# Laboratory NANOFABRICATION (NANOFAB)

## OPERATING INSTRUCTIONS

*This document defines the rules and safety procedures for the access to this laboratory and the usage of equipments here available.*

*LABORATORY  LOCATION: UniMoRe-FIM Dept., Physics Building, Ground floor - Room 080*

### RESPONSIBILITY

- R.S.P.P.  CNR – Istituto Nanoscienze  :          Dr. Milena Toselli
- Laboratory Responsible  (Preposto):          Dr. Gian Carlo Gazzadi

### ACCESS RULES

Two categories of people can access the laboratory:

- GUEST
- USER

*GUEST* is not allowed to operate on the equipments and must always be guided by authorized personnel (*USER*) . *GUEST* has to respect the general safety and conduct rules of the Lab as presented in this Manual (pag. 2) .

*USER*  may operate on the equipments. *USER* could be a CNR employee, a collaborator with fixed-term contracts, a CNR associated, or a PhD student who has completed the "General Training Course on Prevention and Safety at Work". In special cases, *USERS* could be requested to complete the training modules about specific hazards (chemical, biological).

*USER* permission is granted by the Responsible of the Laboratory who evaluates the applicant's background knowledge and organizes a specific training about the safety procedures and the working methods to adopt with the equipment and/or the substances in the Laboratory.

*USERS* and *GUESTS* may ask the *Workers Health and Safety Representative* (**RLS**), Dr. Andrea Bertoni, for assistance in case they perceive any hazard-related issue not properly managed by the Laboratory Responsible.

# GENERAL SAFETY AND CONDUCT RULES

*USERS* and *GUESTS* must comply with the following general rules of prevention and security. Please note that non-observance of safety regulations involves, in addition to the penalties of law, taking disciplinary action against the defaulters.

## IT IS IMPORTANT

- To memorize the location of access and exit ways
- To check the safety signs
- To locate the first aid box and the placement of individual (DPI) and collective (DPC) safety devices
- To locate the containers for waste disposal
- To promptly inform the Responsible of the Laboratory of any irregular situation in the operation of the instruments

- To collaborate with the Responsible of the Laboratory and with other users, in order to maintain the efficiency of the security system

## IT IS MANDATORY

- To carefully read the machine handbook and to strictly follow the given specific rules.
- Before using any chemicals, to acquire information about their characteristics by way of safety data sheets, risk phrases and safety advice, and to follow instructions for their handling, storage and disposal.
- To keep electrical equipments as far away as possible from sources of moisture and/or flammable solvent vapors
- To always use protection devices (DPI and DPC) as indicated by the procedures. Keep them carefully, do not damage or remove them
- To dispose of all processing waste in dedicated containers
- To observe the existing prevention and safety laboratory regulations, and to closely follow the provisions issued by the Responsible
- In case of alarm, to leave the laboratory according to the evacuation procedures envisaged in case of emergency

## IT IS FORBIDDEN

- To work alone in the lab, especially beyond the standard working hours
- to take and preserve food and drink inside the laboratory
- To use electrical equipment not compliant with CE regulation
- To carry out operations for which one has not been authorized and/or trained by the Responsible of the laboratory

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## RULES FOR THE PECULIAR USAGE OF INSTRUMENTS IN THE LABORATORY

This laboratory hosts a **Dual Beam Focused Ion Beam – Scanning Electron Microscope (FIB-SEM)** system and an **Electron Beam Lithography (EBL)** system.

### *DUAL BEAM FIB-SEM*

1) Authorized users must always refer to the **USER GUIDE manual** on the instrument desk to properly operate the instrument. Guest people accompanying an authorized user can stay in the lab only if the authorized user is present and with the only scope of watching user operation.

2) Regarding instrument operation, users must always keep in mind that the **Dual Beam instrument is** designed to be **fully remote-operated** through a control software (XP) and the following PC peripherals:
   - Mouse and Keyboard for setting the vacuum (Pump, Vent, ..) and beam parameters (Energy, current, ...)
   - Joystick for sample movement
   - manual user interface (MUI) for imaging controls (focus, astigmatism, contrast, brightness...).

   Therefore, **IT IS FORBIDDEN** (and actually there is no need) **TO PUT HANDS ON THE APPARATUS** (i.e. vacuum chamber, FIB and SEM columns, detectors and connecting cables) when the system is in operating mode (sample in, vacuum OK, High Voltage (HV) ON). Users are allowed to put hands on the vacuum chamber only to load samples.

3) At the **beginning of a session**, users will normally find the system in **idle status: XP software open, Vacuum ON and HV OFF.**

   **To operate the system** users must follow these steps:
   - a) Vent the chamber
   - b) Insert the sample (use powder-free latex gloves)
   - c) Pump the chamber
   - d) When "Vacuum OK" message is displayed, switch HV ON by pressing the HV button on the table. User is now able to use SEM and FIB columns.

