IIT Bombay Nanofabrication Facility

Policy Manual

Version 2.0

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I. Introduction

"IIT Bombay Nano Fabrication Facility (IITBNF) is one of the premier research centers catering to a large number of users across the institute as well as across the country, thanks to the INUP (Indian Nano electronics Users Program) program. The research activities at the center cover a wide spectrum of topics, starting from CMOS devices to III-V devices to 2-D materials and more. Catering to a large audience across various disciplines brings with it a slew of challenges. From a user’s standpoint, one of the key focuses would be to get the work done at the earliest. This includes allocation of resources in terms of manpower, machine time, and other support systems.

A clear and decisive policy document serves as a guideline to lab members on how to go about their tasks efficiently without any conflicts or confrontations. Being aware of your responsibility as a lab user, can render clarity in execution and implementation of actions in a time bound manner. No policy document is complete and all encompassing. Hence policy making is a collective and continuous activity."

- By Dr. Sandeep S.S., Ex Ph.D. student
II. Lab access and renewal policy

To avail the IITBNF facilities, one needs to go through the **lab access** procedure and register on the online slot booking module. After that, biometric lab access to various labs can be attained. Lab members need to get renewal done every six months (June/July and December/January).

1. **Lab Access Procedure**
   To attain IITBNF lab access, new members should follow the procedure as given in the link:


2. **Lab Access Renewal Procedure**
   Registration for all lab members expires on 30th June and 31st December every year.

   Extension is given every six months when the steps given below are strictly followed:

   - For renewal in June/July, seminars on safety and contamination are arranged for lab members. Attendance is mandatory.
   - For renewal in December/January, all lab members need to give the safety, contamination, basic clean room tests and clear them all.
   - During every extension:
     - Lab members need to meet IT team to check their profile for any modifications/corrections.
     - Lab members need to declare that all the papers/publications associated with work done at IITBNF are uploaded in the repository of IITBNF with the approval by their supervisor.

**Note:**

- Online tests are conducted for:
  - New user throughout the year
  - Lab members once a year in December
  - Members whose registration expires due to 'not using the lab' continuously for 3 months.

- Lab members, who clear the test after 1st October, need not give the test again in December. However, they will have to meet IT team for the extension.
III. General Rules & Regulations

1. Lab entry rules
   For all members/ non-members/ visitors

   ➢ Before entering the labs
     • Remember: The lab is not a meeting place. Enter the lab only if you need to work with
       instruments, or if you are being given a tour. Nobody is allowed to wait inside the lab
       without the presence of their mentor or tour instructor.
     • Wearing socks is mandatory - bring your own pair.
     • Persons wearing shorts and/ or sleeveless clothing will not be allowed inside the labs.
     • Pregnant women are advised not to enter the labs.
     • Place your shoes/ sandals in an orderly manner on the shoe rack outside.
     • Leave your bags, notebooks, water bottles in an orderly manner outside.
     • Only cell phones, laptops are permitted to be taken in.
     • Do not hold the main door open and talk to others across the door.
     • Members: Do not use your own biometric access to let in other people who don't have lab
       access.

   ➢ After entering the labs
     • Wear lab sandals.
     • Wear hairnet.

2. Buddy System

   ➢ For members/ any usage of laboratories
     • For safety reasons, no one is allowed to work alone in the lab between 8pm and 8am on all
       days. During weekends and all holidays also buddy system needs to be followed.
     • A buddy refers to any other lab member (need not be an AU) present with you, while
       working within the lab.

Each lab member is individually responsible to ensure that a buddy is ALWAYS present.

   • Buddies may change during lab use.
   • Buddies must communicate with each other regularly (at least every 15 minutes). This
     ensures the safety and well-being of all lab members during lab use.
   • Usage of any Hazardous Gases (gases stored inside the gas cabinet) between 8pm and
     8am/ holidays requires prior intimation & approval from the facility team. Facility team
     members will ensure/ take care of the service corridor safety.
   • Entry must be made in the 'Buddy Log Book' which is placed in every lab.

   ➢ To make buddy system user-friendly, the following labs have been clubbed:
     • Nano lab: Includes Nano yellow room and Nano room.
     • Micro I semi clean lab: Includes chemistry room and semi clean room.
     • Micro I Yellow room: Includes Karl Suss room and Laser Writer room.
     • Micro II lab: Includes HWCVD room and Bio MEMS room.
3. Chemistry Lab rules

Even if you need to use the lab only for a few minutes (for eg: to use acetone), the following rules must be followed.

**IF IN DOUBT, PLEASE ASK.**

- **Before going into Chemistry Room:**
  - Place regular lab sandals on the shoe rack outside Chemistry Room.
  - Wear covered lab sandals.
  - Wear hair net, chemical resistant apron, facemask, gloves, and goggles.

- **In the Chemistry room, before starting your work:**
  - Fill up the 'Chemical Warning Form' available in the Chemistry Room.
  - Check that the mixture of chemicals which you need is a compatible one.
  - Label the petri dish/ beaker if you want to leave your sample in it for some time with your name, chemical name, contact no.
  - Check that there is space in the ‘Used Chemical’ bottle available for disposing the respective chemical/ mixture after use.

- **After completion of work in the Chemistry room:**
  - Dispose the hairnet, regular gloves, facemask into the dustbin.
  - Place the goggles back into the box provided.
  - Remove the chemical resistant apron, place it on the hanger provided outside.
  - Place the covered lab sandals back on the rack.

4. Clean room rules

- **Nano Litho lab:** Not more than 6 people are allowed at a time.
- **Nano lab:** Not more than 8 people are allowed at a time.
- **AMAT lab:** Not more than 6 people are allowed at a time.
- **Nano electronics device fabrication lab:** Not more than 11 people are allowed at a time.
- **NCPRE fab lab:** Not more than 8 people are allowed at a time.
- **NCPRE Characterization lab:** more than 8 people are allowed at a time.
- **MBE labs:** Not more than 5 people are allowed at a time.

- **Before entering the clean rooms:**
  - Place regular lab sandals on the shoe rack outside Nano lab in an orderly manner.
• Wear the clean room clothing according to the order specified:
  ▪ Wear the hairnet.
  ▪ Wear the facemask.
  ▪ Wear the clean room headgear.
  ▪ Wear the clean room gown.
  ▪ Wear the clean room shoes.
  ▪ Wear the gloves.

➢ While working in the clean rooms:
  • Be conscious of your surroundings, no fast movements should be made inside the lab.
  • After your work is done, ensure that the instrument & its surrounding area are clean and tidy.

➢ While exiting the clean rooms:
  • Remove the clean room clothing according to the order specified:
    ▪ Remove the clean room shoes & place it on its rack in the right manner.
    ▪ Remove the clean room gown & put it up on the hanger.
    ▪ Remove the headgear & put it up on the hanger.
    ▪ Dispose the hairnet, gloves, facemask into the dustbin.

➢ Response to lab rules violations:
  • 1st offence without accident - warning
  • 2nd offence without accident - lab service
  • 3rd offence without accident - report of the offence, determination of the cause, recommendation to avoid repeat. FOC review for punishment.
  • 1st offence with accident - report of the offence, determination of the cause, recommendation to avoid repeat. FOC review for punishment.

