

Specification for the wet chemical etching station for etching of Quartz Components

Wet etching process involves uses liquid chemicals or etchants to remove material from substrate. In the case of quartz these chemicals include Hydrofluoric acid, sulphuric acid etc. The proposed etching station should be well equipped for safe handling of these chemicals as well as ensuring uniform and precision etching of the substrate.

The quartz components for the wet etching application are of varying size ranges and geometrical specifications. The proposed wet etching station should accommodate these components with variable specifications.

Substrate Specification for the proposed etching station

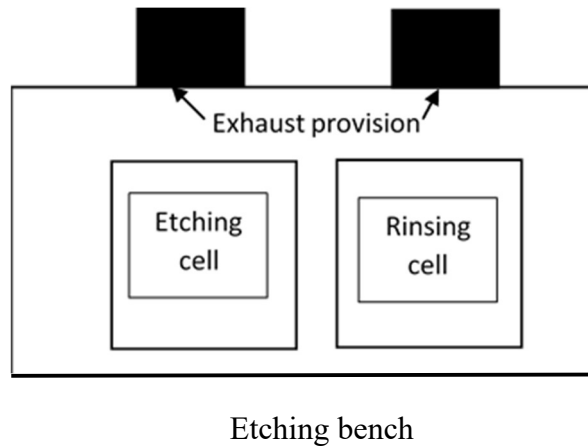
- Wafers of 22mm diameter to be etched in batches not less than 10
- Umbrella Quartz components (fused silica substrate having umbrella geometry) of diameter 30 mm x21-35 mm to be etched in batches not less than 4
- Zerodur blocks of size 65x35 mm
- Fused silica components of size 16x14x7 mm to be etched in batches not less than 4.

The etching uniformity and precision of the components is very critical for the application and hence the proposed etching station should fulfil the process requirement of uniform temperature, concentration and approach to components in the etching bath by control of process variables like rotation of the substrate, mixing of the solution, and uniform heat transfer.

Along with the etching bath a quick rinse setup for removing the remnant etching solution is also recommended. A provision for expanding the etching station in case of such requirement is also preferable. The party may quote the provision for extension as an optional.

The proposed etching station should be fully automated with provision for moving the components from one tub to another. Displacement of the substrate and the duration of the components in each tub and the process parameters should be externally controlled from outside the exhaust hood. There should be a provision for manual movement also.

Block Diagram



1. Etching bench

Typical size: (L x W) – 1500 ± 100 mm x 1200 ± 100 mm

Recommended material: chemical resistant (HF and other acids) like PP or PVDF or Teflon

- The housing provided for the proposed etching station should be well equipped with fume hoods for handling acids.
- Provision for integration of process cells and etching cells.
- Provision for movement of components from one process cell to another.
- Perforated operating table for handling acid leaks and spills with provision for collection of leakage fluid.
- Provision for drainage for used chemicals and spills.
- Provision for Integration of DI water and N₂ Pump.
- Mechanical and electrical components should be separated and provisions for safeguarding electrical components from corrosion.
- Recipe driven control system for operation is recommended.
- There should be provision for manual movement of components from one cell to other.

2. Process Cells

Process cells should be integrated in the housing with closed lids for maintaining long time stability of solution.

2.1 Etching Cell

Typical size: (L x W x H) – 280 x 280 mm x 280 mm.

Recommended material: chemical resistant (HF and other acids) like PVDF or PP or Teflon

- Provisions for uniform mixing and heating of the etching solution (eg. circulation pumps).
- Provision for rotation of the components to ensure uniform approach of etching solution to substrate
- All processing should be fully automated for ensuring non-contact operation.
- There should be provision for in-situ washing of the integrated rotor.

2.2 Rinsing Cell

Typical size: (L x W x H) – 280 x 280 mm x 280 mm.

Recommended material: chemical resistant (HF and other acids) like PP or PVDF or Teflon

- Provision for economic cleaning of components for removing remnant solution and etching products
- Provision for supply of DI water with facility for heating the DI water on requirement.
- There should be provision for time, temperature and flow rate indication as well as control.
- There should be a closure lid for the rinsing cell.

3. Process Control Interface

The etching station need to be automated to avoid contact with HF to the maximum possible extend. So provision for programmed etching recipe control using a PLC system connected to a state of the art Industrial PC is recommended.

The following parameters are to be measured and controlled by the process control Interface

- **Flow control system**-Measurement and control of the flow volume to process cell by using a flow meter.
- **Temperature**- Measurement and control of temperature (maximum temperature of 90°C).
- **Heating control** for Supply tank
- **Level Monitoring and control**
- **Re-dosing of DI water** by means of a pneumatic valve.
- **Time control**
- The system should have provision for safety inter locks in case of emergencies like temperature run away or malfunctioning of blower etc.

4. Chemical Disposal System

- Recipe driven chemical disposal (ex. Neutralizing using $\text{Ca}(\text{OH})_2$) for used chemicals where outlet temperature and number of cycles can be controlled.
- Provision for transportation of the neutralised solution.

5. Miscellaneous

- Provision for circuit draining and filling
- Provision for system cleaning using DI water post processing.

6. Optional Systems

Party should quote following the optional items separately

- ❖ **Exhaust Scrubber**-For cleaning of acid exhaust, preferably a venture type scrubber with centrifugal separator.
- ❖ **HF concentration Detection**- Inline measurement of HF concentration during running process at process temperatures equipped with alarming.
- ❖ **Chemical Dosing System**- Automated dosing setup equipped with inline measurement of etching solution. Dosing and blending by recipe driven chemistry, with options for controlling dosing ratio and dosing volume of the process solution.

- ❖ **Capacity Extension-** Provision for expanding the facility in future with integration into process control interface

7. Installation, Service Support and Training:

- The equipment shall be completely installed by the party and must be delivered ready to use after proper installation and calibration.
- Warranty of the system should be minimum of two years.
- Party should quote separately for consumables and spares for 3 years after warranty.
- Party should install and provide training for the IISU personnel. AMC rates for three years shall be provided after warranty period.
- Party should submit along with offer the filled Compliance matrix attached as annexure-1.
- An SOP including safety aspects is to be supplied by the party.
- **Note: The party should give two part quotation (the technical and commercial separately).**