Standard Operating Manual

Ultra Fab Wet Station E – Semi-clean Non-metal Processing Station
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Ultra Fab Wet Station E – Semi-clean Non-metal Processing Station

1. Picture and Location

This tool is located at NFF Room 2240 Cleanroom Class 1000.

2. Process Capabilities

2.1 Cleanliness Standard: Clean/Semi-clean
2.2 Substrate Size: 2” or 4”

3. Contact List and How to Become a Qualified User

3.1 Emergency Response and Communications

- Security Control Center: 2358-8999 (24hr) & 2358-6565 (24hr)
- Safety Officer: Mr. Wing Leong CHUNG 2358-7211 & 64406238
- Deputy Safety Officer: Mr. Man Wai LEE 2358-7900 & 9621-7708
- NFF Senior Technician: Mr. Henry YEUNG 2358-7896
- NFF Technician: Mr. Michael KWOK or Charles TANG 23587896

3.2 Training to Become a Qualified User

Please follow the procedure below to become a wet station qualified user.

1. Read through the on-line equipment operating manual of the equipment;

2. Attend the equipment hand-on operation training either by peer or NFF staff.

3. If training is provided by NFF staff, user must log in NFF equipment reservation system, and register these trainings.

4. Send an e-mail to Mr. Henry YEUNG requesting wet station qualified exam.

5. Pass the examination for the equipment operation and security.

4. Operating Procedures

4.1 System Description

The Wet Station E is for Semi-clean Non-metal processing. This Wet Station provides three sets PCT heated quartz temperature controlled for resist strip (far right), ITO Etchant (far left), general purpose, a plastic tank for HF dip (middle) and three quick dump rinse baths (QDR).

EMO Red button for emergency stop of the wet station.
Power On Main power on for wet station.
Power Off Main power off for wet station.
SILENCE Silence any alarm at this wet station.
RESET  Resets alarm system to this wet station.
Drain On/Off Dispose chemical to Neutralization Tank.
Manual Aspirator Aspirates HF to HF Collection Tank.
LOW PURGE Red indicator light will flash when no enough air
to purge the electronics for this wet station
PLENUM L/L Red indicator light will flash when the plenum
liquid level is too high

There are six controllers at this wet station. The UFT-65 Filtered Etch
Temperature Controller is for Filtered BOE Etch bath. The UFT-820
Temperature Controller is PCT Tiger TT4 Heated bath. The UFT 48-9 Quick
Dump Rinser is for quick dump rinse (QDR) bath. The UFT 620 Timer is for
time counting for HF bath.

4.1.1 UFT-820 Temperature Controller

PWR ON/OFF Turn on/off the power of temperature controller.
Heat On/Off Activate and deactivate the heater output.
Timer Run Start or Restart the timer
Timer Stop/Reset Stop and Reset the timer
Alarm.Sil Silence the audio for both the timer and any alarm
conditions.
Cancel flashing alpha code in the process display
Examine the process set point and this Timer Preset.
Reset: Exit the program mode.

PROG: Adjust parameters into program mode

Save: Permanently save the system setup parameters.

△: Up key, active in the program mode to increment the display

▽: Down key, active in the program mode to decrement the display

### 4.1.2 UFT 48-8 Quick Dump Rinser

- **START**: Activate the dump rinser
- **RESET**: Deactivate the dump rinser, automatically reset itself in preparation for another run, and exit the program mode
- **PROG**: Adjust parameters into program mode
- **HOLD**: Halt the operation temporarily
4.2 Safety Warnings

2. Some chemicals are dangerous when mixed with other chemicals or heated while others are dangerous on their own.
3. Do not allow to heat HF or BOE chemical.
4. Mixing hot piranha with organic compounds may cause an explosion. This includes acetone and IPA.
5. When preparing the piranha solution, always add the peroxide to the acid. The H2O2 is added immediately before the etching process because it immediately produces an exothermic reaction with gas (pressure) release.
6. All chemicals used in NFF are controlled items. No chemicals can be brought in or taken out without permission.
7. Users should have a good understanding of all the chemicals they intend to use and know what to do when accidents of the materials with which they are working.
8. HF is potentially lethal. If HF is spilled on a person, FOR SKIN CONTACT:
   i. Move victim immediately under safety shower and flush affected area with large amounts of cool running water.
   ii. Remove all contaminated clothing while flushing with water.
   iii. The rinsing may be limited to 5 minutes, with 2.5% calcium GLUCONATE GEL (available in first aid kit) applied as soon as the rinsing is stopped.
   iv. While the victim is being rinse with water, someone should alert first aid or medical personnel, arrange for subsequent treatment and inform NFF staff.
   v. Apply the gel every 15 minutes and massaged into the tissue continuously until pain and/or redness disappear. It is advisable for the individual applying the gel to wear rubber gloves to prevent a possible secondary HF burn.
   vi. After treatment of burned area is begun, the victim should be examined to
ensure there are no other burned areas that have overlooked.