5. Violation/Offence response

➢ 1st offence without accident - warning,
➢ 2nd offence without accident -lab service.
➢ 3rd offence without accident - report of the offence, determination of the cause recommendation to avoid repeat. FOC review for punishment.
➢ 1st offence with accident - report of the offence, determination of the cause, recommendation to avoid repeat. FOC review for punishment.
IV. **Roles & Responsibilities: SO, AU, Operator, Lab-in-Charge**

1. **System Owner (SO)**

   - **Tool up-time**
     - To ensure high tool uptime for their respective tools.
     - During troubleshooting, by Equipment maintenance team (EMT) or Service Engineers, SO presence is highly desired but not mandatory.

   - **Training**
     - To ensure completion of training requests by uniformly allocating slots in the following order: First to the operator (including M. Tech RAs) & then to other AUs.
     - To conduct authorization tests to qualify users as an AU.
     - Can delegate tasks to AUs (uniformly) if needed.
     - Can delegate to AUs (uniformly) if needed.

   - **Technical expertise**
     - To advise operators & other AUs when a query comes up, by taking help from respective faculty in charges if needed, for a non-standard hardware, process or contamination-related issues.
     - To monitor and respond to drifts in baseline process data of equipment's.

   - **Documentation (through IT team)**
     - To take care of modification of SOPs and training policy as & when required.
     - To prepare tool troubleshooting reports, circulate and upload.

2. **Authorized User (AU)**

   - **Tool up-time**
     - AU presence is highly desirable during EMT or Service Engineer tool troubleshooting but it is not mandatory.

   - **Tool operating requests**
     - Not obligated to book slots and complete process requests for users in the absence of operator.

   - **Training**
     - To complete training requests as delegated by SO.
     - AU will not take authorization tests to qualify a user as an AU.
3. Operator

➤ **Tool uptime**
  • Operator’s presence is mandatory during troubleshooting / AMC by Service Engineer or EMT.
  • To escalate the issue to EMT and LIC for tool troubleshooting as soon as hardware/process issue is observed.

➤ **Tool operating requests**
  • Book slots and complete process requests for users.

➤ **Training**
  • To complete training requests as delegated by SO.
  • To take authorization tests to qualify a user as an AU.

➤ **Baseline recipe runs**
  • Run baseline recipe at specified frequency, collect data and log it.

➤ **Communication**
  • To inform all lab users of any status change of tool by sending out mails, lock out/tag out the tool, black out without giving technical details.

4. Lab- in-charge (LIC)

✓ Check of all equipment in respective labs.
✓ Coordination with SO & EMT to keep uptime of tool high.
✓ Monitoring baseline recipe checks taking help from operators.
✓ Conducting PM schedule of all equipment.
✓ Coordinating AMC visits for equipment.
✓ Maintaining troubleshoot logs, tool related documents.
✓ If any modifications done on SOP - check for implementation & follow up with SO.
✓ Coordination with IT team for update of equipment information (contamination related, status of equipment etc.).
✓ Ensure safety, facility readiness, consumables availability, and supervise regular cleanliness of the respective lab.
✓ Manage operators of respective labs, as operators to report to LIC.
V. Equipment Usage Policy at IITBNF

Submit a request (Process/Training) for equipment online. Go to “www.iitbnf.iitb.ac.in --> For Members--->Online Modules -->Equipment usage Request” to submit a request.

1. Process Request

- SO/ FIC will approve/disapprove the request within 2 days of submission of the request. If not, requester should raise the flag to SO/LIC/Assistant Lab manager within 2 days after the mentioned time period or send a mail to “iitbnf.access@gmail.com”.
  Note: Slots can be rejected for following reasons - Incomplete or not clear details of sample history, contamination issue, feasibility issue, equipment ‘not working’.
- Requester will receive a mail from SO regarding the approved or rejected mail.
- If the request is approved by SO/FIC, operator will book a slot within one day after SO’s approval as per the requester’s mentioned preferred slot.
- If no preferred dates are given, operator will book slots as per his/her convenience.
  Note: If no slot is booked, requester should raise the flag to SO/LIC/Assistant Lab manager within 2 days after mentioned time period, or send a mail to “iitbnf.access@gmail.com”.
- If the ‘preferred dates’ submitted by requester are not convenient for operator, operator needs to coordinate with requester and then book the slots accordingly with mutual consent.
- When a slot is booked, requester will receive a mail about the scheduled slot dates.
- If for some reason, the slot was not used or cancelled, a fresh request needs to be submitted by the requester to book another slot.
- If the request is rejected by SO/FIC, requester should check the ‘comments’ made by the SO for rejection and submit a fresh request accordingly.

2. Training Request

- SO will check the details of the request w.r.t. feasibility and contamination for future usage of the tool by the requester.
  Note: Training can be rejected for following reasons - Incomplete or not clear details of sample history, equipment ‘not working’, usage requirement of requester as an AU.
- If the request is approved by SO/FIC, the lab member should receive a mail from the SO/Operator/AU of that equipment about the schedule of 1st training slot within 7 working days of submitting a training request. If not, member should raise the flag to LIC/Assistant Lab manager within 2 days after the above mentioned time period or email to “iitbnf.access@gmail.com”.
- Not more than 3 members should be trained at a time.
- Member needs to be in touch with SO/Operator/AU for taking mutually convenient dates for future training slots.
- After every training slot, it is mandatory for the member to make entries on the online form. [Go to www.iitbnf.iitb.ac.in -->For Members -->Slot Booking. Logon to the module. Click on Management-->Equipment Training].
- When all training slots are completed, the SO/operator conducts a test for the member. The authorization is granted to the member upon passing the test. [While filling this data online, the
member should choose the ‘authorization’ option under ‘type of run’ for the final slot on the online training form.]

- A formal mail will be received by lab member granting him/her formal authorization for the equipment. After that, member can book slots on his/her own for the equipment. Note for SO: Authorization on the slot booking module should be given only after checking that PROPER ‘authorization’ entry has been made in the training form.

- A lab member should complete training and authorization test within 20 working days of submission of a training request [provided the equipment is in a ‘working’ condition]. In case this does not happen, the member/ SO/ operator should raise the flag to LIC/Assistant Lab Manager. Note for Trainers/ Trainees: If the training is not happening as per expectations, raise the flag to LIC/ Assistant Lab Manager or email to “iitbnf.access@gmail.com”.

- More than one training run per equipment per day is not recommended. But in emergency, it may be taken.

- If a lab member does not attend the scheduled training slots without informing the SO/ Operator/ AU, the penalty will be that he/ she will be debarred from submitting any training requests on any equipment at IITBNF for a period of one month.

- If the request is rejected by SO/FIC, requester should check the comments made by the SO for rejection and if required, submit a fresh request accordingly.

- Lab members should have adequate knowledge of the type of process that is being carried out in the particular equipment before submitting a training request [Silicon VLSI Technology: Fundamentals, Practice, and Modeling by James D. Plummer (Author), Michael Deal (Author), & Griffin].

