UiB NanoStructures Laboratory

Standard Operating Procedure

XACTIC Xetch X3 Fluorination chamber

Purpose of the instrument:

The Xetch is an isotropic silicon etcher (and fluorination system). It uses Xenon Difluoride (XeF2) gas as etchant/reactant. The XeF2 bottle contains solid XeF2, a white crystalline compound that resembles rock salt. At room temperature, the vapor pressure of XeF2 is 3.9 Torr.

Location of the instrument:

Allégaten 55, room 267

Primary Staff Contacts:

Sabrina Eder (Mob: 9420 47 33, E-mail: sabrina.eder@uib.no)

Martin Greve (Mob: 900 79 974, E-mail: martin.greve@uib.no)

Instrument booking:

No booking required.

Instrument access:

The instrument can be used by approved users after an introduction and basic training by UiB personnel. For training requests please contact primary staff.

WARNINGS

The instrument operates with XeF_2 which forms hydrofluoric acid (HF) fumes when exposed to moisture in the air. **HF is an extremely toxic and corrosive chemical**. Atomic fluorine can also be produced, which is also toxic and corrosive.

- Do not attempt to alter system interlocks.
- Do not change the XeF2 bottle
- Do not change the N2 bottle if you don't have training
- **Do not expose the main chamber to excess humidity**
- **Do not put wet samples into the chamber**
- **Wear safety googles and nitrile gloves when loading/unloading the sample**

If the alarm goes off leave the lab and contact Sabrina, Martin or Espen.

The UiB NanoStructures Lab is operated for the benefit of all researchers. YOU MUST HAVE RECEIVED PERSONAL TRAINING ON THE INSTRUMENT TO BE PERMITTED TO OPERATE IT! IF YOU HAVE BEEN TRAINED AND ARE STILL UNCERTAIN AS TO HOW TO OPERATE THE INSTRUMENT CONTACT ONE OF THE STAFF MEMBERS. If you encounter any problems with this piece of equipment, please contact the staff member listed above immediately. There is never a penalty for asking questions. If the equipment is not behaving exactly the way it should, contact a staff member. This SOP only serves as a quick reference. For further details consult the manual and/or service engineers.

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Deleted: Lyell Warren, Ferrotec/Temescal (California, +9h), (Tel: +1 925 519 3253, E-mail: lwarren@ferrotec.com)¶

Deleted: For process information contact Ping Chang, Ferrotec/Temescal (California, +9h), (E-mail: pchang@ferrotec.com)¶

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Deleted: with a **high-power, high-voltage supply** delivering potentially lethal electrical currents. Under no circumstances operate the instrument with removed side-panels or without training.¶
Hot titanium may ignite when in contact with oxygen. Since titanium is a deposition material, users must wait for the system to cool down to a temperature below 40° C before opening the chamber. If the chamber is opened while the titanium is hot, a flash fire may occur.

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1 Introduction

of cycles: Since the e1 Series is primarily a pulsed xenon difluoride etching system, the duration of the etch is controlled by the number of cycles. A cycle consists of the xenon difluoride sublimating to the set pressure in the expansion chamber, etching for a set amount of time and evacuation of the main chamber and expansion chamber. Etch Time When the valve between the main chamber and expansion chamber is opened the pressure equilibrates and the etching process begins. The etch time is the time between the opening of the valve between the expansion chamber and the process chamber and the opening of the valve between the process chamber and the pump. XeF2 Pressure In order to introduce the proper amount of xenon difluoride into the main chamber, a set pressure change of xenon difluoride must be delivered to the expansion chamber. Because xenon difluoride has a vapor pressure of ~4T at room temperature the upper limit for the XeF2 pressure is approximately 4T. Due to the slightly elevated temperature inside of the etcher cabinet, you may be able to get considerably higher XeF2 pressures.

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There are three main chambers in the system (1) XeF2 source chamber (2) Expansion Chamber and (3) Main chamber. Sublimated XeF2 and nitrogen gas is collected in the expansion chamber before entering the main chamber. Samples are exposed to XeF2 gas in a cyclic (pulsed) mode in which the main chamber is repeatedly filled with XeF2 (and N2) and pumped out again.
This contains information about basic procedures. The manual can be found in the lab in the blue folder.

2 Safety

XeF2 forms hydrofluoric acid (HF) fumes when exposed to moisture in the air. HF is an extremely toxic and corrosive chemical. Atomic fluorine can also be produced, which is also toxic and corrosive.