vii. Arrange to have the victim seen by a physician. During transportation to hospital or waiting for a physician to see the victim, continue massaging calcium gluconate gel.

FOR EYE CONTACT:

i. Immediately flush the eyes for at least 15 minutes with large amount of gently flow water under eye washer.

ii. While the victim is being rinse with water, someone should alert first aid or medical personnel and arrange for subsequent treatment.

iii. Take the victim to a doctor, preferably an eye specialist, as soon as possible.

iv. Rubbing of eyes is to be avoided.

9. If other chemical is spilled, remove clothing and rinse affected area in safety shower for 15 minutes and inform NFF staff. Seek urgent medical advice.

10. Chemical Spill Control, in the event of small spill, it can usually be cleaned up safely by NFF staffs only, but the spill is too large to clean up safely or if someone has been injury or contaminated, immediately call the SCC. Report all spills of hazardous chemicals to SEPO.

11. The Emergency Off – Button (EMO Button) shuts down the machine immediately. Only use the EMO in emergency situations. Emergency situations are where injury of personnel or serious damages of the system impends immediately.

12. According to the general fire emergency procedure of HKUST, please report the accident to the Security Control Center first. The nature of other emergencies will determine whether you will call police, staff, or both. If someone is injured, the 9-999 emergency number should be called before calling staff. If there is a facilities problem, such as a flood or a utility problem that does not present a danger to lab users but may result in damage to equipment, the staff or EMO need to be called. The 9-999 emergency should not be called for facility or equipment problem. Always call 9-999 when a potentially life threatening
situation might exist (injury, fire, gas leak, etc.)

13. All spills on the wet bench during process should be cleaned up immediately.
14. When working at the wet station, always use appropriate personal protective equipment (PPE) – apron, face shield, chemical resisted gloves. After complete the process, rinse the PPE and fully dry it and return it back.
15. The apron must fully cover your shoulders at all times, make sure it is tied around the neck and do not let it slip off while you work.
16. Even you wearing PPE, never put your hands or fingers into a chemical bath.
17. Do not walk away from wet station while wearing PPE. If you need to step away from the wet station at any time, rinse off gloves at the rinse bath, dry with wiper and put it back.
18. Never touch any surface while wearing chemical-resisted gloves that other lab users may come into contact with, such as table tops, door handles, phone, computer keyboards, face shield, apron, etc. Gloves shall be removed before touching other surfaces.
19. Check the leakage of chemical-resisted gloves by N2 Gun every time.
20. Tanks are breakable, carefully place wafers in them, never bang a cassette on the side.
21. Keep the cassette handle with cassette throughout the etching or cleaning process.
22. No Solvent allowed at this wet station.
23. Never operate the heated tanks without the proper fluid level.
24. Read and understand the MSDS for the chemical being used.
25. Know the location of the nearest safety shower and eyewash station.
26. Make sure the wet station having sufficient exhaust.
27. Improper disposal of waste could result in explosion and injury. Take time to consider how to dispose in your process or contact NFF staff.
28. Don’t dispose hot chemicals. The temperature should be below 30°C before disposing.
29. If the machine failure while being used, never try to fix the problem by yourself. Please contact NFF staff.
30. When Neutralization system has the problem, the buzzer (there is one over between Wet Station D and E) will audible. If this happens, none of the wet
station may be used.

4.3 Operation Precautions and Rules

1. Do not operate the machine unless you are properly trained and approved by NFF staff.

2. All wet-processing baths are designed and arranged according to their cleanliness levels and purpose; users are not allowed to use those solutions for different purpose.

3. Each Wet Station has its own Teflon wafer cassette and cassette handler and 2” dipper basket (chemically resistance). User doesn’t mix it with other wet stations.

