APEX Metals ICP RIE Standard Operating Procedure

QUICK GUIDE

PROCEDURE OVERVIEW

1. Load a dummy carrier
2. Run a cleaning recipe and then a conditioning recipe
3. Load and run your sample
4. When finished, check to see which clean steps you need to perform

CRITICAL PRECAUTIONS AND COMMON MISTAKES

- Never place unauthorized materials into the chamber
- Make sure you are up to date on the latest restrictions and requirements on the tool, including sample prep and mounting
- Only 4” wafers; any pieces must be mounted onto a carrier
- Always return tool to standby default temperatures after you are finished with your process by pressing “Set Standby Temp” button on the Start Job tab

Before you start

- Remember to LOG IN
- If using pieces, check that your sample is properly mounted on a clean carrier

Tool condition for the next user

- If using chlorine or BCl3, follow the special cleaning and prep procedure to recondition the chamber
- Always press “Set Standby Temp” after you finish
- Pump down load lock
HOW TO VENT AND PUMP LOADLOCK

- There are four buttons on the right side of the load lock towards the front. The top left button Vent/Pump can be used to either vent a loadlock that is pumped down, or to pump down the loadlock that is at atmosphere.
- While the LED ring is green, the button can start a process. Flashing green light means the selected process is running. If there is no light, then that process is not available (for example: cannot use Load/Unload if there is no wafer present in loadlock).

- To exchange a wafer or place a new wafer onto the robot arm, press “Vent/Pump” button and wait for the process to complete. You should head a hissing sound of nitrogen escaping from the loadlock once it is ready to open.

- Open the lid.
- Using clean gloves, carefully remove and replace the wafer. Only 4” wafers can be used. The wafer flat must align with the two bottom pins.
- Do not press down on the arm and avoid touching it.
- Close the lid
- Press “Vent/Pump” (should have red circle).
- Once all the rings turn green, the loadlock pump down is complete
**FLUORINE BASED ETCH PROCESS FLOW**

- **Pre-Clean**
  - Run the "clean" recipe with sapphire wafer in the tool for 10 min

- **Condition**
  - Run your recipe with sapphire wafer (or your own wafer) for 2 to 5 min depending on application
  - This will prepare the chamber conditions for your device

- **Process**
  - Run your process
  - If using chips, make sure to select proper carrier wafer
  - Do not use the provided sapphire wafer as a carrier

- **Clean**
  - Start "clean" recipe with sapphire wafer for 10 min. You can log out on NEMO once you have confirmed that the wafer has loaded properly and the plasma has ignited.

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**CHLORINE BASED ETCH PROCESS FLOW**

- **Pre-Clean**
  - Run the "Chlorine clean" recipe with sapphire wafer in the tool for 10 min

- **Condition**
  - Run your recipe with sapphire wafer (or your own wafer) for 2 to 5 min depending on application
  - This will prepare the chamber conditions for your device

- **Process**
  - Run your process
  - If using chips, make sure to select proper carrier wafer
  - Do not use the provided sapphire wafer as a carrier

- **Post-Clean**
  - Run "Chlorine clean" recipe with sapphire wafer for 10 min.

- **Fluorine prep**
  - Start "clean" recipe with sapphire wafer for 30 min. You can log out on NEMO once you have confirmed that the wafer has loaded properly and the plasma has ignited.
HOW TO RUN A RECIPE

1. Check tool condition
   - Press “User Login” in the upper right corner of the screen. Select your account, type in the password and log in.

   - Make sure there are no active alarms on the tool in the “Alarms” screen. If any alarms exist, please notify staff.

2. Select and run a recipe
   - In the “Process” tab, “Start Job” subtab, select the recipe that you want to run.
     - Recipes with a gear icon are engineering recipes that are available for everyone to run and to modify
     - Recipes with a person are user-specific (or lab-specific). Only the logged in account will have access to those recipes.
- Enter Job Id. This field must not be blank for a job to run. If you wish to extract run data for the process, then enter your net ID and date so you can find the run easily in the future. Otherwise, any set of characters will work.
- Make sure both “No Transfer” and “Auto Vent” are not checked for a standard process. Discuss your needs with staff if you need to run a process without performing wafer transfer.
- Press “Start Job”

- If prompted, enter the step times for all variable time steps in the selected recipe.
- Press “Start Process”
3. Monitoring process conditions

- When the plasma strikes, monitor the following parameters:
  - He backside flow rate: should not exceed 10 sccm, otherwise there is contamination on the chuck or the backside of the wafer
  - Reflected power for both RF1 and RF2: any numbers other than 0 for reflected power can indicate serious damage to the matching network
- If any of these parameters are outside of normal range, notify staff as soon as possible

- If the plasma does not strike (high reflected power), use the “Next step” button to skip the etch step and move to dechuck step, then notify staff. This may be either an issue with the tool itself, or the recipe conditions.

- After the process is completed, vent the loadlock and unload your sample.
- Do not forget the pump the loadlock back down if finished.
MODIFYING RECIPES

- Currently, the “New Recipe” button is disabled. Please contact staff to assist you in creating a recipe from scratch. This is especially important for any recipe running Cl2 or BCl3 gasses.

- Open the “Recipes” tab
- To modify an existing process, click “Load” and select a recipe to view
- You can modify gas flow rates, pressures and RF powers in the process or etch step of your recipe. Please discuss your planned changes with staff. There are limitations on the tool capabilities (for example, cannot run large volumes of gas and expect very low pressure)
- Don’t forget to press “Save” for your changes to take effect
# TOOL HEALTH CHECKLIST

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
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<tbody>
<tr>
<td>Log into your account</td>
<td></td>
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<tr>
<td>Check “Alarms” panel to make sure there are no active alarms</td>
<td><img src="image1" alt="Image of Alarms panel" /></td>
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<tr>
<td>In the Process panel, under “Start Job” check base pressure in the chamber. It is displayed on the right under the top down view of the tool next to “PM1” row.</td>
<td><img src="image2" alt="Image of Process panel" /></td>
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<tr>
<td>The pressure should be in the 10E-7 range or better, depending on how long ago the last process was run.</td>
<td></td>
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<tr>
<td>In Process panel, check “Job History” to examine last process run on the tool.</td>
<td><img src="image3" alt="Image of Job History panel" /></td>
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<td>Make sure you are sorting by time to view the latest process that the previous user ran. In the Jobs window.</td>
<td><img src="image4" alt="Image of Jobs window" /></td>
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<tr>
<td>Make a decision whether a clean is required. This will depend on your process window, feature sizes and critical contamination requirements.</td>
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