

APPENDIX B LUND NANO LAB

INTRODUCTION

The Lund Nano Lab (LNL) of the Division of Solid State Physics, Lund University, is an open-access resource within NanoLund Consortium at Lund University. The laboratory is accessible to all academic researchers and corporate users. LNL provides access to and expertise in MOVPE, aerosol technology and aerotaxy, ALD, nanoimprint lithography and other methods of micro/nanofabrication. The lab staff are responsible for cleanroom and safety training of new lab users and will provide technical support for lab customers. All LNL users must attend a safety update course (given 4 times/year) at least once a year in order to keep the access to the lab.

CLEANROOM BASICS

LNL includes three cleanroom areas on two levels: (1) Nano-process lab (“white area”, level 1), (2) Nano-epitaxy lab (“blue area”, level 2) and (3) Berzelius lab (“green area”, level 2). The Nano-process and Nano-epitaxy labs were built in 2007, while the older Berzelius lab was constructed in 1984. Each cleanroom area has its own entrance (white, blue and green) and different gowning procedures. Gowning procedures are detailed in the Rules and Work Instructions section of the appendix. Figures B1 and B2 show schematics of the LNL cleanroom, Level 1 and Level 2 respectively:

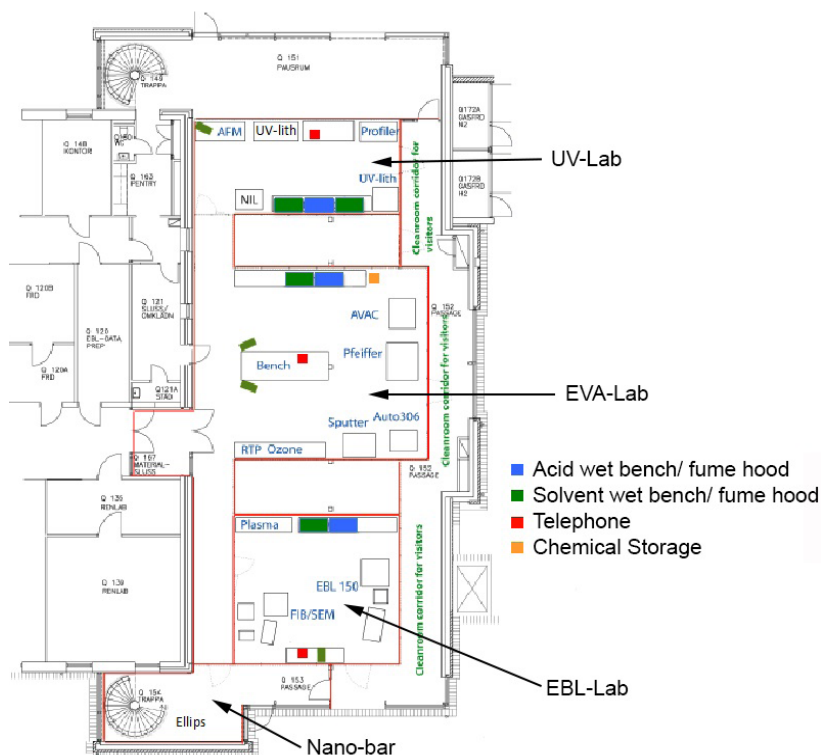
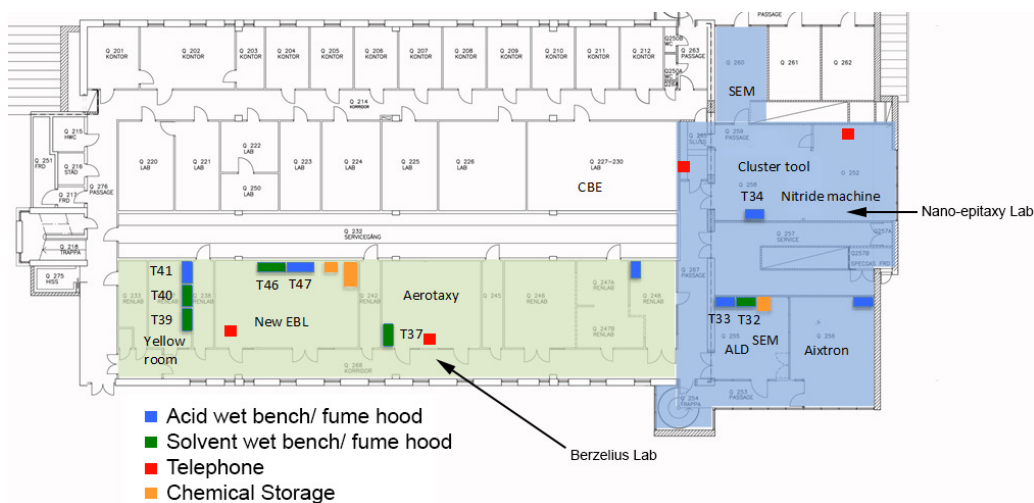