- Do not attempt to alter system interlocks.
- Do not change the XeF2 bottle
- Do not change the N2 bottle if you don't have training
- **Do not expose the main chamber to excess humidity**
- **Do not put wet samples into the chamber**
- **Wear safety googles and nitrile gloves when loading/unloading the sample**

If the alarm goes off leave the lab and contact Sabrina, Martin or Espen.

3 Standard operation procedures

Before loading the sample

(1) Check that the N2 valve is open and the pressure is around 20 psi.

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(2) Check that the air compressor is on, and that the pressure is between 70 and 100 psi. Check also the value on the backside of the machine

(3) Turn on the exhaust (correct flow at the black mark)

(4) Turn on the pump/hear if the pump is on, check that the ballast is open

(5) Turn on the computer (if the pump is off, make sure to turn the pump on prior to the computer)

Sample Loading/unloading

- The SPTS program automatically starts choose NORMAL, as shown in Figure. Allow the NORMAL startup routine to complete. The control program will run an automatic system purge routine that sequences the various valves making sure that all of the chambers have been purged. This takes about 10 minutes

- Log in using the following username: admin, password: xetch2019
- Check the last sensor calibration, if it has been more than 3 days, go to section 5 and perform a pressure sensor re-calibration procedure – this takes about an hour
- When machine status reads ready, click load/unload sample

- Confirm that you really wish to load/change the sample. Use nitrile gloves and load your sample. Note; don't expose the main chamber to excess humidity and don't put wet samples into the chamber.
- Press done if you are about to perform an etching procedure

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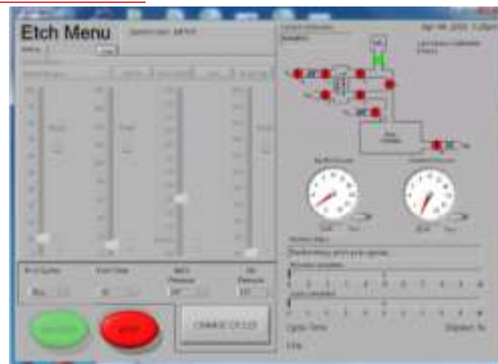
Etching procedure

- Press “Etch menu” in the main menu
- The system will prompt the lot number, see below, click done

- In the main menu, press etch menu

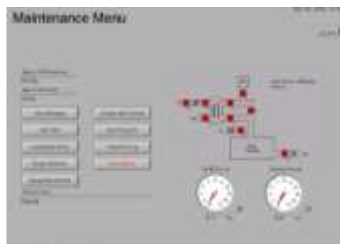


cycles The duration of the etch is controlled by the number of cycles. A

5 Pressure sensor calibration (gauge recalibrate)

1. Press maintenance menu

2. Go to Gauge recalibrate



3. Set the number of purge cycles to 0 and Hard pump time to 10 minutes

4. Press Start test. After the procedure record the process low change and Exp. Change in the lab book
5. Quit the program, and restart it (allow the system to start via normal mode)
6. Re-run the gauge calibration, but this time using the defaults of 3 purge cycles, 60 minutes of hard pump and 50 mTorr base pressure.

Document History

Version 0.1, xx-xx-xxxx, Author: Ranveig Flatabø: Basics, Usage Procedure
Version 0.2, 16-OCT-2023, Author: Sabrina Eder, Changes: Front Page Layout
Version 0.2, 01-NOV-2023, Author: Sabrina Eder, Changes: Front Page Layout

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The SYSTEM MAP screen on the computer located in the electronics rack of the system gives basic status information of the system:¶
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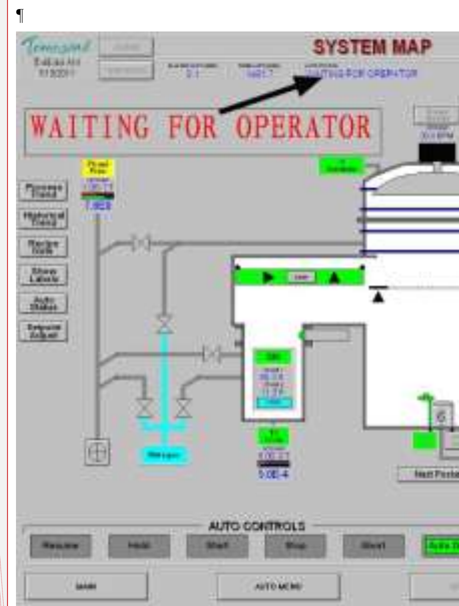

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