area since incompatible chemicals may mix and create a dangerous reaction. Please use the proper chemicals in the proper fume hoods at all times. If you are unsure about which hood to use, please ask CEITEC Nano staff.

In order for the fume hoods to effectively exhaust harmful vapors the sash must be positioned at or below the marks on each side of the fume hood and the fume hood exhaust ports (perforated surface near the front and sides of the bench) must be unobstructed by cleanroom wipes, hotplates, waste bottles, etc. With these two conditions met, the fume hood will function properly. If they are not met the fume hood will release vapors into the breathing space which may cause injury.

6.1 Handling Hazardous Chemicals

Users must employ the utmost caution when handling any and all hazardous chemicals. It is the user's responsibility to review the MSDS and become familiar with the hazards associated for all chemicals involved in his or her processing. Near fume hoods the necessary protective gear is readily available and it is the user's responsibility to utilize it. Available are the following protective items:

- Aprons
- Face shields
- Heavy acid-resistant gloves
- Goggles

When using the heavy acid-resistant gloves, always make sure your regular nitrile gloves are clean before putting the heavy ones on. If you spill a small amount of any chemical on the surface of your heavy gloves, immediately rinse it with water. Always rinse the heavy gloves when you are finished using them. If you spill a small amount of any chemical on the surface of your normal nitrile gloves, immediately rinse and replace the gloves with a new pair, discarding the dirty pair. This is to avoid spreading chemicals and chemical residue to things like door handles, buttons, etc. Remember, part of the gowning procedure is to put on two pairs of gloves. This allows you to change the external glove within the cleanroom. Never take off both pairs of gloves inside the cleanroom.

ALWAYS label your beakers so that you and other users know which beaker contains what chemical. Beaker labels are available next to all fume hoods. Proper labeling is essential since most chemicals are colorless and it is easy to confuse them. If your process requires a long period of time you may properly cover your beaker with a watch glass and leave a note with the following information (legible!):

1. Your name
2. Chemical identification
3. When you will be back to finish your process and clean up.

If you empty a bottle of any chemical you should not rinse the empty bottle. Put the cap on the bottle and place the bottle onto the shelf in the bottom part of the wet-bench. CEITEC Nano staff will pick it

up and dispose of it properly. You may get a new bottle of chemical from the safety storage cabinets located in the lab(s).

6.2 Using Hydrofluoric Acid and Piranha

Extra caution must be employed when using HF (hydrofluoric acid), or any mixtures containing HF (e.g. BOE). Users MUST wear an apron, heavy nitrile gloves and face shield when using any chemical containing HF. In addition, there are polypropylene bins labeled "Secondary Containment for HF Use" located in the shelves of the fume hoods with approved HF use. These should be placed on the fume hood surface and all beakers or bottles containing HF must be placed within the secondary containment. HF waste is disposed of in dedicated HF drain, sink is contained in every fume hood, where HF can be used.

Hydrogen fluoride gas is an acute poison that may immediately and permanently damage lungs and the corneas of the eyes. Hydrofluoric acid is a contact-poison with the potential for deep, initially painless burns and ensuing tissue death. By interfering with body calcium metabolism, the concentrated acid may also cause systemic toxicity and eventual cardiac arrest and fatality, after contact with as little as 160 cm^2 of skin. HF is particularly dangerous because, unlike other acids which cause immediate pain upon contact with skin, HF contact can cause latent burns that may take hours before they start to cause pain. If no action is taken to remedy the effects of the HF exposure, the fluorine ions will migrate through the flesh eventually reaching the bones causing serious bodily harm. Calcium Gluconate Gel is located in the first aid kit in the lab. Please follow all the required precautions and use utmost care when handling HF!!!

When using Piranha Etch (concentrated sulfuric acid and hydrogen peroxide), you must wear an apron, heavy nitrile gloves and face shield. The Piranha solution will remain active and produces gaseous byproducts and heat (temperature of the fresh mixture could reach 120 °C) for several hours after the mixture is made. The solution can be disposed of only after it has cooled down to maximum 40 °C. Never drain fresh or active piranha solution into waste, it can lead to explosion!!!