### 3. Lithography and SEM tools usage

RAITH is a heavily loaded instrument, hence the following policy has been made to share and distribute the load amongst all three lithography tools - RAITH, EVO SEM and FESEM:

- If samples with film thickness or feature sizes less than 200nm - FESEM to be used.
- If imaging is to be done at an angle other than 45 or 90 degree - FESEM to be used.
- If EVO SEM is down, all SEM requests can be transferred to FESEM.
VI. Critical Tool Policy

(As per FOC meeting- 12th June 2019)

These tools are widely used and their upkeep is of utmost priority. FICs should take the lead for driving the issues to make the tools UP on a high priority basis taking help from all teams (purchase, EMT, facility, process).

Critical Tools List
VII. New Tool Purchase and Installation Policy, July 20, 2022

Documented by Prof. Udayan and IITBNF lab staff

1. FIC proposes tool purchase to FOC
   a. Purpose
   b. Contamination Policy
   c. Restrictions, if any
   d. Lab (cleanroom / non-cleanroom)

   **FOC approval required**

2. Initiate Purchase
   a. Tool Specs – to be shared / discussed with Process, EMT, Facility, New Tool Committee
   b. FIC to Submit Purchase request on the online Purchase module

3. Once Purchase Order is ready
   a. Share the PO details with Process, EMT, Facility
   b. Estimated Arrival Time of New Tool to be announced

   **Update FOC**

4. Before Tool arrives at IITBNF
   a. Space Allocation
   b. SO / Operator assigning
   c. EMT, Facilities, Process person assigning
   d. Facilities Preparedness (New tool requirements excel sheet to be filled by FIC / SO)
   e. Chemical / New Material / Gas – Requirements
   f. Safety requirements (Scrubbers, GLD, etc)
   g. Site visit by vendor

   **FOC & Safety Approval required**

5. Tool Arrival at IITB
   a. Place in the corridor area safely
   b. Check for any damage to the box (shock, tilt, etc)
   c. Intimate OEM / Indian vendor
   d. Site visit by vendor (local vendor)

   **Update FOC**
Gantt chart plan

6. Shifting tool to the planned location
   a. With / Without vendor
   b. Tool shifting path
   c. Check packing list & compare as per PO

7. Facilities Installation
   a. Cooling water
   b. CDA
   c. Non-toxic gases
   d. Toxic gases & Scrubber, if any
   e. Exhaust
   f. Electrical & Grounding
   g. Temperature & Humidity

New Tool Committee Update

8. Installation
   a. Hardware Installation (assembly) without powering up
   b. Tool power up
   c. Hardware run check (pump, cooling water, MFCs gas flow, etc)
   d. Process run check (dummy runs) – as per PO / discussion
   e. Process qualify (baseline run) – characterization, etc.
   f. Video recording – tool operation, training, basic maintenance (if any) & submit to IT team for online uploading

New Tool Committee Update

9. Tool Acceptance – as per PO / discussion with vendor
   a. Final Installation report
   b. FIC signature

Update FOC

10. Make list of spares / consumables and initiate purchase – SO, Operator & EMT

11. SOP, Policy Document, tool health monitoring plan – SO, Process Team & FIC
   a. Timeline – within 1 week after tool installation & baseline check is done
12. Tool on website – online & slot booking

13. Tool monitoring & operation
   a. 2 weeks of operator based usage of the tool
   b. Baseline runs repeatability check

14. Tool Training
   a. After 2 weeks training for 1 person / FOC faculty

15. Tool Opening
   a. After 4 weeks of tool monitoring, open tool for training for all “send email”

   FOC approval required
VIII. Anti-Contamination Policy

General Awareness about Contamination Control requirements

CMOS industry is following Moore’s law from several decades; currently 7 nm technology nodes are under research and development. Shrinking device size increases the demand to monitor and control cross contamination among different semiconductor equipment. In the current scenario, academia and industry are developing technologies and policies to monitor and control cross contamination in their equipment. IITBNF also considers efforts towards controlling contamination extremely important and required. Developing anti contamination policies is a regular and evolving exercise, which is done keeping mainly two things in mind, first to control cross contamination and second to open the equipment for maximum usage by lab members.

About this Page

This page/document describes the general classifications by which equipment are grouped into which help minimize cross-contamination. This page also lists the anti-contamination policy listed in the form of allowed flow charts. Some of the exceptions are also listed. There may be alternate methods to allow a certain process flow, depending on the tool, material, and process flow even if it is not possible with allowed policy flow charts. For any questions about contamination concerns, contact System owner / Faculty in-charge/Process committee for the particular tool.

1. Contamination Categories

Equipment at IITBNF is classified in one of the several contamination categories, described below. When defining the process flow, the choice of processing tools which are acceptable will depend on the previous tool and materials used. In general, wafers can be processed in only equipment within the same contamination group or in groups which can take higher contamination risk which is described by the anti-contamination policy flow charts. First let’s understand different contamination categories.

1) Clean:

- Equipment with the lowest tolerance for contamination fall into this group. Other than for photolithography and some approved analytical tools, wafers containing any metals or metal films are strictly prohibited from being processed in this equipment.
- Wafers that at any point have received processing on any equipment outside of this group cannot be processed on anything listed in this group.
- Wafers previously undergone lithography are acceptable for processing (following appropriate photoresist restrictions or resist stripping procedures).
- Processing in any of the general-purpose wet benches must be done with appropriate dedicated lab ware to prevent cross-contamination. Given the appropriate materials consideration as listed in Allowed materials in tools, wafers processed in ‘Clean’ equipment may subsequently be processed in any other category allowed by anti-contamination policy flow charts, listed later in this document.
2) **Clean (for Si)**
Same definitions as “Clean”, except that only silicon substrates are allowed.

3) **Clean (III-V compounds)**
Same definitions as “Clean”, except that only III-V substrates are allowed.

4) **Clean PV:**
Same definition as "Clean" except the samples will be sodium or potassium contaminated. Please see anti-contamination policy flow charts for its allowed usage policy.

5) **Semi-Clean PV:**
- Wafers processed in "Clean" and "Clean PV" equipment can be processed in "Semi-Clean PV" equipment.
- The materials allowed in "Semi Clean PV" equipment are: Ag, Al, Ti, Pd, and Pt.
- The materials which are not allowed in "Semi Clean PV" equipment are: Ni, Hf, W, Ta, Cr, Zr, Mo, and Au. Other materials may be allowed after appropriate contamination reviews.
- The samples processed in "Semi Clean PV" equipment are Na and K contaminated. Please see anti-contamination policy flow charts for its allowed usage policy.

6) **Semi-Clean:**
- **Semi-Clean A:** Wafers containing standard metals, Aluminum (Al), Tungsten (W), and Titanium (Ti) may be processed in “Semi-Clean A” category equipment. Processing in any of the general-purpose wet benches must be done with appropriately dedicated lab ware to prevent cross-contamination, which means the user must have a dedicated beaker set for “Semi Clean A” category samples if the samples need to go back to “Semi-Clean A” category equipment. Given the appropriate **Allowed materials in tools**, wafers processed in “Semi-Clean A” equipment may subsequently be processed in any “Semi-Clean A” or “Semi-Clean B” or Gold-Contaminated tool or other categories as per allowed anti-contamination flow charts. For detailed policy which includes integration with other contamination categories such as Litho, Analytical, In Line A/AC/ACT, etc., please see anti-contamination policy flow charts.