Figure B1: Nano-process lab, white area (Level 1).

RULES AND WORK INSTRUCTIONS

Entering Cleanrooms

Depending on where the main work is being carried out, you may enter the LNL cleanrooms via level 1, white-marked area, or via level 2, blue/green marked area, using the corresponding cleanroom garments. To minimise contamination in the Nano-process lab, movement between the levels is restricted:



- Lab users dressed in white coveralls may go to the “blue area” only; entrance to the “green” part of the lab is forbidden. The duration of such visits should be limited (10-15 minutes), no regular work should be performed in white coveralls in the “blue” area, but it is acceptable to do time-limited work such as loading/unloading samples or similar activities.
- People dressed in blue or green coats may visit the “Nano-bar” room (ISO 7) on level 1, but not inside the ISO 5 area of the Nano-process laboratory (except in case of emergency).

Gowning Procedure

There are different gowning procedures for different levels of LNL. On level 1 (Nano-process lab, class ISO 5): users should wear white coveralls, hood, booties and disposable gloves. On level 2 (Nano-epitaxy lab, the “blue area”, class ISO 7), users should wear blue lab coats, hairnet, disposable gloves and lab shoes (booties covering ordinary footwear are also acceptable). In the Berzelius lab or “Green area” (on level 2, class ISO 8) users wear green lab coats, hairnet, disposable gloves and lab shoes (or booties to cover ordinary shoes). Figure B3 illustrates the different garments needed for the Nano-process lab, Nano-epitaxy lab and Berzelius lab, going left to right.

Before Entering the Changing Area

Remove any outdoor clothing or other extraneous garments (such as pullovers or jackets) outside the lab. Watches and rings may be placed in small lockers (changing room, level 1). Mobile phones are NOT allowed in the Nano-process lab, level 1. On level 2 (Nano-epi and Berzelius labs), it is permissible to take phones once they have been cleaned. It is recommended to visit a restroom before entering the cleanroom. Please note: you must remove any cosmetics since these are regarded as contaminants.

Exiting the Cleanroom

To exit the cleanroom, use the following procedure to remove your cleanroom garments:

- For level 1: remove booties and put them on a shelf. Take off your hood and coveralls and hang them on the hanger without allowing any part of them to touch the floor. Remove and dispose of your gloves. Collect your personal belongings from your locker. As you are leaving the changing room, dispose of your hairnet.
- For level 2: remove cleanroom shoes and put them on a shelf. Take off your coat and hang it on the hanger. Remove and dispose of your gloves. As you are leaving the changing room, dispose of your hairnet and booties.

Working Hours and Lab Buddies

The lab is open 24/7/365 except for certain holidays. When closed, notifications will be sent via LIMS to all registered users. The lab staff is typically present between 8.00 and 17.00 on weekdays. To get the full support of the staff and for safety reasons, lab users should only use the labs during the normal working hours. If you are working late (after 19.00 or any time during weekends and holidays), a lab buddy must be present.



Figure B3: Cleanroom apparel, from left to right, for Nano-process lab, white area (Level 1), Nano-epitaxy lab, blue area and Berzelius lab, green area (Level 2)

When Work in LNL is Completed

It is the responsibility of each user to inform the Lab Operations Manager when their work in LNL is finished. Your LIMS account and LU lab access card will be deleted.