6.3 Hazardous Waste Disposal

It is imperative that users only put the correct chemicals in the waste sinks. Failure to do so will result in a possibly violent reaction between incompatible chemicals. Acids and bases are disposed of in the alkali sink of the fume hood. It is possible to run water dilution of the wasted chemicals when disposed. HF containing chemicals have separate HF sink, also with the possibility of water dilution. Savage sink is available at all fume hoods. This one can be used only for very small amounts of non-toxic chemicals, which are diluted by the water. E.g., this sink can be used for rinse water, when cleaning the lab ware. Organic solvents can be disposed of only in stainless steel fume hoods. They have dedicated sinks connected to local waste canisters.

6.4 Bringing Non-Stock Chemicals into CEITEC Nano

CEITEC Nano supplies a wide variety of chemicals to the users. If would like to bring any chemical into the CEITEC Nano labs, YOU MUST RECEIVE APPROVAL FROM CEITEC NANO STAFF BEFORE BRINGING ANY NON-STOCK CHEMICAL INTO THE FACILITY. We will need to examine the MSDS in order to provide proper storage and disposal for all non-stock chemicals. Users that bring in chemicals without notifying CEITEC Nano staff create a safety hazard for all users. Please note that certain chemicals may not be permitted to enter the facility. Requests will be handled on a case by case basis. Please contact CEITEC Nano staff via email nano@ceitec.vutbr.cz to inquire about bringing non-stock chemicals.

7. Using CEITEC Nano Equipment

*No user is allowed to operate any piece of CEITEC Nano equipment without supervision until he or she has completed sufficient **training AND authorization** by CEITEC Nano staff.*

All equipment/processes must be carried out within the guidelines provided by CEITEC Nano's management. Materials and/or processes not in common use at the facility need to be reviewed by CEITEC Nano management, and the facility reserves the right to disallow processes that might harm equipment or disrupt other processes.

Each instrument in the CEITEC Nano facility has a CEITEC Nano Staff Member in charge of maintenance and repair (Instrument Guarantee), and Authorized Users. To become an authorized user, please follow the procedure below. Note that these procedures apply to most pieces of instrumentation inside the facility. However, there are a number of more complex instruments that require more extensive training procedures.

Logbooks

Almost every piece of CEITEC Nano equipment has a log book, either electronic or written, sometimes both. It is essential that users make a log book entry for every equipment usage.

The electronic logbooks are connected to the CEITEC booking system and serve for reporting to Ministry of Education, Youth and Sports of the Czech Republic. Proper filling of the instrument use into the electronic logbook is essential for financing the facility.

The manually written log book entries enable CEITEC Nano staff to track equipment malfunction and/or equipment abuse. In addition, they also provide a record of process parameters and results for previous usage which can be valuable to new users.

7.1 Training and Authorization

Make an appointment with CEITEC Nano staff or any authorized user of the particular piece of equipment to obtain training on the operation of the machine. A list of authorized users for individual equipment in the CEITEC Nano facility can be found on the wall near the specific instrument. CEITEC Nano staff will inform you if the equipment you wish to use requires extra training. Go through as many hands on training sessions as necessary until you feel comfortable operating the equipment. You are not permitted to use any equipment alone before being officially authorized. An authorized user MUST BE WITH YOU at all times while you are learning/practicing. Users must not only "push buttons", they should have a good understanding of everything that happens with each part of the process.

When you feel you understand the process thoroughly and can operate the machine independently, you may make an appointment with the Instrument Guarantee for authorization. To obtain the Instrument Guarantee contact visit the equipment section at CEITEC Nano webpage: http://nano.ceitec.cz. Be sure to review your notes prior to authorization. Have your samples and/or materials ready for the authorization procedure. During the authorization procedure, the Guarantee will watch you use the system while you explain the operation of the instrument. If you demonstrate that you are sufficiently knowledgeable with the operation of the instrument, the Guarantee will give

you authorization to independently use the instrument and your name will be added to the authorized user list.

To insure the safety of people in the lab and to minimize equipment down time, it is absolutely necessary that all CEITEC Nano users follow this procedure. Equipment authorization will only be done by CEITEC Nano staff.