- **Semi-Clean B:** This subclass covers more metals other than previously approved for use in “Semi-Clean A” equipment, except where otherwise noted. These materials are deposited in equipment used for CMOS compatible films. The “Semi-Clean B” materials are: Ni, Co, Pt, Al, Hf, Ta, Mo, W, Ti, Cr, Zr, Pd.

  - **“Semi-Clean B” to “Semi-clean B”**
    Processing in any of the general-purpose wet benches must be done with appropriately dedicated lab ware to prevent cross-contamination, which means the user must have dedicated beaker set for “Semi-Clean B” category samples if the sample needs to go back to “Semi-Clean B” category equipment.
“Semi-Clean B” to “Semi-clean A”

“Semi-clean B” wafers may be processed in “Semi-Clean A” category equipment after following some precautions/conditions.

1. “Semi-Clean B” wafers must be cleaned or wet-etched using dedicated “Semi-Clean B” lab ware at the general purpose wet bench. Do not use metal lab ware such as metal baths, metal tweezers, etc.
2. “Semi-Clean B” wafers may be etched in “Semi-Clean A” plasma etch tools provided the “Semi-Clean B” film is not being etched. Etching other films and stopping on “Semi-Clean B” films is OK. However, dry etching of “Semi-Clean B” films is permitted in “Semi-Clean A” equipment only on a case-by-case basis (contact Process committee).

- Given the appropriate Allowed materials in tools, wafers processed in “Semi-Clean B” equipment may subsequently be processed in other categories as per the anti-contamination flow charts below. For detailed policy which includes integration with other contamination categories such as Litho, Analytical, In Line/off Line analytical, etc., please see anti-contamination flow charts.

7) Gold Contaminated:

- Wafers containing other non-standard metals, including gold and copper (see below for Zn), may be processed in this equipment. Please see anti-contamination flow charts for usage policy for this category as well.
- Ordinary metallic Zn is allowed in gold contaminated category equipment BUT evaporation of Zn, or etching of films containing Zn, is conditionally restricted in gold contaminated chambers/equipment, due to high volatility/vapor pressure of Zn.
- Annealing of Zn or its films such as ZnO in furnaces is also conditionally restricted.
- The Zn restriction was introduced in Dec 2014. Conditionally restricted implies, in equipment/chamber where the deposition and etching is already allowed it is still allowed but in equipment [gold contaminated] where deposition and etching of Zn or its films is never done, cannot be assumed to be allowed for these processes. This also includes new chambers/equipment being characterized as gold contaminated. Please discuss with the Process committee if you have any such special requests.
- While using a wet bench, please ensure that beakers you are using are already allowed to use gold contaminated samples; otherwise you may be contaminating the non-gold contaminated beakers with your samples.

8) Litho/Analytical:

- Because of their general necessity throughout a process flow, all lithography and some analytical category tools processed samples are allowed in most of the categories.
- Standard resist stripping and equipment-specific, pre-clean procedures designed into the particularly sensitive process modules minimize any potential contamination risk from shared lithography (and other select) tools.
- Some analytical tools present low risk of cross-contamination; other analytical tools are particularly sensitive to contamination issues or run high risk of transferring contaminants.
Consult the materials guidelines for each of these tools, before processing given in the [Allowed materials in tools](#).

- As always, when in doubt about contamination risks in any step in your process flow, don't hesitate to contact the Process committee. Please see anti-contamination flow charts for usage policy for this category as well.

This category has been split into 3 major categories - Lithography (Litho), Analytical (A) and Litho/Analytical

1. Lithography category includes all the lithography related tools like laser mask writer, spinners, optical and e-beam lithography tools.

2. Analytical category includes majorly the characterization tools either with a dedicated tip, chuck or both.
   
   This category is further subdivided into a few sub categories.
   
   - **In line** - “In Line” equipment is defined where a sample can go back and forth between other processing equipment such as deposition, etch, etc. equipment. This category is defined to identify and segregate critical In Line equipment at IITBNF. Sample processed may go to any other category equipment depending on allowed anti-contamination flow charts. Please see anti-contamination policy flow charts for its allowed policy.

   - **In line AC** - ‘C’ stands for a possibility to put different chuck or carrier wafer underneath your sample in analytical equipment. You may only process external samples or from NCPRE or from offline equipment provided you use a dedicated chuck or carrier wafer underneath your sample after approval from the process committee. This is also assuming cross contamination can happen only through chuck, and measurement is done at RT as for high temperature process detailed analysis of the setup is required to comment on cross contamination possibilities.

   - **In line ACT** - Similar to In Line AC category with additional allowed usage policy for external samples after approval from process committee. In “In line ACT” analytical equipment, ‘C’ stands for a possibility to put a different chuck or carrier wafer underneath your sample and ‘T’ stands for a possibility to use a dedicated Tip. This is also assuming cross contamination can happen only through chuck or from tip, and measurement is done at RT.

   - **Off-line A** - By definition “Off-Line” equipment is defined for samples that cannot go back to critical deposition, etch, etc. equipment in the fabrication facility. External samples or samples from NCPRE can be processed in this category. Sample from off-Line ‘A’ category equipment can go to another off-Line ‘A’ category equipment ONLY but cannot go back to any of the other category equipment.

3. Litho/analytical category includes a few special tools which are capable of analyzing the samples as well as perform lithography. Eg - Raith EBL short (Raith SEM)
Table 1: Table for some of the Equipment with changed categories.

<table>
<thead>
<tr>
<th>In Line AC</th>
<th>In Line ACT</th>
<th>Off Line A</th>
<th>Litho</th>
<th>Litho/Analytical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ellipsometer</td>
<td>AFM</td>
<td>XPS</td>
<td>DSAs</td>
<td>Raith SEM</td>
</tr>
<tr>
<td>XRD</td>
<td>Dektak</td>
<td>EVO SEM</td>
<td></td>
<td>MJB4</td>
</tr>
<tr>
<td>All Microscopes</td>
<td>4-probe automatic</td>
<td>4-probe Manual</td>
<td></td>
<td>MJB3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ambios Profilometer</td>
<td>All PR Spinners</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wafer dicer (NMPF)</td>
<td>Raith EBL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wire bonder (NMPF)</td>
<td>Laser writer</td>
<td></td>
</tr>
</tbody>
</table>