CHEMICALS

Working with Chemicals

Safe work with chemicals requires special training, which includes:

- studying SDSs of chemicals,
- writing Risk Assessment Forms (RAF) for any new chemical process,
- practical training in how to use wet benches and fume hoods.

Maps indicating the positions of wet benches and fume hoods appear in Figures B1 and B2. In total, there are seven wet benches and fume hoods in the cleanroom areas. There are four wet benches which can be used for HF-based solutions, two of which are located on level 1 (EVA lab and EBL lab). The other two are located on level 2 (ALD lab and New EBL lab).

Protective Equipment

All users who work with chemicals must use protective equipment, which includes aprons, goggles, chemical gloves, sleeves and face shields. Using face shields is compulsory when using chemicals. Figure B4 demonstrates the user's protective gowning in the Nano-process laboratory.

Handling Chemical Waste

Collect solid waste in dedicated boxes separate from the solvents, bases and acids which are also collected in their own dedicated bottles. Items contaminated with resists or solvents must be placed in dedicated bins. Do not mix organic and inorganic chemicals. There is a solvent drain system on level 1 which is equipped with a level meter. When the red LED starts blinking DO NOT pour in more solvent waste; contact lab personnel. When using dedicated bottles to collect waste, do not fill the bottles to the top; leave sufficient space for any gas produced. Make sure waste bottles are correctly marked. It is absolutely forbidden to pour any chemical into the sink.



Figure B4: Full chemical protection: face shield, chemical gloves, apron, and sleeves.

Chemical Spillage

The spillage of chemicals in the cleanroom is an emergency and constitutes a serious accident because chemical vapours will spread through the internal lab ventilation. Lab staff must be informed immediately in case of a chemical spillage. Follow the instructions given by lab staff. A small spillage can easily be handled by lab users. Any work to remove a spillage must be carried out with extreme caution, using all available protection (chemical gloves, apron, face shield and sleeves).

In the case of a larger chemical spillage, inform all users present in the lab (all rooms on the same floor) that they must leave the lab calmly via the changing room. Leave the lab yourself. Contact lab staff to report the spillage; they will then take over. Remain in the vicinity to answer any questions the lab staff might have regarding the spillage. If nobody from the lab staff is readily available, contact emergency service by calling 0-112 (112 from any mobile phone) and inform them of:

- the chemical,
- the amount of liquid spilled,
- any lab users affected by the spillage.

The lab will be reopened when it is safe again. In case of personnel being exposed to chemicals, contact emergency service immediately and give the following address for the ambulance: Professorsgatan 3, 223 63, Lund.

ALARMS AND EMERGENCY

Emergency Procedures

In the case of an evacuation alarm (bells and sirens), evacuate the cleanroom at once. Leave the lab immediately via the nearest emergency exit; there is no time for changing clothes. Check that no one is left behind; if so, help them evacuate without risking your own life. Remember to check the evacuation routines. Identify your assembly point and go directly to it, see figure B5.

There are two types of alarms in the Lund Nano Lab:

- Visual (the alarm lamp stations) installed in the cleanroom show the status of Lund Nano Lab, such as ventilation, power and so on.
- Audible (bells and sirens) activated in case smoke, fire or process gas detection. Local audible alarms (buzzers) can be activated due to an equipment malfunction, such as insufficient ventilation through wet benches.