7.2 Equipment Scheduling

The CEITEC Nano booking system can be accessed through your on line user account. Users are responsible for reserving equipment for training time as well. Please make your reservations as far in advance as possible. If you make a reservation and then will not use the equipment for any reason, please be sure to remove the reservation so that other users can schedule time.

Please be prompt. You must begin your process within 15 minutes of the start of your reserved time slot. After 15 minutes you will lose your reservation privileges and the equipment is considered available to other authorized users.

8. General Behavior Inside the Cleanroom

We strive to keep running our facility as efficiently as possible. Please help us by being committed to preservation of resources, and to keeping to a minimum the necessity for facility staff to spend time on cleaning up after users, repairing things, etc. Never, however, hesitate to request staff time to help you with things that you are unsure about.

The following bullets are meant as a brief reminder of appropriate general behavior while inside the cleanroom. The list is by no means comprehensive, but contains items we believe are of particular importance.

- Eating, drinking and gum chewing are prohibited while inside the lab.
- Any abnormalities while using the equipment must promptly be reported to CEITEC Nano staff.
- Avoid sudden and fast movements (i.e., NO RUNNING). Approach corners and turns slowly, to avoid collisions with others. Remember that other users may be handling sensitive materials.
- Never open your suit while inside the cleanroom.
- Never touch your skin with your gloves. If you do, immediately put on a new pair of gloves.
- Do not walk around unnecessarily and be cautious when approaching another work area. Personnel movement is to be restricted to minimize disturbing settled particulate matter.
- If you turn it ON, remember to turn it OFF.
- If you make a mess, clean it up. Return everything to its original condition, or ideally, leave conditions a little better than you found them. This includes your entire set-up for experiments or projects.
- Excess storage in the cleanroom is not permitted.
- Be aware of supplies. If quantities of stock appear to be low, report it to the CEITEC Nano staff.
- Use special care to keep wet-benches in ultra-clean conditions.
- Hot plates (one of the main causes of cleanroom fires):
    1. Never leave on when unattended
    2. Make sure that the temperature is: 20 °C BELOW flash point of contents and 20 °C BELOW melting point of beaker materials.
    3. Ask for help if you are unsure of any part of the process.
- Any work or tools dropped on the floor shall be considered contaminated, and must be cleaned.
- ANYTHING left unattended MUST be labelled with your NAME, PHONE NUMBER WHERE YOU REALLY CAN BE REACHED (not the number of your department's front office), WHAT IT IS THAT IS SITTING THERE, and the DATES AND TIME of when you left it AND when you will return to get it. We will THROW OUT anything not appropriately labeled….no questions asked.
- Disposal of solvent and/or photoresist-soaked materials: We have several containers in the cleanroom built specifically for the disposal of solvent soaked materials, and require that they be used for the disposal of all such materials. The cleanroom is constantly recirculated, so all released vapors will find their way back into the space eventually for everyone to breathe. The following materials should be put in the solvent cans:
    - Any alcohols (ethanol, methanol, isopropanol, etc.)
    - Acetone
    - TCE (Trichloroethylene)

        - Chlorobenzene (especially hazardous)
        - Photoresist and related products
- Disposal of acid-soaked materials: We have several containers in the cleanroom built specifically for the disposal of acid soaked materials, and require that they be used for the disposal of all such materials. The following materials should be put in the acid cans:
    - Acetic acid
    - Buffered Oxide Etch (HF)
    - Chrome Etch
    - E-6 Metal Etch
    - Hydrochloric acid
    - Hydrofluoric acid
    - Nitric acid
    - Phosphoric acid
    - Hydrobromic acid
    - Sulfuric acid

9. Visitor Policy

Whenever possible, visitors should remain outside of the cleanroom (the lights inside the cleanroom are on all the time and the entire facility may be viewed through the windows in the corridor).

An authorized user must escort the visitor AT ALL TIMES. The escort is responsible for ensuring that the visitor adheres to gowning requirements and follows the facility policies and procedures. The escort should ensure that all visitors fill and sign the attendance sheet (available at the magnetic board next to the User Office) and hand it to the User Office. We report the visitor statistics to Ministry of Education, Youth and Sports of the Czech Republic. Proper filling of the attendance sheets is essential for financing the facility.