2. Miscellaneous Definitions

- **IITBNF**: All Labs in New Nanoelectronics bldg., NMPF labs and old building EE Annexe falls under IITBNF.
- **Chuck Contact**: Equipment where the sample is in contact only with the chuck of the equipment is considered as chuck contact equipment. No other part of the equipment is in contact with the sample. Ex: Ellipsometer, Microscopes, etc.
- **Tip - Chuck Contact**: Equipment where chuck as well as the tip [stylus, etc.] is in contact with the sample is considered as Tip-Chuck contact equipment. Ex: AFM, Dektak Profilo, 4 Probe, etc.
- **Internal Sample**: Sample Issued at IITBNF and is never taken out from IITBNF lab premises or NMPF and hence never processed or opened outside of IITBNF labs is considered an internal sample. If NCPRE users issue samples from IITBNF, maintaining these criteria, then they are also internal samples. If you procure your samples on your own you must open the new wafer box inside IITBNF AND in front of a process staff for it to be considered an internal sample.
- **External Samples**: Samples which are processed or procured outside IITBNF or NMPF are considered as external samples. Even if the sample is processed outside the IITBNF labs even once, it is considered an external sample.
- **Semi-Clean Ambiance**: Laboratory where personal footwear is not allowed and general cleanliness is maintained is considered as having a Semi-Clean ambiance. Micro 1, Micro 2 etc. fall in this ambiance category.
- **Carrier Wafer**: Near all the In Line ‘AC’ and In Line ‘ACT’ category equipment, two carrier wafers one each for NCPRE and external samples is kept in dedicated wafer boxes. These dedicated wafers are to be used underneath the external samples or for samples from NCPRE. Please ask the equipment operator about these wafers. Carrier wafers are not required underneath if your samples are internal samples.
- **Allowed materials page on IITBNF Website**: This page categorizes equipment into different groups based on contamination control policy. Information of allowed substrates, materials, chemicals, gases and targets for each and every equipment is provided here. Some of the not allowed materials are also listed. Equipment groupings are a very general planning for the tool, as you refine your process flow; make sure to check it against the materials requirements for each individual piece of equipment. If a material is not allowed in the equipment the
process flow cannot be allowed even if it is following the anti-contamination policy flow charts. Equipment SOP, allowed materials page and anti-contamination policy flow chart, all must be satisfied to allow a new material or process.

3. Usage of Glass
   - Normal Glass coverslips or soda lime or borosilicate glass substrates contain Na and K at percentage levels. Na, K are carrier lifetime killers in CMOS devices.
   - Glass coverslips, Soda Lime or normal Borosilicate glass as allowed only in off line A tools.
   - Though Quartz is the best choice which is completely free of Na and K, quality Borosilicate (borofloat, schott, BK247) is recommended over soda lime for usage in gold contaminated and inline Analytical tools post approval from process committee.

4. Exceptions
   - There are a few exceptions in which non-standard equipment sequence may be acceptable- If you have a non-standard process flow requirement, please discuss your project with a member of the Process committee, who should be able to help you design a process flow to accommodate your needs.
   - We will consider experimental data in order to allow a non-standard process flow.
   - Fig. 7 below lists the anti-contamination exception flow chart based on an experimental data submitted to the process committee.
5. Approved process flow charts

Fig 1: Anti-contamination Flow Chart 1
Fig 2: Anti-Contamination Flow Chart 2

Fig 3: Anti Contamination Flow Chart 3
6. Ongoing activities to develop Anti-Contamination Policy

- TXRF Analysis using SR-TXRF, to quantify surface metal contamination, of different equipment to monitor and control cross contamination, and to upgrade anti-contamination policies is in progress.
- CV Shift Analysis for 4TEBE [NCPRE] and PECVD [NCPRE] to quantify surface and embedded Na and K ions introduced by the two equipment is in progress.
- Anti-contamination policy development using carrier lifetime measurement techniques will be explored as well.

7. Addendum to the anti-contamination policy

- This is an addendum to the existing anti-contamination policy and is valid only for already allowed materials in the lab.
- Usage of Na and K not allowed as per the standard policy.
- If the material is a new chemical/material (not mentioned on the IITBNF website), the user is supposed to follow the standard online "New Material approval" on the IITBNF website.
- Samples from OE lab (now HSC lab) should be considered as 'external' samples as the lab is now under NCPRE.
- For all samples processed outside IITBNF (external samples), the user should contact the process committee and concerned FIC for approvals.
- Processes below 250°C (T< 250°C), are only considered under this policy

<table>
<thead>
<tr>
<th>SN no.</th>
<th>Tool Names</th>
<th>Materials Allowed</th>
<th>Contamination remarks</th>
<th>Dedicated Chuck</th>
<th>Dedicated Tip</th>
<th>Clean Carrier Wafer</th>
<th>Pre-coating</th>
<th>Process Temp Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AJA 6 TEBE</td>
<td>IPA, Photoresists</td>
<td>Gold contaminated</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sputter (Orion)</td>
<td>IPA, Photoresist, ebeam resist, Nb, NbN, Yb, Sn, Ge, Pt, Au, Gd, IrMn, Cr, YIG, Fe, Ni, Ta, Cu, Ru, Cr, MgO, Al2O3, SnGe alloy, Ti, CoFeB, SiO2, Al, Co, W, Ag</td>
<td>Na+ and K+ are not allowed. For outside/ NCPRE/ Org electronics lab samples, contact SO/ Process engineer.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Reduce process temp to sub 250°C</td>
</tr>
<tr>
<td></td>
<td>Process</td>
<td>Materials</td>
<td>Instructions</td>
<td>Options</td>
<td>Options</td>
<td>Options</td>
<td>Options</td>
<td>Options</td>
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</tr>
<tr>
<td>3</td>
<td>Sputter (ATC 2200)</td>
<td>IPA, Si, Ge</td>
<td>1. Targets used in orion cannot be used in ATC 2200 sputter as Orion is Cu and Au contaminated. Separate (dedicated) targets are to be used for ATC. 2. Resist coated samples are not allowed. 3. Au/ Cu coated samples are not allowed.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Reduce process temp to sub 250ºC</td>
</tr>
<tr>
<td>4</td>
<td>ALD LL</td>
<td>Precursors for processing</td>
<td>Samples from gold contaminated tools and having photoresist not allowed. Samples with Na and K not allowed</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>ALD non LL</td>
<td>Precursors for processing</td>
<td>Samples from gold contaminated tools and having photoresist not allowed. Samples with Na and K not allowed</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Reduce process temp to sub 250ºC</td>
</tr>
<tr>
<td>6</td>
<td>ICPCVD</td>
<td>IPA for cleaning, Si, TiN, ZnO, GaN, GaAs, Al</td>
<td>Gold contaminated wafers not allowed. Outside samples, NCPRE Samples, OE Lab, Na+ &amp; K+ not allowed further information contact SO/Process InCharge</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Reduce process temp to sub 250ºC</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Thermal Evaporator - Al</td>
<td>IPA, Any material (including photoresists) that will not evaporate up to 100 C</td>
<td>Separate crucibles need to be used for different metals</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Reduce process temp to sub 250ºC</td>
</tr>
<tr>
<td>8</td>
<td>Thermal Evaporator-Cr/Au</td>
<td>Any metal other than Cr &amp; Au, taking Chromium (Melting Point :977degC @ 10E-6 mbar) as baseline, follow the link : <a href="http://projects.olin.edu/thinfilms">http://projects.olin.edu/thinfilms</a></td>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Reduce process temp to sub 250ºC</td>
</tr>
<tr>
<td>9</td>
<td>PIII</td>
<td>PPR, PMMA, SiO2, SiNx, a-Si, Si, SiGe, Ge, Ni, Co, Pt, Al, Hf, Ta, Mo, W, Ti, Cr, Zr, Pd</td>
<td>Samples from gold contaminated tools are not allowed</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>STSRIE</td>
<td>SiO2, SiON, Si, Ge, Al2O3, HfO2, NbN, Al, Pt, Ti (burried under resists), EBL/Photoresists</td>
<td>No metal etching allowed</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>O2 clean at the beginning and N2 purge at the end of the process mandatory</td>
</tr>
<tr>
<td>11</td>
<td>Plasma ash</td>
<td>ppr, su8, cblack, PDMS, PMMA, metals, oxides, Polymer(VDF-TrFe0/ BaTiO3</td>
<td>Powdered material not allowed. And Na+ and K+ are not allowed. For outside/ NCPRE/ Org electronics lab samples, contact SO/ Process engineer.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>ICPRIE (New)</td>
<td>GaAs/ GaN</td>
<td>No metal allowed</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>ICPRIE (old)</td>
<td>GaAs/ GaN</td>
<td>No metal allowed</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>DektakXT</td>
<td>No sticky and soft</td>
<td>Litho/ Analytical</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sample allowed. Density should be greater than 1.001g/cm³</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>UV-Vis-NIR - Lambda 750</td>
<td>Solid film/liquids provided it does not contain toxic or hard to clean chemicals.</td>
<td>Litho/Analytical</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>HRXRD</td>
<td>IPA to clean chuck, Only thin films</td>
<td>Substrate should not be reacting with the chuck</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>
8. Anti-contamination Policy for External Samples, July 06, 2022