4. The Teflon cassette, cassette handle, 2” dipper basket with black button label is only allowed in this wet station.

5. Photoresist on metallized wafers cannot be stripped in this sulfuric acid solution.

6. Don’t send the cassette boxes of this station to any places.

7. Do not store wafer(s) in wet station cassette. To store wafer(s) in your own plastic cassettes and boxes.

8. Don’t dispose hot chemicals. The temperature should be below 30°C before disposing.

9. Don’t leave any unnecessary things on top of the wet station.

10. If your wafers have an unknown contaminant on them, they are not allowed in this wet station.

11. If your wafer has ever contact with any metal on it, it may not be processed in
4.4 Initial Status Checks

1. Please check the status of shutdown notice posted in the NFF reservation website.
2. Before operate the machine, please make sure you have read check list and fill the log sheet.

4.5 Initial System Checks

Before starting, verify the machine is in the correct idle state:
1. If system power is off, notify NFF staff to turn on power switch on the controller. Leave system ON, after your process.
2. Verify that the chemical you want to use is filled to the proper level.
3. Verify that the bath temperature is reached the set point.
4. Verify that the wet station has DI water and Nitrogen.
5. Verify that the exhaust level is normal.
6. Check log sheet that last user had no problem.

4.6 Personal Protective Equipment (PPE)

Users are required to use additional Personal Protective Equipment (PPE) when working in the wet station.

4.6.1 Sequence for Wearing PPE

PPE consists of three items that should be worn in the following order: an apron, a face shield, and chemical resisted gloves. Check all items for damage.
before each use, inspect the apron and face shield for damage (e.g. cracks, scratches). Gloves are to be inspected for damage and contamination. Use Nitrogen Spray Gun injects the Nitrogen to the chemical resisted glove and immerse to the DI water Bath for leakage check. Face Shield places over face and eyes, and then adjust to fit.

4.6.2 Sequence for Removing PPE

PPE should be removed in the following order: chemical resisted gloves, a face shield and an apron. Rinse and dry the chemical resisted gloves, remove them and hang them up. Hang face shields and avoid damage it. Lastly remove the apron and be careful to hang it. If apron has any liquid, use a wipe to dry it. Do not leave inside out.

4.7 Quick Dump Rinse Operation

The purpose of QDR is to rapidly wash surface of the water and leave the wafer in a clean condition.

1. Place the wafer in the quick dump rinse (QDR) bath, initially should be full of DI water and close the lid.

2. Press the START button of UFT 48-8 quick dump rinser controller to activate the QDR. It will cycle down from 4 to 0 in the display window.

3. After completion of the cycle the warning sound will be audible until the RESET button are pressed.
4. Press **RESET** button to automatically reset itself in preparation for another run.
5. Press **HOLD** button to manually dump or fill the bath.

### 4.8 Aspirator Operation

1. The aspirator can be activated by pressing the **ASPIRATOR** button located on the front panel of the wet station. The aspirator timer is set by default to thirty seconds.
2. Use the aspirator to dispose the water-soluble acids to Neutralization Tank except HF and BOE. HF and BOE need to dispose to HF Collection Tank. Please notify to swap the valve if you need dispose HF and BOE.
3. Be careful not to mix solvents with acids when aspirating this is a potentially explosive combination.

### 4.9 Resist Strip Operation Procedure

This solution consists of 90% concentrated sulfuric acid (H2SO4) and 10% hydrogen peroxide (H2O2) and is heated to 120°C. Sulfuric acid is about 95-98% pure, the hydrogen peroxide is 30% in water. This combination is excellent for removing organics.

1. Open wet station cover.
2. Wear **Personal Protective Equipment (PPE)** following the Step 4.6.1.
3. Place the wafer to designated Teflon Cassette. Use designated Teflon Cassette handles to attach to the notches on both end walls of Teflon cassette. Both of them are marked with black label.
4. Carefully lower the wafer to the heated sulfuric acid H2SO4:H2O2 (10:1) bath.
5. Refill 10-20ml H2O2 if no bubbles in the chemical bath to the heated sulfuric acid bath.
7. Carefully remove wafer cassette with cassette handler from chemical bath, holding it above the bath until it stops dripping.
8. Place the cassette in the quick dump rinse bath to start the DI rinse 4 cycles.
9. Press Timer Run to count the process time.
10. After the process time is finished, carefully remove the cassette from the solution and immerse it into the QDR follow the step 4.7.
11. It is important to use a visual checking for this process because many factors
may affect the removal rate. Make sure there is enough space between wafers in the cassette so that the wafer(s) will be seen easily.