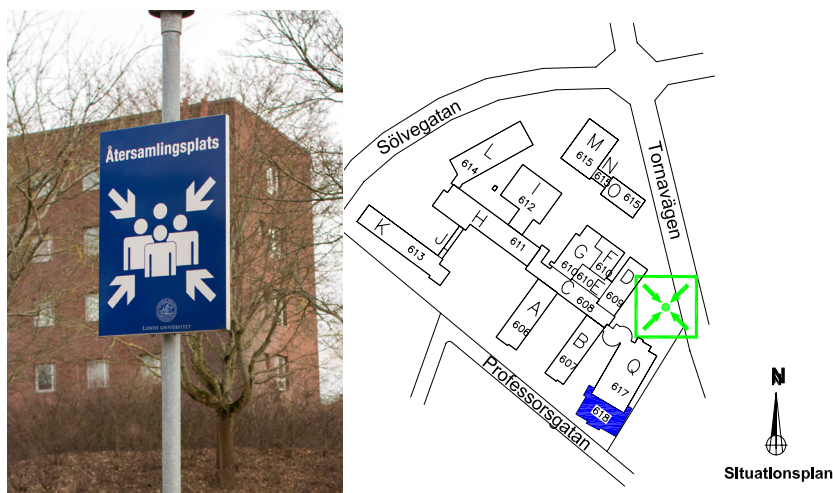


Figure B5: Outdoor assembly point sign and schematic of the area.

Audible alarms (bells and sirens) mean that you must evacuate the lab immediately. You should activate the alarm manually (open cover or break the glass) if the automatic fire/gas safety system does not work.

Table B1 shows information specific to LNL regarding what to do in case of an alarm. Please note the relevant contact telephone numbers are available by the phones in the lab.

Alarm Type	Reason of the Alarm	What to do
Blue	Power failure.	Leave the lab. Contact LNL safety personnel, Operations Lab Manager or their deputy.
Yellow	Process ventilation malfunction (wet benches will make a continuous alarm sound).	Not safe to work with chemicals. Switch off hot plates or other equipment on wet benches, leave the lab. Contact LNL safety personal, Operations Lab Manager or its Deputy
Orange	Process gas cabinet ventilation malfunction.	Contact LNL safety personal, Operations Lab Manager or its Deputy. Be prepared to leave the lab.
Red + local sound from lamp post	Process gas detected, low concentration.	Switch active equipment to a safe state. Contact LNL safety personal, Operations Lab Manager or its Deputy. Go to corridor Q267, check gas detection system. Be prepared to leave the lab.
Red + bell or siren sound (Evacuation)	Smoke, fire, manual alarm activation and/or high concentration of process gas	DANGER! Leave the lab immediately! No time to change clothes!

Table B1: Possible reasons for an alarm and instructions on what to do.

LNL Contact Information

LNL address: Lund University
Physics Department, Division of Solid State Physics
Professorsgatan 1
223 63 Lund

Telephone numbers to lab areas:

UVL-lab, Q161, Nano-process: (046-22)23980
EVA-lab, Q158, Nano-process: 23981
EBL-lab, Q156, Nano-process: 23982
Aerotaxy lab, Q243-244, Berzelius: 23985
New EBL-lab, Q239-241, Berzelius: 23986
Nano-epi, Level 2 (corridor): 27663
Epi Room, Q258: 23983

Actions in case of a serious personal accident

- Call for help.
- Give first aid.
- Call for an ambulance.
- Give the address of your location (see below).
- If a chemical accident, also give the chemical name, concentration, volume, and exposure time, if known.
- Assist the injured person and send someone to meet the ambulance and paramedics.
- Guide the paramedics to the injured person.
- It is compulsory for at least one person to accompany the injured person to the hospital, if no lab staff is available, a user should do this.
- It is important that rinsing is continued during transportation to paramedics/hospital, using a handheld bottle.
- If no lab staff is available, contact a relative of the injured person. Each group has a register with this information.

Emergency number

112

Swedish Poison Information Centre

010-456 6700

Emergency contact information for the different Myfab sites:

Electrum: KTH, Royal Institute of Technology Electrumlaboratoriet Isafjordsgatan 22-24 164 40 Kista Emergency/on duty number: 070-648 60 32 St Erik eye clinic: 08-672 31 00	MC2: Chalmers University of Technology Microtechnology and Nanoscience - MC2 Kemivägen 9 412 96 Göteborg Chalmers Fastigheter emergency number: 031-772 49 37
MSL: Uppsala University Ångströmlaboratoriet Regementsvägen 1 752 37 Uppsala Akademiska Hus emergency number: (018) 683 204	LNL: Lund University Physics Department, Division of Solid State Physics Sölvegatan 14C 223 63 Lund