APPROVAL FOR EXTERNAL SAMPLES:

External samples

External sample and not listed material on IITBNF Website

New chemical approval required

External sample and listed material on IITBNF Website

New Chemical Approved

Fabrication Tools (Growth, Deposition, Lithography and etching tools)

Characterization tools

The user has to send mail to iitbnfprocessapprovals@gmail.com

2 - 3 working days

The process team will take all the required info from the user

Elemental characterization required *

If urgent

Process team will have a meeting with Process committee and FIC (FIC would be requested to join the weekly process meeting)

The Process team will get back with all the details and write to FIC and Process committee for their inputs

User will be intimated about the decision

# This will include Sample history, basic characterization done

*The proposed table is given for reference
IX. Device Characterization Lab’s Policy

Background of the Policy:-

Electronic measurements are very sensitive. It has been noticed that turning ON/OFF of any tools or chargers disturbs the measurement, and in the worst case even leads to the breakdown of the devices in the Device Characterization Lab. That’s why a modification in policy is needed to protect the measurement from getting affected.

NEW POLICY FOR THE DEVICE CHARACTERIZATION LAB

1. For those involved in managing the lab

a. All switchboards must be labelled as Electronic / Non-Electronic.
b. Components frequently turning ON/OFF must be on a Non-Electronic Switchboard. For example, Vacuum pump, Lamp source, Dehumidifiers.
c. Put a label stating “Never pull out any plug or insert/ re-insert any plug in the Lab.”
d. In case an EMT/Facility team is required in the lab for any work, the Lab should be Black out for some time. The Blackout time can be decided in coordination with Lab In-charge / Lab RA.

2. For the lab users

Before entering into the Lab
- Must Plan and book the slot one day in Advance.

On entering the Lab
- Always first check the online Slot Booking Module. If your work is going to overlap with someone else’s work on another tool/s, you must switch ON relevant switches for the Vacuum pump for the respective tools.
- If your tool is already ON, you can start your work. However, if all switches are not ON, contact SO / Lab RA or the user already doing the measurement before turning any switch.

While using the Lab
- Do not plug in or plug off any chargers, any laptops etc. when the measurement is going on any system. Coordinate with the Lab members.
- Must not plug out and plug in any tools without the prior permission of Lab In-charge.
- Must not turn any switch while measurements are going ON in the Lab.
• In case you are leaving the lab during the measurements, put a label near the tool stating measurements are going on.
• You should not change the grounding lines already present. If any change is needed, please contact SO/Lab In-charge/FIC.

**Before Leaving the Lab**

• If your slot is already overlapping with someone else’s slot, don’t turn OFF the system, simply leave the lab.
• In case you want to cancel your booked slot, you must inform the user whose slot was overlapping with your slot before his/her slot ends for proper turning OFF of the tools.
• In case of a cancelled slot, if you forget to inform the user who has booked the slot prior to you, then it’s your responsibility to turn the tools OFF.
• If your slot is not overlapping with anyone, i.e, when your slot is over, at that time if no other instrument is in use, then you should turn OFF all the tools before leaving the Lab.

**POLICY IMPLEMENTATION DETAILS**

• Need to be approved from Lab FIC.
• Send the Updated Policy to all Lab Users along with a Quiz to be solved in one week time.
• Revoke the Policy of those not writing the quiz.
• Retrain and Reauthorize them.

**Domain where new Char Lab Policy is applicable:**

• 3.1 DC Lab
• 3.2 DC Lab

User Education - New user, annual review with compliance signature for continued access to Device Characterization Lab.

Violation is by DAC.
X. Violations policy & Disciplinary committee

1. Principle of Violations policy

- The IITBNF facilities contains hazards that could destroy (in order of priority):
  - Health and Life: safety risks.
  - Property: equipment / facilities risk.
  - Professional career: damage to research quality and productivity.
- These hazards are contained due to:
  - Intelligent and responsive policy definition.
  - Strict adherence to policy by users / staff.
  - Strict implementation of violation policy as deterrence and training.

Zero tolerance for violations with proportional punishment is a fair principle to run IITBNF. The core idea is that of deterrence to ensure low violation.

2. Nature of Violations

Offence - is violation of expected responsibilities from all stakeholders. The expected responsibilities are as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>Expectation</th>
<th>Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users, SOs, LICs (Students)</td>
<td>Stringently abide by user policy</td>
<td>Students’ Representative Committee</td>
</tr>
<tr>
<td>System Owner, Lab in-charge (Non-students)</td>
<td>Ensure that the system / tools are Safe from inappropriate use</td>
<td>Process Committee</td>
</tr>
<tr>
<td>Facilities Staff</td>
<td>Ensure that facilities are operational</td>
<td>Facilities Committee</td>
</tr>
</tbody>
</table>
3. Student’s Representative Committee (SRC)

- **Purpose**
  - SRC will act as a representative body for students, and will attend and conclude DAC meetings as applicable.
  - This is also to ensure that the policy is applied to everyone equally, without any partial bias or interest.

- **SRC Body**
  - 1 member (preferably a PhD student) from each research group with at least 5 members who use IITBNF. The member should be a frequent user of IITBNF in past one year with at least another year ahead.
  - Minimum: 7, Maximum: 9

- **Member Assignation**
  - The replacement/additional candidate may be suggested by the existing SRC.

- **Duties**
  - Attending DAC meetings
  - SRC will hold authority in resolving the cases presented in DAC meetings and impose punishments as prescribed in the policy.
  - Raise and discuss issues affecting users at IITBNF

- **Tenure**
  - 2 years typical, can be increased to a maximum of 3 years if a suitable replacement is not found. At the discretion of SRC’s approval.
  - Can be terminated on the basis of non-participation in the prescribed duties (not allowed to miss more than 3 consecutive meetings)
4. Escalation Path and Procedure for DAC Meeting

1. If any user (AU/SO/Staff) identifies any violation, the complaint can be made to the concerned SOs, LIC, FIC (Faculty In-charge), Asst. LM & FOC via mail, or can be reported online at [http://www.cen.iitb.ac.in/complaint/index.php](http://www.cen.iitb.ac.in/complaint/index.php).

2. Concerned SO/LIC will send an email (with details of the Violation) to the defaulter, SRC, Asst. LM and FIC of the tool/facility immediately.