12. If still have resist on the wafer(s), re-immers the wafer(s) to sulfuric acid bath for another 5-10 minutes while and recheck the wafer(s).

13. Repeat step 4-13 until is completely etched.

14. If you need remove native oxide, please follow the step 4.9 HF Dip operation procedure.

15. Take off PPE, chemical resistant gloves, face shield and then apron, follow the step 4.6.2.

16. Remove Cassette Handle and load cassette with wafers into Spin Rinser Dryer SRD for final rinse and dry cycle (Refer to SRD operation Manual).

17. Close wet station cover.

Note: You can use microscope for photoresist removal inspect

1) Set microscope to fluorescence mode.
2) Scan over the wafer along two orthogonal diameters.
3) Look for irregularly shaped residues/red fluorescence on the surface.
4) Photoresist removal is complete if none is found.
5) Otherwise try stripping again

4.10 HF Dip Operation Procedure

Dilute hydrofluoric acid (HF) is used to remove native silicon dioxide from wafer(s). Since it acts quickly, need dip the wafer(s) for a short time only.

1. Open the Wet station cover.

2. Wear Personal Protective Equipment (PPE) following the Step 4.6.1.

3. Place the wafer to designated Teflon Cassette. Use designated Teflon Cassette handles to attach to the notches on both end walls of Teflon cassette. Both of them are marked with brown label.

4. Place the wafer(s) in the 1% HF solution. Use the Stop Watch or any controller to count the process time. Soak the wafer(s) for 1 minute.

5. Transfer the wafer to the quick dump rinse (QDR) bath follow the Step 4.7.

6. If the native oxide has not been completely etched away, a film of water will adhere to be the etched surface and will appear wet. If the oxide is completely etched away, the surface will become hydrophobic and wafer will not wet it.
7. If still have silicon dioxide on the wafer(s), re-immers the wafer(s) in the HF solution for a while and recheck the wafer.

8. Repeat step 4-7 until Silicon dioxide is completely etched

9. Take off PPE, chemical resistant gloves, face shield and then apron, follow the step 4.6.2.

10. Remove Cassette Handle and load cassette with wafers into Spin Rinser Dryer SRD for final rinse and dry cycle (Refer to SRD operation Manual).

11. Close wet station cover.

4.11 Indium-Tin-Oxide (ITO) Etch Operation Procedure

This chemical solution (HCl: H2O: HNO3= 4:2:1) is used to etch ITO. For small amount wafer(s), you can prepare the solution in the plastic container.

1. Open the Wet Station Cover

2. Wear Personal Protective Equipment (PPE) following the Step 4.6.1.

3. Take a plastic container which is stored in Wet Station E Lab wares Storage Box.

4. Take chemicals which are already stored in the acid cabinet to prepare the mixture of ITO etchant.

5. Place the wafer to designated Teflon Cassette which is marked with black label.

6. Place the cassette in the vertical direction to the plastic container.

7. Immerse in the ITO etchant at Room Temperature.

8. Use the stop watch or use any controller in the wet station D to count the process time.

9. Press HOLD in the Quick Dump Rinse Controller to drain out the DI water.

10. After the etch time is finished, carefully remove the cassette from the solution and immerse it into the QDR follow the step 2-5 of 4.7.

11. Take off PPE, chemical resistant gloves, face shield and then apron, follow the step 4.6.2.

12. Solution should be aspirated to N-tank when finished.

13. Remove Cassette Handle and load cassette with wafers into Spin Rinser Dryer SRD for final rinse and dry cycle (Refer to SRD operation Manual).

14. Close wet station cover.
4.12 Clean up

1. Clean up the wet station. Thoroughly rinse off any drips (assume they are acid) with DI spray gun, gently dry with the N2 gun. Ensure the bench top is clean and dry.
2. Leave the dump rinsers filled with water and the lid closed.
3. Put the chemicals back to their original location after using it.
4. Close wet station Cover.
5. Do not leave cleanroom wipers on the bench top.
6. Fill out the log sheet.

4.13 Check out

Check out the equipment via Equipment Card Reader after use.