Laboratory SESAMo - MFE (SESAMO A)

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

RESPONSIBILITY

- R.S.P.P. CNR – Istituto Nanoscienze : Dr. Milena Toselli
- Laboratory Responsible (Preposto): Prof. Umberto del Pennino

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

In the SESAMo – MFE Lab are present the following systems**:**

System for Electron Spectroscopies containing:

Soft X-ray source (15 keV)
Ultra-violet source (up to 5 kV)
Very low energy electron source (LEED)
High voltage low current sources (up to 700 V)
High current low voltage source 30 V, 10 A)
Ion gun (up to 2 kV)
Motorized sample holder
Electron energy analysers (up to 2 keV)
Turbomolecular pumps
Ionic pump (up to 7 kV)

System for Scanning Tunnel Microscopy (STM) containing:

Ion gun (up to 2 kV)
Two ionic pumps (up to 7 kV)
High voltage low current sources (up to 700 V)
High current low voltage source 30 V, 10 A)

All these instruments are inserted in or connected to a stainless-steel Ultra High Vacuum vessel with some view port in glass or Pb-glass. Pb shield for windows are present near the X-ray source.
Each instrument has its own electrical switch and its use is quite safe for the user.
Care must be taken in switching on the voltage sources checking that all the control knobs are set to zero before switching on. These knobs must be returned to zero before switching off.
The X-ray source control cannot be switched on if its cooling circuit has not been already activated.
In venting the UHV system, care must be taken to not create an over-pressure in the chamber.
All the instruments manuals are in the metal cabinet or on the system desk.

High pressure bottles :

Sometime inert gases (N2, He, Ar) must be used to fill-up the system (N2) or to check for leaks (He). These gases are contained in 200 Atm cylinders mounted on cart. They cannot be removed from the cart and, when empty, the cylinder must be changed only in the cylinder warehouse outside the building. Always use the appropriate regulator on a cylinder. If a regulator doe not fit a cylinder valve, replace the cylinder, not the regulator. Do not attempt to adapt or modify a regulator to fit a cylinder it was not designed for. Regulators are designed to fit only specific cylinder valves to avoid improper use.

Inspect regulators, pressure relief devices, valves, cylinder connections, and hose lines frequently for damage.

Close the main cylinder valve whenever the cylinder is not in use.

Remove regulators from unused cylinders and always put the safety cap in place to protect the valve.

Always secure cylinders, whether empty or full, to prevent them from falling over and damaging the valve (or falling on your feet). Secure cylinders by firmly chaining or strapping them to a wall, lab bench, or other fixed support.

To use the pressure cylinder:
- make sure that the gas pressure regulator is well mounted and closed
- make sure that the gas line is connected to the instrument
- open the gas faucet and regulate the exit pressure using the regulator
- close the pressure regulator and the gas faucet after use

At the end of the experiment or at the end of a working day high pressure cylinders must be disconnected from the instrument and immediately placed into the external cabinet.

To transport a cylinder, put on the safety cap and strap the cylinder to a hand truck in an upright position. Never roll a cylinder.

Solvents

When it is required the use of chemicals every operation must be done in the chemistry room equipped with fume hood and metallic cabinets for acids and bases. Solvents and other chemical waste must be poured in the suited reservoir in that room.

Vacuum Pumps

Mechanical vacuum pumps used in laboratories pose many hazards. There are mechanical hazards associated with the moving parts. There are chemical hazards of contaminating the pump oil with volatile substances and subsequently releasing them into the lab. There are also fire hazards when pumps malfunction or overheat and ignite nearby flammable or combustible materials.

Follow these guidelines for safe pump operation:

Do not place pumps in an enclosed, unventilated cabinet allowing heat and exhaust to build up.

Do not operate pumps near containers of flammable chemicals, flammable chemical wastes, or combustible materials such as paper or cardboard.

Always close the valve between the vacuum vessel and the mechanical pump before shutting off the pump to avoid sucking vacuum oil into the system.

With **oil rotary pumps** many vapors condense in the pump oil. Solvents in the oil degrade its performance (and eventually ruin the pump), create a chemical hazard when the oil is

changed, and are emitted in an oil mist vented from the system. Other vapors pass directly into the exhaust stream. To avoid these problems:

Trap evaporated materials with a cold trap before they reach the pump. Depending on the material that is to be trapped, this can be a filtration flask either at room temperature or placed in an ice bath. For more volatile solvents more sophisticated options exist (e.g. dry ice trap).

Vent the pump exhaust properly.

Electrical Hazard

Properly ground all electrical equipment.

If sparks are noticed while plugging or unplugging equipment or if the power cord feels hot, do not use the equipment until it can be serviced by an electrician.

Do not run electrical cords along the floor where they will be a tripping hazard and be subject to wear. If a cord must be run along the floor, protect it with a cord cover.

Do not plug too many items into a single outlet. Cords that enable you to plug more than one item in at a time should not be used.

Multi-plug strips can be used if they are protected with a circuit breaker. Do not overuse or daisy-chain in a series.

Do not use extension cords for permanent wiring. If you must use extension cords throughout the lab, then it is time to have additional outlets installed.

PROTECTION DEVICES IN THE LABORATORY

If it was necessary to clean samples or UHV parts just before their insertion into the vessel, by the use of very small quantity of solvent, gloves and goggles, present in the laboratory, must be used.
When cryogenic liquids are used to cool down the samples thermal gloves and goggles must be worn.

EVACUATION PROCEDURES IN THE EVENT OF AN EMERGENCY

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

1. If it not dangerous for her/him switch off high voltage sources.

2. 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

3. Do not use elevators

4. Only if the situation allows it, before walking away and in the shortest time possible,

safely store any materials and equipments.

5. Do not perform any operation for which they have not been previously trained.

6. Do not reenter the building until you are told to do so by the Director or Safety coordinator.