3. Template of the email prepared by LM/SO/LIC
   - Description of violation with notes on evidence source/credibility.
   - Potential impact of violation.
   - Actual impact of violation.
   The documentation has to be carried out by Asst. LM/LIC.

4. If Violation is related to Equipment/Facility, concerned in-charge can also be called for the meeting.

5. Quorum is a minimum of 3 Members from appropriate committee (from Table VIII.1), Asst. LM, and LIC(s). Additional members may be invited upon requirement.

6. If the defaulter fails to appear in DAC without a justifiable reason, his/her lab access will be revoked immediately.

7. DAC meeting is planned once a month normally. For INUP Users & Safety Violations, DAC will meet ASAP.

8. DAC decision will be e-mailed to defaulter, LIC(s), Asst. LM and SRC members. For added transparency, the guide/PI of the defaulter will also be copied on the email. A detailed record of the minutes of the meeting is to be maintained through an online portal. The general details of the meetings will be available to all users on CEN slotbooking.
### 5. Types of Violation and Punishment (Table VIII.2)

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Description</th>
<th>Examples</th>
<th>Maximum Punishment (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>With harm</td>
</tr>
</tbody>
</table>
| 1     | Impermanent violation - any offence which can be corrected within a few days without harming lab or other users in any way (Not tool-related) | • Missing log book entry  
• Not following proper gowning procedure  
• Not attending training session  
• Not doing timely disposal of labeled chemicals  
• Inadequate behaviour | • Warning (only applicable in case for the first offence based on the extent of violation)  
• Up to 2 weeks of lab service |
| 2     | Permanent equipment/consumables/facilities/samples safety violation - any offence that could compromise equipment health requiring maintenance/vendor service | • Not following SOP  
• Using lab consumable for non-authorized use  
• Contamination related issues  
• Not turning on scrubber, purge gas | 8-week suspension + 8-week lab service  
4-week suspension + 4-week lab service |
The suspension will be immediate, followed by lab service.

- During the suspension, the user cannot enter the lab. No equipment usage requests can be raised.
- **Lab service:** 1 day = 4 hours, 1 week = 20 hours. The assignment of duties will be following the DAC decision. LICs are expected to assign the duty to the defaulter and make sure that the work is completed. A detailed report of the fulfillment of the assigned duties has to be submitted by the defaulter to DAC before due time.
- Permanent removal is always an option for severe violations subject to approval by a 6-member FOC.
- **Relaxation in Punishment:**
  - Based on the discussion during DAC, the punishment can be reduced to one of the following levels - 10%, 25%, 50%, 75% of the total punishment.
- **Frequent Violations:** In case of frequent violations (more than three) in the past year in the same category, the defaulter will have to serve an increased punishment. The punishment can be increased upto 200%, with the possibility of overriding the maximum punishment prescribed above.
- **Grace Period:** If a grace period (maximum 2 weeks) is requested by the defaulter to start the punishment on reasonable grounds, the punishment can be increased upto 200% with possibility of overriding the maximum punishment prescribed above. Any offence during the grace period, will lead to strict action by the DAC.
- If the punishment given by DAC is not acceptable by the defaulter, it can be escalated to the FOC by the PI or concerned in-charge. FOC will have the final say in the matter.

**Implication on regular lab running**

- Surveillance by video for entire lab.
- Active vigilance by SO and Staff.
- Active vigilance by users.
- Maintenance of online log of violations.
- Online complaint system for reporting and tracking complaints.
- Maybe add a Disciplinary inspection team for weekly inspections reporting to lab manager
- Weekly inspections reporting to lab manager.

**In case of a witness to a violation**

- Try to inform the potential violator of the proper operating procedure.
- Lodge a complaint to concerned SOs and LIC.
- Inform SO or Lab manager if urgent.

**For violators**

- Stop your current activity safely for the lab property/person (not necessarily for your samples) after referring to the SOP.
- Report your violation with details.
XI. Equipment Up & Down Policy

If any user (AU/SO/Operator) faces an issue while using tool

The user to inform SO over phone and email, also the user to send Email to process technologist @ iitbnf.process@gmail.com

SO should blackout the tool in the slot booking module as first response and send email about “Tool down” status to censtudent, censtaff, IITBNF FOC

SO to check the tool and validate the reported issue

If SO is not able to resolve the issue: inform EMT over phone and email, If resolved send email about “Tool Up” status to censtudent, censtaff, IITBNF FOC

EMT to take lead, taking help from SO / AU / LIC & start troubleshooting

EMT will send email to SO and iitbnf.process@gmail.com about the status of the tool troubleshooting

EMT will send email to SO about the status of the tool

If tool is “Up”, SO should check the working condition (baseline recipe) of the tool & update the status and take the approval from 'Process Technologist' @ iitbnf.process@gmail.com and remove blackout

If troubleshooting is not successful, EMT will inform/discuss with FIC, SO, process technologist about further action; SO will extend blackout as needed

SO to send email about “Tool Up” status to censtudent, censtaff, IITBNF FOC
XII. Lab Shutdown Policy

Half Yearly Shutdown Plan:

- IT has been decided during the FOC meeting held on Nov 27, 2019, in discussion with SRC members that there will be a half yearly shutdown (once in 6 months) for maintenance work of the lab and equipment, during the second week of May and second week of November every year.
- Labs included are Ground floor labs (Micro1, Micro1 YR, Micro2, Nano, Nano Litho) and NanoE Building (MBE 1&2, 1.1 & 1.2)
- In case of an emergency, a forced shut down of the lab will be done without any prior notice (only email will be sent).

Facility PM Activities:

AHU PM

- Removing the supply air filter, return air filter and fresh air filter.
- Wet cleaning and drying of filters
- Install cleaned filter supply, return and fresh air
- Cleaning /washing of evaporator coil with (DX coil) with coil shine and jet pump.
- Outdoor unit condenser coil dry / wet cleaning with jet pump and servicing
- Blower motor and blower drum greasing.
- Alignment of belt , belt tension checking
- Internal Cleaning of AHU and body & impeller blower drum.
- Checkup of electrical connections like heater, blower motor, electrical panel, outdoor units.
- Reading of blower amps, compressor amps and heater amps.
- Checking of Suction/ discharge gas pressure.
- All dampers checked, greasing done to protect from rust.
- AHU filter differential pressure checked form magnetic gauge
- Checking of room pressure

Chiller PM

- Removing old water from chiller tank
- Cooling coil / Evaporator coil cleaning with coil shine.
- Tank flush out by water after cleaning.
- Condenser coil dry cleaning and wet cleaning done.
- Internal Cleaning of chiller and body cleaning.
- All nut bolts properly tighten and greasing done to protect rust.
- Pouring new RO water.
- Checked winding resistance of compressor, compressor and condenser fan.
- Check all internal parts of the chiller and condenser.
- Checking of compressor gas pressure
**UPS PM**

- Servicing of UPS by vendor
- Battery testing by team
- Exhaust check
- AC check

**EMT PM Activities:**

- Pump servicing
- Vacum testing
- Tool inlet/ outlet water flow

**Points to be noted:**

- Individual labs will be opened up as and when they are ready in phases. Lab members will be allowed to use the tools of those labs when they are UP.
- During lab shut down, if any issues are faced by members while using the tools, staff will be giving priority to only the Lab shut down related work.
XIII. Inventory Policy

Objectives:

To maintain sufficient stock of various consumables like wet chemicals, wafers, photo-resists, gases, targets etc.