10. Enforcement

We embrace the idea of a user facility and recognize that the success of the facility depends on making it a friendly and accessible environment for the users. Although we hope to never have to penalize users for not following the policies outlined above, the user must recognize that the successful operation of the facility depends on strict adherence to these policies. Adherence to these policies is essential for maintaining a clean environment; it is in everyone's best interest to follow them. Unfortunately we must prepare for breaches of cleanroom policy. We reserve the right to invoke the following penalties for the listed transgressions:

- **Failure to create an entry in the logbook for a particular piece of equipment:**
  - First offense: Verbal warning
  - Second offense: Written warning
  - Third offense: Suspension from the cleanroom for 3 weeks.
- **Failure to properly label chemicals:**
  - First offense: Verbal warning
  - Second offense: Written warning
  - Third offense: Suspension from the cleanroom for 3 weeks.
- **Not wearing proper safety equipment or not following proper gowning/de-gowning procedure (Safety glasses, face shield while working with acids/bases at wet-benches, cleanroom attire):**
  - First offense: Verbal warning
  - Second offense: Written warning
  - Third offense: Suspension from the cleanroom for 3 weeks.
- **Not cleaning up after use of the facility.**
  - First offense: Verbal warning
  - Second offense: Written warning
  - Third offense: Suspension from the cleanroom for 3 weeks.

Suspension from the cleanroom for 3 weeks without prior warning:

- Use of any cleanroom equipment without being an authorized user for the equipment.
- Granting access to an unauthorized user to use equipment. No user can grant access to an unauthorized user to use equipment without his/her constant supervision. Authorized users are allowed to train other users on the equipment.
- Using the facility without swiping your access card.
- Using the facility with someone else's access card without being an authorized user and/or not under supervision.
- Using equipment reserved for another user. A user may not use any equipment reserved by another user for the first 15 minutes of the first hour the equipment is reserved. After that time, the equipment may be used until the next reservation. If a user's run exceeds a scheduled time, the next user who has reserved the equipment should try to reach a compromise with the previous user. The machine does, however, belong to the user who reserved it, and he/she may ask the previous user to terminate their run.
- Using equipment when it is undergoing maintenance and is marked not to be used or "Machine Down". Under no circumstances is a user allowed to perform any maintenance on any equipment.

- Not leaving the cleanroom during an emergency. During an emergency, the emergency lights and/or siren will go off. The lights are located in visible places throughout the cleanroom. In such a situation, every user must immediately leave the cleanroom. Users should not take time to de-gown.
- Installing software on any computers or modifying equipment settings on equipment dedicated computers.
- Removing supplies and/or equipment from the facility.

11. Ethical Rules

- The user agrees to work in the laboratory and on the research infrastructure instruments in an effective, ecological and efficient way.
- If the user carries out measurements for a third party using the instruments of the research infrastructure, he or she must contact the CEITEC Nano user office C1.04, phone 54114 9207, e-mail nano@ceitec.cz and negotiate the procedure first.
- The CEITEC Nano staff will make every effort to meet the user's needs based on mutual communication and collaboration.
- The CEITEC Nano staff will not further process the results of measurements and analyses without getting the user's consent first.
- The user is obliged to acknowledge the research infrastructure if the measurement results are made public.
- The user is responsible for the measurement data and archiving thereof.

CHANGES

v 2016-09-15 RK -> v 2016-09-19 MU

in sec. 9 - added a sentence about filling the attendance sheets

added this changelog

v 2016-09-15 MU -> v 2016-09-20 MU

in sec. 1.2 – added info about MSDSs

in sec 1.1 – lights should remain on all the time …

v 2016-09-20 MU -> v 2016-09-26 MU

added section about LN2 safety

v 2016-09-26 MU -> **v 2016-10-06 MU-HS**

improved section about chemical safety and chemical spills

v 2016-10-06 MU-HS -> v 2016-10-14 RK

improved section about chemical safety and added MSDS link