

# **Sop for Tube Cleaning**

## **Introduction:-**

Tube cleaning of Quartz tube(s) is nothing but etching the tube(s) in 2% Hydrofluoric (HF) Acid. The Hydrofluoric Acid is 49% HF in water by weight. Quartz Tube cleaning is a necessary process. Etching the tube removes a few microns of quartz and exposes a new clean surface. The Quartz tube(s) has to be cleaned at least once before first time or initial use and then depending upon the usage one can set the period of cleaning. Quartz glass has extremely high chemical resistance to acid and alkali solutions. The only acid that reacts comparatively rapidly with quartz glass is hydrofluoric acid, but the resistance of the glass to this reagent is still high.

Treatment in hydrofluoric acid is widely employed when it is necessary to clean the surface of quartz / glass tubes.

**Note:** Leak checking of PP tube should be done one day before the process. Make sure the bottom of the tube is dry. Put a big white paper at the bottom of the bucket. Place the PP tube in the bucket. Chain the tube to the wall. Fill the tube with water and leave overnight to check for leaks from the bottom of the tube.

## **Equipments:-**

1. HF (49%)

*The HF is dangerous so handle with care. Concentrated HF (liquid or vapor) can cause severe burns, electrolyte imbalance, pulmonary edema, and life threatening cardiac arrhythmias*

Note: In case of HF is exposed to the skin then hold that part under running water and apply 'Calcium Gluconate' which is available in lab.

2. Plastic Measuring Cylinder
3. Syphon pump
4. Chemical Resistant Gown
5. Chemical Resistant shoes
6. Chemical Resistant Gloves
7. Safety Goggles
8. Head cap
9. Face Mask
10. Jerry cans
11. DI water as per need

**Safety:-**

- Always do the cleaning with **at least 2** buddies.
- Wear hair net, mask, gloves, chemical resistant gown, chemical resistant gloves, and safety goggles before starting the process.
- **Calcium Gluconate gel** should be nearby to use in case of emergency.

### **a) Preparation of 2% HF solution**

- Switch ON the exhaust of Fume hood.
- The resistivity of DI water should be  $> 15 \text{ M}\Omega$ . Clean all the beakers, measuring cylinders, plastic bucket, Syphon pump and Funnel with DI water before using it.
- **Glass beakers must not be used for HF as HF attacks glass. Use only PVC beaker and PVC measuring cylinder for HF.**

### **Procedure:-**

#### **b) Cleaning the HF 'tube bath'**

1. Clean the PP'tube bath' with DI water, in which tube will be kept for etching.
2. After cleaning the bath check the PH of the DI water it should be Neutral or slightly Acidic (i.e. in the range of 6-7 on ph scale). If the ph is not in this range clean the tube with fresh DI water till the ph reaches about 7.

#### **c) Cleaning the Quartz tube**

1. Place the quartz tube which is to be cleaned inside the 'PP' tube bath. This PP tube bath must be kept in a bucket for safety (in case the PP tube leaks it is safer). The PP tube must be chained to the wall

2. For making the HF solution we use ratio of 1:10 (1ml of HF and 10ml of DI water. For cleaning the big size Quartz tube we use 1.5liter of HF and 15 liter of DI water solution.

3. **Arrangement of HF tube cleaning set up**



4. The HF solution is always ready in the Lab, if not please contact to SO or lab in-charge.
5. First put the quartz tube and then pour solution in PP tube bath using the PVC funnel.
6. Make sure that quartz tube should be submerging under HF.
7. Close the bath from top and hold it with the help of C clamp. Don't over tighten this is just to hold in place.
8. Leave the Tube untouched for 24 hours.

#### **d) Cleaning the tube after HF bath**

9. For removing the tube from the bath, first needs to remove all the 2% HF in jerry cans with the help of Syphon pump.
10. Keep the empty jerry cans in big plastic tub on the floor. One person will hold the tail of the syphon pump in that jerry can and other person will hold the mouth of the syphon pump in the PP tube bath.
11. Initially open the valve and squeeze the pump (For creating pressure) and then close the valve visually we can see the HF is collect in the pipe then squeeze out and open the valve. The flow will start from PP tube bath to the Jerry can.
12. Once the jerry can is full with HF close the valve of syphon pump. Close that jerry can properly wipe it with DI water and keep it safely. Then take another empty can and repeat same steps.
13. Once the HF is transferred to the jerry cans. Fill the bath with DI water around 15 liters and remove this used DI water with the help of Syphon pump.



Syphon pump

14. This DI water is very acidic so after removing from PP bath tube, send this to disposal.
15. Again Fill the bath with DI water around 15 liters and remove this used DI water with the help of Syphon pump.
16. Measure the ph of the DI water which is removed from the bath, if it is in the neutral range on ph scale, we can remove the tube.
17. If the ph is not in the neutral range on the ph scale add on the DI water till it get neutralized and then flush out this water in the fume hood. Add on fresh DI water in pp tank and removing it with the help of Syphon pump. As we get the ph in neutralrange, we can remove the tube. Normally it is repeated for 3-4 times
18. After removing the tube its almost dry but at the end of tube some water exist so , air dry it with help of N<sub>2</sub> gun.
19. Wrap the lint free cloth on cleaned tube and the wrap with paper. If possible placed it directly in respective space of the furnace
20. Then clean nearby area two times with the help of water.
21. Clean all the equipment's with water.
22. Wash the chemical gloves with the water and hang on its proper place for drying.
23. Wash under water and remove used nitrile gloves and keep it in the dustbin.
24. Wash hands properly after everything is done.
25. Switch off the exhaust fan.

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