- To maintain sufficient stock of various lab consumables like gloves, goggles, tweezers etc.
- To maintain AMCs up to date - Maintained by **equipment maintenance team (EMT)**
- To keep sufficient stock of essential spares for maintenance of tools.
- It is the goal of this team to ensure that at no point in time, experiments should stop for want of consumables and spares.

Clarification on the items to be maintained by the team

Following is the list of items that are maintained as part of the team. For some of them, stock is not maintained.

1. Spare parts of Equipment:
   - Equipment spares
   - EMT spares – maintained by EMT
   - Air conditioners
2. Dehumidifiers
3. Bulk chemicals
4. Resists
5. Developers
6. Toxic Gases
7. Non-toxic gases
8. Wafers and Mask plates
9. Precious metals – Gold and Platinum

The team would be responsible for maintaining the stock of bulk consumables and spare parts recommended by system owner/tool staff. Bulk consumables are those used by a large number of users and projects. Certain users may want to maintain their own stock of some of the bulk chemicals to take care of special processing needs. In such cases:

- The user should inform the inventory team of this and the quantity of the chemical being stocked.
- The user should maintain his/ her own stock including ordering of the chemical. The inventory team would provide all help for ordering the chemical.
The user should inform the inventory team if he/she is willing to share the chemical with the rest of the lab should the lab stock deplete due to unforeseen circumstances. The use of this chemical by the user from the lab would be on a reciprocal basis. i.e. if the user is not willing to share it with the lab under crunch situations, the user cannot draw the same chemical from the lab inventory.

Non bulk chemicals are those chemicals that are required by individual users in small quantities. All chemicals NOT LISTED in appendix A can be considered non bulk. These have to be bought by the user him/ herself. The procedure for the purchase of these is given in ‘Appendix B’. A list of non-bulk chemicals purchased by the lab users is given on the web site of the CEN with the name of the user and vendor details. It is the responsibility of the individual user to store the item and maintain a stock of the item. The inventory team would provide guidance and help.

**AMC Policy for Equipment**

- AMC for all equipment at IITBNF are taken care of either by vendors or internally by Equipment Maintenance Team. The facility equipment (like UPS, chillers, AHUs, etc.) are also listed under the Equipment.
- The Purchase Order tracking for the AMCs which are given to vendors can be viewed by logging on to:

  [http://www.cen.iitb.ac.in/inventory/](http://www.cen.iitb.ac.in/inventory/)
  [http://www.inup.iitb.ac.in/purchase_track/](http://www.inup.iitb.ac.in/purchase_track/)

- If the purchase tracking of AMC for any equipment cannot be located, Purchase Team (Jomon, phone # 4441) needs to be contacted.
- There may be some exceptions regarding AMC availability for some of the tools.

**Steps to be followed for the Renewal of AMCs:**

1. Two months before the expiry of AMC, IT generated mail is received regarding AMC renewal.
2. LIC will get the quote from vendor.
3. EMT head will check the quote: Cost and technical specifications (compare with previous year AMC) and give the approval.
4. Final technical approval from faculty in charge should be taken by LIC.
5. LIC should submit technically approved AMC quote to Purchase Team.
6. Purchase team should get the fund approval from concerned authority.
7. PO of AMC processing should be started by Purchase team.
8. Once PO is generated, purchase team must send the copy of PO to EMT head.
9. EMT head will upload the scanned copy of PO in the AMC module.
10. When the first advance payment is done, EMT head should be intimated.
11. EMT head will then communicate with vendor regarding scheduling of AMC (in coordination with LIC and SO).
12. LIC will make all arrangements for the AMC schedule.
13. Once AMC is completed, service report should be uploaded on the AMC module by EMT head.
14. SO & LIC should take care that SOP is modified if necessary and equipment must be released for usage after the baseline check is made.
15. Before the final (2nd installment) payment is released, Purchase team should check with EMT head for completion of the AMC visits.

**Note:**
- Whenever Purchase team communicates with vendor, EMT head should be copied in all mails.
- Every three months, an IT reminder mail will be received by SO, LIC, EMT head, faculty in charge of tool, inventory faculty in charge, to schedule an AMC visit.
- Whenever an IT mail regarding AMC visit or renewal is received, EMT head must reply to 'all' about the plan of execution of AMC/ PM for the particular tool.
- The AMC and PM for facility equipment are completely taken care of by Facility team head in coordination with LICs.

➢ **Roles of the team members:**
   - Faculty in-charges: Overall guidance.
   - Asst. Lab manager: Supervision of the activities and personnel in this team and communication of related policies to all lab members.
   - Materials management in-charge: Organization and maintenance of stocks and relevant registries, triggering of purchase of bulk items. Communication of stock situation to other members of the team and also to the lab, adding data and documents on the AMC module.
   - Supporting staff members: Stock Management for chemicals and gases online updation. Purchase of items/material for the running of the lab on a day-to-day basis.
   - CENIT: Updation of the CEN website with purchase policies and relevant documentation.
Appendix A: Some decisions taken by the faculty oversight committee

Only 4 wafers are issued at a time for 2”
Only 8 wafers are issued at a time for 4”

1. Breakage of wafers or damage of samples during processing of samples is an accident for which the lab has no insurance. Replacement of wafers will not be done by IITBNF. New wafers can be issued to the project account of the user. - **FOC decision on 13 June 2014**

2. Requisition of wafers in large numbers (more than 4 for 2 inch Si wafers and 8 for 4 inch Si wafers) will be considered only if the stock of the wafer being requested does not fall below 8 months upon the issue of the requested number of wafers. Broken & damaged wafers costing to be taken by common pool. - **FOC decision on 4th Oct 2013**

3. Research groups that want to get more than the standard issue size (4 of 2” and 8 of 4”) should project their requirements well in advance. Otherwise they would be issued only the standard numbers. Any group/any faculty who has any specific requirements over and above the standard issue size can send the request to the inventory team and it will be ordered and included in the stock. - **FOC decision on 29th June 2012**
Appendix B: Purchase procedure for non-bulk chemicals by the user

1. If the item was already used in the lab, one can contact vendor and procure it him/herself. In case the item is already available in the lab, the user may contact the person who has purchased the item. Please check the list of bulk chemicals and non-bulk chemicals.

2. If it is a new chemical, the user has to fill online chemical approval form
http://www.cen.iitb.ac.in/chemical_approval/index.php

3. Submit the duly filled form, MSDS of chemical, prepare 2/3 ppt. slides highlighting storage, precautions while handling, and disposal of chemical to Chemical Safety Team. The user should start procurement procedure with the following information: project code to bill the purchase to be obtained from the supervisor, hard copy of the quotation. If the chemical is available from Sigma Aldrich, it can be bought without a PO as IIT has rate contract with Sigma Aldrich.

4. For industry users, if a chemical needs to be purchased from their own funds, IITBNF will help procuring the chemical. The chemical can be labeled & stored in the lab. It is up-to the industry representative to manage their own inventory.

5. For procurement of consumables, kindly send an e-mail to consumables.cen@gmail.com.

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