   At the **end of a session** users must **put the system back in idle status** by the following steps:
   - e) Switch the beams OFF by clicking "Beams OFF" icon in the control software
   - f) Vent the chamber
   - g) Take out the sample (use powder-free latex gloves)
   - h) Pump the chamber and wait until "Vacuum OK" message is displayed.
   - i) Switch HV OFF by pressing the HV button on the table.

4) In case of **system malfunctioning** an error message will be prompted by the control software and the system will be put in idle state. User must **immediately contact the laboratory manager (Dr. Gian Carlo Gazzadi, Tel. 5323)** to check for a solution. If the lab manager is not available, user must **press the HV button on the table** before leaving the lab.

5) In case of a **general alarm** press the **HV button** on the table before leaving the lab. This will shut down the SEM and FIB columns leaving the Vacuum ON for a later recovery of your session.

6) In case of **extreme emergency** inside the lab **(fire, water flooding)** push the big **emergency button (RED)** on the table before leaving the lab: this will shut down the system completely.

*EBL system*

1) Authorized users must always refer to the **USER GUIDE manual** on the instrument desk to properly operate the instrument. Guest people accompanying an authorized user can stay in the lab only if the authorized user is present and with the only scope of watching user operation.

2) Regarding instrument operation, users must always keep in mind that the **EBL system is** designed to be **fully remote-operated** through a control software (SmartSEM) and the following PC peripherals:
- Mouse and Keyboard for setting the vacuum (Pump, Vent, ..) and beam parameters (Energy, current, ...)
- Joystick for sample movement
- HardPanel for imaging controls (focus, astigmatism, contrast, brightness...).

Therefore, **IT IS FORBIDDEN** (and actually there is no need) **TO PUT HANDS ON THE APPARATUS** (i.e. vacuum chamber, SEM column, detectors and connecting cables) when the system is in operating mode (sample in, vacuum OK, High Tension (HT) ON). Users are allowed to put hands on the vacuum chamber only to load samples.

3) At the **beginning of a session**, users will normally find the system in **STAND-BY mode** (**STANDBY button** on the chamber stand is lit **WHITE**)**: Computer, electronics and High Tension (HT) OFF, Vacuum ON.**

**To operate the system** users must follow these steps:
   a) Press the **ON button (GREEN)** on the vacuum chamber table: computer and electronics will power up.
   b) Start the SEM control software (SmartSEM)
   c) Vent the chamber
   d) Insert the sample (use powder-free latex gloves)
   e) Pump the chamber
   f) When "Vacuum OK" message is displayed user can switch HT ON in the control software and use the SEM column.

At the **end of a session** users must **put the system back in STAND-BY mode** by the following steps:
   g) Switch HT OFF in the control software
   h) Vent the chamber
   i) Take out the sample (use powder-free latex gloves)
   j) Pump the chamber and wait until "Vacuum OK" message is displayed.

k) Press the **STANDBY button (WHITE)** on the vacuum chamber table: computer and electronics will shut down.

4) In case of **system malfunctioning** an error message will be prompted by the control software and the system will be put in idle state. User must **immediately contact the laboratory manager (Dr. Gian Carlo Gazzadi, Tel. 5323)** to check for a solution. If the lab manager is not available, **switch HT OFF** in the control software before leaving the lab.

5) In case of a **general alarm** press **STANDBY button (WHITE)** on the chamber stand before leaving the lab. This will shut down the system leaving the Vacuum ON for a later recovery of your session.

6) In case of **extreme emergency** inside the lab **(fire, water flooding)** push the **OFF button (RED)** on the vacuum chamber table before leaving the lab: this will shut down the system completely.

## *LIQUID NITROGEN USE*

1) Dual Beam instrument is equipped with an **EDX analysis system**, which requires **liquid nitrogen** to work.

2) **To handle and load liquid nitrogen** into the EDX resevoir always wear the **protective mask and gloves** available in the lab.

## *PROTECTION DEVICES IN THE LABORATORY*

The following safety equipment is available in the laboratory **to handle liquid nitrogen**:

**- Protective mask**

**- Protective gloves**

## *EVACUATION PROCEDURE IN CASE OF EMERGENCY*

In case of emergency and warning, users and/or guests attending the laboratories must respect the following procedures:

1. Proceed in an orderly way in order to leave the building by following the shortest route indicated by relevant signs, and gather at the meeting point
2. Do not use elevators
3. Only if the situation allows it, before walking away and in the shortest time possible, safely store any materials and equipments.
4. Do not perform any operation for which they have not been previously trained.